NATIONAL QUALITY FORUM
Driving measurable health improvements together

Memo

June 29, 2021

To: Consensus Standards Approval Committee (CSAC)

From: Surgery Project Team

Re: Surgery Fall 2020 Measures

CSAC Action Required

The CSAC will review recommendations from the Surgery project at its June 29-30, 2021 meeting and vote on whether to uphold the recommendations from the Standing Committee.

This memo includes a summary of the project, measure recommendations, themes identified and responses to the public and member comments, and the results from the NQF member expression of support. The following documents accompany this memo:

1. **Surgery Fall 2020 Draft Report**. The draft report has been updated to reflect the changes made following the Standing Committee's discussion of public and member comments. The complete draft report and supplemental materials are available on the project webpage.
2. **Comment Table**. Staff has identified themes within the comments received. This table lists five comments received during the post-meeting comment period and the NQF/Standing Committee responses.

Background

Given the increasing rates and costs associated with inpatient and outpatient surgeries in the United States (U.S.), both performance measurement and reporting provide an opportunity to improve the safety and quality of care received by patients undergoing surgery and surgical procedures. In 2010, 28.6 million ambulatory surgery visits to hospitals and ambulatory surgical centers occurred, representing 48.3 million procedures.[1] In 2014, 17.2 million hospital visits included at least one surgery.[2] Of these surgeries, over half of them occurred in a hospital-owned ambulatory surgical center.[2]

Over time, less invasive surgical techniques, patient conveniences (e.g., less time spent undergoing a procedure), and lower costs have led to an increased volume of ambulatory surgeries.[3,4] However, there are risks associated with ambulatory surgeries, including increased pain, longer time than anticipated to return to daily activities, and unplanned subsequent hospital visits following surgery.[5,6] Beneficiaries of private payers accounted for 48.6 percent of ambulatory surgery visits, with Medicare and Medicaid beneficiaries accounting for 30.8 percent and 14.0 percent of visits, respectively.[2] With the continued growth in the outpatient surgery market, both monitoring and assessing the quality of the services provided hold great importance. Patients, purchasers, and payers need information about the safety and quality of care to make informed decisions about the risks and benefits of ambulatory surgery.

For this project, the Standing Committee evaluated eight measures undergoing maintenance review against NQF's standard evaluation criteria. The Standing Committee recommended seven measures for endorsement and one measure for inactive endorsement with reserve status. The recommended measures are listed below:

- **NQF #0127** Preoperative Beta Blockade (The Society of Thoracic Surgeons (STS))
- **NQF #0134** Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) (STS)
- **NQF #1550** Hospital-Level Risk-Standardized Complication Rate (RSCR) Following Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA) (Yale Center for Outcomes Research & Evaluation (CORE)/Centers for Medicare & Medicaid Services (CMS))
- **NQF #1551** Hospital-Level 30-Day Risk-Standardized Readmission Rate (RSRR) Following Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA) (Yale CORE)/CMS)
- **NQF #3030** STS Individual Surgeon Composite Measure for Adult Cardiac Surgery (STS)
- **NQF #3031** STS Mitral Valve Repair/Replacement (MVRR) Composite Score (STS)
- **NQF #3032** STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score (STS)

The Standing Committee recommended inactive endorsement with reserve status for the following measure:

- **NQF #0117** Beta Blockade at Discharge (STS)

Draft Report

The Surgery fall 2020 draft report presents the results of the evaluation of eight measures considered under the Consensus Development Process (CDP). Seven measures are recommended for endorsement, one measure is recommended for inactive endorsement with reserve status.

The measures were evaluated against the 2019 version of the measure evaluation criteria.

Status	Maintenance	New	Total
Measures under review	8	0	8
Measures recommended for endorsement	7	0	7
Measures recommended for inactive endorsement with reserve status	1	0	1
Reasons for not recommending	Importance – 0 Scientific Acceptability – 0 Use – 0 Overall Suitability – 0 Competing Measure – 0	Importance – 0 Scientific Acceptability – 0 Use – 0 Overall Suitability – 0 Competing Measure – 0	

CSAC Action Required

Pursuant to the CDP, the CSAC is asked to consider endorsement of seven candidate consensus measures.

In addition, the CSAC is asked to consider approval of one measure recommended for inactive endorsement with reserve status.

Measures Recommended for Endorsement

NQF #0127 Preoperative Beta Blockade (STS)

Overall Suitability for Endorsement: Yes-18; No-0

NQF #0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) (STS)

Overall Suitability for Endorsement: Yes-14; No-1

NQF #1550 Hospital-Level Risk-Standardized Complication Rate (RSCR) Following Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA) (Yale CORE/CMS)

Overall Suitability for Endorsement: Yes-17; No-1

NQF #1551 Hospital-Level 30-Day Risk-Standardized Readmission Rate (RSRR) Following Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA) (Yale CORE/CMS)

Overall Suitability for Endorsement: Yes-17; No-0

NQF #3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery (STS)

Overall Suitability for Endorsement: Yes-17; No-0

NQF #3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score (STS)

Overall Suitability for Endorsement: Yes-17; No-0

NQF #3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score (STS)

Overall Suitability for Endorsement: Yes-17; No-0

Measures Recommended for Inactive Endorsement with Reserve Status

NQF #0117 Beta Blockade at Discharge (STS)

Overall Recommendation for Inactive Endorsement with Reserve Status: Yes-17; No-0

When improvement in performance on an endorsed measure has essentially closed the performance gap and the measure continues to meet all other endorsement criteria, the Standing Committee can recommend that the measure remain endorsed with reserve status. Reserve status results in measures maintaining endorsement, thereby remaining in the measure portfolio, while indicating that the measure may not have a sufficient gap to make it a priority for adoption.

Comments and Their Disposition

NQF received five comments from two member organizations pertaining to the draft report and to the measures under review.

A table of comments submitted during the comment period, with the responses to each comment and the actions taken by the Standing Committee and measure developers, is posted to the Surgery project

webpage.

Comments and Committee Responses

Comments about specific measure specifications and rationale were forwarded to the developers, who were invited to respond.

The Standing Committee reviewed all of the submitted comments (general and measure specific) and developer responses. Committee members focused their discussion on measures or topic areas with the most significant and recurring issues.

Measure-Specific Comments

NQF #0117 Beta Blockade at Discharge (STS)
One commenter raised concerns that placing measures on reserve status could be counterproductive. They requested that the Standing Committee recommend active endorsement.

Committee Response
With no new information presented, the Standing Committee did not revote on this measure.

Developer Response
Comment is from the measure steward, so no response was requested.

NQF #0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft – Consensus Not Reached on Performance Gap
One commenter raised concerns that the measure may be placed on reserve status if the gap criterion is not passed and felt this measure should be passed for endorsement.

Committee Response
The Standing Committee chose to revote on this measure since the measure was consensus not reached during the measure evaluation meeting. The committee decided to pass this measure on gap criteria and measure endorsement. The Committee indicated that the impact to patient outcomes was a consideration in this decision.

Developer Response
Comment is from the measure steward, so no response was requested.

Member Expression of Support

Throughout the 16-week continuous public commenting period, NQF members had the opportunity to express their support ('support' or 'do not support') for each measure submitted for endorsement consideration to inform the Committee's recommendations. No NQF members provided their expression of support or non-support.

Removal of NQF Endorsement

Four measures previously endorsed by NQF have not been re-submitted, and endorsement has been removed.

Measure	Measure Description	Reason for Removal of Endorsement
NQF #0354 Hip Fracture Mortality Rate (IQI 19)	In-hospital deaths per 1,000 hospital discharges with hip fracture as a principal diagnosis for patients ages 65 years and older. Excludes periprosthetic fracture discharges, obstetric discharges, cases in hospice care at admission, and transfers to another hospital.	Developer is not seeking re-endorsement.
NQF #0359 Abdominal Aortic Aneurysm Repair Mortality Rate (IQI 11)	In-hospital deaths per 1,000 discharges with abdominal aortic aneurysm (AAA) repair, ages 18 years and older. Includes metrics for discharges grouped by type of diagnosis and procedure. Excludes obstetric discharges and transfers to another hospital.	Developer is not seeking re-endorsement.
NQF #0365 Pancreatic Resection Mortality Rate (IQI 9)	In-hospital deaths per 1,000 discharges with pancreatic resection, ages 18 years and older. Includes metrics for discharges grouped by type of diagnosis and procedure. Excludes acute pancreatitis discharges, obstetric discharges, and transfers to another hospital.	Developer is not seeking re-endorsement.

Measure	Measure Description	Reason for Removal of Endorsement
NQF #0533 Postoperative Respiratory Failure Rate (PSI 11)	Postoperative respiratory failure (secondary diagnosis), prolonged mechanical ventilation, or reintubation cases per 1,000 elective surgical discharges for patients ages 18 years and older. Excludes cases with principal diagnosis for acute respiratory failure; cases with secondary diagnosis for acute respiratory failure present on admission; cases in which tracheostomy is the only operating room procedure or in which tracheostomy occurs before the first operating room procedure; cases with neuromuscular disorders, laryngeal, pharyngeal or craniofacial surgery, esophageal resection, lung cancer, lung transplant or degenerative neurological disorders; cases with a procedure on the nose, mouth, or pharynx; cases with respiratory or circulatory diseases; and obstetrics charges.	Developer is not seeking re-endorsement.

References

1 Hall MJ. Ambulatory Surgery Data From Hospitals and Ambulatory Surgery Centers: United States,2010. 2017;(102):15.

2 Steiner CA, Karaca Z, Moore BJ, et al. Surgeries in Hospital-Based Ambulatory Surgery and Hospital Inpatient Settings, 2014: Statistical Brief #223. In: *Healthcare Cost and Utilization Project (HCUP) Statistical Briefs*. Rockville (MD): Agency for Healthcare Research and Quality (US); 2006. http://www.ncbi.nlm.nih.gov/books/NBK442035/. Last accessed March 2020.

3 Munnich EL, Parente ST. Procedures take less time at ambulatory surgery centers, keeping costs down and ability to meet demand up. *Health Aff (Millwood)*. 2014;33(5):764-769.

4 Accounting for the cost of US health care: A new look at why Americans spend more | McKinsey. https://www.mckinsey.com/industries/healthcare-systems-and-services/our-insights/accounting-for-the-cost-of-us-health-care. Last accessed March 2020.

5 Manohar A, Cheung K, Wu CL, et al. Burden incurred by patients and their caregivers after outpatient surgery: a prospective observational study. *Clin Orthop Relat Res*. 2014;472(5):1416-1426.

6 Fox JP, Vashi AA, Ross JS, et al. Hospital-based, acute care after ambulatory surgery center discharge. *Surgery*. 2014;155(5):743-753.

Appendix A: CSAC Checklist

The table below lists the key considerations to inform the CSAC's review of the measures submitted for endorsement consideration.

Key Consideration	Yes/No	Notes
Were there any process concerns raised during the CDP project? If so, briefly explain.	No	*
Did the Standing Committee receive requests for reconsideration? If so, briefly explain.	Yes	STS requested reconsideration of Standing Committee's endorsement decision for NQF #0117. However, #0117 is recommended for endorsement (with reserve status) so the reconsideration process does not apply.
Did the Standing Committee overturn any of the Scientific Methods Panel's ratings of Scientific Acceptability? If so, state the measure and why the measure was overturned.	No	*
If a recommended measure is a related and/or competing measure, was a rationale provided for the Standing Committee's recommendation? If not, briefly explain.	Yes	*
Were any measurement gap areas addressed? If so, identify the areas.	No	*
Are there additional concerns that require CSAC discussion? If so, briefly explain.	Yes	The STS raised concerns about the performance gap criterion and the use of "reserve status." STS requested NQF re-evaluate the must-pass status of performance gap and clarify what constitutes "topped out." It expressed concern that placing a measure on reserve status will result in a backsliding on performance.

*Cell left intentionally blank

Appendix B: Measures Not Recommended for Endorsement

The Surgery Standing Committee recommends all candidate measures for endorsement or inactive endorsement with reserve status.

Appendix C: NQF Member Expression of Support Results

No NQF members provided their expression of support.

Appendix D: Details of Measure Evaluation

Rating Scale: H=High; **M**=Moderate; **L**=Low; **I**=Insufficient; **NA**=Not Applicable

Note: Vote totals may differ between measure criteria and between measures as Standing Committee members often have to join calls late or leave calls early. NQF ensures that quorum is maintained for all live voting. All voting outcomes are calculated using the number of Standing Committee members present for that vote as the denominator. One Standing Committee member was on inactive status for this cycle.

During the first measure evaluation meeting on February 12, 2021, some Standing Committee members were unable to attend the entire meeting due to early departures and late arrivals. The vote totals reflect members present and eligible to vote. Quorum (14 out of 20 Standing Committee members) was met and maintained for the entirety of this meeting.

During the second measure evaluation meeting on February 16, 2021, voting quorum was not achieved. Therefore, the Standing Committee discussed all relevant criteria and voted after the meeting using an online voting tool.

During the post-comment meeting on June 1, 2021, voting quorum (15 out of 20) Standing Committee members was met and maintained for the entirety of the meeting.

Measures Recommended

NQF #0127 Preoperative Beta Blockade

Submission | Specifications

Description: Percent of patients aged 18 years and older undergoing isolated CABG who received beta blockers within 24 hours preceding surgery.

Numerator Statement: Number of patients undergoing isolated CABG who received beta blockers within 24 hours preceding surgery

Denominator Statement: Patients aged 18 years and older undergoing isolated CABG

Exclusions: Cases are removed from the denominator if preoperative beta blocker was contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room.

Adjustment/Stratification: No risk adjustment or stratification

Level of Analysis: Facility, Clinician : Group/Practice

Setting of Care: Inpatient/Hospital

Type of Measure: Process

Data Source: Registry Data

Measure Steward: The Society of Thoracic Surgeons

STANDING COMMITTEE MEETING February 12, 2021

Importance to Measure and Report: The measure meets the Importance criteria.

(1a. Evidence, 1b. Performance Gap)

1a. Evidence: **H-0; M-17; L-0; I-0 (denominator = 17)**; 1b. Performance Gap: **H-1; M-13; L-3; I-0 (denominator = 17)**

Rationale:

- As part of the previous submission in 2016, the developer included the 2011 American College of Cardiology Foundation and the American Heart Association (ACCF/AHA) Guideline for Coronary Artery Bypass Graft Surgery. The recommendation stated the following:

  - Beta blockers should be administered for at least 24 hours before CABG to all patients without contraindications to reduce the incidence or clinical sequelae of postoperative atrial fibrillation. (Class I Recommendation, Level of Evidence: B)
  - Preoperative use of beta blockers in patients without contraindications, particularly in those with an LVEF greater than 30%, can be effective in reducing the risk of in-hospital mortality. (Class IIa Recommendation, Level of Evidence: B)
- The developer indicated that no changes have occurred in the evidence since the prior submission.
- The Standing Committee agreed that no changes have been made to the evidence and that it sufficiently ties this process to patient outcomes.
- The developer included the number of operations conducted in this submission, as requested by the Standing Committee during the previous submission. The measure results that were calculated using registry data for January-December 2018 are 1,035 participants and 146,984 operations and for January-December 2019, 997 participants and 146,297 operations.

Year	Mean	STD	IQR	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
2018	0.95	0.086	0.067	0.095	0.838	0.910	0.948	0.968	0.980	0.990	0.996	1.00	1.00	1.00
2019	0.95	0.082	0.057	0.37	0.86	0.92	0.96	0.97	0.98	0.99	1.00	1.00	1.00	1.00

- The developer also provided disparities data for January 2016 – December 2019. Each year in the table below represents January-December.

Groups	2016	2017	2018	2019
All	95.18%	95.53%	96.02%	96.55%
Male	95.02%	95.38%	95.91%	96.42%
Female	95.68%	95.98%	96.38%	96.98%
Age<75	95.29%	95.63%	96.16%	96.66%
Age>=75	94.72%	95.09%	95.45%	96.12%
White	95.52%	95.75%	96.16%	96.56%
Black	96.10%	96.36%	96.75%	96.92%
Other	92.12%	93.22%	94.46%	96.23%
Insurance, Age >=65 Medicare + Medicaid	94.55%	94.97%	95.40%	95.96%
Insurance, Age >=65 Medicare + Commercial without Medicaid	95.35%	95.60%	95.82%	96.28%
Insurance, Age >=65 Medicare without Medicaid/Commercial	94.13%	95.00%	95.56%	96.50%
Insurance, Age<65 Medicare/Medicaid	95.95%	95.97%	96.43%	96.60%
Insurance, Age<65	95.39%	95.57%	96.30%	96.83%

Groups	2016	2017	2018	2019
Commercial/HMO				
Insurance, Age<65 None/Self Paid	96.61%	97.34%	97.80%	97.48%
Insurance, Age<65 Other	95.10%	95.40%	97.11%	96.88%

The Standing Committee noted that while performance on this measure is very high, it is lower than the performance on NQF #0117, with a median rate of 98% (vs. 100% for NQF #0117). Standing Committee members agreed that in addition to NQF #0127 having more overall opportunity for improvement than NQF #0117 at the median, the lower deciles of performance also demonstrated greater variability in performance. Ultimately, the Standing Committee determined that this measure still has enough room for improvement to meet the performance gap criterion.

1. **Scientific Acceptability of Measure Properties: The measure meets the Scientific Acceptability criteria.**

(2a. Reliability precise specifications, testing; 2b. Validity testing, threats to validity
2a. Reliability: **H-1; M-17; L-0; I-0 (denominator = 18)**; 2b. Validity: **H-0; M-14; L-3; I-1 (denominator = 18)**

Rationale:

- The developer conducted performance measure score reliability testing using a beta-binomial model of signal-to-noise ratio.
- The developer highlighted that the reliability of the measure varies by the number of eligible patients (denominator). In this case, 99% of the STS participants met the 8-patient sample size necessary for 0.50 reliability and 97% meet the 20-patient sample size necessary for 0.70 reliability.
- The Standing Committee questioned the reliability of the measure for participants with a low sample size. The developer clarified that all STS process measures are binary results (meets/does not meet) with a confidence interval. STS noted that, in general, the smaller the sample size, the larger the confidence interval, which results in most small groups receiving two stars.
- A Standing Committee member stated that they appreciated the testing for demonstrating different reliabilities at different case counts, noting that there was a range of reliability for each count. The same Standing Committee member also noted that reliability of distribution was helpful and that reliability of "binning" providers into scores would also be helpful.
- The Standing Committee ultimately agreed that the measure was reliable.
- The developer conducted data element validity testing using the STS Adult Cardiac Surgery Database Audit, which randomly selected 10% of participating sites to evaluate the accuracy, consistency, and comprehensiveness of data collection. The audit process involved re-abstraction of data for 20 cases and comparison of 82 individual data elements with those submitted to the data warehouse. The results presented are from the 2015 audit. The data element validity results provided demonstrate an overall agreement rate of 99.14%, with most elements in the high 90% agreement range.
- The developer also examined measure score validity using known-group validity. For the measure score, three performance groups were calculated and compared. The three groups had different proportions.
    - Known-group validity testing demonstrated that low-performance groups had lower observed rates and that high-performance groups had higher observed rates (81.3% vs 99.3%).
- The developer also conducted measure score validity testing using the predictive validity/stability of measure score results over time for the October 2013 – September 2014 and October 2014 – September 2015 periods.

    - Predicted validity/stability analysis demonstrated that among participants who were high performers during the first period, 77% were also high performance in the second period. In addition, 77% of mid-performers remained in the mid-performer category. Low performance showed more changes, with 67% remaining in the low-performer category in the second performance period.
- The developer reported that for the period October 2014 – September 2014, around 50% of participants had performances indistinguishable from the STS average (95% CI), and the remaining participants performed differently.
    - 538 (51.7%) performed as expected
    - 197 (18.9%) had lower-than-expected performance
    - 306 (29.4%) had higher-than-expected performance
- The Standing Committee had no issues or concerns regarding validity.

2. Feasibility: H-6; M-10; L-2; I-0 (denominator = 18)

(3a. Clinical data generated during care delivery; 3b. Electronic sources; 3c. Susceptibility to inaccuracies/ unintended consequences identified 3d. Data collection strategy can be implemented)

Rationale:

- The required data elements are collected and used by healthcare personnel during the provision of care and abstracted from a record by someone other than person obtaining original information. Some data elements are available through electronic sources. Local availability of data elements varies from full electronic health record (EHR) capability to no availability; however, all data elements are submitted to the STS database in an electronic format following a standard set of data specifications.
- STS Adult Cardiac Surgery Database participants (single or group of surgeons) pay annual participant fees of $3,500 if the majority of surgeons in the group are STS members and $4,750 if the majority are not STS members. In addition, there is a fee of $150 per member and $350 per non-member for surgeons listed on the database's Participation Agreement. STS analyses indicated that the STS database includes more than 90% of cardiothoracic programs in the U.S. There are no additional costs for data collection specific to the measure.
- The Standing Committee had no concerns regarding the feasibility of the measure.

3. Use and Usability

4a. Use; 4a1. Accountability and transparency; 4a2. Feedback on the measure by those being measured and others; 4b. Usability; 4b1. Improvement; 4b2. The benefits to patients outweigh evidence of unintended negative consequences to patients)

4a. Use: **18; No Pass-0 (denominator = 18)** *4b. Usability:* **H-2; M-15; L-1; I-0 (denominator = 18)**

Rationale:

- This measure is part of a publicly reported composite (the Perioperative Medications domain) as part of the voluntary STS Public Reporting of the isolated CABG composite as well as CMS' Merit-Based Incentive Payment System.
- The Standing Committee had no questions or concerns regarding the use of the measure.
- The developer states that the STS Adult Cardiac Surgery Database (ACSD) Participant Feedback Reports provide performance results for this measure to the participants on a quarterly basis.
- In the previous measure submission, performance on this measure showed a rate of 93.25% for the period October 2011 – September 2012. In this submission, the developer included the overall rates of 95.53%, 96.03%, and 96.54%, for calendar years 2017, 2018, and 2019, respectively.
- The Standing Committee noted that the data demonstrate improvement over time and expressed no major concerns regarding usability.

4. Related and Competing Measures

- This measure is related to the following additional measures:
    - NQF #0114 Risk-Adjusted Postoperative Renal Failure
    - NQF #0115 Risk-Adjusted Surgical Re-exploration
    - NQF #0116 Anti-Platelet Medication at Discharge
    - NQF #0117 Beta Blockade at Discharge
    - NQF #0118 Anti-Lipid Treatment Discharge

  - NQF #0119 Risk-Adjusted Operative Mortality for CABG
  - NQF #0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)
  - NQF #0130 Risk-Adjusted Deep Sternal Wound Infection
  - NQF #0131 Risk-Adjusted Stroke/Cerebrovascular Accident
  - NQF #0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
  - NQF #0696 STS CABG Composite
- The developer stated that the measure specifications are harmonized to the extent possible. They noted that the related measures identified are NQF-endorsed measures developed by or with STS. All these measures are either components of NQF #0696 or are the overall composite NQF #0696.
- The Standing Committee discussed related and competing measures during the post-comment web meeting on June 1, 2021. The Standing Committee did not raise any additional concerns or questions.

5. **Standing Committee Recommendation for Endorsement**: **Yes-18; No-0 (denominator = 18)**

6. **Public and Member Comment**

   No public and member comments were received for this measure.

7. **Consensus Standards Approval Committee (CSAC) Vote: Y-X; N-X**
8. **Appeals**

NQF #0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Submission | Specifications

Description: Percentage of patients aged 18 years and older undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft

Numerator Statement: Number of patients undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft

Denominator Statement: Patients aged 18 years and older undergoing isolated CABG

Exclusions: Cases are removed from the denominator if the patient had a previous CABG prior to the current admission or if IMA was not used and one of the following reasons was provided:

Subclavian stenosis
Previous cardiac or thoracic surgery
Previous mediastinal radiation
Emergent or salvage procedure
No (bypassable) LAD disease

Adjustment/Stratification: No risk adjustment or risk stratification

Level of Analysis: Facility, Clinician : Group/Practice

Setting of Care: Inpatient/Hospital

Type of Measure: Process

Data Source: Registry Data

Measure Steward: The Society of Thoracic Surgeons

STANDING COMMITTEE MEETING February 12, 2021 and June 1, 2021

1. **Importance to Measure and Report: <u>The measure meets the Importance criteria.</u>**

(1a. Evidence, 1b. Performance Gap)

1a. Evidence: **H-0; M-18; L-0; I-0 (denominator = 18)**; 1b. Performance Gap: **H-3; M-7; L-4; I-1 (denominator = 15)**

Rationale:

In 2016, the developer included the 2011 ACCF/AHA Guideline for Coronary Artery Bypass Graft Surgery. The recommendation stated the following:

- If possible, the left internal mammary artery (LIMA) should be used to bypass the left anterior descending (LAD) artery when bypass of the LAD artery is indicated. (Class I, Level of Evidence: B)
- The right internal mammary artery is probably indicated to bypass the LAD artery when the LIMA is unavailable or unsuitable as a bypass conduit. (Class II, Level of Evidence: C)
- When anatomically and clinically suitable, use of a second IMA to graft the left circumflex or right coronary artery (when critically stenosed and perfusing LV myocardium) is reasonable to improve the likelihood of survival and to decrease reintervention. (Class II, Level of Evidence: B)

- Evidence submitted at the last review included observational, retrospective, and prospective studies – randomized controlled trials that demonstrated the value of using the IMA in coronary artery bypass graft surgery.
- The developer attested to no changes to the evidence for this submission.
- The Standing Committee noted that the evidence was largely unchanged from the previous maintenance cycle and passed the measure on evidence.
- In the previous review, the Standing Committee had asked the developer to provide the number of patients included in the measure to help inform discussion of the performance gap. The developer has included the number of operations in this submission. Measure results calculated using registry data for January-December 2018 (1035 participants and 151,805 operations) and January-December 2019 (999 participants and 150,773 operations).

Year	Mean	STD	IQR	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
2018	0.99	0.027	0.013	0.44	0.97	0.98	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00
2019	0.99	0.017	0.011	0.74	0.97	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00

- The developer reported that for analysis of disparities, eligible patients from STS database participants with procedures between January 2016 and December 2019 were used. Relevant subgroups were defined by age, gender, race, and insurance status.
- Each year in the table below represents January-December.

Groups	2016	2017	2018	2019
All	99.04%	99.09%	99.22%	99.33%
Male	99.22%	99.25%	99.38%	99.44%
Female	98.48%	98.59%	98.73%	98.97%
Age<75	99.17%	99.21%	99.32%	99.40%
Age>=75	98.48%	98.63%	98.82%	99.03%
White	99.11%	99.19%	99.28%	99.40%
Black	98.70%	98.75%	98.99%	98.91%
Other	98.79%	98.62%	98.95%	99.07%
Insurance, Age >=65 Medicare + Medicaid	98.37%	98.15%	98.33%	98.92%
Insurance, Age >=65 Medicare + Commercial without Medicaid	99.02%	99.03%	99.19%	99.29%

Groups	2016	2017	2018	2019
Insurance, Age >=65 Medicare without Medicaid/Commercial	98.74%	98.96%	99.12%	99.23%
Insurance, Age<65 Medicare/Medicaid	99.00%	98.99%	99.13%	99.22%
Insurance, Age<65 Commercial/HMO	99.37%	99.46%	99.51%	99.53%
Insurance, Age<65 None/Self Paid	99.12%	99.05%	99.36%	99.41%
Insurance, Age<65 Other	99.27%	99.25%	99.36%	99.71%

- The Standing Committee noted that the performance gap for this measure was very similar to the one for NQF #0117.
- The developer expressed strong concerns with considering reserve status for this measure as it is more closely tied to patient mortality and outcomes than NQF #0117. The developer further shared that it is easier and faster for surgeons to perform a CABG using veins for grafts; therefore, this measure is important to encourage use of the IMA. In response to the assertion that performance on the measure is topped out, the developer noted that a 1 percent decrease in performance would represent 1,500 patients with a poorer outcome.
- A Standing Committee member questioned whether this measure is the only incentive keeping surgeons "honest" about using the proper grafting technique, especially given the existing mortality and complication measures.
- The developer noted that the existing measures cover a 30-day period and the impact of the graft choice would not be evident in that time frame. They stated that while most surgeons will continue to do the right thing, some may not.
- Other Standing Committee members noted that while they agree the measure is important and that there may be a perverse incentive to not use the IMA for grafting, the criterion under discussion is whether there is a sufficient performance gap to warrant continued active endorsement.
- The Standing Committee and developers raised questions regarding the impact and intent of reserve status: What does it mean? How might it be perceived? Would measures be difficult to find and use?
- NQF staff clarified that reserve status measures are still endorsed. The reserve status indicates that performance on the measure is very good with limited room for improvement. Currently in NQF's measure search tool, all endorsed measures (both active and inactive reserve status) are listed in search results. A reserve status measure appears no different from an actively endorsed measure until a user selects the measure to learn more about it.
- The Standing Committee did not initially reach consensus regarding performance gap.

During the post-comment web meeting, the Standing Committee re-visited the discussion of gap for this measure. The discussion focused on the impact of the lower-end performance on the measure. The developer shared that there are several studies demonstrating an increase in mortality and morbidity if the IMA is not used for a graft. Ultimately, the Standing Committee agreed that the gap was sufficient to warrant a national performance measure and passed the

2. Scientific Acceptability of Measure Properties: The measure meets the Scientific Acceptability criteria.

(2a. Reliability - precise specifications, testing; 2b. Validity - testing, threats to validity)

2a. Reliability: **H-6; M-12; L-0; I-0 (denominator = 18)**; 2b. Validity: **H-2; M-15; L-1; I-0 (denominator = 18)**

Rationale:

- The developer conducted performance measure score reliability testing using a beta-binomial model of signal-to-noise ratio.
- The developer highlighted that the reliability of the measure varies by the number of eligible patients (denominator). In addition, 80% of the STS participants meet the 54-patient sample size necessary for 0.50 reliability and 41% meet the 126 patient sample size necessary for 0.70 reliability.
- The Standing Committee noted that the testing is very similar to the testing for NQF #0117 and that the same discussion applies. They were satisfied that the measure is reliable.
- The developer conducted data element validity testing using the STS Adult Cardiac Surgery Database Audit, which randomly selected 10% of participating sites to evaluate the accuracy, consistency, and comprehensiveness of data collection. The audit process involves re-abstraction of data for 20 cases and the comparison of 82 individual data elements with those submitted to the data warehouse. The results presented are from the 2015 audit. The method is appropriate for establishing data element validity.

  The data element validity results provided demonstrate an overall agreement rate of 99.14%, with most elements in the high 90% agreement range.

The developer also examined measure score validity using known-group analysis. For the measure score, three performance groups were calculated and compared. The three groups had different proportions.

Low-performance groups had lower observed rates and high-performance groups had higher observed rates (93.5% vs 100%). It is unclear how low and high-performance groups were defined.

The developers also conducted measure score validity testing using predictive validity/stability of measure score results over time for October 2013 – September 2014 and October 2014 – September 2015.

Predicted validity/stability analysis demonstrated that among participants that were high performers during the first period, 93% were also high performance in the second period. In addition, 21% of mid-performers remained in the mid-performer category. Low performance showed more changes, with 37% remaining in the low-performer category in the second performance period.

The developer reported that for the period of October 2014 – September 2014, approximately 90% of participants had performance indistinguishable from the STS average (95% CI), and the remaining participants performed differently.

- 944 (90.7%) performed as expected
- 76 (7.3%) had lower-than-expected performance
- 21 (2.0%) had higher-than-expected performance

The Standing Committee noted concerns with using known-groups analysis with the measure score and with using test-retest as a methodology for establishing validity. Despite these concerns, the Standing Committee determined that the measure was valid.

3. Feasibility: H-6; M-11; L-1; I-0 (denominator = 17)

(3a. Clinical data generated during care delivery; 3b. Electronic sources; 3c. Susceptibility to inaccuracies/ unintended consequences identified 3d. Data collection strategy can be implemented)

Rationale:

- The required data elements are collected and used by healthcare personnel during the provision of care and abstracted from a record by someone other than the person obtaining the original information. Some data elements are available through electronic sources. Local availability of data elements varies from full electronic health record (EHR) capability to no availability; however, all data elements are submitted to the STS database in an electronic format following a standard set of data specifications.
- STS Adult Cardiac Surgery Database participants (single or group of surgeons) pay annual participant fees of $3,500 if the majority of surgeons in the group are STS members and $4,750 if the majority are not STS members. In addition, there is a fee of $150 per member and $350 per non-member for surgeons listed on the database's Participation Agreement. STS analyses indicated that the STS database includes more than 90% of cardiothoracic programs in the U.S. There are no additional costs for data collection specific to the measure.
- The Standing Committee discussed a high rating versus a moderate rating for feasibility, noting that the measure is automatically calculated for providers using the STS Adult Cardiac Registry. Standing Committee members noted that data submission to the registry requires staff to abstract the data for entry into the registry and that this requirement led to their consideration of feasibility as moderate instead of high.

4. Use and Usability

4a. Use; 4a1. Accountability and transparency; 4a2. Feedback on the measure by those being measured and others; 4b. Usability; 4b1. Improvement; 4b2. The benefits to patients outweigh evidence of unintended negative consequences to patients)

4a. Use: **Pass-18; No Pass-0 (denominator = 18)** *4b. Usability:* **H-4; M-13; L-1; I-0 (denominator = 18)**
Rationale:

- This measure is publicly reported through the STS Public Reporting Program, both individually and as part of the STS CABG Composite.
- All Adult Cardiac Surgery Database participants receive quarterly feedback reports providing a detailed analysis of the participant's performance, including benchmarking. Dashboard-type reporting on STS.org has been provided for real-time, online data updates to STS surgeon members. Participants also have access to a guide to help interpret performance results.
- The Standing Committee had no concerns regarding use of the measure.
- In the 2016 submission, the developer provided a rate of 98.36% for the period of October 2011 – September 2012. For this submission, the developer provided overall rates of 99.06%, 99.18%, and 99.29%, for calendar years 2017, 2018, and 2019, respectively.
- The Standing Committee had no questions regarding the usability of the measure.

5. Related and Competing Measures

- This measure is related to the following measures:
    - NQF #0114 Risk-Adjusted Postoperative Renal Failure
    - NQF #0115 Risk-Adjusted Surgical Re-exploration
    - NQF #0116 Anti-Platelet Medication at Discharge
    - NQF #0117 Beta Blockade at Discharge
    - NQF #0118 Anti-Lipid Treatment Discharge
    - NQF #0119 Risk-Adjusted Operative Mortality for CABG
    - NQF #0127 Preoperative Beta Blockade
    - NQF #0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)
    - NQF #0130 Risk-Adjusted Deep Sternal Wound Infection
    - NQF #0131 Risk-Adjusted Stroke/Cerebrovascular Accident
    - NQF #0696 STS CABG Composite

The related measures identified are NQF-endorsed measures developed by or with STS. All these measures are either components of NQF #0696 or are the overall composite NQF #0696. The developer indicated that they are harmonized.

The Standing Committee discussed related and competing measures during the post-comment web meeting on June 1, 2021. The Standing Committee did not raise any additional concerns or questions.

6. Standing Committee Recommendation for Endorsement: **Y-14**; **N-1 (denominator = 15)**

7. **Public and Member Comment**

   NQF received one comment for this measure. The commenter raised concerns regarding the impact if the Committee were to place the measure on reserve status.

8. **Consensus Standards Approval Committee (CSAC) Vote: Y-X; N-X**
9. **Appeals**

NQF #1550 Hospital-Level Risk-Standardized Complication Rate (RSCR) Following Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA)

Submission

Description: The measure estimates a hospital-level risk-standardized complication rate (RSCR) associated with elective primary THA and TKA in Medicare Fee-For-Service beneficiaries who are age 65 and older. The outcome (complication) is defined as any one of the specified complications occurring from the date of index admission to 90 days post date of the index admission (the admission included in the measure cohort).

Numerator Statement: The outcome for this measure is any complication occurring during the index admission (not coded present on arrival) to 90 days post-date of the index admission. Complications are counted in the measure only if they occur during the index hospital admission or during a readmission. The complication outcome is a dichotomous (yes/no) outcome. If a patient experiences one or more of these complications in the applicable time period, the complication outcome for that patient is counted in the measure as a "yes".

Denominator Statement: The target population for the publicly reported measure includes admissions for Medicare FFS beneficiaries who are at least 65 years of age undergoing elective primary THA and/or TKA procedures.

Additional details are provided in S.7 Denominator Details.

Exclusions: This measure excludes index admissions for patients in the following categories:

1. Without at least 90 days post-discharge enrollment in FFS Medicare
2. Discharged against medical advice (AMA)
3. Had more than two THA/TKA procedure codes during the index hospitalization

After applying these exclusion criteria, we randomly select one index admission for patients with multiple index admissions in a calendar year. Therefore, we exclude the other eligible index admissions in that year.

Adjustment/Stratification: Statistical risk model

Level of Analysis: Facility

Setting of Care: Inpatient/Hospital

Type of Measure: Outcome

Data Source: Claims, Enrollment Data

Measure Steward: Centers for Medicare & Medicaid Services

STANDING COMMITTEE MEETING February 16, 2021

1. **Importance to Measure and Report: The measure meets the Importance criteria.**

(1a. Evidence, 1b. Performance Gap)

1a. Evidence: **Pass-18; No Pass-0 (denominator = 18)**; 1b. Performance Gap: **H-0; M-18; L-0; I-0 (denominator = 18)**

Rationale:

- As part of the previous submission in 2017, the developer included a logic model that suggested that improved communication between providers involved at care transitions, prevention of and response to complications, patient safety, coordinated transitions to the outpatient environment, medication reconciliation, patient education, and disease management strategies lead to improved patient outcomes by decreasing the risk of complications following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA). The developer included empirical data and references from various studies supporting this logic model.

- In this submission, the developer provided updated citations and references for the rationale for measure development and more recent studies that provide additional support for the previous conclusions.
- The Standing Committee noted the evidence was directionally the same yet stronger than the evidence for the previous maintenance submission.
- The developers provided three-year, hospital-level, risk standardized complication rates (RSCR) from April 1, 2016 to March 31, 2019 using Medicare administrative claims data (n= 962,744 admissions) from 3,418 hospitals. The RSCRs had a mean of 2.5% and range from 1.2-10.6% in the study cohort. The median risk-standardized rate was 2.4%.
- The developer also provided disparities data on THA/TKA risk-standardized complication rate (RSMR) across hospitals by proportion of patients with social risk (dual-eligible patients and AHRQ SES Index Scores).
- The Standing Committee observed that there was an appropriate measure performance gap and did not express any further concerns.

2. Scientific Acceptability of Measure Properties: The measure meets the Scientific Acceptability criteria.

(2a. Reliability precise specifications, testing; 2b. Validity testing, threats to validity

2a. Reliability: **H-0; M-15; L-2; I-0 (denominator = 17, due to SMP member recusal)**; 2b. Validity: **H-0; M-14; L-3; I-0 (denominator = 17, due to SMP member recusal)**

Rationale:

- This measure was deemed as complex and scientific acceptability was evaluated by the NQF Scientific Methods Panel (SMP). A summary of the SMP's review is included below.
- The developers conducted two types of reliability testing. The developers estimated the measure score level by calculating the intraclass correlation coefficient (ICC) using a split sample (i.e., test-retest) method, and then estimated the facility-level reliability (signal-to-noise reliability) using Adams' Method.
    - For signal-to-noise analysis, the developers reported a median reliability of 0.87, ranging from 0.46 to 1.00, and a mean of 0.83. The 25th and 75th percentiles were 0.74 and 0.94, respectively.
    - For split-sample reliability, the developers included 962,744 admissions in the analysis using three years of data. Using the Spearman-Brown prediction formula, the developers estimated the agreement between the two independent assessments of the RSCR for each hospital with 25 admissions was 0.524.
- The SMP reviewers generally agreed that the testing approach and results were acceptable. The SMP rated this measure moderate for reliability: H-2; M-6; L-0; I-0.
- The Standing Committee noted that while the reliability testing methods were robust, there are concerns from public commenters regarding the reliability at the lower end of case counts.
- A Standing Committee member who also serves on the SMP noted that reliability standards are currently in flux but that generally, higher is better. They stated it would be helpful to see the reliability of classification to obtain a better understanding of the risk of misclassification at different case counts.
- The developer noted that misclassification was rare, with most providers classified as no different than average. The developer attributes this to a narrowing of variation in performance as performance improves, use of a 95% confidence interval, and the impact of statistical modeling.
- The Standing Committee was satisfied with the developer's rationale and expressed no further concerns. Because voting was conducted after the meeting using an online voting tool, the Standing Committee voted on the reliability criteria rather than on whether to accept the SMP's ratings.
- The developers conducted validity testing at the measure score level. The measure was compared to the Overall Hospital Star Rating and Hospital THA/TKA Surgical Volume.

  - The developer reported the correlation between THA/TKA complications and Star-Rating summary score to be -0.185.
  - A general trend was noted that high-volume hospitals (i.e., those in the upper deciles) have lower RSCRs than hospitals in other volume deciles.
  - The developer stated that overall, the results above show that the trend and direction of this association is in line with what would be expected. Risk model discrimination and calibration: c statistic = 0.65
- The SMP reviewers generally accepted the validity testing results as a weak but acceptable demonstration of validity. The SMP rated this measure moderate for validity: H-0; M-6; L-1; I-1.
- The Standing Committee noted that the measure currently only includes inpatient procedures. As THA/TKA procedures shift to outpatient settings, the change in patient mix for inpatient procedures could be a threat to the validity of the measure.
- A Standing Committee member noted the inclusion group is Medicare FFS and requested clarification on the included and excluded populations.
- The developer clarified that Medicare Advantage patients are not included. The developer noted that one third of Medicare patients are enrolled in Medicare Advantage plans and that they would seek to incorporate those patients in future versions of this measure.
- The Standing Committee noted that the validity testing employed a circular comparison to a composite that included this measure as a component. A Standing Committee member suggested that the developer could use the logic model provided in the evidence section as a validation tool for the measure.
- The developer appreciated the feedback but shared that it is difficult to find comparison measures and to get data to validate processes. They further noted that processes do not always fully correlate with outcomes. The developer shared that they had recently gained access to results of patient-reported outcome performance measures (PRO-PMs) related to THA/TKA and were working to analyze the relationship with this measure.
- The Standing Committee then raised concerns regarding the risk model. They noted that the c statistic of 0.65 indicated a poor fit.
- The developer responded that this result indicated that outcomes on this measure are more reflective of quality of care delivered by the facility and not strongly related to patient factors.
- The Standing Committee noted that both the SMP and public commenters had raised questions regarding the lack of risk adjustment for social risk factors, noting that the odds ratios for some social factors were larger than those for some clinical factors. Given the elective nature of THA/TKA procedures, the Standing Committee was concerned that patient selection could result in increased disparities and access issues if social risk was not adequately addressed in the risk adjustment.
- The developer provided additional information on their approach to risk model development, stating that they looked at patient-level clinical variables first and then social risk factors. They shared that when the impact of social risk factors was examined in a multivariate model (as opposed to individually), the odds ratios decreased significantly. They further shared that when considering risk factors to include, they considered which factors a hospital could influence. They shared that hospitals participating in the Comprehensive Care for Joint Replacement model through the CMS Innovation Center had demonstrated that hospitals are able to effectively address issues related to social risk. The developer noted that hospital results were highly correlated both with and without the risk-factor adjustment. These considerations, coupled with the report from the Office of the Assistant Secretary for Planning and Evaluation (ASPE) of the U.S. Department of Health and Human Services (HHS) advising against adjustment for social risk factors for public reporting, led to the decision not to include social risk factors in the risk adjustment model.
- The Standing Committee was satisfied with the developer's rationale and expressed no further concerns on the measure's validity. Because voting was conducted after the meeting using an online voting tool, the Standing Committee voted on the validity criteria rather than on whether to accept the SMP's ratings.

3. **Feasibility: H-4; M-13; L-1; I-0 (denominator = 18)**

(3a. Clinical data generated during care delivery; 3b. Electronic sources; 3c. Susceptibility to inaccuracies/ unintended consequences identified 3d. Data collection strategy can be implemented)

Rationale:

- All the data elements for this measure originate from defined fields in electronic claims.
- The necessary data are coded by someone other than the person obtaining original information.
- This measure uses administrative claims data and enrollment data and as such, it offers no data collection burden to hospitals or providers.
- The Standing Committee expressed no concerns regarding the feasibility of the measure.

4. Use and Usability

4a. Use; 4a1. Accountability and transparency; 4a2. Feedback on the measure by those being measured and others; 4b. Usability; 4b1. Improvement; 4b2. The benefits to patients outweigh evidence of unintended negative consequences to patients)

4a. Use: **Pass-18; No Pass-0 (denominator = 18)** *4b. Usability:* **H-1; M-17; L-0; I-0 (denominator = 18)**

Rationale:

- This measure is publicly reported on CMS' Care Compare website and used in CMS' Hospital Value-Based Purchasing (HVBP) Program.
- The Standing Committee had no questions or concerns regarding use of the measure.
- The developer provided information on their feedback loop for the measure, noting that CMS' QualityNet website gives facilities detailed patient-level results and benchmarks to assist in interpretation. The developer also maintains an email inbox for questions and feedback.
- The developers reported that the median hospital 30-day, all-cause, RSCR for the THA/TKA complications measure for the 3-year period between April 1, 2016 – March 31, 2019 was 2.4%.
- The median RSCR decreased by 0.1 absolute percentage points from April 2016 – March 2017 (median RSCR: 2.5%) to April 2018 – March 2019 (median: RSCR: 2.4%).
- The developer noted that a potential unintended harm of this measure is that providers could inappropriately shift care, which could result in increased patient morbidity and mortality, and other unintended consequences for patients. The developers monitor for this unintended consequence and have not seen any indications it is occurring.
- The Standing Committee did not express any concerns regarding usability of the measure.

5. Related and Competing Measures

- This measure is related to the following measures:
    - NQF #1551 Hospital-Level 30-Day Risk-Standardized Readmission Rate (RSRR) Following Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA)
    - NQF #3493 Risk-Standardized Complication Rate (RSCR) Following Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA) for Merit-Based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
    - NQF #3474 Hospital-Level, Risk-Standardized Payment Associated With a 90-Day Episode of Care for Elective Primary Total Hip and/or Total Knee Arthroplasty (THA/TKA)
- The developer stated that the measure specifications are harmonized to the extent possible. They noted that they focused on related outcome (mortality and readmissions) measures in their harmonization analysis. Their rationale for this was that clinical coherence of the measured cohort takes precedence over alignment with related non-outcome measures. They state that many process measures are limited due to the broader patient exclusions necessary to examine only a specific subset of patients who are eligible for that measure (for example, patients who receive a specific medication or undergo a specific procedure).
- The Standing Committee discussed related and competing measures during the post-comment web meeting on June 1, 2021. The Standing Committee did not raise any additional concerns or questions.

6. **Standing Committee Recommendation for Endorsement**: **Yes-17; No-1 (denominator = 18)**

7. Public and Member Comment

- NQF received one comment on this measure. The commenter voiced concern about the measure's reliability, particularly at lower case counts, the decision to not include social risk

adjustment, and whether the performance variation was sufficient to adequately distinguish performance.

Committee Response:
The Standing Committee notes the concerns raised. However, the comment does not provide additional concerns or information that would require a revote on the evaluation criteria.

Measure Steward/Developer Response:
RELIABILITY
In the testing attachment for this measure, we provided both split sample and signal-to-noise reliability. Both the split-sample reliability and signal-to noise reliability results indicate sufficient measure score reliability. Both measures were deemed scientifically acceptable by both the Scientific Methods Panel and the Standing Committee.
As a metric of agreement, we calculated the ICC for hospitals with 25 admissions or more. Using the Spearman-Brown prediction formula, the agreement between the two independent assessments of the RSMR for each hospital was 0.524. The split-sample reliability score represents the lower bound of estimate of the true measure reliability. We calculated the signal-to-noise reliability score for each hospital with at least 25 admissions. We also calculated the signal-to-noise reliability score for each hospital with at least 25 admissions. The median reliability score was 0.87; the 25th and 75th percentiles were 0.74 and 0.94, respectively.
SOCIAL RISK FACTOR ADJUSTMENT
While there is a conceptual pathway by which patients with social risk factors could experience worse outcomes, the empiric evidence, and CMS's policy decision to adjust the measure at the payment/program level, do not support risk adjustment at the hospital level.
In our testing attachment we provided analyses showing that adjustment for social risk factors (dual eligibility and low AHRQ SES) did not have an appreciable impact on hospital measure scores: differences between adjusted and unadjusted measures scores were small, and correlations between adjusted and unadjusted measure scores were near 1. This suggests that existing clinical risk factors capture much of the risk related to social risk.
Importantly, we also found that both the patient-level and hospital-level dual eligibility, as well as low AHRQ SES Index effects, were significantly associated with THA/TKC readmission. The significance of the hospital-level effects indicates that if dual eligibility or low AHRQ SES Index variables were used to adjust for patient-level differences, then some of the differences between hospitals would also be adjusted for, potentially obscuring a signal of hospital quality.
In additional analyses we have examined the relationship between measure scores and the hospital-proportion of patients with social risk for the hospitals with the highest proportion of patients with social risk (the fifth quintile) and found that there is no significant correlation.
Given these empiric findings, and the recommendation from the Office of the Assistant Secretary for Planning and Evaluation (ASPE) that quality measures should not be adjusted for social risk factors (ASPE 2020), CMS chose not to adjust this measure for social risk factors at this time.
VARIATION IN MEASURE SCORE
The analyses submitting with our testing attachment show meaningful differences in performance and therefore substantial opportunity for improvement.
There are meaningful differences in the distribution – for example, hospitals in the 10th percentile are performing about 24% better than the average performer, and hospitals in the 90th percentile are performing about 20% worse than the average performer.
In addition, the median odds ratio (1.38) suggests a meaningful increase in the risk of

complications if a patient has a THA/TKA procedure at a higher-risk hospital compared to a lower-risk hospital. A value of 1.38 indicates that a patient has a 38% increase in the odds of a complications at a higher-risk hospital compared to a lower-risk hospital, indicating the impact of quality on the outcome rate. This variation suggests there remain differences in the quality of care received across hospitals for THA/TKA procedures. This evidence supports continued measurement to reduce the variation.

References:

Department of Health and Human Services, Office of the Assistant Secretary of Planning and Evaluation (ASPE). Second Report to Congress: Social Risk Factors and Performance in Medicare's Value-based Purchasing Programs. 2020; https://aspe.hhs.gov/system/files/pdf/263676/Social-Risk-in-Medicare%E2%80%99s-VBP-2nd-Report.pdf. Accessed May 4, 2021.

8. **Consensus Standards Approval Committee (CSAC) Vote: Y-X; N-X**
9. **Appeals**

NQF #1551 Hospital-Level 30-Day Risk-Standardized Readmission Rate (RSRR) Following Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA)

Submission

Description: The measure estimates a hospital-level risk-standardized readmission rate (RSRR) following elective primary THA and/or TKA in Medicare Fee-For-Service (FFS) beneficiaries who are 65 years and older. The outcome (readmission) is defined as unplanned readmission for any cause within 30 days of the discharge date for the index admission (the admission included in the measure cohort). A specified set of planned readmissions do not count in the readmission outcome.

Numerator Statement: The outcome for this measure is 30-day readmissions. We define readmissions as inpatient admissions for any cause, with the exception of certain planned readmissions, within 30 days from the date of discharge of the index hospitalization. If a patient has more than one unplanned admission (for any reason) within 30 days after discharge from the index admission, only one is counted as a readmission. The measure looks for a dichotomous yes or no outcome of whether each admitted patient has an unplanned readmission within 30 days. However, if the first readmission after discharge is considered planned, any subsequent unplanned readmission is not counted as an outcome for that index admission, because the unplanned readmission could be related to care provided during the intervening planned readmission rather than during the index admission.

Denominator Statement: The target population for the publicly reported measure includes admissions for Medicare FFS beneficiaries who are at least 65 years of age undergoing elective primary THA and/or TKA procedures.

Additional details are provided in S.9 Denominator Details.

Exclusions: The THA/TKA readmission measure excludes admissions for patients in the following categories:

1. Without at least 30 days post-discharge enrollment in FFS Medicare
2. Discharged against medical advice (AMA)
3. Admitted for the index procedure and subsequently transferred to another acute care facility
4. Had more than two THA/TKA procedure codes during the index hospitalization
5. Had THA/TKA admissions within 30 days of a prior THA/TKA index admission

Adjustment/Stratification: Statistical risk model

Level of Analysis: Facility

Setting of Care: Inpatient/Hospital

Type of Measure: Outcome

Data Source: Claims, Enrollment Data

Measure Steward: Centers for Medicare & Medicaid Services

STANDING COMMITTEE MEETING February 16, 2021

1. Importance to Measure and Report: The measure meets the Importance criteria.

(1a. Evidence, 1b. Performance Gap)

1a. Evidence: **Pass-17; No Pass-0 (denominator = 17)**; 1b. Performance Gap: **H-1; M-16; L-0; I-0 (denominator = 17)**

Rationale:

- As part of the previous submission in 2017, the developer included a logic model that suggested that improved communication between providers involved at care transitions, prevention of and response to complications, patient safety, coordinated transitions to the outpatient environment, medication reconciliation, patient education, and disease management strategies leads to improved patient outcomes by decreasing the risk of readmissions following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA). The developer included empirical data and references from various studies supporting this logic model.
- In this submission, the developer provided updated citations and references for the rationale for measure development.
- The Standing Committee noted the evidence was directionally the same yet stronger than the evidence for the previous maintenance submission.
- The developers provided three-year, hospital-level, risk standardized readmission rates (RSRR) from July 1, 2016 to June 30, 2019 using Medicare administrative claims data (n= 992,016 admissions) from 3,412 hospitals. The RSRRs have a mean of 4.0% and range from 2.5-9.0% in the study cohort. The median risk-standardized rate is 4.0%.
- The developer also provided disparities data on THA/TKA risk-standardized readmission rate (RSRR) across hospitals by proportion of patients with social risk (dual-eligible patients and AHRQ SES Index Scores).
- The Standing Committee questioned whether the performance gap was sufficient to justify continued active endorsement, with 98% of facilities performing no different than expected. The developer shared that CMS has criteria for the removal of topped out measures from its programs and that this measure does not meet CMS criteria for being topped out.
- The Standing Committee observed that there was an appropriate measure performance gap and did not express any further concerns.

2. Scientific Acceptability of Measure Properties: The measure meets the Scientific Acceptability criteria.

(2a. Reliability precise specifications, testing; 2b. Validity testing, threats to validity

2a. Reliability: **H-1; M-15; L-0; I-0 (denominator = 16, due to SMP member recusal)**; 2b. Validity: **H-0; M-15; L-1; I-0 (denominator = 16, due to SMP member recusal)**

Rationale:

- This measure was deemed as complex and scientific acceptability was evaluated by the NQF Scientific Methods Panel (SMP). A summary of the SMP's review is included below.
- The developers conducted two types of reliability testing. The developers estimated measure score level by calculating the intraclass correlation coefficient (ICC) using a split sample (i.e., test-retest) method, and then estimated the facility-level reliability (signal-to-noise reliability) using Adams' Method.
    - For signal-to-noise analysis, the developers reported a median reliability of 0.77, ranging from 0.29 to 0.99 and a mean of 0.72. The 25th and 75th percentiles were 0.58 and 0.88, respectively.
    - Using the Spearman-Brown prediction formula, the developers estimated that the agreement between the two independent assessments of the RSRR for each hospital with 25 admissions was 0.454.
- The SMP reviewers generally agreed the testing approach and results were acceptable. The SMP rated this measure moderate for reliability: H-2; M-5; L-1; I-0.
- The Standing Committee noted that the reliability discussion for NQF #1550 also applies to NQF #1551.

- In addition to questions and concerns raised for NQF #1550, a Standing Committee member questioned whether the measure could be expanded to even lower-volume hospitals to provide feedback on their performance.
- A CMS representative clarified that all hospitals are included in the measure calculations and receive feedback reports from CMS. They shared that CMS' goal is to assess as many hospitals as possible but that at very small numbers, one event influences the results, making it difficult to interpret results reliably.
- The Standing Committee expressed no further concerns. Because voting was conducted after the meeting using an online voting tool, the Standing Committee voted on the reliability criteria rather than on whether to accept the SMP's ratings.
- The developers conducted validity testing at the measure score level. The measure was compared to the Hospital Star Rating readmission group score, the Overall Hospital Star Rating, and Hospital THA/TKA Surgical Volume
    - The developers reported the correlation between THA/TKA RSRRs and Star-Rating readmissions score as -0.301, which suggests that hospitals with lower THA/TKA RSRRs are more likely to have higher Star-Rating readmission scores.
    - The developers reported the correlation between THA/TKA RSRRs and Star-Rating summary score is -0.239, which suggests that hospitals with lower THA/TKA RSRRs are more likely to have higher Star-Rating summary scores.
    - The developers reported the risk model discrimination and calibration as c statistic of 0.67. The developer reports good discrimination and predictive ability based on risk decile plot.
- The SMP reviewers generally accepted the validity testing results as an acceptable demonstration of validity. The SMP rated this measure moderate for validity: H-0; M-7; L-0; I-1.
- The Standing Committee noted that the entire validity discussion for NQF #1550 applies to NQF #1551 as well.
- In addition to comments shared for NQF #1550, the developer shared that for readmissions measures, such as this one, U.S. Congress has mandated that results be stratified into five categories by dual-eligible status.
- The Standing Committee expressed no further concerns. Because voting was conducted after the meeting using an online voting tool, the Standing Committee voted on the reliability criteria rather than on whether to accept the SMP's ratings.

3. Feasibility: H-3; M-13; L-1; I-0 (denominator = 17)

(3a. Clinical data generated during care delivery; 3b. Electronic sources; 3c. Susceptibility to inaccuracies/ unintended consequences identified 3d. Data collection strategy can be implemented)

Rationale:

- All the data elements for this measure originate from defined fields in electronic claims.
- The necessary data are coded by someone other than the person obtaining the original information.
- This measure uses administrative claims data and enrollment data and as such, it offers no data collection burden to hospitals or providers.
- The Standing Committee had no concerns regarding the feasibility of the measure.

4. Use and Usability

4a. Use; 4a1. Accountability and transparency; 4a2. Feedback on the measure by those being measured and others; 4b. Usability; 4b1. Improvement; 4b2. The benefits to patients outweigh evidence of unintended negative consequences to patients)

4a. Use: **Pass-17; No Pass-0 (denominator = 17)** *4b. Usability:* **H-0; M-17; L-0; I-0 (denominator = 17)**

Rationale:

- This measure is publicly reported on CMS' Care Compare website and used in CMS' Hospital Value-Based Purchasing (HVBP) Program.

- A Standing Committee member suggested providing context for the measure when it is publicly reported to help patients understand the impact and implication of a readmission. They also felt a low-volume indicator could be useful for the context of results.
- The developer provided information on their feedback loop for the measure, noting that CMS' QualityNet website gives facilities detailed patient-level results and benchmarks to assist in interpretation. The developer also maintains an email inbox for questions and feedback.
- Overall, the Standing Committee expressed no major concerns regarding use of the measure.
- The developers reported that the median hospital 30-day, all-cause, RSRR for the THA/TKA readmission measure for the 3-year period between July 1, 2016 and June 30, 2019 was 4.0%. The median RSRR decreased by 0.1 absolute percentage points from July 2016 – June 2017 (median RSRR: 4.0%) to July 2018 – June 2019 (median: RSRR: 3.9%).
- The developer noted that a potential unintended harm of this measure is that providers could inappropriately shift care, which could result in increased patient morbidity and mortality and other unintended consequences for patients. The developers monitor for this unintended consequence and have not seen any indications it is occurring.
- The Standing Committee did not express any concerns regarding usability of the measure.

5. **Related and Competing Measures**
   - This measure is related to the following measures:
     - NQF #1550 Hospital-Level Risk-Standardized Complication Rate (RSCR) Following Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA)
     - NQF #3493 Risk-Standardized Complication Rate (RSCR) Following Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA) for Merit-Based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
     - NQF #3474 Hospital-Level, Risk-Standardized Payment Associated With a 90-Day Episode of Care for Elective Primary Total Hip and/or Total Knee Arthroplasty (THA/TKA)
   - The developer stated that the measure specifications are harmonized to the extent possible. They noted that they focused on related outcome (mortality and readmissions) measures in their harmonization analysis. Their rationale for this was that clinical coherence of the measured cohort takes precedence over alignment with related non-outcome measures. They stated that many process measures are limited due to the broader patient exclusions necessary to examine only a specific subset of patients who are eligible for that measure (e.g., patients who receive a specific medication or undergo a specific procedure).
   - The Standing Committee discussed related and competing measures during the post-comment web meeting on June 1, 2021. The Standing Committee did not raise any additional concerns or questions.
6. **Standing Committee Recommendation for Endorsement**: **Yes-17; No-0 (denominator = 17)**
7. **Public and Member Comment**
   - NQF received one comment on this measure. The commenter voiced concern about the measure's reliability, particularly at lower case counts, the decision to not include social risk adjustment, and whether the performance variation was sufficient to adequately distinguish performance.

     Committee Response:

     The Standing Committee notes the concerns raised. However, the comment does not provide additional concerns or information that would require a revote on the evaluation criteria.

     Measure Steward/Developer Response:

     RELIABILITY

     In the testing attachment for this measure, we provided both split sample and signal-to-noise reliability. Both the split-sample reliability and signal-to noise reliability results indicate sufficient measure score reliability. Both measures were deemed scientifically acceptable by both the Scientific Methods Panel and the Standing Committee.

     As a metric of agreement, we calculated the ICC for hospitals with 25 admissions or more. Using

the Spearman-Brown prediction formula, the agreement between the two independent assessments of the RSMR for each hospital was 0.454. The split-sample reliability score represents the lower bound of estimate of the true measure reliability.
We also calculated the signal-to-noise reliability score for each hospital with at least 25 admissions. The median reliability score was 0.77; the 25th and 75th percentiles were 0.58 and 0.88, respectively.

SOCIAL RISK FACTOR ADJUSTMENT

While there is a conceptual pathway by which patients with social risk factors could experience worse outcomes, the empiric evidence, and CMS's policy decision to adjust the measure at the payment/program level, do not support risk adjustment at the hospital level.
In our testing attachment we provided analyses showing that adjustment for social risk factors (dual eligibility and low AHRQ SES) did not have an appreciable impact on hospital measure scores: differences between adjusted and unadjusted measures scores were small, and correlations between adjusted and unadjusted measure scores were near 1. This suggests that existing clinical risk factors capture much of the risk related to social risk.
Importantly, we also found that both the patient-level and hospital-level dual eligibility, as well as low AHRQ SES Index effects, were significantly associated with THA/TKC readmission. The significance of the hospital-level effects indicates that if dual eligibility or low AHRQ SES Index variables were used to adjust for patient-level differences, then some of the differences between hospitals would also be adjusted for, potentially obscuring a signal of hospital quality.
Finally, CMS adjusts for social risk (dual eligibility) within the Hospital Readmission Reduction Program (HRRP), which is consistent with recommendations from the Office of the Assistant Secretary for Planning and Evaluation (ASPE) that quality measures should not be adjusted for social risk factors (ASPE 2020). Given these empiric findings, ASPE's latest recommendations, and CMS' policy decision to adjust for social risk at the program/payment level, CMS chose not to adjust this measure for social risk factors at this time.

VARIATION IN MEASURE SCORE

The analyses submitting with our testing attachment show meaningful differences in performance and therefore substantial opportunity for improvement.
As presented in our submission form, the range of measure scores was 2.5%-9.0% with a mean of 4.0%. In addition, the median odds ratio of 1.25 suggests a meaningful increase in the risk of readmission if a patient is admitted with THA/TKA at a higher risk hospital compared to a lower risk hospital. A value of 1.25 indicates that a patient's risk of readmission is 25% greater in a higher-risk hospital than a lower-risk hospital. This variation in rates suggests there are differences in the quality of care received across hospitals performing THA/TKA procedures on Medicare FFS patients.

References:

Department of Health and Human Services, Office of the Assistant Secretary of Planning and Evaluation (ASPE). Second Report to Congress: Social Risk Factors and Performance in Medicare's Value-based Purchasing Programs. 2020; https://aspe.hhs.gov/system/files/pdf/263676/Social-Risk-in-Medicare%E2%80%99s-VBP-2nd-Report.pdf. Accessed May 4, 2021.

8. **Consensus Standards Approval Committee (CSAC) Vote: Y-X; N-X**
9. **Appeals**

NQF #3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery
Submission

Description: The STS Individual Surgeon Composite Measure for Adult Cardiac Surgery includes five major procedures (isolated CABG, isolated AVR, AVR+CABG, MVRR, MVRR+CABG) and comprises the following two domains:

Domain 1 – Risk-Adjusted Operative Mortality

Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Risk-Adjusted Major Morbidity

Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation,
2. Deep sternal wound infection,
3. Permanent stroke,
4. Renal failure, and
5. Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

All measures are based on audited clinical data collected in the STS Adult Cardiac Surgery Database. Individual surgeons with at least 100 eligible cases during the 3-year measurement window will receive a score for each domain and an overall composite score. In addition to calculating composite score point estimates with credible intervals, surgeons will be assigned rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Numerator Statement: Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes in detail this multiprocedural, multidimensional composite measure.

The STS Individual Surgeon Composite Measure for Adult Cardiac Surgery includes five major procedures, i.e., isolated coronary artery bypass grafting (CABG), isolated aortic valve replacement (AVR), AVR+CABG, isolated mitral valve repair or replacement (MVRR), and MVRR+CABG, and comprises the following two domains:

Domain 1 – Risk-Adjusted Operative Mortality

Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Risk-Adjusted Major Morbidity

Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation
2. Deep sternal wound infection
3. Permanent stroke
4. Renal failure and
5. Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons

Individual surgeons with at least 100 eligible cases during the 3-year measurement window will receive a score for each domain and an overall composite score. In addition to calculating composite score point estimates with credible intervals, surgeons will be assigned rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated CABG, isolated AVR, AVR+CABG, isolated MVRR, and MVRR+CABG.

Time Window: 3 years

By including composite performance scores for a portfolio of five procedures that account for nearly 80% of a typical STS Adult Cardiac Surgery Database participant surgeon's clinical activity, this metric provides a more balanced and comprehensive perspective than focusing on just one procedure or one

end point. Recognizing that surgeons' practices vary, each surgeon's composite performance is implicitly "weighted" by the proportion of each type of procedure he or she performs. For instance, the results of surgeons who primarily perform mitral procedures are affected most by their mitral surgery results. This approach is especially relevant for surgeons with highly specialized practices who may do relatively few isolated CABG procedures and whose performance would thus be difficult to assess using a CABG measure only. Finally, performance on each of these procedures is estimated using risk models specific to those procedures, in most cases the exact or slightly modified versions of previously published models (references provided below).

Final Composite Score:

The overall composite score was calculated as a weighted sum of (1 minus risk-adjusted mortality rate) and (1 minus risk-adjusted major morbidity rate). Mortality and morbidity rates were weighted inversely by their respective standard deviations across surgeons. This procedure is equivalent to first rescaling mortality and morbidity rates by their respective standard deviations across surgeons and then assigning equal weighting to the rescaled mortality rate and rescaled morbidity rate. Standard deviations derived from the data were used to define the final composite measure as 0.81 x (1 minus risk-standardized mortality rate) + 0.19 x (1 minus risk-standardized complication rate).

Details regarding the current STS adult cardiac surgery risk models can be found in the following manuscripts:

- Shahian DM, O'Brien SM, Filardo G, Ferraris VA, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 1--coronary artery bypass grafting surgery. Ann Thorac Surg. 2009 Jul;88(1 Suppl):S2-22.
- O'Brien SM, Shahian DM, Filardo G, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 2—isolated valve surgery. Ann Thorac Surg 2009;88(1 Suppl):S23–42.
- Shahian DM, O'Brien SM, Filardo G, Ferraris VA, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 3--valve plus coronary artery bypass grafting surgery. Ann Thorac Surg 2009 Jul;88(1 Suppl):S43-62.

Additional details regarding the Individual Surgeon Composite Measure for Adult Cardiac Surgery are provided in the attached manuscript:

Shahian DM, He X, Jacobs JP, Kurlansky PA, Badhwar V, Cleveland JC Jr, Fazzalari FL, Filardo G, Normand SL, Furnary AP, Magee MJ, Rankin JS, Welke KF, Han J, O'Brien SM. The Society of Thoracic Surgeons Composite Measure of Individual Surgeon Performance for Adult Cardiac Surgery: A Report of The Society of Thoracic Surgeons Quality Measurement Task Force. Ann Thorac Surg. 2015;100:1315-25.

Denominator Statement: See response in S.4. Numerator Statement

Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated CABG, isolated AVR, AVR+CABG, isolated MVRR, and MVRR+CABG.

Exclusions: Measure exclusions: Individual surgeons who do not meet the minimum case requirement (i.e., at least 100 eligible cases during the 3-year measurement window) will not receive a score for each domain and an overall composite score.

Adjustment/Stratification: Statistical risk model

Level of Analysis: Clinician : Individual

Setting of Care: Inpatient/Hospital

Type of Measure: Composite

Data Source: Registry Data

Measure Steward: The Society of Thoracic Surgeons

STANDING COMMITTEE MEETING February 12, 2021

1. Importance to Measure and Report: <u>The measure meets the Importance criteria.</u>

(1a. Evidence, 1b. Performance Gap)

1a. Evidence: **Pass-18; No Pass-0 (denominator = 18)**; 1b. Performance Gap: **H-2; M-16; L-0; I-0 (denominator = 18);** 1c. Composite – Quality Construct and Rationale: **H-5; M-12; L-0; I-0 (denominator = 17)**

Rationale:

- As part of the previous submission in 2016, the developer provided information regarding services and/or care that a provider can undertake to influence mortality and each of the five morbidities included in this composite.
- The developer attested to no changes to the evidence for this submission.
- The Standing Committee agreed the evidence is unchanged and sufficient to tie the components of this composite to patient outcomes.
- The developer provided composite measure results for patients undergoing cardiac surgery during a three-year period, January 2017 – December 2019. The developer included surgeons with at least 10 eligible records during the study period in the hierarchical model for estimating composite scores and noted that while surgeons with 10 eligible cases are included in the hierarchical model procedure, composite scores will typically only be reported by the STS for surgeons with at least 100 cases during a three-year time period. The developer did not provide performance gap information for the individual component measures.
- The developer reports that 9.52% of surgeons with >100 cases (n = 1,841 surgeons with 584,571 operations) have lower than expected performance on the measure based on 98% Bayesian credible interval. In comparison, 9.51% of surgeons with >10 cases (n = 2,098 surgeons with 600,207 operations) have lower than expected performance.
- The developer provided disparities data via public comment, using logistic regression to study the associations of race, ethnicity, and insurance status with operative mortality and major morbidity. The only significant associations (p-value <.0001) were major morbidity and Medicare or Medicaid (for patients age <65 vs. commercial-HMO for patients age <65) and major morbidity and Black race.
- The Standing Committee had no issues or questions related to performance gap.
- The developer noted that this measure is based on a combination of risk-adjusted mortality and risk-adjusted major complications. To assess overall quality, the composite comprises two domains:
    - Domain 1 is risk-adjusted operative mortality (before hospital discharge or within 30 days of operation) for isolated coronary artery bypass grafting (CABG), isolated aortic valve replacement (AVR), AVR+CABG, isolated mitral valve repair or replacement (MVRR), and MVRR+CABG. This domain is calculated as a single measure.
    - Domain 2 is risk-adjusted major morbidity, which is an "any or none" measure of the following complications: (1) prolonged ventilation; (2) deep sternal wound infection; (3) permanent stroke; (4) renal failure; and (5) reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.
- The developer states that the domains are rescaled by their respective standard deviation across surgeons and then assigned equal weighting to the rescaled rates. Using standard deviations derived from the data, the final composite measure is 0.81 x (1 minus risk-standardized mortality rate) + 0.19 x (1 minus risk-standardized complication rate).
- The developer's rationale for the composite is that differentiating performance based on mortality alone fails to account for the fact that not all operative survivors received equal quality care. By combining results from five of the most frequently performed procedures and risk-adjusted occurrences of any of the five major complications, this composite provides a more comprehensive quality assessment that should help surgeons identify potential areas for improvement. By aggregating the surgeries and rates, the composite yields a more comprehensive view of surgeon performance, which may be more useful for accountability purposes.
- The Standing Committee had no issues or questions related to composite construct and rationale.

2. Scientific Acceptability of Measure Properties: The measure meets the Scientific Acceptability criteria.

(2a. Reliability - precise specifications, testing; 2b. Validity - testing, threats to validity
2a. Reliability: **H-8; M-9; L-0; I-0 (denominator = 17)**; 2b. Validity: **H-2; M-15; L-0; I-0 (denominator = 17);** 2c. Composite Quality Construct**: H-5; M-12; L-0; I-0 (denominator = 17)**

Rationale:

- To demonstrate reliability, the developer conducted composite-score-level signal-to-noise analysis. They utilized a Bayesian approach to generate possible values for each surgeon's score and then estimated the true values by conducting Markov Chain Monte Carlo simulations. The data used in the simulation originated from a three-year period of July 2011 – June 2014, which is rather dated. The developer included results for a range of case counts and indicated that they intend to use a 100-case threshold for public reporting.
- The results of the reliability analysis range from a reliability of 0.77 (95% Prl 0.75 – 0.79) for 10 index cases to 0.82 (95% Prl 0.81 – 0.84) for 200 cases. At the planned public reporting threshold of 100 index cases, the reliability is 0.81 (95% Prl 0.79 – 0.82).
- The Standing Committee noted that the reliability testing methodology for this measure was very sophisticated and expressed appreciation for the innovative technique. They had no concerns with the reliability of the measure.
- The developer examined measure score validity using known-group analysis. Using data from July 2011 – June 2014, the surgeons were divided into three groups as follows:
    - Surgeons were labeled as having higher-than-expected performance if the 98% credible interval surrounding a surgeon's composite score fell entirely above the overall STS average composite score.
    - Surgeons were labeled as having lower-than-expected performance if the 98% credible interval surrounding a surgeon's composite score fell entirely below the overall STS average composite score.
    - Surgeons were labeled as higher-than-expected performance (3 stars), lower-than-expected performance (1 star), and indistinguishable from the average or as-expected performance (2 stars).
- Mortality (domain 1) and morbidity (domain 2) scores were then compared for each group of surgeons.
- The developers reported that compared to surgeons receiving 1 star, those with 3 stars had lower risk-adjusted mortality (1.2% vs. 4.2%) and lower risk-adjusted morbidity (8.8% vs. 22.6%) during July 2011 – June 2014. Thus, the differences in performance were clinically meaningful as well as statistically significant. STS surgeons deemed better by the composite scores have (on average) higher performance during the same time window on each individual domain of the composite measure.
- The Standing Committee expressed concerns with the circular reasoning in the validity testing, which compared performance on the composite component measures to the overall composite score. The developer shared that there are no external comparisons available for this measure.
- The developer indicated that they calculate a risk score for operative mortality and major complications for each patient and use these patient-level scores to adjust for case mix. The scores were calculated using existing and modified risk models from the measures on which this measure is based. Calculating a risk score using this method limited the number of baseline covariates to a feasible number.
- The developer stated that they validated this risk approach by performing sensitivity analyses comparing each surgeon's risk-adjusted mortality and complication rates in models adjusting for 41 and 47 individual covariates with models adjusting for a single composite risk score.
- A Standing Committee member asked for the rationale for including race in the clinical risk model. The developer shared that the model fit suffers if race is not included and while the exact mechanism is unclear, they suspect a genetic component is at work that contributes to poorer outcomes for non-White patients. They also shared that they are working on adding geocoding to patient records in the registry to allow for more exploration of the impact of social risk factors.
- The Standing Committee accepted the measure as valid.
- The developer used Pearson correlations to verify that each of the two domains of the measure contribute statistical information but do not dominate the composite. Data from July 2011 – June 2014 were used for the calculation. Results were 0.73 for mortality domain versus overall composite measure and 0.92 for morbidity domain score versus overall score. The developers interpret this to mean that risk-adjusted morbidity explains more of the variation in the overall composite score but does not dominate the score.
- The overall composite score was calculated as a weighted sum of (1 minus risk-adjusted mortality rate) and (1 minus risk-adjusted major morbidity rate). Mortality and morbidity rates

were weighted inversely by their respective standard deviations across surgeons. Standard deviations derived from the data were used to define the final composite measure as 0.81 × (1 minus risk-standardized mortality rate) + 0.19 × (1 minus risk-standardized complication rate).
- Weighting was assessed by an Expert Panel. It was consistent with the panel's clinical assessment of each domain's relative importance. The developer stated that a one percentage point change in a surgeon's risk-adjusted mortality rate has the same impact on the overall score as a 4.3 percentage point change in the site's risk-adjusted morbidity rate.
- The Standing Committee had no issues or questions regarding the composite construct.

3. Feasibility: H-4; M-12; L-1; I-0 (denominator = 17)

(3a. Clinical data generated during care delivery; 3b. Electronic sources; 3c. Susceptibility to inaccuracies/ unintended consequences identified 3d. Data collection strategy can be implemented)

Rationale:
- The required data elements are collected and used by healthcare personnel during the provision of care and abstracted from a record by someone other than person obtaining original information. Some data elements are available through electronic sources. Local availability of data elements varies from full electronic health record (EHR) capability to no availability; however, all data elements are submitted to the STS database in an electronic format following a standard set of data specifications.
- STS Adult Cardiac Surgery Database participants (single or group of surgeons) pay annual participant fees of $3,500 if the majority of surgeons in the group are STS members and $4,750 if the majority are not STS members. In addition, there is a fee of $150 per member and $350 per non-member for surgeons listed on the database's Participation Agreement. STS analyses indicated that the STS database includes more than 90% of cardiothoracic programs in the U.S. There are no additional costs for data collection specific to the measure.
- The Standing Committee had no concerns regarding the feasibility of the measure.

4. Use and Usability

4a. Use; 4a1. Accountability and transparency; 4a2. Feedback on the measure by those being measured and others; 4b. Usability; 4b1. Improvement; 4b2. The benefits to patients outweigh evidence of unintended negative consequences to patients)

4a. Use: **Pass-17; No Pass-0 (denominator = 17)** *4b. Usability:* **H-2; M-14; L-0; I-1 (denominator = 17)**

Rationale:
- This measure was initially endorsed in 2017. It is not currently used in an accountability program. The developer provided plans for a path to public reporting, possibly as soon as this year. The developer stated that concerns regarding the confidentiality and formatting of surgeon-level results delayed distribution of confidential surgeon-level feedback reports until January 2020. Providing a private review period of measure results prior to public reporting is a best practice. The developer has a strong record of publicly reporting measure results.
- The developer shared that of the 2,098 surgeons who met the completeness and minimum procedure thresholds, 1,841 performed at least 100 eligible cases within the three-year measurement period. Of this subset of surgeons, approximately 400 opted in for receipt of their confidential, surgeon-level performance results in January 2020. The report includes overall results, results by domain, benchmarks, and information on how to interpret the results.
- A Standing Committee member asked for clarification on the use criterion, which requires a maintenance measure to be in an accountability program within three years of its initial endorsement.
- NQF staff explained that given the developer's strong track record of publicly reporting its measures, staff determined that the plan for publicly reporting the measure this year was highly credible and that the measure would be in an accountability program soon, likely before the completion of this endorsement cycle.
- The Standing Committee accepted this rationale and voted to pass the measure on use.
- The developer stated that they are unable to provide performance trends as performance data on this measure was only first distributed the consenting surgeons in January 2020.
- As a proxy for trend data on this measure, the developer provided 10 years of star rating trends for the five procedures aggregated within the composite. There is a general trend of reduction in participants receiving one or three stars and an increase in participants receiving two stars.

The developer stated that this is consistent with their performance improvement goal of reducing variation.
- The developer identified that potential harms related to the use of this measure include gaming and risk aversion. The developer stated that they control these through a careful audit process and a robust risk-adjustment methodology.
- The Standing Committee had no concerns regarding the usability of this measure.

5. **Related and Competing Measures**

   The developers identified the following related measures:
   - NQF #0696 STS CABG Composite
   - NQF #2561 Aortic Valve Replacement Composite Score
   - NQF #2563 Aortic Valve Replacement + CABG Composite Score
   - NQF #3031 Mitral Valve Repair/Replacement Composite Score
   - NQF #3032 Mitral Valve Repair/Replacement + CABG Composite Score
   - The developer stated that the measure specifications have been harmonized to the extent possible.
   - The Standing Committee discussed related and competing measures during the post-comment web meeting on June 1, 2021. The Standing Committee did not raise any additional concerns or questions.
6. **Standing Committee Recommendation for Endorsement**: **Y-17**; **N-0 (denominator = 17)**
7. **Public and Member Comment**

   NQF received one comment for this measure, correcting a typographical error in the submission materials.
8. **Consensus Standards Approval Committee (CSAC) Vote: Y-X; N-X**
9. **Appeals**

NQF #3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Submission | Specifications

Description: The STS Mitral Valve Repair/Replacement (MVRR) Composite Score measures surgical performance for isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD). To assess overall quality, the STS MVRR Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation,
2. Deep sternal wound infection,
3. Permanent stroke,
4. Renal failure, and
5. Reoperations for bleeding, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Outcome data are collected on all patients and from all participants. For optimal measure reliability, participants meeting a volume threshold of at least 36 cases over 3 years (i.e., approximately one mitral case per month) receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Numerator Statement: Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.

The STS Mitral Valve Repair/Replacement (MVRR) Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation
2. Deep sternal wound infection
3. Permanent stroke
4. Renal failure and
5. Reoperations for bleeding, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD).

Time Window: 3 years

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 36 isolated MVRR procedures in the patient population.

Estimation of Composite Scores and Star Ratings: The statistical methodology used to estimate the STS MVRR composite score and star rating for each participant site was similar to that used for the STS isolated CABG, isolated AVR, and AVR+CABG measures. As with previous composite scores, we first translated risk-standardized event rates into risk-standardized absence of event rates so that a higher score indicated better performance. We then rescaled the morbidity and mortality domains by dividing by their respective standard deviations and then added the two domains together.

Denominator Statement: See response in S.4. Numerator Statement for complete description of measure specifications.

Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD).

Exclusions: Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 36 isolated MVRR procedures in the patient population.

Adjustment/Stratification: Statistical risk model

Level of Analysis: Facility, Clinician : Group/Practice

Setting of Care: Inpatient/Hospital

Type of Measure: Composite

Data Source: Registry Data

Measure Steward: The Society of Thoracic Surgeons

STANDING COMMITTEE MEETING February 12, 2021

1. Importance to Measure and Report: The measure meets the Importance criteria.

(1a. Evidence, 1b. Performance Gap)

1a. Evidence: **Pass-16; No Pass-0 (denominator = 16)**; 1b. Performance Gap: **H-1; M-16; L-0; I-0 (denominator = 17);** 1c. Composite - Quality Construct and Rationale: **H-3; M-14; L-0; I-0 (denominator = 17)**

Rationale:

- As part of the previous submission in 2016, the developer provided information regarding services and/or care that a provider can undertake to influence mortality and each of the five morbidities included in this composite.
- The developer attested to no changes to the evidence for this submission.
- The Standing Committee agreed the evidence is unchanged and sufficient to tie the components of this composite to patient outcomes.
- The developer provided the distribution of results for this measure from two consecutive time periods, January 2016 – December 2018 and January 2017 – December 2019, for registry participants with at least 36 eligible cases.

Category	Jan 2016 – Dec 2018	Jan 2017 – Dec 2019
# of Participants	458	450
# Operations	57,114	57,373
Mean	0.938	0.942
STD	0.0149	0.01487
IQR	0.0196	0.0178
0%	0.881	0.871
10%	0.919	0.922
20%	0.926	0.932
30%	0.932	0.936
40%	0.937	0.940
50%	0.940	0.944
60%	0.944	0.950
70%	0.947	0.950
80%	0.950	0.954
90%	0.955	0.958
100%	0.972	0.974

The developer provided disparities data presented by domain for insurance status, race, and ethnicity. The only significant association (p-value <.0001) was major morbidity and Black race.

Risk-adjusted odds ratios

Insurance Status	Mortality Adjusted Odd Ratio (95% CI)	p-value	Major Morbidity Adjusted Odd Ratio (95%CI)	p-value
Insurance status among patients age >= 65 Medicare without Medicaid/Commercial-HNO	Ref	*	Ref	*
Insurance status among patients age >= 65 Medicare + Medicaid dual eligible	0.73 (0.55, 0.97)	0.0298	1.07 (0.92, 1.24)	0.3701

Insurance Status	Mortality Adjusted Odd Ratio (95% CI)	p-value	Major Morbidity Adjusted Odd Ratio (95%CI)	p-value
Insurance status among patients age >= 65 Medicare + Commercial-HMO without Medicaid	0.83 (0.72, 0.96)	0.0118	1.00 (0.93, 1.08)	0.9651
Insurance status among patients age >= 65 Commercial-HMO without Medicare	1.01 (0.79, 1.30)	0.9101	0.99 (0.87, 1.13)	0.8680
Insurance status among patients age < 65 Commercial-HMO without Medicare/Medicaid	Ref	*	Ref	*
Insurance status among patients age < 65 Medicare or Medicaid	1.09 (0.91, 1.30)	0.3340	1.14 (1.05, 1.23)	0.0016
Insurance status among patients age < 65 None/Self Paid	1.11 (0.78, 1.59)	0.5700	0.94 (0.80, 1.09)	0.4055
Insurance status among patients age < 65 Other	1.13 (0.76, 1.70)	0.5387	0.98 (0.81, 1.18)	0.8101
Black race	0.82 (0.70, 0.97)	0.0240	**1.19 (1.09, 1.29)**	**<.0001**
Hispanic ethnicity	0.85 (0.70, 1.04)	0.1246	1.01 (0.90, 1.13)	0.8454

*Cell left intentionally blank

- The Standing Committee had no issues or questions related to performance gap.
- The developer's rationale for the composite is that differentiating performance based on mortality alone fails to account for the fact that not all operative survivors received equal quality care. By combining results of risk-adjusted mortality and the risk-adjusted occurrence of any of the five major complications, this composite provides a more comprehensive quality assessment that should help participants identify potential areas for improvement. By aggregating the surgeries and rates, the composite yields a more comprehensive view of participant performance, which may be more useful for accountability purposes.
- The developer noted that this measure is constructed using two domains:
    - Domain 1 is the absence of operative mortality (before hospital discharge or within 30 days of operation) for patients undergoing MVRR. This domain is calculated as a single measure.
    - Domain 2 is the absence of major morbidity, which is a "none or any" measure of the following complications: (1) prolonged ventilation; (2) deep sternal wound infection; (3)

permanent stroke; (4) renal failure; and (5) reoperations for bleeding, prosthetic or native valve dysfunction, or other cardiac reasons, but not for other non-cardiac reasons.

- The developer stated that the domains are rescaled by their respective standard deviation across surgeons and then assigned equal weighting to the rescaled rates. After the rescaling, the relative weights were 0.74 for mortality and 0.26 for morbidity. The developer stated that this weighting was consistent with their Expert Panel's clinical assessment of each domain's relative importance.

The Standing Committee had no issues or questions related to composite construct and rationale.

2. Scientific Acceptability of Measure Properties: <u>The measure meets the Scientific Acceptability criteria.</u>

(2a. Reliability - precise specifications, testing; 2b. Validity - testing, threats to validity

2a. Reliability: **H-1; M-16; L-0; I-0 (denominator = 17)**; 2b. Validity: **H-1; M-16; L-0; I-0 (denominator = 17)**; 2c. Composite Quality Construct: **H-3; M-14; L-0; I-0 (denominator = 17)**

Rationale:

- The developer conducted one set of testing for clinician group and facility. For the adult cardiac database, 92% of the participants are surgical groups with a one-to-one relationship to an individual facility.
- To demonstrate reliability, the developer conducted composite-score-level signal-to-noise analysis. They utilized a Bayesian approach to generate possible values for each participant's score and then estimated the true values by conducting Markov Chain Monte Carlo simulations. The data used in the simulation are from a three-year period of July 2011 – June 2014, which is rather dated. The developer included results for a range of case counts and indicated that they use a 36-case threshold for public reporting.
- The results of the reliability analysis range from a reliability of 0.55 (95% Prl 0.49 – 0.60) for 25 index cases to 0.69 (95% Prl 0.62 – 0.76) for 100 cases. At the planned public reporting threshold of 36 index cases, the reliability is 0.58 (95% Prl 0.52 – 0.64).
- The Standing Committee noted that this measure submission is very similar to the submission for NQF #3030. The Standing Committee agreed that the discussion for that measure applied to this measure as well and did not need to be repeated.
- The Standing Committee had no concerns with the reliability of the measure.
- The developer examined measure score validity using known-group analysis. Participants were divided into three groups as follows:
    - Participants were labeled as having higher-than-expected performance if the 95% credible interval surrounding a participant's composite score fell entirely above the overall STS average composite score.
    - Participants were labeled as having lower-than-expected performance if the 95% credible interval surrounding a participant's composite score fell entirely below the overall STS average composite score.
    - Participants were labeled as higher-than-expected performance (3 stars), lower-than-expected performance (1 star), and indistinguishable from the average or as-expected performance (2 stars).
- Mortality (domain 1) and morbidity (domain 2) scores were then compared for each group of participants.
- The developers reported that compared to participants receiving 1 star, those with 3 stars had lower risk-adjusted mortality (1.2% vs. 6.8%) and lower risk-adjusted morbidity (11.4% vs. 31.2%) during the period of July 2011 – June 2014. Thus, differences in performance were clinically meaningful as well as statistically significant. STS participants deemed better by the composite scores have (on average) higher performance during the same time window on each individual domain of the composite measure.
- The developers also examined measure score validity using predictive validity/stability of measure score results over time. Stability could be considered a test of reliability versus a test of validity of a measure. This methodology has been accepted to demonstrate validity in previous submissions.

- For the data periods of July 2011 – June 2014 and July 2012 – June 2015, the Pearson correlation between composite scores was 0.83.
- To adjust for case mix in this measure, the developer modified and re-estimated the previously published 2008 STS isolated valve model. The need for modification was due to broader inclusion criteria for this measure and to account for the major morbidity component.
- The bootstrap-adjusted estimated c-statistic was 0.746 for the morbidity model and 0.807 for the mortality model. The developer interprets this to demonstrate well-calibrated risk models with good discrimination power.
- The Standing Committee accepted the measure as valid.
- The developer used Pearson correlations to verify that each of the two domains of the measure contribute statistical information but do not dominate the composite. Data from July 2011 – June 2014 were used for the calculation. The results were 0.74 for mortality domain versus overall composite measure and 0.89 for morbidity domain score versus overall score. The developers interpreted this to mean that risk-adjusted morbidity explains more of the variation in the overall composite score but does not dominate the score.
- The developer stated that the domains were rescaled by dividing their respective standard deviation across STS participants and then added together. After the rescaling, the relative weights were 0.74 for mortality and 0.26 for morbidity.
- Weighting was assessed by an Expert Panel. It was consistent with the panel's clinical assessment of each domain's relative importance. The developer states that a one percentage point change in a participant's risk-adjusted mortality rate has the same impact on the overall score as a 2.8 percentage point change in the site's risk-adjusted morbidity rate.
- The Standing Committee had no issues or questions regarding the composite construct.

3. Feasibility: H-6; M-10; L-1; I-0 (denominator = 17)

(3a. Clinical data generated during care delivery; 3b. Electronic sources; 3c. Susceptibility to inaccuracies/ unintended consequences identified 3d. Data collection strategy can be implemented)

Rationale:

- The required data elements are collected and used by healthcare personnel during the provision of care and abstracted from a record by someone other than the person obtaining the original information. Some data elements are available through electronic sources. Local availability of data elements varies from full electronic health record (EHR) capability to no availability; however, all data elements are submitted to the STS database in an electronic format following a standard set of data specifications.
- STS Adult Cardiac Surgery Database participants (single or group of surgeons) pay annual participant fees of $3,500 if the majority of surgeons in the group are STS members and $4,750 if the majority are not STS members. In addition, there is a fee of $150 per member and $350 per non-member for surgeons listed on the database's Participation Agreement. STS analyses indicated that the STS database includes more than 90% of cardiothoracic programs in the U.S. There are no additional costs for data collection specific to the measure.
- The Standing Committee had no concerns regarding the feasibility of the measure.

Stars	2019	2018	2017
*	1.85	2.41	3.64
**	91.81	87.06	85.65
***	6.34	10.53	10.71

- The developer identified the potential harms related to the use of this measure: gaming and risk aversion. The developer stated that they control these through a careful audit process and a robust risk-adjustment methodology.
- The Standing Committee had no concerns regarding the usability of this measure.

4. Use and Usability

4a. Use; 4a1. Accountability and transparency; 4a2. Feedback on the measure by those being measured and others; 4b. Usability; 4b1. Improvement; 4b2. The benefits to patients outweigh evidence of unintended negative consequences to patients)

4a. Use: Pass-17; No Pass-0 (denominator = 17) 4b. Usability: H-1; M-16; L-0; I-0 (denominator = 17)

Rationale:

The composite is publicly reported through the STS Public Reporting Program.

All Adult Cardiac Surgery Database participants receive quarterly feedback reports providing a detailed analysis of the participant's performance, including benchmarking. Dashboard-type reporting on STS.org has been provided for real-time, online data updates to STS surgeon members. Participants also have access to a guide to help interpret performance results.

- The Standing Committee had no questions or issues regarding use of the measure.
- The developer stated there has been a decrease in 1-star and 3-star ratings over time, which they stated is consistent with their quality goal of reducing variation among participants.

5. **Related and Competing Measures**

   The developers identified the following related measures:

   - NQF #0696 STS CABG Composite
   - NQF #2561 Aortic Valve Replacement Composite Score
   - NQF #2563 Aortic Valve Replacement + CABG Composite Score
   - NQF #3032 Mitral Valve Repair/Replacement + CABG Composite Score

   - The identified measures are all developed by STS and the developer indicated that they are harmonized.
   - The Standing Committee will discuss related and competing measures during the post-comment web meeting on June 1, 2021. The Standing Committee did not highlight any comments or concerns.

6. **Standing Committee Recommendation for Endorsement**: **Yes-17; No-0 (denominator = 17)**
7. **Public and Member Comment**

NQF did not receive any public or member comments for this measure.

8. **Consensus Standards Approval Committee (CSAC) Vote: Y-X; N-X**
9. **Appeals**

NQF #3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Submission

Description: The STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score measures surgical performance for MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF). To assess overall quality, the STS MVRR +CABG Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation,
2. Deep sternal wound infection,
3. Permanent stroke,
4. Renal failure, and
5. Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Outcome data are collected on all patients and from all participants. For optimal measure reliability, participants meeting a volume threshold of at least 25 cases over 3 years receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Numerator Statement: Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.

The STS Mitral Valve Repair/Replacement (MVRR) Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation,
2. Deep sternal wound infection,
3. Permanent stroke,
4. Renal failure, and
5. Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Patient Population: The analysis population consists of patients aged 18 years or older who MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF).

Time Window: 3 years

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 25 MVRR + CABG procedures in the patient population.

Estimation of Composite Scores and Star Ratings:

To be consistent with the conventions of previous composite measures, risk-adjusted event rates were first converted into risk-adjusted absence-of-event rates. To calculate the composite, participant-specific absence of mortality rates and absence of morbidity rates were weighted inversely by their respective standard deviations across participants. This procedure was equivalent to first rescaling the absence of mortality rates and absence of morbidity rates by their respective standard deviations across participants, and then assigning equal weighting to the rescaled rates. Finally, in order to draw statistical inferences about participant performance, a Bayesian credible interval surrounding each participant's composite score was calculated. Unlike frequentist confidence intervals, Bayesian credible intervals have an intuitively direct interpretation as an interval containing the true value of the composite score with a specified probability (e.g., 95%). To determine star ratings for each participant, the credible interval of its composite score was compared with the STS average. Participants whose intervals were entirely above the STS average were classified as 3-star (higher than expected performance), and participants whose intervals were entirely below the STS average were classified as1-star (lower than expected

performance). Credible intervals based on different probability levels (90%, 95%, 98%) were explored, and the resulting percentages of 1, 2, and 3-star programs were calculated.

Denominator Statement: See response in S.4. Numerator Statement for complete description of measure specifications.

Patient Population: The analysis population consists of patients aged 18 years or older who MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF).

Exclusions: Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 25 MVRR + CABG procedures in the patient population.

Adjustment/Stratification: Statistical risk model

Level of Analysis: Facility, Clinician : Group/Practice

Setting of Care: Inpatient/Hospital

Type of Measure: Composite

Data Source: Registry Data

Measure Steward: The Society of Thoracic Surgeons

STANDING COMMITTEE MEETING February 12, 2021

1. Importance to Measure and Report: The measure meets the Importance criteria.

(1a. Evidence, 1b. Performance Gap)

1a. Evidence: **Pass-17; No Pass-0 (denominator = 17)**; 1b. Performance Gap: **H-1; M-16; L-0; I-0 (denominator = 17)**; 1c. Composite - Quality Construct and Rationale: **H-3; M-14; L-0; I-0 (denominator = 17)**

Rationale:

- As part of the previous submission in 2016, the developer provided information regarding services and/or care that a provider can undertake to influence mortality and each of the five morbidities included in this composite.
- The developer attested to no changes to the evidence for this submission.
- The Standing Committee agreed the evidence is unchanged and sufficient to tie the components of this composite to patient outcomes.
- The developer provided the distribution of STS mitral valve repair/replacement (MVRR) + CABG measure results from two consecutive time periods, January 2016 – December 2018 and January 2017 – December 2019 for registry participants with at least 25 eligible cases.

Category	Jan 2016 – Dec 2018	Jan 2017 – Dec 2019
# of Participants	289	272
# Operations	16,175	15,087
Mean	0.866	0.864
STD	0.02745	0.02595
IQR	0.352	0.328
0%	0.741	0.768
10%	0.831	0.831
20%	0.845	0.844
30%	0.854	0.854
40%	0.863	0.861
50%	0.869	0.866
60%	0.875	0.871
70%	0.882	0.878
80%	0.889	0.885
90%	0.897	0.894
100%	0.936	0.921

The developer provided disparities data presented by domain for insurance status, race, and ethnicity. The only significant association (p-value <.0001) was major morbidity and Black race.

Risk-adjusted odds ratios

Insurance status	Mortality Adjusted Odd Ratio (95% CI)	p-value	Major Morbidity Adjusted Odd Ratio (95%CI)	p-value
Insurance status among patients age >= 65 Medicare without Medicaid/Commercial-HNO	Ref	*	Ref	*
Insurance status among patients age >= 65 Medicare + Medicaid dual eligible	0.94 (0.71, 1.24)	0.6578	0.81 (0.68, 0.98)	0.0287
Insurance status among patients age >= 65 Medicare + Commercial-HMO without Medicaid	0.97 (0.84, 1.13)	0.7131	0.98 (0.90, 1.07)	0.6597
Insurance status among patients age >= 65 Commercial-HMO without Medicare	0.84 (.064, 1.09)	0.1880	1.04 (0.88, 1.22)	0.6680
Insurance status among participant age < 65 Commercial-HMO without Medicare/Medicaid	Ref	*	Ref	*
Insurance status among participant age < 65 Medicare or Medicaid	1.17 (0.96, 1.42)	0.1265	1.09 (0.98, 1.22)	0.1148
Insurance status among participant age < 65 None/Self Paid	0.97 (0.65, 1.45)	0.8796	1.02 (0.83, 1.25)	0.8393
Insurance status among participant age < 65 Other	1.23 (0.77, 1.97)	0.3833	1.00 (0.76, 1.31)	0.9743
Black race	0.91 (0.75, 1.11)	0.3471	1.28 (1.15, 1.43)	<.0001
Hispanic ethnicity	1.13 (0.92, 1.39)	0.2510	1.10 (0.97, 1.24)	0.1558

*Cell left intentionally blank

The Standing Committee had no issues or questions related to performance gap.

- The developer's rationale for the composite is that differentiating performance based on mortality alone fails to account for the fact that not all operative survivors received equal quality care. By combining the results of risk-adjusted mortality and the risk-adjusted occurrence of any of five major complications, this composite provides a more comprehensive quality assessment that should help participants identify potential areas for improvement. By aggregating the surgeries and rates, the composite yields a more comprehensive view of participant performance, which may be more useful for accountability purposes.

The developer notes that this measure is constructed using two domains:

  - Domain 1 is the absence of operative mortality (before hospital discharge or within 30 days of operation) for patients undergoing MVRR + CABG. This domain is calculated as a single measure.
  - Domain 2 is the absence of major morbidity, which is a "none or any" measure of the following complications: (1) prolonged ventilation; (2) deep sternal wound infection; (3) permanent stroke; (4) renal failure; and (5) re-operations for bleeding, prosthetic or native valve dysfunction, or other cardiac reasons, but not for other non-cardiac reasons.

- The developer stated that the domains were rescaled by dividing their respective standard deviation across STS participants and then added together. After the rescaling, the relative weights were 0.74 for mortality and 0.26 for morbidity. The developer stated that this weighting was consistent with their Expert Panel's clinical assessment of each domain's relative importance.
- The Standing Committee had no issues or questions related to composite construct and rationale.

2. Scientific Acceptability of Measure Properties: The measure meets the Scientific Acceptability criteria.

(2a. Reliability - precise specifications, testing; 2b. Validity - testing, threats to validity
2a. Reliability: **H-0; M-16; L-0; I-0 (denominator = 16)**; 2b. Validity: **H-0; M-16; L-0; I-0 (denominator = 16)**; 2c. Composite Quality Construct: **H-1; M-16; L-0; I-0 (denominator = 17)**

Rationale:

- The developer conducted one set of testing for clinician group and facility. For the adult cardiac database, 92% of the participants are surgical groups with a one-to-one relationship to an individual facility.
- To demonstrate reliability, the developer conducted composite-score-level signal-to-noise analysis. They utilized a Bayesian approach to generate possible values for each participant's score and then estimated the true values by conducting Markov Chain Monte Carlo simulations. The data used in the simulation are from a three-year period of July 2011 – June 2014, which is rather dated. The developer included results for a range of case counts and indicated that they intend to use a 25-case threshold for public reporting.
- The results range from a reliability of 0.42 (95% Prl 0.0.35 – 0.0.48) to 0.62 (95% Prl 0.52 – 0.70) for 50 cases. At the planned public reporting threshold of 25 index cases, the reliability is 0.0.50 (95% Prl 0.44 – 0.57).
- The Standing Committee had no questions or concerns regarding the reliability of the measure.
- The developer examined measure score validity using known-group analysis. Participants were divided into three groups as follows:
  - Participants were labeled as having higher-than-expected performance if the 95% credible interval surrounding a participant's composite score fell entirely above the overall STS average composite score.
  - Participants were labeled as having lower-than-expected performance if the 95% credible interval surrounding a participant's composite score fell entirely below the overall STS average composite score.

    - Participants were labeled as higher-than-expected performance (3 stars), lower-than-expected performance (1 star), and indistinguishable from the average or as-expected performance (2 stars).
- Mortality (domain 1) and morbidity (domain 2) scores were then compared for each group of participants.
- The developers reported that compared to participants receiving 1 star, those with 3 stars had lower risk-adjusted mortality (3.0% vs. 11.2%) and lower risk-adjusted morbidity (20.9% vs. 52.3%) during July 2011 – June 2014. Thus, differences in performance were clinically meaningful as well as statistically significant. STS participants deemed better by the composite scores have (on average) higher performance during the same time window on each individual domain of the composite measure.
- The developers also examined measure score validity using predictive validity/stability of the measure score results over time. Stability could be considered a test of reliability versus a test of validity of a measure. This methodology has been accepted to demonstrate validity in previous submissions.
- For the data periods of July 2011 – June 2014 and July 2012 – June 2015, the Pearson correlation between composite scores was 0.79.
- To adjust for case mix in this measure, the developer modified and re-estimated the previously published 2008 STS valve+CABG model. The need for modification was due to broader inclusion criteria for this measure and to account for the major morbidity component.
- The bootstrap-adjusted estimated c-statistic was 0.708 for the morbidity model and 0.738 for the mortality model. The developer interprets this to demonstrate well-calibrated risk models with good discrimination power.
- The Standing Committee noted that the discussion from NQF #3030 applies to this measure and accepted the measure as valid.
- The developer used Pearson correlations to verify that each of the two domains of the measure contribute statistical information but do not dominate the composite. Data from July 2011 – June 2014 were used for the calculation. Results were 0.60 for mortality domain versus overall composite measure and 0.91 for morbidity domain score versus overall score. The developers interpret this to mean that risk-adjusted morbidity explains more of the variation in the overall composite score but does not dominate the score.
- The developer stated that the domains were rescaled by dividing their respective standard deviation across STS participants and then added together. After the rescaling, the relative weights were 0.74 for mortality and 0.26 for morbidity.
- Weighting was assessed by an Expert Panel. It was consistent with the panel's clinical assessment of each domain's relative importance. The developer stated that a one percentage point change in a participant's risk-adjusted mortality rate has the same impact on the overall score as a 2.8 percentage point change in the site's risk-adjusted morbidity rate.
- The Standing Committee had no issues or questions regarding the composite construct.

3. Feasibility: H-6; M-10; L-1; I-0 (denominator = 17)

(3a. Clinical data generated during care delivery; 3b. Electronic sources; 3c. Susceptibility to inaccuracies/ unintended consequences identified 3d. Data collection strategy can be implemented)

Rationale:

- The required data elements are collected and used by healthcare personnel during the provision of care and abstracted from a record by someone other than person obtaining original information. Some data elements are available through electronic sources. Local availability of data elements varies from full electronic health record (EHR) capability to no availability; however, all data elements are submitted to the STS database in an electronic format following a standard set of data specifications.
- STS Adult Cardiac Surgery Database participants (single or group of surgeons) pay annual participant fees of $3,500 if the majority of surgeons in the group are STS members and $4,750 if the majority are not STS members. In addition, there is a fee of $150 per member and $350 per non-member for surgeons listed on the database's Participation Agreement. STS analyses indicated that the STS database includes more than 90% of cardiothoracic programs in the U.S. There are no additional costs for data collection specific to the measure.
- The Standing Committee had no concerns regarding the feasibility of the measure.

4. Use and Usability

4a. Use; 4a1. Accountability and transparency; 4a2. Feedback on the measure by those being measured and others; 4b. Usability; 4b1. Improvement; 4b2. The benefits to patients outweigh evidence of unintended negative consequences to patients)

4a. Use: **Pass-17; No Pass-0 (denominator = 17)***4b. Usability:* **H-1; M-16; L-0; I-0 (denominator = 17)**

Rationale:

- This composite is publicly reported through the STS Public Reporting Program.
- All Adult Cardiac Surgery Database participants receive quarterly feedback reports providing a detailed analysis of the participant's performance, including benchmarking. Dashboard-type reporting on STS.org has been provided for real-time, online data updates to STS surgeon members. Participants also have access to a guide to help interpret performance results.
- The Standing Committee had no concerns regarding use of the measure.
- The developer stated that there has been a decrease in 1-star and 3-star ratings over time, which they stated is consistent with their quality goal of reducing variation among participants.

Star ratings in percentages, 2017-2019

Stars	2019	2018	2017
*	2.55	2.08	2.74
**	88.0	89.97	91.78
***	9.45	7.96	5.48

- The developer identified the potential harms related to the use of this measure: gaming and risk aversion. The developer stated that they control these through a careful audit process and a robust risk-adjustment methodology.
- The Standing Committee had no concerns regarding the usability of this measure.

Related and Competing Measures

The developers identified the following related measures:

- NQF #0696 STS CABG Composite
- NQF #2561 Aortic Valve Replacement Composite Score
- NQF #2563 Aortic Valve Replacement + CABG Composite Score
- NQF #3031 Mitral Valve Repair/Replacement Composite Score

- The identified measures are all developed by STS and the developer indicated that they are harmonized.
- The Standing Committee will discuss related and competing measures during the post-comment web meeting on June 1, 2021. The Standing Committee did not raise any additional concerns or questions.

5. **Standing Committee Recommendation for Endorsement**: **Yes-17; No-0 (denominator = 17)**
6. **Public and Member Comment**

   NQF received one comment for this measure, correcting a typographical error in the submission materials.
7. **Consensus Standards Approval Committee (CSAC) Vote: Y-X; N-X**
8. **Appeals**

Measures Recommended for Inactive Endorsement With Reserve Status

NQF #0117 Beta Blockade at Discharge

Submission

Description: Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on beta blockers

Numerator Statement: Number of patients undergoing isolated CABG who were discharged on beta blockers

Denominator Statement: Patients aged 18 years and older undergoing isolated CABG

Exclusions: Cases are removed from the denominator if there was an in-hospital mortality or if discharge beta blocker was contraindicated.

Adjustment/Stratification: No risk-adjustment or stratification

Level of Analysis: Facility, Clinician : Group/Practice

Setting of Care: Inpatient/Hospital

Type of Measure: Process

Data Source: Registry Data

Measure Steward: The Society of Thoracic Surgeons

STANDING COMMITTEE MEETING February 12, 2021

3. Importance to Measure and Report: The measure does not meet the Importance criteria.

(1a. Evidence, 1b. Performance Gap)

1a. Evidence: **H-0; M-18; L-0; I-0 (denominator = 18)**; 1b. Performance Gap: **H-2; M-4; L-12; I-0 (denominator = 18)**

Rationale:

- As part of the previous submission in 2016, the developer included the 2011 ACCF/AHA Guideline for Coronary Artery Bypass Graft Surgery. The recommendation stated that the beta blockers should be prescribed to all CABG patients without contraindications at the time of hospital discharge (Class I Recommendation, Level of Evidence: C).
- The developer also provided a summary of peer-reviewed literature during the last maintenance review in 2016, which supported that the utilization of beta-blockers at discharge confers a strong risk reduction in mortality.
- The developer attested to no changes to the evidence for this submission.
- The Standing Committee noted that the evidence was largely unchanged from the previous submission in 2016. A Standing Committee member mentioned that a large new study was recently published this year (2021) that strengthened the existing evidence for postoperative use of beta blockers.
- The Standing Committee concluded that the measure meets the evidence criterion.
- As part of the previous review in 2016, the Standing Committee had asked the developer to include the number of patients included in the measure to help inform discussion of the performance gap. The developer included the number of operations in this submission along with measure results calculated using registry data for January-December 2018 (1037 participants and 151,805 operations) and January-December 2019 (999 participants and 150,773 operations).

Year	Mean	STD	IQR	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
2018	0.98	0.034	0.019	0.66	0.95	0.98	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00
2019	0.98	0.043	0.016	0.00	0.96	0.98	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00

The developer also provided disparities data for January 2016 – December 2019. Each year in the table below represents January-December.

Group	2016	2017	2018	2019
All	98.60%	98.64%	98.79%	98.95%
Male	98.67%	98.67%	98.84%	98.99%
Female	98.39%	98.53%	98.65%	98.79%
Age<75	98.69%	98.70%	98.89%	99.00%
Age>=75	98.23%	98.36%	98.39%	98.74%
White	98.73%	98.70%	98.86%	98.97%

Group	2016	2017	2018	2019
Black	98.72%	98.75%	98.89%	98.95%
Other	97.56%	98.06%	98.21%	98.76%
Insurance, Age >=65 Medicare + Medicaid	98.42%	98.15%	98.45%	98.67%
Insurance, Age >=65 Medicare + Commercial without Medicaid	98.70%	98.75%	98.78%	98.85%
Insurance, Age >=65 Medicare without Medicaid/Commercial	98.13%	98.28%	98.59%	98.89%
Insurance, Age<65 Medicare/Medicaid	98.62%	98.67%	98.64%	98.83%
Insurance, Age<65 Commercial/HMO	98.80%	98.86%	99.07%	99.17%
Insurance, Age<65 None/Self Paid	99.17%	98.79%	99.04%	99.03%
Insurance, Age<65 Other	98.79%	98.48%	99.12%	99.08%

- The Standing Committee questioned what constitutes a meaningful performance gap and the implications of placing a measure on reserve status. The Standing Committee noted that the performance appears fairly topped out, with median rates of 100% and little variation by insurance type, gender, or race. Standing Committee members also shared that with performance rates this high, a great deal of resources are required to achieve a small gain and that those resources may be better spent on more impactful areas.
- A Standing Committee member raised a concern that when the overall performance is this high, a participant needs to perform perfectly to score well. Another Standing Committee member raised a concern regarding whether performance would remain high if the measure were to be placed on reserve status.
- The developer acknowledged and agreed with this concern; however, they added that they viewed cardiothoracic surgery as the ultimate high-reliability surgery and that all participants should achieve 100% on this measure. They also clarified that they do not penalize small volume programs unless there was a statistically significant gap in performance. The developer also stated that they will continue to collect and use this measure; therefore, the benefit to reserve status may be limited.
- The Standing Committee voted and reached consensus that the measure did not have a sufficient performance gap to warrant maintaining active endorsement.
- When improvement in performance on an endorsed measure has closed the performance gap and the measure continues to meet all other endorsement criteria, the Standing Committee can recommend that the measure remain endorsed with reserve status. Reserve status results in measures maintaining endorsement, thereby remaining in the measure portfolio, while

indicating that the measure may not have a sufficient gap to make it a priority for adoption. NQF staff described the process, criteria, and rationale for reserve status.
- Because the Standing Committee agreed that reserve status should be considered for this measure, discussion and voting continued on the remaining criteria.

2. Scientific Acceptability of Measure Properties: The measure meets the Scientific Acceptability criteria.

(2a. Reliability - precise specifications, testing; 2b. Validity - testing, threats to validity
2a. Reliability: **H-1; M-15; L-1; I-0 (denominator = 17)**; 2b. Validity: **H-2; M-11; L-2; I-2 (denominator = 17)**

Rationale:
- The developer conducted performance measure score reliability testing using a beta-binomial model of signal-to-noise ratio.
- The developer highlighted that the reliability of the measure varies by number of eligible patients (denominator). In this case, 95% of the STS participants meet the 27-patient sample size necessary for 0.50 reliability and 76% meet the 62-patient sample size necessary for 0.70 reliability.
- Similar to the discussion for measure NQF #0127, the Standing Committee questioned the reliability of the measure for participants with a low sample size. The developer clarified that all STS process measures are binary results (i.e., meets/does not meet) with a confidence interval. They noted, in general, the smaller the sample size, the larger the confidence interval, which results in most small groups receiving two stars.
- A Standing Committee member stated that they appreciated the testing for demonstrating different reliabilities at different case counts, noting that there was a range of reliability for each count. The same Standing Committee member also noted that reliability of distribution was helpful and that reliability of "binning" providers into scores would also be helpful.
- The Standing Committee ultimately agreed that the measure was reliable.
- The developer conducted data element validity testing using the STS Adult Cardiac Surgery Database Audit, which randomly selected 10% of participating sites to evaluate the accuracy, consistency, and comprehensiveness of data collection. The audit process involved re-abstraction of data for 20 cases and a comparison of 82 individual data elements with those submitted to the data warehouse. The results presented are from the 2015 audit.
    - The data element validity results provided demonstrate an overall agreement rate of 96.17%, with most elements in the high 90% agreement range.
- The developer also examined measure score validity using known-group analysis. For the measure score, three performance groups were calculated and compared. The three groups had different proportions.
    - Known-group validity testing demonstrated that low-performance groups had lower observed rates and that high-performance groups had higher observed rates (91.1% vs 99.9%).
- The developers also conducted measure score validity using predictive validity/stability of measure score results over time for October 2013 – September 2014 and October 2014 – September 2015 periods.
    - Predicted validity/stability analysis demonstrated that among participants that were high performers during the first period, 76.1% were also high performance in the second period. In addition, 90% of mid-performers remained in the mid-performer category. Low performance showed more changes, with 49% remaining in the low-performer category in the second performance period.
- The developer reported that for the period of October 2014 – September 2014, around 80% of participants had performance indistinguishable from the STS average (95% CI), and the remaining participants performed differently.
    - 859 (82.9%) performed as expected
    - 94 (9.1%) had lower-than-expected performance
    - 83 (8%) had higher-than-expected performance
- The Standing Committee had no issues or concerns regarding validity.

3. Feasibility: H-7; M-10; L-1; I-0 (denominator = 18)

(3a. Clinical data generated during care delivery; 3b. Electronic sources; 3c. Susceptibility to inaccuracies/ unintended consequences identified 3d. Data collection strategy can be implemented)

Rationale:

- The required data elements are collected and used by healthcare personnel during the provision of care and abstracted from a record by someone other than the person obtaining the original information. Some data elements are available through electronic sources. Local availability of data elements varies from full electronic health record (EHR) capability to no availability; however, all data elements are submitted to the STS database in an electronic format following a standard set of data specifications.
- STS Adult Cardiac Surgery Database participants (single or group of surgeons) pay annual participant fees of $3,500 if the majority of surgeons in the group are STS members and $4,750 if the majority are not STS members. In addition, there is a fee of $150 per member and $350 per non-member for surgeons listed on the database's Participation Agreement. STS analyses indicated that the STS database includes more than 90% of cardiothoracic programs in the U.S. There are no additional costs for data collection specific to the measure.
- The Standing Committee discussed a high rating versus a moderate rating for feasibility, noting that the measure is automatically calculated for providers using the STS Adult Cardiac Registry. Standing Committee members noted that data submission to the registry requires staff to abstract the data for entry into the registry and that this requirement led to their consideration of feasibility as moderate instead of high.

4. Use and Usability

4a. Use; 4a1. Accountability and transparency; 4a2. Feedback on the measure by those being measured and others; 4b. Usability; 4b1. Improvement; 4b2. The benefits to patients outweigh evidence of unintended negative consequences to patients)

4a. Use: **Pass-18; No Pass-0 (denominator = 18)***4b. Usability:* **H-7; M-10; L-1; I-0 (denominator = 18)**

Rationale:

- This measure is part of a publicly reported composite: the Perioperative Medications domain of the isolated CABG composite.
- The developer noted that the STS Adult Cardiac Surgery Database (ACSD) Participant Feedback Reports provide performance results for this measure to the participants on a quarterly basis.
- The Standing Committee questioned whether publicly reporting as part of a composite meets the intent of the use criterion. NQF Staff shared that the Standing Committee had previously discussed this at length and at that time, they had concluded that this did meet the use criterion. The Standing Committee agreed with this previous conclusion and had no additional questions or concerns regarding the use of the measure.
- In the 2016 submission, the developer provided a performance rate of 97.96% for the period October 2011 – September 2012. For this submission, the developer provided overall rates of 98.62%, 98.80%, and 98.94%, for calendar years 2017, 2018, and 2019, respectively.
- The Standing Committee had no questions regarding the usability of the measure.

Related and Competing Measures

This measure is related to the following measures:

- NQF #0114 Risk-Adjusted Postoperative Renal Failure
- NQF #0115 Risk-Adjusted Surgical Re-exploration
- NQF #0116 Anti-Platelet Medication at Discharge
- NQF #0118 Anti-Lipid Treatment Discharge
- NQF #0119 Risk-Adjusted Operative Mortality for CABG
- NQF #0127 Preoperative Beta Blockade
- NQF #0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)
- NQF #0130 Risk-Adjusted Deep Sternal Wound Infection
- NQF #0131 Risk-Adjusted Stroke/Cerebrovascular Accident
- NQF #0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

    - NQF #0696 STS CABG Composite
- The developer stated that the measure specifications are harmonized to the extent possible. They noted that the related measures identified are NQF-endorsed measures developed by or with STS. All these measures are either components of NQF #0696 or are the overall composite NQF #0696.
- The Standing Committee discussed related and competing measures during the post-comment web meeting on June 1, 2021. The Standing Committee did not raise any additional concerns or questions.

5. **Standing Committee Recommendation for Endorsement**: **Voted to recommend the measure for 'Inactive Endorsement With Reserve Status,' Yes-17; No-0 (denominator = 17)**

Rationale

The Standing Committee recommended the measure for inactive endorsement with reserve status.

6. **Public and Member Comment**

   NQF received one comment for this measure. The commenter voiced concern that placing the measure on reserve status would be counterproductive.

7. **Consensus Standards Approval Committee (CSAC) Vote: Y-X; N-X**
8. **Appeals**

NATIONAL QUALITY FORUM
Driving measurable health improvements together

Surgery Fall 2020 Review Cycle

CSAC Review

June 29-30, 2021

Funded by the Centers for Medicare & Medicaid Services under contract HHSM-500-2017-00060I Task Order HHSM-500-T0001

Standing Committee Recommendations

Eight measures reviewed for fall 2020

- Two measures were reviewed by the Scientific Methods Panel *(SMP passed both measures on Scientific Acceptability criterion)*

One measure recommended for inactive endorsement with reserve status

- **NQF #0117** Beta Blockade at Discharge (The Society of Thoracic Surgeons (STS)) (maintenance)

NATIONAL QUALITY FORUM

Standing Committee Recommendations (continued)

Seven measures recommended for endorsement

- **NQF #0127** Preoperative Beta Blockade (STS) (maintenance)
- **NQF #0134** Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) (STS) (maintenance)
- **NQF #1550** Hospital-Level Risk-Standardized Complication Rate (RSCR) Following Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA) (Yale Center for Outcomes Research & Evaluation (CORE)/Centers for Medicare & Medicaid Services (CMS)) (maintenance)
- **NQF #1551** Hospital-Level 30-Day Risk-Standardized Readmission Rate (RSRR) Following Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA) (Yale CORE)/CMS) (maintenance)
- **NQF #3030** STS Individual Surgeon Composite Measure for Adult Cardiac Surgery (STS) (maintenance)
- **NQF #3031** STS Mitral Valve Repair/Replacement (MVRR) Composite Score (STS) (maintenance)
- **NQF #3032** STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score (STS) (maintenance)

Public and Member Comment and Member Expressions of Support

Five comments received

Two comments were supportive of the measures under review (one each for NQF #0117 and NQF #0134). Two comments were not supportive of the measures under review (one each for NQF #1550 and NQF #1551). One comment was a correction of a typographical error and was neutral.

No NQF members provided their expressions of support or non-support.

Questions?

NQF Project team:

- Amy Moyer, Senior Director
- Janaki Panchal, Manager
- Karri Albanese, Analyst
- Mike DiVecchia, Senior Project Manager

- Project webpage: https://www.qualityforum.org/Surgery_2017-2018.aspx

- Project email address: surgery@qualityforum.org

NATIONAL QUALITY FORUM
Driving measurable health improvements together

Surgery, Fall 2020 Cycle: CDP Report

DRAFT TECHNICAL REPORT FOR CSAC REVIEW
JUNE 29, 2021

This report is funded by the Centers for Medicare & Medicaid Services under contract HHSM-500-2017-00060I Task Order HHSM-500-T0001.

Contents

Executive Summary

In 2010, 28.6 million ambulatory surgery visits to hospitals and ambulatory surgical centers occurred, representing 48.3 million surgical and nonsurgical procedures.[1] In 2014, 17.2 million hospital visits included at least one surgery.[2] Of these surgeries, over half of them occurred in a hospital-owned ambulatory surgical center.[2]

Quality measurement in surgery is essential to improve outcomes for the millions of individuals undergoing surgery and surgical procedures each year. To date, the National Quality Forum (NQF) has endorsed more than 50 measures that address surgical care, including perioperative safety, general surgery, and a range of specialties, including cardiac, cardiothoracic, colorectal, ocular, orthopedic, urogynecologic, and vascular surgery.

For this project, the Standing Committee evaluated eight measures undergoing maintenance review against NQF's standard evaluation criteria. The Standing Committee recommended seven measures for endorsement and one measure for inactive endorsement with reserve status. The recommended measures are listed below:

NQF #0127 Preoperative Beta Blockade (The Society of Thoracic Surgeons (STS))
NQF #0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) (STS)
NQF #1550 Hospital-Level Risk-Standardized Complication Rate (RSCR) Following Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA) (Yale Center for Outcomes Research & Evaluation (CORE)/Centers for Medicare & Medicaid Services (CMS))
NQF #1551 Hospital-Level 30-Day Risk-Standardized Readmission Rate (RSRR) Following Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA) (Yale CORE)/CMS)
NQF #3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery (STS)
NQF #3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score (STS)
NQF #3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score (STS)

The Standing Committee recommended inactive endorsement with reserve status for the following measure:

NQF #0117 Beta Blockade at Discharge (STS)

Brief summaries of the fall 2020 measures are included in the body of the report; detailed summaries of the Standing Committee's discussion and ratings of the criteria for each measure are in Appendix A.

Introduction

Given the increasing rates and costs associated with inpatient and outpatient surgeries in the United States (U.S.), both performance measurement and reporting provide an opportunity to improve the safety and quality of care received by patients undergoing surgery and surgical procedures. In 2010, 28.6 million ambulatory surgery visits to hospitals and ambulatory surgical centers occurred, representing 48.3 million procedures.[1] In 2014, 17.2 million hospital visits included at least one surgery.[2] Of these surgeries, over half of them occurred in a hospital-owned ambulatory surgical center.[2]

Over time, less invasive surgical techniques, patient conveniences (e.g., less time spent undergoing a procedure), and lower costs have led to an increased volume of ambulatory surgeries.[3,4] However, there are risks associated with ambulatory surgeries, including increased pain, longer time than anticipated to return to daily activities, and unplanned subsequent hospital visits following surgery.[5,6] Beneficiaries of private payers accounted for 48.6 percent of ambulatory surgery visits, with Medicare and Medicaid beneficiaries accounting for 30.8 percent and 14.0 percent of visits, respectively.[2] With the continued growth in the outpatient surgery market, both monitoring and assessing the quality of the services provided hold great importance. Patients, purchasers, and payers need information about the safety and quality of care to make informed decisions about the risks and benefits of ambulatory surgery.

NQF Portfolio of Performance Measures for Surgery Conditions

The Surgery Standing Committee (Appendix C) oversees NQF's portfolio of Surgery measures (Appendix B), which includes measures for perioperative safety, general surgery, and a range of specialties, including cardiac, cardiothoracic, colorectal, ocular, orthopedic, urogynecologic, and vascular surgery. This portfolio contains 58 measures: 10 process measures, 37 outcome and resource use measures, four structural measures, and seven composite measures (see table below).

Table 1. NQF Surgery Portfolio of Measures

Type	Structure	Process	Outcome/Resource Use	Composite
Abdominal and Colorectal Surgery	0	0	1	0
Cardiac Surgery	3	5	16	6
General Surgery	0	0	2	0
Cross-Cutting (Inpatient Surgery)	0	0	2	0
Cross-Cutting (Outpatient Surgery)	0	0	2	0
Ocular Surgery	0	0	3	0
Orthopedic Surgery	0	0	4	0
Thoracic Surgery	1	0	1	1
Urogynecology/Gynecology	0	3	0	0
Vascular Surgery	0	2	6	0
Total	4	10	37	7

Additional measures have been assigned to other portfolios. These include healthcare-associated infection measures (Patient Safety), care coordination measures (Geriatrics and Palliative Care), patient experience measures (Patient Experience and Function), imaging efficiency measures (Cost and Efficiency), and a variety of condition- or procedure-specific outcome measures (Cardiovascular, Cancer, Renal, etc.).

Surgery Measure Evaluation

On February 12 and 16, 2021, the Surgery Standing Committee evaluated eight measures undergoing maintenance review against NQF's standard measure evaluation criteria.

Table 2. Surgery Measure Evaluation Summary

Type	Maintenance	New	Total
Measures under review	8	0	8
Measures recommended for endorsement	7	0	7
Measures recommended for inactive endorsement with reserve status	1	0	1

Comments Received Prior to Standing Committee Evaluation

NQF accepts comments on endorsed measures on an ongoing basis through the Quality Positioning System (QPS). In addition, NQF solicits comments for a continuous 16-week period during each evaluation cycle via an online tool located on the project webpage. For this evaluation cycle, the commenting period opened on December 11, 2020, and closed on April 30, 2021. Pre-meeting commenting closed on January 26, 2021. As of that date, 11 comments were submitted. Seven comments were submitted by the STS on the measures they steward. These comments consisted of clarifications, supplemental information, and responses to staff preliminary analyses. Four comments were submitted by NQF members on the CMS-stewarded joint replacement measures. The comments expressed concern for both measures regarding the reliability results at the minimum case count, the decision not to include social risks in the risk model, and whether sufficient variation in performance is present to support continued use in accountability programs. These comments were shared with the Standing Committee prior to the measure evaluation meetings (Appendix F).

Comments Received After Standing Committee Evaluation

The continuous 16-week public commenting period with NQF member support closed on April 30, 2021. Following the Standing Committee's evaluation of the measures under review, NQF received five comments from two member organizations and individuals pertaining to the draft report and to the measures under review. Two of the comments raised concerns regarding the reliability results, the lack of social risk adjustment, and whether the performance variation was significant enough to distinguish providers. Two of the comments raised concerns regarding the use of reserve status. One comment corrected a typographical error in the measure submission materials. All comments for each measure under review have been summarized in Appendix A.

Summary of Measure Evaluation

The following brief summaries of the measure evaluation highlight the major issues that the Standing Committee considered. Details of the Standing Committee's discussion and ratings of the criteria for each measure are included in Appendix A.

Cardiothoracic Surgery Measures

NQF #0117 Beta Blockade at Discharge (STS): Recommended for Inactive Endorsement With Reserve Status

Description: Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on beta blockers; **Measure Type**: Process; **Level of Analysis**: Facility, Clinician : Group/Practice; **Setting of Care**: Inpatient/Hospital; **Data Source**: Registry Data

This measure was discussed during the first measure evaluation web meeting. The Standing Committee noted that this process measure is part of the "use of all evidence-based perioperative medications" domain in NQF #0696 *STS CABG Composite Score*. The Standing Committee noted that the evidence was largely unchanged from the previous maintenance cycle. A Standing Committee member mentioned that a large new study was recently published this year (2021) that strengthens the existing evidence for postoperative use of beta blockers.

The Standing Committee and developers engaged in a robust conversation about what constitutes a meaningful performance gap and the implications of placing a measure on reserve status. The Standing Committee noted that the performance appears fairly topped out, with median rates of 100 percent and little variation by insurance type, gender, or race. Standing Committee members shared that with performance rates this high, a great deal of resources are required to achieve a small gain and those resources may be better spent on more impactful areas. A Standing Committee member raised a concern that when the overall performance is this high, a participant needs to perform perfectly to score well. Another Standing Committee member raised a concern regarding whether performance would remain high if the measure were to be placed on reserve status. The developer echoed this concern, adding that they view cardiothoracic surgery as the ultimate high-reliability surgery and that all participants should achieve 100 percent on this measure. They also clarified that they do not penalize small volume programs, unless there is a statistically significant gap in performance. The developer also stated that they will continue to collect and use this measure, so the benefit to reserve status may be limited. The Standing Committee voted and reached consensus that the measure did not have a sufficient performance gap to warrant maintaining active endorsement. NQF staff described the process, criteria, and rationale for reserve status. When improvement in performance on an endorsed measure has closed the performance gap and the measure continues to meet all other endorsement criteria, the Standing Committee can recommend that the measure remain endorsed with reserve status. Reserve status results in measures maintaining endorsement, thereby remaining in the measure portfolio, while indicating that the measure may not have a sufficient gap to make it a priority for adoption. The Standing Committee agreed that reserve status should be considered for this measure and continued discussing and voting on the remaining criteria.

The Standing Committee revisited the question of how reliable the measure is for participants with a low sample size. The developer clarified that all STS process measures are binary results (meets/does not meet) with a confidence interval. In general, the smaller the sample size, the larger the confidence interval, which results in most small groups receiving two stars. A Standing Committee member stated that they appreciated the testing for demonstrating different reliabilities at different case counts, noting that there is a range of reliability for each count. The same Standing Committee member noted that reliability of distribution is helpful and that reliability of "binning" providers into stars would also be helpful. The Standing Committee was satisfied with the measure's reliability. They had no issues or questions regarding validity.

The Standing Committee held brief discussions related to feasibility and use and usability. They discussed a high rating versus a moderate rating for feasibility, noting that the measure is automatically calculated for providers using the STS Adult Cardiac Registry. Standing Committee members noted that data submission to the registry requires staff to abstract the data for entry into the registry and that this requirement led to their consideration of feasibility as moderate instead of high. The Standing Committee questioned whether public reporting as part of a composite meets the intent of the use criterion. NQF staff shared that the Standing Committee had previously discussed this matter at length and at that time, they had concluded that this did meet the use criterion. The Standing Committee agreed with this previous conclusion. The Standing Committee raised no questions regarding the usability of the measure and voted unanimously to recommend inactive endorsement with reserve status. The Standing Committee discussed related and competing measures during the post-comment web meeting on June 1, 2021. The Standing Committee did not highlight any comments or concerns..

NQF #0127 Preoperative Beta Blockade (STS): Recommended

Description: Percent of patients aged 18 years and older undergoing isolated CABG who received beta blockers within 24 hours preceding surgery.; **Measure Type**: Process; **Level of Analysis**: Facility, Clinician : Group/Practice; **Setting of Care**: Inpatient/Hospital; **Data Source**: Registry Data

This measure was discussed during the first measure evaluation web meeting. The Standing Committee noted that this process measure is part of the "use of all evidence-based perioperative medications" domain in NQF #0696 *STS CABG Composite Score*. The Standing Committee noted that the evidence was unchanged from the previous maintenance cycle. They had no issues regarding the evidence tying this process to patient outcomes.

The Standing Committee noted that while performance on this measure is very high, it is lower than the performance on NQF #0117, with a median rate of 98 percent versus 100 percent for NQF #0117. The Standing Committee discussed whether they would be consistently applying the criteria if they were to vote to pass this measure on performance gap. Standing Committee members pointed out that in addition to NQF #0127 having more overall opportunity for improvement than NQF #0117 at the median, the lower deciles of performance on NQF #0127 also demonstrated greater variability in performance than the lower performance deciles for NQF #0117. The Standing Committee determined that this measure still has enough room for improvement to meet the performance gap criterion.

The Standing Committee noted that the reliability and validity testing methodologies and results were very similar to those used for NQF #0117 and that the same discussion points apply to this measure (NQF #0127). The Standing Committee had no concerns related to feasibility or use and usability and determined that the measure met all of these criteria. The Standing Committee discussed related and competing measures during the post-comment web meeting on June 1, 2021. The Standing Committee did not highlight any comments or concerns.

NQF #0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) (STS): Recommended

Description: Percentage of patients aged 18 years and older undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft; **Measure Type**: Process; **Level of Analysis**: Facility, Clinician : Group/Practice; **Setting of Care**: Inpatient/Hospital; **Data Source**: Registry Data

This measure was discussed during the first measure evaluation web meeting. The Standing Committee noted that this process measure is a component measure of the composite NQF #0696 *STS CABG Composite Score*. The Standing Committee agreed that the evidence was largely unchanged from the previous maintenance cycle and passed the measure on evidence.

The Standing Committee noted that the performance gap for this measure was very similar to that for NQF #0117. The developer expressed strong concerns with considering reserve status for this measure, as it is more closely tied to patient mortality and outcomes than NQF #0117. The developer further shared that it is easier and faster for surgeons to perform a CABG using veins for grafts; therefore, this measure is important to encourage use of the IMA. In response to the assertion that performance on the measure is topped out, the developer noted that a 1 percent decrease in performance would represent 1,500 patients with a poorer outcome. A Standing Committee member questioned whether this measure is the only incentive keeping surgeons "honest" about using the proper grafting technique, especially given the existing mortality and complication measures. The developer noted that the existing measures cover a 30-day post-surgery period and the impact of the graft choice would not be evident in that time frame. They stated that while most surgeons will continue to do the right thing, some may not. Other Standing Committee members noted that while they agree the measure is important and that there may be a perverse incentive to not use the IMA for grafting, the criterion under discussion is whether there is a sufficient performance gap to warrant continued active endorsement. The Standing Committee and developers raised questions regarding the impact and intent of reserve status: What does it mean? How might it be perceived? Would measures be difficult to find and use? NQF staff clarified that reserve status measures are still endorsed. The reserve status indicates that performance on the measure is very good with limited room for improvement. Currently in NQF's measure search tool, all endorsed measures (both active and inactive reserve status) are listed in search results. A reserve status measure appears no different from an actively endorsed measure, until a user selects the measure to learn more about it. The Standing Committee was unable to reach consensus regarding performance gap during the measure evaluation meeting. During the post-comment web meeting on June 1, 2021, the Standing Committee re-visited the discussion of gap for this measure. The discussion focused on the impact of the lower-end performance on the measure. The developer shared that there are several studies demonstrating an increase in mortality and morbidity if the IMA is not used for a

graft. Ultimately, the Standing Committee agreed that the gap was sufficient to warrant a national performance measure and passed the measure on gap.

The Standing Committee had no issues with reliability beyond those already discussed for NQF #0117. The Standing Committee was satisfied that the measure was reliable. The Standing Committee noted concerns with using known-groups analysis with the measure score and with using test-retest as a methodology for establishing validity. Despite these concerns, the Standing Committee determined that the measure was valid.

The Standing Committee held brief discussions related to feasibility and use and usability, noting that NQF #0117, NQF #0127, and NQF #0134 are similar with regard to these criteria. The Standing Committee discussed related and competing measures during the post-comment web meeting on June 1, 2021. The Standing Committee did not highlight any comments or concerns. The Standing Committee voted on the overall suitability for endorsement during the post-comment web meeting and recommended the measure for endorsement.

NQF #3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery (STS): Recommended

Description: The STS Individual Surgeon Composite Measure for Adult Cardiac Surgery includes five major procedures (isolated CABG, isolated AVR, AVR+CABG, MVRR, MVRR+CABG) and comprises the following two domains:

Domain 1 – Risk-Adjusted Operative Mortality

Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Risk-Adjusted Major Morbidity

Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation,
2. Deep sternal wound infection,
3. Permanent stroke,
4. Renal failure, and
5. Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

All measures are based on audited clinical data collected in the STS Adult Cardiac Surgery Database. Individual surgeons with at least 100 eligible cases during the 3-year measurement window will receive a score for each domain and an overall composite score. In addition to calculating composite score point estimates with credible intervals, surgeons will be assigned rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance; **Measure Type**: Composite; **Level of Analysis**: Clinician : Individual; **Setting of Care**: Inpatient/Hospital; **Data Source**: Registry Data

This complex measure was not reviewed by the Scientific Methods Panel (SMP) prior to the measure evaluation meeting because the testing information submitted was unchanged from the previous submission.

This measure was discussed during the first measure evaluation web meeting. The Standing Committee noted that the evidence was unchanged from the previous submission. They had no issues regarding the evidence tying the components of this composite measure to patient outcomes. The Standing Committee also had no issues with the performance gap or the composite construct and rationale.

The Standing Committee noted that the reliability testing methodology (Bayesian approach to generate possible values, followed by a Monte Carlo simulation to estimate the true values) for this measure was very sophisticated and expressed appreciation for the innovative technique. The Standing Committee expressed concerns with the circular reasoning in the validity testing, which compared performance on the composite component measures to the overall composite score. The developer shared that there are no external comparisons available for this measure. A Standing Committee member asked for the rationale for including race in the clinical risk model. The developer shared that the model fit suffers if race is not included and while the exact mechanism is unclear, they suspect a genetic component is at work that contributes to poorer outcomes for non-White patients. They also shared that they are working on adding geocoding to patient records in the registry to allow for more exploration of the impact of social risk factors. The Standing Committee was satisfied that the measure meets all of the Scientific Acceptability criteria (i.e., reliability, validity, and composite construct).

The Standing Committee expressed no concerns regarding the feasibility or usability of the measure. A Standing Committee member asked for clarification on the use criterion, which requires a maintenance measure to be in an accountability program within three years of its initial endorsement. NQF staff explained that given the STS's strong track record of publicly reporting its measures, staff determined that the plan for publicly reporting the measure this year was highly credible and the measure would be placed in an accountability program soon, likely before the completion of this endorsement cycle. The Standing Committee accepted this rationale and voted to pass the measure on use. The Standing Committee discussed related and competing measures during the post-comment web meeting on June 1, 2021. The Standing Committee did not highlight any comments or concerns.

NQF #3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score (STS): Recommended

Description: The STS Mitral Valve Repair/Replacement (MVRR) Composite Score measures surgical performance for isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD). To assess overall quality, the STS MVRR Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation,
2. Deep sternal wound infection,
3. Permanent stroke,
4. Renal failure, and
5. Reoperations for bleeding, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Outcome data are collected on all patients and from all participants. For optimal measure reliability, participants meeting a volume threshold of at least 36 cases over 3 years (i.e., approximately one mitral case per month) receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance; **Measure Type**: Composite; **Level of Analysis**: Facility, Clinician : Group/Practice; **Setting of Care**: Inpatient/Hospital; **Data Source**: Registry Data

This complex measure was not reviewed by the SMP prior to the measure evaluation meeting because the testing information submitted was unchanged from the previous submission.

This measure was discussed during the first measure evaluation web meeting. The Standing Committee noted that this measure submission is very similar to the submission for NQF #3030. The Standing Committee agreed that the discussion for that measure (NQF #3030) applied to this measure as well (NQF #3031) and did not need to be repeated. The Standing Committee noted that the evidence was unchanged from the previous maintenance cycle. They had no issues regarding the evidence tying the components of this composite measure to patient outcomes. The Standing Committee also had no issues with the performance gap or the composite construct and rationale. The Standing Committee was satisfied that the measure meets all of the Scientific Acceptability criteria (i.e., reliability, validity, and composite construct). The Standing Committee expressed no concerns regarding the feasibility or use and usability of the measure. They noted that this measure is publicly reported, clearly meeting the use criterion. The Standing Committee discussed related and competing measures during the post-comment web meeting on June 1, 2021. The Standing Committee did not highlight any comments or concerns.

NQF #3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score (STS): Recommended

Description: The STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score measures surgical performance for MVRR + CABG with or without concomitant Atrial

Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF). To assess overall quality, the STS MVRR +CABG Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation,
2. Deep sternal wound infection,
3. Permanent stroke,
4. Renal failure, and
5. Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Outcome data are collected on all patients and from all participants. For optimal measure reliability, participants meeting a volume threshold of at least 25 cases over 3 years receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance; **Measure Type**: Composite; **Level of Analysis**: Facility, Clinician : Group/Practice; **Setting of Care**: Inpatient/Hospital; **Data Source**: Registry Data

This complex measure was not reviewed by the SMP prior to the measure evaluation meeting because the testing information submitted was not unchanged from the previous submission.

This measure was discussed during the first measure evaluation web meeting. The Standing Committee noted that this measure is identical to NQF #3031, except for the addition of the CABG procedure. The Standing Committee agreed that no additional discussion was warranted and passed the measure on all criteria. The Standing Committee discussed related and competing measures during the post-comment web meeting on June 1, 2021. The Standing Committee did not highlight any comments or concerns.

Orthopedic Surgery Measures

NQF #1550 Hospital-Level Risk-Standardized Complication Rate (RSCR) Following Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA) (Yale CORE/CMS): Recommended

Description: The measure estimates a hospital-level risk-standardized complication rate (RSCR) associated with elective primary THA and TKA in Medicare Fee-For-Service beneficiaries who are age 65 and older. The outcome (complication) is defined as any one of the specified complications occurring from the date of index admission to 90 days post date of the index admission (the admission included in the measure cohort).; **Measure Type**: Outcome; **Level of Analysis**: Facility; **Setting of Care**: Inpatient/Hospital; **Data Source**: Claims, Enrollment Data

Prior to the Standing Committee meeting, the SMP reviewed this measure. The SMP did not note any particular areas of concern and passed the measure with a moderate rating for both reliability and validity.

This measure was discussed during the second measure evaluation web meeting. Since quorum was not met during the meeting, the Standing Committee discussed all criteria and then voted after the meeting using an online voting tool.

The Standing Committee noted the evidence was directionally the same yet stronger than the evidence for the previous maintenance submission. The Standing Committee observed that there was an appropriate measure performance gap and did not express any concerns.

The Standing Committee noted that while the reliability testing methods were robust, there are concerns from public commenters regarding the reliability at the lower end of case counts. A Standing Committee member who also serves on the SMP noted that reliability standards are currently in flux but that generally, higher is better. They stated it would be helpful to see the reliability of classification to obtain a better understanding of the risk of misclassification at different case counts. The developer responded by identifying the two types of reliability testing performed (i.e., signal-to-noise and split sample). They noted that misclassification was rare, with most providers classified as no different than average. The developer attributes this to a narrowing of variation in performance as performance improves, use of a 95 percent confidence interval, and the impact of statistical modeling.

The Standing Committee had a robust discussion on validity. They noted that the measure currently only includes inpatient procedures. As THA/TKA procedures shift to outpatient settings, the change in patient mix for inpatient procedures could be a threat to the validity of the measure. A Standing Committee member noted the inclusion group, Medicare FFS, and requested clarification on the included and excluded populations. The developer clarified that Medicare Advantage patients are not included. The developer noted that one third of Medicare patients are enrolled in Medicare Advantage plans and that they would seek to incorporate those patients in future versions of this measure. The Standing Committee noted that the validity testing employed a circular comparison to a composite that includes this measure as a component. A Standing Committee member suggested that the developer could use the logic model provided in the evidence section as a validation tool for the measure. The developer appreciated the feedback but shared that it is difficult to find comparison measures and to get data to validate processes. They further noted that processes do not always fully correlate with outcomes. The

developer shared that they have recently gained access to results of patient-reported outcome performance measures (PRO-PMs) related to THA/TKA and are working to analyze the relationship with this measure.

The discussion then turned to the risk model. The Standing Committee noted that the c-statistic of 0.65 indicates a poor fit. The developer responded that this result indicates that outcomes on this measure are more reflective of quality of care delivered by the facility and not strongly related to patient factors. The Standing Committee noted that both the SMP and public commenters had raised questions regarding the lack of risk adjustment for social risk factors, noting that the odds ratios for some social factors are larger than those for some clinical factors. Given the elective nature of THA/TKA procedures, the Standing Committee was concerned that patient selection could result in increased disparities and access issues if social risk is not adequately addressed in the risk adjustment. The developer provided additional information on their approach to risk model development, stating that they look at patient-level clinical variables first and then social risk factors. They shared that when the impact of social risk factors is examined in a multivariate model (as opposed to individually), the odds ratios decrease significantly. They further shared that when considering risk factors to include, they consider which factors a hospital can influence. They shared that hospitals participating in the Comprehensive Care for Joint Replacement model through the CMS Innovation Center have demonstrated that hospitals are able to effectively address issues related to social risk. The developer noted that hospital results are highly correlated both with and without the risk factor adjustment. These considerations, coupled with the report from the Office of the Assistant Secretary for Planning and Evaluation (ASPE) of the U.S. Department of Health and Human Services (HHS) advising against adjustment for social risk factors for public reporting, led to the decision not to include social risk factors in the risk-adjustment model.

The Standing Committee expressed no concerns with the feasibility or use and usability of the measure. Discussion of related measures was deferred to the post-comment web meeting. After the measure evaluation meeting, the Standing Committee voted using an online tool and passed the measure on all criteria. The Standing Committee discussed related and competing measures during the post-comment web meeting on June 1, 2021. The Standing Committee did not highlight any comments or concerns.

NQF #1551 Hospital-Level 30-Day Risk-Standardized Readmission Rate (RSRR) Following Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA) (Yale CORE/CMS): Recommended

Description: The measure estimates a hospital-level risk-standardized readmission rate (RSRR) following elective primary THA and/or TKA in Medicare Fee-For-Service (FFS) beneficiaries who are 65 years and older. The outcome (readmission) is defined as unplanned readmission for any cause within 30 days of the discharge date for the index admission (the admission included in the measure cohort). A specified set of planned readmissions do not count in the readmission outcome.; **Measure Type**: Outcome; **Level of Analysis**: Facility; **Setting of Care**: Inpatient/Hospital; **Data Source**: Claims, Enrollment Data

Prior to the Standing Committee meeting, the SMP reviewed this measure. The SMP did not note any particular areas of concern and passed the measure with a moderate rating for both reliability and validity.

This measure was discussed during the second measure evaluation web meeting. Since quorum was not met during the meeting, the Standing Committee discussed all criteria and then voted after the meeting using an online voting tool.

The Standing Committee noted the evidence was directionally the same yet stronger than the evidence for the previous submission. The Standing Committee questioned whether the performance gap was sufficient to justify continued active endorsement, with 98 percent of facilities performing no different than expected. The developer shared that CMS has criteria for the removal of topped out measures from its programs and that this measure does not meet CMS' criteria for being topped out.

The Standing Committee noted that NQF #1551 received similar public comments to those for NQF #1550 and that the reliability discussion for NQF #1550 also applies to this measure. A Standing Committee member questioned whether the measure could be expanded to even lower-volume hospitals to provide feedback on their performance. A CMS representative clarified that all hospitals are included in the measure calculations and receive feedback reports from CMS. They shared that CMS' goal is to assess as many hospitals as possible but that at very small numbers, one event influences the results, making it difficult to interpret results reliably.

The Standing Committee noted that the entire validity discussion for NQF #1550, including the discussion of the risk model, applies to NQF #1551 as well. The developer shared that for readmissions measures, such as this one, U.S. Congress has mandated that results be stratified into five categories by dual-eligible status.

The Standing Committee expressed no concerns with the feasibility or use and usability of the measure. A Standing Committee member suggested providing context for the measure when it is publicly reported to help patients understand the impact and implication of a readmission. They also felt a low-volume indicator could be useful for the context of results. Discussion of related measures was deferred to the post-comment web meeting. After the measure evaluation meeting, the Standing Committee voted using an online tool and passed the measure on all criteria. The Standing Committee discussed related and competing measures during the post-comment web meeting on June 1, 2021. The Standing Committee did not highlight any comments or concerns.

Measures Withdrawn from Consideration

Four measures previously endorsed by NQF have not been re-submitted for maintenance of endorsement or have been withdrawn during the endorsement evaluation process. Endorsement for these measures has been removed.

Table 3. Measures Withdrawn from Consideration

Measure	Reason for withdrawal
NQF #0354 Hip Fracture Mortality Rate (IQI 19)	Developer is not seeking re-endorsement.
NQF #0359 Abdominal Aortic Aneurysm Repair Mortality Rate (IQI 11)	Developer is not seeking re-endorsement.
NQF #0365 Pancreatic Resection Mortality Rate (IQI 9)	Developer is not seeking re-endorsement.
NQF #0533 Postoperative Respiratory Failure Rate (PSI 11)	Developer is not seeking re-endorsement.

References

1. Hall MJ. Ambulatory Surgery Data From Hospitals and Ambulatory Surgery Centers: United States, 2010. 2017;(102):15.
2. Steiner CA, Karaca Z, Moore BJ, et al. Surgeries in Hospital-Based Ambulatory Surgery and Hospital Inpatient Settings, 2014: Statistical Brief #223. In: *Healthcare Cost and Utilization Project (HCUP) Statistical Briefs*. Rockville (MD): Agency for Healthcare Research and Quality (US); 2006. http://www.ncbi.nlm.nih.gov/books/NBK442035/. Last accessed March 2020.
3. Munnich EL, Parente ST. Procedures take less time at ambulatory surgery centers, keeping costs down and ability to meet demand up. *Health Aff (Millwood)*. 2014;33(5):764-769.
4. Accounting for the cost of US health care: A new look at why Americans spend more | McKinsey. https://www.mckinsey.com/industries/healthcare-systems-and-services/our-insights/accounting-for-the-cost-of-us-health-care. Last accessed March 2020.
5. Manohar A, Cheung K, Wu CL, et al. Burden incurred by patients and their caregivers after outpatient surgery: a prospective observational study. *Clin Orthop Relat Res*. 2014;472(5):1416-1426.
6. Fox JP, Vashi AA, Ross JS, et al. Hospital-based, acute care after ambulatory surgery center discharge. *Surgery*. 2014;155(5):743-753.

Appendix A: Details of Measure Evaluation

Rating Scale: H=High; **M**=Moderate; **L**=Low; **I**=Insufficient; **NA**=Not Applicable

Note: Vote totals may differ between measure criteria and between measures as Standing Committee members often have to join calls late or leave calls early. NQF ensures that quorum is maintained for all live voting. All voting outcomes are calculated using the number of Standing Committee members present for that vote as the denominator. One Standing Committee member was on inactive status for this cycle.

During the first measure evaluation meeting on February 12, 2021, some Standing Committee members were unable to attend the entire meeting due to early departures and late arrivals. The vote totals reflect members present and eligible to vote. Quorum (14 out of 20 Standing Committee members) was met and maintained for the entirety of this meeting.

During the second measure evaluation meeting on February 16, 2021, voting quorum was not achieved. Therefore, the Standing Committee discussed all relevant criteria and voted after the meeting using an online voting tool.

During the post-comment meeting on June 1, 2021, voting quorum (15 out of 20) Standing Committee members was met and maintained for the entirety of the meeting.

Measures Recommended

NQF #0127 Preoperative Beta Blockade

Submission | Specifications

Description: Percent of patients aged 18 years and older undergoing isolated CABG who received beta blockers within 24 hours preceding surgery.

Numerator Statement: Number of patients undergoing isolated CABG who received beta blockers within 24 hours preceding surgery

Denominator Statement: Patients aged 18 years and older undergoing isolated CABG

Exclusions: Cases are removed from the denominator if preoperative beta blocker was contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room.

Adjustment/Stratification: No risk adjustment or stratification

Level of Analysis: Facility, Clinician : Group/Practice

Setting of Care: Inpatient/Hospital

Type of Measure: Process

Data Source: Registry Data

Measure Steward: The Society of Thoracic Surgeons

STANDING COMMITTEE MEETING February 12, 2021

1. **Importance to Measure and Report: The measure meets the Importance criteria.**

(1a. Evidence, 1b. Performance Gap)

1a. Evidence: **H-0; M-17; L-0; I-0 (denominator = 17)**; 1b. Performance Gap: **H-1; M-13; L-3; I-0 (denominator = 17)**

Rationale:

As part of the previous submission in 2016, the developer included the 2011 American College of Cardiology Foundation and the American Heart Association (ACCF/AHA) Guideline for Coronary Artery Bypass Graft Surgery. The recommendation stated the following:

Beta blockers should be administered for at least 24 hours before CABG to all patients without contraindications to reduce the incidence or clinical sequelae of postoperative atrial fibrillation. (Class I Recommendation, Level of Evidence: B)

Preoperative use of beta blockers in patients without contraindications, particularly in those with an LVEF greater than 30%, can be effective in reducing the risk of in-hospital mortality. (Class IIa Recommendation, Level of Evidence: B)

- The developer indicated that no changes have occurred in the evidence since the prior submission.
- The Standing Committee agreed that no changes have been made to the evidence and that it sufficiently ties this process to patient outcomes.
- The developer included the number of operations conducted in this submission, as requested by the Standing Committee during the previous submission. The measure results that were calculated using registry data for January-December 2018 are 1,035 participants and 146,984 operations and for January-December 2019, 997 participants and 146,297 operations.

Year	Mean	STD	IQR	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
2018	0.95	0.086	0.067	0.095	0.838	0.910	0.948	0.968	0.980	0.990	0.996	1.00	1.00	1.00
2019	0.95	0.082	0.057	0.37	0.86	0.92	0.96	0.97	0.98	0.99	1.00	1.00	1.00	1.00

The developer also provided disparities data for January 2016 – December 2019. Each year in the table below represents January-December.

Year	2016	2017	2018	2019
All	95.18%	95.53%	96.02%	96.55%
Male	95.02%	95.38%	95.91%	96.42%
Female	95.68%	95.98%	96.38%	96.98%
Age<75	95.29%	95.63%	96.16%	96.66%
Age>=75	94.72%	95.09%	95.45%	96.12%
White	95.52%	95.75%	96.16%	96.56%
Black	96.10%	96.36%	96.75%	96.92%
Other	92.12%	93.22%	94.46%	96.23%
Insurance, Age >=65 Medicare + Medicaid	94.55%	94.97%	95.40%	95.96%
Insurance, Age >=65 Medicare + Commercial without Medicaid	95.35%	95.60%	95.82%	96.28%
Insurance, Age >=65 Medicare without Medicaid/Commercial	94.13%	95.00%	95.56%	96.50%
Insurance, Age<65	95.95%	95.97%	96.43%	96.60%

Year	2016	2017	2018	2019
Medicare/Medicaid				
Insurance, Age<65 Commercial/HMO	95.39%	95.57%	96.30%	96.83%
Insurance, Age<65 None/Self Paid	96.61%	97.34%	97.80%	97.48%
Insurance, Age<65 Other	95.10%	95.40%	97.11%	96.88%

The Standing Committee noted that while performance on this measure is very high, it is lower than the performance on NQF #0117, with a median rate of 98% (vs. 100% for NQF #0117). Standing Committee members agreed that in addition to NQF #0127 having more overall opportunity for improvement than NQF #0117 at the median, the lower deciles of performance also demonstrated greater variability in performance. Ultimately, the Standing Committee determined that this measure still has enough room for improvement to meet the performance gap criterion.

2. Scientific Acceptability of Measure Properties: The measure meets the Scientific Acceptability criteria.
(2a. Reliability precise specifications, testing; 2b. Validity testing, threats to validity
2a. Reliability: **H-1; M-17; L-0; I-0 (denominator = 18)**; 2b. Validity: **H-0; M-14; L-3; I-1 (denominator = 18)**

Rationale:

- The developer conducted performance measure score reliability testing using a beta-binomial model of signal-to-noise ratio.
- The developer highlighted that the reliability of the measure varies by the number of eligible patients (denominator). In this case, 99% of the STS participants met the 8-patient sample size necessary for 0.50 reliability and 97% meet the 20-patient sample size necessary for 0.70 reliability.
- The Standing Committee questioned the reliability of the measure for participants with a low sample size. The developer clarified that all STS process measures are binary results (meets/does not meet) with a confidence interval. STS noted that, in general, the smaller the sample size, the larger the confidence interval, which results in most small groups receiving two stars.
- A Standing Committee member stated that they appreciated the testing for demonstrating different reliabilities at different case counts, noting that there was a range of reliability for each count. The same Standing Committee member also noted that reliability of distribution was helpful and that reliability of "binning" providers into scores would also be helpful.
- The Standing Committee ultimately agreed that the measure was reliable.
- The developer conducted data element validity testing using the STS Adult Cardiac Surgery Database Audit, which randomly selected 10% of participating sites to evaluate the accuracy, consistency, and comprehensiveness of data collection. The audit process involved re-abstraction of data for 20 cases and comparison of 82 individual data elements with those submitted to the data warehouse. The results presented are from the 2015 audit. The data element validity results provided demonstrate an overall agreement rate of 99.14%, with most elements in the high 90% agreement range.

- The developer also examined measure score validity using known-group validity. For the measure score, three performance groups were calculated and compared. The three groups had different proportions.

  Known-group validity testing demonstrated that low-performance groups had lower observed rates and that high-performance groups had higher observed rates (81.3% vs 99.3%).

The developer also conducted measure score validity testing using the predictive validity/stability of measure score results over time for the October 2013 – September 2014 and October 2014 – September 2015 periods.

Predicted validity/stability analysis demonstrated that among participants who were high performers during the first period, 77% were also high performance in the second period. In addition, 77% of mid-performers remained in the mid-performer category. Low performance showed more changes, with 67% remaining in the low-performer category in the second performance period.

The developer reported that for the period October 2014 – September 2014, around 50% of participants had performances indistinguishable from the STS average (95% CI), and the remaining participants performed differently.

- 538 (51.7%) performed as expected
- 197 (18.9%) had lower-than-expected performance
- 306 (29.4%) had higher-than-expected performance

The Standing Committee had no issues or concerns regarding validity.

3. Feasibility: H-6; M-10; L-2; I-0 (denominator = 18)

(3a. Clinical data generated during care delivery; 3b. Electronic sources; 3c. Susceptibility to inaccuracies/ unintended consequences identified 3d. Data collection strategy can be implemented)

Rationale:

- The required data elements are collected and used by healthcare personnel during the provision of care and abstracted from a record by someone other than person obtaining original information. Some data elements are available through electronic sources. Local availability of data elements varies from full electronic health record (EHR) capability to no availability; however, all data elements are submitted to the STS database in an electronic format following a standard set of data specifications.
- STS Adult Cardiac Surgery Database participants (single or group of surgeons) pay annual participant fees of $3,500 if the majority of surgeons in the group are STS members and $4,750 if the majority are not STS members. In addition, there is a fee of $150 per member and $350 per non-member for surgeons listed on the database's Participation Agreement. STS analyses indicated that the STS database includes more than 90% of cardiothoracic programs in the U.S. There are no additional costs for data collection specific to the measure.
- The Standing Committee had no concerns regarding the feasibility of the measure.

4. Use and Usability

4a. Use; 4a1. Accountability and transparency; 4a2. Feedback on the measure by those being measured and others; 4b. Usability; 4b1. Improvement; 4b2. The benefits to patients outweigh evidence of unintended negative consequences to patients)

4a. Use: **18; No Pass-0 (denominator = 18)** *4b. Usability:* **H-2; M-15; L-1; I-0 (denominator = 18)**

Rationale:

- This measure is part of a publicly reported composite (the Perioperative Medications domain) as part of the voluntary STS Public Reporting of the isolated CABG composite as well as CMS' Merit-Based Incentive Payment System.
- The Standing Committee had no questions or concerns regarding the use of the measure.
- The developer states that the STS Adult Cardiac Surgery Database (ACSD) Participant Feedback Reports provide performance results for this measure to the participants on a quarterly basis.
- In the previous measure submission, performance on this measure showed a rate of 93.25% for the period October 2011 – September 2012. In this submission, the developer included the overall rates of 95.53%, 96.03%, and 96.54%, for calendar years 2017, 2018, and 2019, respectively.
- The Standing Committee noted that the data demonstrate improvement over time and expressed no major concerns regarding usability.

5. Related and Competing Measures

This measure is related to the following additional measures:

  - NQF #0114 Risk-Adjusted Postoperative Renal Failure
  - NQF #0115 Risk-Adjusted Surgical Re-exploration
  - NQF #0116 Anti-Platelet Medication at Discharge
  - NQF #0117 Beta Blockade at Discharge
  - NQF #0118 Anti-Lipid Treatment Discharge
  - NQF #0119 Risk-Adjusted Operative Mortality for CABG
  - NQF #0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)
  - NQF #0130 Risk-Adjusted Deep Sternal Wound Infection
  - NQF #0131 Risk-Adjusted Stroke/Cerebrovascular Accident
  - NQF #0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
  - NQF #0696 STS CABG Composite

- The developer stated that the measure specifications are harmonized to the extent possible. They noted that the related measures identified are NQF-endorsed measures developed by or with STS. All these measures are either components of NQF #0696 or are the overall composite NQF #0696.
- The Standing Committee discussed related and competing measures during the post-comment web meeting on June 1, 2021. The Standing Committee did not highlight any comments or concerns.

6. Standing Committee Recommendation for Endorsement: Yes-18; No-0 (denominator = 18)

7. Public and Member Comment

NQF did not receive any public or member comment for this measure.

8. Consensus Standards Approval Committee (CSAC) Vote: Y-X; N-X

9. Appeals

Description: Percentage of patients aged 18 years and older undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft

Numerator Statement: Number of patients undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft

Denominator Statement: Patients aged 18 years and older undergoing isolated CABG

Exclusions: Cases are removed from the denominator if the patient had a previous CABG prior to the current admission or if IMA was not used and one of the following reasons was provided:

- Subclavian stenosis
- Previous cardiac or thoracic surgery
- Previous mediastinal radiation
- Emergent or salvage procedure
- No (bypassable) LAD disease

Adjustment/Stratification: No risk adjustment or risk stratification

Level of Analysis: Facility, Clinician : Group/Practice

Setting of Care: Inpatient/Hospital

Type of Measure: Process

Data Source: Registry Data

Measure Steward: The Society of Thoracic Surgeons

STANDING COMMITTEE MEETING February 12, 2021 and June 1, 2021

1. Importance to Measure and Report: The measure meets the Importance criteria.

(1a. Evidence, 1b. Performance Gap)

1a. Evidence: **H-0; M-18; L-0; I-0 (denominator = 18)**; 1b. Performance Gap: **H-3; M-7; L-4; I-1 (denominator = 15)**

Rationale:

In 2016, the developer included the 2011 ACCF/AHA Guideline for Coronary Artery Bypass Graft Surgery. The recommendation stated the following:

  - If possible, the left internal mammary artery (LIMA) should be used to bypass the left anterior descending (LAD) artery when bypass of the LAD artery is indicated. (Class I, Level of Evidence: B)
  - The right internal mammary artery is probably indicated to bypass the LAD artery when the LIMA is unavailable or unsuitable as a bypass conduit. (Class II, Level of Evidence: C)
  - When anatomically and clinically suitable, use of a second IMA to graft the left circumflex or right coronary artery (when critically stenosed and perfusing LV myocardium) is reasonable to improve the likelihood of survival and to decrease reintervention. (Class II, Level of Evidence: B)

- Evidence submitted at the last review included observational, retrospective, and prospective studies – randomized controlled trials that demonstrated the value of using the IMA in coronary artery bypass graft surgery.
- The developer attested to no changes to the evidence for this submission.
- The Standing Committee noted that the evidence was largely unchanged from the previous maintenance cycle and passed the measure on evidence.
- In the previous review, the Standing Committee had asked the developer to provide the number of patients included in the measure to help inform discussion of the performance gap. The developer has included the number of operations in this submission. Measure results calculated using registry data for January-December 2018 (1035 participants and 151,805 operations) and January-December 2019 (999 participants and 150,773 operations).

Year	Mean	STD	IQR	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
2018	0.99	0.027	0.013	0.44	0.97	0.98	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00
2019	0.99	0.017	0.011	0.74	0.97	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00

The developer reported that for analysis of disparities, eligible patients from STS database participants with procedures between January 2016 and December 2019 were used. Relevant subgroups were defined by age, gender, race, and insurance status. Each year in the table below represents January-December.

Year	2016	2017	2018	2019
All	99.04%	99.09%	99.22%	99.33%
Male	99.22%	99.25%	99.38%	99.44%
Female	98.48%	98.59%	98.73%	98.97%
Age<75	99.17%	99.21%	99.32%	99.40%
Age>=75	98.48%	98.63%	98.82%	99.03%
White	99.11%	99.19%	99.28%	99.40%
Black	98.70%	98.75%	98.99%	98.91%
Other	98.79%	98.62%	98.95%	99.07%
Insurance, Age >=65 Medicare + Medicaid	98.37%	98.15%	98.33%	98.92%
Insurance, Age >=65 Medicare + Commercial without Medicaid	99.02%	99.03%	99.19%	99.29%
Insurance, Age >=65 Medicare without Medicaid/Commercial	98.74%	98.96%	99.12%	99.23%
Insurance, Age<65 Medicare/Medicaid	99.00%	98.99%	99.13%	99.22%
Insurance, Age<65 Commercial/HMO	99.37%	99.46%	99.51%	99.53%
Insurance, Age<65 None/Self Paid	99.12%	99.05%	99.36%	99.41%
Insurance, Age<65 Other	99.27%	99.25%	99.36%	99.71%

- The Standing Committee noted that the performance gap for this measure was very similar to the one for NQF #0117.
- The developer expressed strong concerns with considering reserve status for this measure as it is more closely tied to patient mortality and outcomes than NQF #0117. The developer further shared that it is easier and faster for surgeons to perform a CABG using veins for grafts; therefore, this measure is important to encourage use of the IMA. In response to the assertion that performance on the measure is topped out, the developer noted that a 1 percent decrease in performance would represent 1,500 patients with a poorer outcome.

- A Standing Committee member questioned whether this measure is the only incentive keeping surgeons "honest" about using the proper grafting technique, especially given the existing mortality and complication measures.
- The developer noted that the existing measures cover a 30-day period and the impact of the graft choice would not be evident in that time frame. They stated that while most surgeons will continue to do the right thing, some may not.
- Other Standing Committee members noted that while they agree the measure is important and that there may be a perverse incentive to not use the IMA for grafting, the criterion under discussion is whether there is a sufficient performance gap to warrant continued active endorsement.
- The Standing Committee and developers raised questions regarding the impact and intent of reserve status: What does it mean? How might it be perceived? Would measures be difficult to find and use?
- NQF staff clarified that reserve status measures are still endorsed. The reserve status indicates that performance on the measure is very good with limited room for improvement. Currently in NQF's measure search tool, all endorsed measures (both active and inactive reserve status) are listed in search results. A reserve status measure appears no different from an actively endorsed measure until a user selects the measure to learn more about it.
- The Standing Committee did not initially reach consensus regarding performance gap.
- During the post-comment web meeting, the Standing Committee re-visited the discussion of gap for this measure. The discussion focused on the impact of the lower-end performance on the measure. The developer shared that there are several studies demonstrating an increase in mortality and morbidity if the IMA is not used for a graft. Ultimately, the Standing Committee agreed that the gap was sufficient to warrant a national performance measure and passed the measure on gap.

2. Scientific Acceptability of Measure Properties: The measure meets the Scientific Acceptability criteria.
(2a. Reliability - precise specifications, testing; 2b. Validity - testing, threats to validity)
2a. Reliability: **H-6; M-12; L-0; I-0 (denominator = 18)**; 2b. Validity: **H-2; M-15; L-1; I-0 (denominator = 18)**

Rationale:

- The developer conducted performance measure score reliability testing using a beta-binomial model of signal-to-noise ratio.
- The developer highlighted that the reliability of the measure varies by the number of eligible patients (denominator). In addition, 80% of the STS participants meet the 54-patient sample size necessary for 0.50 reliability and 41% meet the 126 patient sample size necessary for 0.70 reliability.
- The Standing Committee noted that the testing is very similar to the testing for NQF #0117 and that the same discussion applies. They were satisfied that the measure is reliable.
- The developer conducted data element validity testing using the STS Adult Cardiac Surgery Database Audit, which randomly selected 10% of participating sites to evaluate the accuracy, consistency, and comprehensiveness of data collection. The audit process involves re-abstraction of data for 20 cases and the comparison of 82 individual data elements with those

submitted to the data warehouse. The results presented are from the 2015 audit. The method is appropriate for establishing data element validity.

The data element validity results provided demonstrate an overall agreement rate of 99.14%, with most elements in the high 90% agreement range.

The developer also examined measure score validity using known-group analysis. For the measure score, three performance groups were calculated and compared. The three groups had different proportions.

Low-performance groups had lower observed rates and high-performance groups had higher observed rates (93.5% vs 100%). It is unclear how low and high-performance groups were defined.

The developers also conducted measure score validity testing using predictive validity/stability of measure score results over time for October 2013 – September 2014 and October 2014 – September 2015.

Predicted validity/stability analysis demonstrated that among participants that were high performers during the first period, 93% were also high performance in the second period. In addition, 21% of mid-performers remained in the mid-performer category. Low performance showed more changes, with 37% remaining in the low-performer category in the second performance period.

The developer reported that for the period of October 2014 – September 2014, approximately 90% of participants had performance indistinguishable from the STS average (95% CI), and the remaining participants performed differently.

- 944 (90.7%) performed as expected
- 76 (7.3%) had lower-than-expected performance
- 21 (2.0%) had higher-than-expected performance

The Standing Committee noted concerns with using known-groups analysis with the measure score and with using test-retest as a methodology for establishing validity. Despite these concerns, the Standing Committee determined that the measure was valid.

3. Feasibility: H-6; M-11; L-1; I-0 (denominator = 17)

(3a. Clinical data generated during care delivery; 3b. Electronic sources; 3c. Susceptibility to inaccuracies/ unintended consequences identified 3d. Data collection strategy can be implemented)

Rationale:

- The required data elements are collected and used by healthcare personnel during the provision of care and abstracted from a record by someone other than the person obtaining the original information. Some data elements are available through electronic sources. Local availability of data elements varies from full electronic health record (EHR) capability to no availability; however, all data elements are submitted to the STS database in an electronic format following a standard set of data specifications.

- STS Adult Cardiac Surgery Database participants (single or group of surgeons) pay annual participant fees of $3,500 if the majority of surgeons in the group are STS members and $4,750 if the majority are not STS members. In addition, there is a fee of $150 per member and $350 per non-member for surgeons listed on the database's Participation Agreement. STS analyses indicated that the STS database includes more than 90% of cardiothoracic programs in the U.S. There are no additional costs for data collection specific to the measure.
- The Standing Committee discussed a high rating versus a moderate rating for feasibility, noting that the measure is automatically calculated for providers using the STS Adult Cardiac Registry. Standing Committee members noted that data submission to the registry requires staff to abstract the data for entry into the registry and that this requirement led to their consideration of feasibility as moderate instead of high.

4. Use and Usability

4a. Use; 4a1. Accountability and transparency; 4a2. Feedback on the measure by those being measured and others; 4b. Usability; 4b1. Improvement; 4b2. The benefits to patients outweigh evidence of unintended negative consequences to patients)

4a. Use: **Pass-18; No Pass-0 (denominator = 18)** *4b. Usability:* **H-4; M-13; L-1; I-0 (denominator = 18)**

Rationale:

- This measure is publicly reported through the STS Public Reporting Program, both individually and as part of the STS CABG Composite.
- All Adult Cardiac Surgery Database participants receive quarterly feedback reports providing a detailed analysis of the participant's performance, including benchmarking. Dashboard-type reporting on STS.org has been provided for real-time, online data updates to STS surgeon members. Participants also have access to a guide to help interpret performance results.
- The Standing Committee had no concerns regarding use of the measure.
- In the 2016 submission, the developer provided a rate of 98.36% for the period of October 2011 – September 2012. For this submission, the developer provided overall rates of 99.06%, 99.18%, and 99.29%, for calendar years 2017, 2018, and 2019, respectively.
- The Standing Committee had no questions regarding the usability of the measure.

5. Related and Competing Measures

- This measure is related to the following measures:
    - NQF #0114 Risk-Adjusted Postoperative Renal Failure
    - NQF #0115 Risk-Adjusted Surgical Re-exploration
    - NQF #0116 Anti-Platelet Medication at Discharge
    - NQF #0117 Beta Blockade at Discharge
    - NQF #0118 Anti-Lipid Treatment Discharge
    - NQF #0119 Risk-Adjusted Operative Mortality for CABG
    - NQF #0127 Preoperative Beta Blockade
    - NQF #0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)
    - NQF #0130 Risk-Adjusted Deep Sternal Wound Infection
    - NQF #0131 Risk-Adjusted Stroke/Cerebrovascular Accident
    - NQF #0696 STS CABG Composite
- The related measures identified are NQF-endorsed measures developed by or with STS. All these measures are either components of NQF #0696 or are the overall composite NQF #0696. The developer indicated that they are harmonized.

- The Standing Committee discussed related and competing measures during the post-comment web meeting on June 1, 2021. The Standing Committee did not highlight any comments or concerns.

6. **Standing Committee Recommendation for Endorsement: Y-14; N-1 (denominator = 15)**
7. **Public and Member Comment**

   NQF received one comment for this measure. The commenter raised concerns regarding the impact if the Committee were to place the measure on reserve status.

8. **Consensus Standards Approval Committee (CSAC) Vote: Y-X; N-X**
9. **Appeals**

NQF #1550 Hospital-Level Risk-Standardized Complication Rate (RSCR) Following Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA)

Submission | Specifications

Description: The measure estimates a hospital-level risk-standardized complication rate (RSCR) associated with elective primary THA and TKA in Medicare Fee-For-Service beneficiaries who are age 65 and older. The outcome (complication) is defined as any one of the specified complications occurring from the date of index admission to 90 days post date of the index admission (the admission included in the measure cohort).

Numerator Statement: The outcome for this measure is any complication occurring during the index admission (not coded present on arrival) to 90 days post-date of the index admission. Complications are counted in the measure only if they occur during the index hospital admission or during a readmission. The complication outcome is a dichotomous (yes/no) outcome. If a patient experiences one or more of these complications in the applicable time period, the complication outcome for that patient is counted in the measure as a "yes".

Denominator Statement: The target population for the publicly reported measure includes admissions for Medicare FFS beneficiaries who are at least 65 years of age undergoing elective primary THA and/or TKA procedures.

Additional details are provided in S.7 Denominator Details.

Exclusions: This measure excludes index admissions for patients in the following categories:

1. Without at least 90 days post-discharge enrollment in FFS Medicare
2. Discharged against medical advice (AMA)
3. Had more than two THA/TKA procedure codes during the index hospitalization

After applying these exclusion criteria, we randomly select one index admission for patients with multiple index admissions in a calendar year. Therefore, we exclude the other eligible index admissions in that year.

Adjustment/Stratification: Statistical risk model

Level of Analysis: Facility

Setting of Care: Inpatient/Hospital

Type of Measure: Outcome

Data Source: Claims, Enrollment Data

Measure Steward: Centers for Medicare & Medicaid Services

STANDING COMMITTEE MEETING February 16, 2021

1. Importance to Measure and Report: The measure meets the Importance criteria.

(1a. Evidence, 1b. Performance Gap)

1a. Evidence: **Pass-18; No Pass-0 (denominator = 18)**; 1b. Performance Gap: **H-0; M-18; L-0; I-0 (denominator = 18)**

Rationale:

- As part of the previous submission in 2017, the developer included a logic model that suggested that improved communication between providers involved at care transitions, prevention of and response to complications, patient safety, coordinated transitions to the outpatient

environment, medication reconciliation, patient education, and disease management strategies lead to improved patient outcomes by decreasing the risk of complications following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA). The developer included empirical data and references from various studies supporting this logic model.

- In this submission, the developer provided updated citations and references for the rationale for measure development and more recent studies that provide additional support for the previous conclusions.
- The Standing Committee noted the evidence was directionally the same yet stronger than the evidence for the previous maintenance submission.
- The developers provided three-year, hospital-level, risk standardized complication rates (RSCR) from April 1, 2016 to March 31, 2019 using Medicare administrative claims data (n= 962,744 admissions) from 3,418 hospitals. The RSCRs had a mean of 2.5% and range from 1.2-10.6% in the study cohort. The median risk-standardized rate was 2.4%.
- The developer also provided disparities data on THA/TKA risk-standardized complication rate (RSMR) across hospitals by proportion of patients with social risk (dual-eligible patients and AHRQ SES Index Scores).
- The Standing Committee observed that there was an appropriate measure performance gap and did not express any further concerns.

2. Scientific Acceptability of Measure Properties: The measure meets the Scientific Acceptability criteria.
(2a. Reliability precise specifications, testing; 2b. Validity testing, threats to validity
2a. Reliability: **H-0; M-15; L-2; I-0 (denominator = 17, due to SMP member recusal)**; 2b. Validity: **H-0; M-14; L-3; I-0 (denominator = 17, due to SMP member recusal)**

Rationale:

- This measure was deemed as complex and scientific acceptability was evaluated by the NQF Scientific Methods Panel (SMP). A summary of the SMP's review is included below.
- The developers conducted two types of reliability testing. The developers estimated the measure score level by calculating the intraclass correlation coefficient (ICC) using a split sample (i.e., test-retest) method, and then estimated the facility-level reliability (signal-to-noise reliability) using Adams' Method.
    - For signal-to-noise analysis, the developers reported a median reliability of 0.87, ranging from 0.46 to 1.00, and a mean of 0.83. The 25th and 75th percentiles were 0.74 and 0.94, respectively.
    - For split-sample reliability, the developers included 962,744 admissions in the analysis using three years of data. Using the Spearman-Brown prediction formula, the developers estimated the agreement between the two independent assessments of the RSCR for each hospital with 25 admissions was 0.524.
- The SMP reviewers generally agreed that the testing approach and results were acceptable. The SMP rated this measure moderate for reliability: H-2; M-6; L-0; I-0.
- The Standing Committee noted that while the reliability testing methods were robust, there are concerns from public commenters regarding the reliability at the lower end of case counts.
- A Standing Committee member who also serves on the SMP noted that reliability standards are currently in flux but that generally, higher is better. They stated it would be helpful to see the reliability of classification to obtain a better understanding of the risk of misclassification at different case counts.

- The developer noted that misclassification was rare, with most providers classified as no different than average. The developer attributes this to a narrowing of variation in performance as performance improves, use of a 95% confidence interval, and the impact of statistical modeling.
- The Standing Committee was satisfied with the developer's rationale and expressed no further concerns. Because voting was conducted after the meeting using an online voting tool, the Standing Committee voted on the reliability criteria rather than on whether to accept the SMP's ratings.
- The developers conducted validity testing at the measure score level. The measure was compared to the Overall Hospital Star Rating and Hospital THA/TKA Surgical Volume.
    - The developer reported the correlation between THA/TKA complications and Star-Rating summary score to be -0.185.
    - A general trend was noted that high-volume hospitals (i.e., those in the upper deciles) have lower RSCRs than hospitals in other volume deciles.
    - The developer stated that overall, the results above show that the trend and direction of this association is in line with what would be expected. Risk model discrimination and calibration: c statistic = 0.65
- The SMP reviewers generally accepted the validity testing results as a weak but acceptable demonstration of validity. The SMP rated this measure moderate for validity: H-0; M-6; L-1; I-1.
- The Standing Committee noted that the measure currently only includes inpatient procedures. As THA/TKA procedures shift to outpatient settings, the change in patient mix for inpatient procedures could be a threat to the validity of the measure.
- A Standing Committee member noted the inclusion group is Medicare FFS and requested clarification on the included and excluded populations.
- The developer clarified that Medicare Advantage patients are not included. The developer noted that one third of Medicare patients are enrolled in Medicare Advantage plans and that they would seek to incorporate those patients in future versions of this measure.
- The Standing Committee noted that the validity testing employed a circular comparison to a composite that included this measure as a component. A Standing Committee member suggested that the developer could use the logic model provided in the evidence section as a validation tool for the measure.
- The developer appreciated the feedback but shared that it is difficult to find comparison measures and to get data to validate processes. They further noted that processes do not always fully correlate with outcomes. The developer shared that they had recently gained access to results of patient-reported outcome performance measures (PRO-PMs) related to THA/TKA and were working to analyze the relationship with this measure.
- The Standing Committee then raised concerns regarding the risk model. They noted that the c statistic of 0.65 indicated a poor fit.
- The developer responded that this result indicated that outcomes on this measure are more reflective of quality of care delivered by the facility and not strongly related to patient factors.
- The Standing Committee noted that both the SMP and public commenters had raised questions regarding the lack of risk adjustment for social risk factors, noting that the odds ratios for some social factors were larger than those for some clinical factors. Given the elective nature of THA/TKA procedures, the Standing Committee was concerned that patient selection could result

in increased disparities and access issues if social risk was not adequately addressed in the risk adjustment.

- The developer provided additional information on their approach to risk model development, stating that they looked at patient-level clinical variables first and then social risk factors. They shared that when the impact of social risk factors was examined in a multivariate model (as opposed to individually), the odds ratios decreased significantly. They further shared that when considering risk factors to include, they considered which factors a hospital could influence. They shared that hospitals participating in the Comprehensive Care for Joint Replacement model through the CMS Innovation Center had demonstrated that hospitals are able to effectively address issues related to social risk. The developer noted that hospital results were highly correlated both with and without the risk-factor adjustment. These considerations, coupled with the report from the Office of the Assistant Secretary for Planning and Evaluation (ASPE) of the U.S. Department of Health and Human Services (HHS) advising against adjustment for social risk factors for public reporting, led to the decision not to include social risk factors in the risk adjustment model.
- The Standing Committee was satisfied with the developer's rationale and expressed no further concerns on the measure's validity. Because voting was conducted after the meeting using an online voting tool, the Standing Committee voted on the validity criteria rather than on whether to accept the SMP's ratings.

3. Feasibility: H-4; M-13; L-1; I-0 (denominator = 18)

(3a. Clinical data generated during care delivery; 3b. Electronic sources; 3c. Susceptibility to inaccuracies/ unintended consequences identified 3d. Data collection strategy can be implemented)

Rationale:

All the data elements for this measure originate from defined fields in electronic claims.

The necessary data are coded by someone other than the person obtaining original information.

This measure uses administrative claims data and enrollment data and as such, it offers no data collection burden to hospitals or providers.

The Standing Committee expressed no concerns regarding the feasibility of the measure.

4. Use and Usability

4a. Use; 4a1. Accountability and transparency; 4a2. Feedback on the measure by those being measured and others; 4b. Usability; 4b1. Improvement; 4b2. The benefits to patients outweigh evidence of unintended negative consequences to patients)

4a. Use: **Pass-18; No Pass-0 (denominator = 18)** *4b. Usability:* **H-1; M-17; L-0; I-0 (denominator = 18)**

Rationale:

- This measure is publicly reported on CMS' Care Compare website and used in CMS' Hospital Value-Based Purchasing (HVBP) Program.
- The Standing Committee had no questions or concerns regarding use of the measure.
- The developer provided information on their feedback loop for the measure, noting that CMS' QualityNet website gives facilities detailed patient-level results and benchmarks to assist in interpretation. The developer also maintains an email inbox for questions and feedback.

- The developers reported that the median hospital 30-day, all-cause, RSCR for the THA/TKA complications measure for the 3-year period between April 1, 2016 – March 31, 2019 was 2.4%.
- The median RSCR decreased by 0.1 absolute percentage points from April 2016 – March 2017 (median RSCR: 2.5%) to April 2018 – March 2019 (median: RSCR: 2.4%).
- The developer noted that a potential unintended harm of this measure is that providers could inappropriately shift care, which could result in increased patient morbidity and mortality, and other unintended consequences for patients. The developers monitor for this unintended consequence and have not seen any indications it is occurring.
- The Standing Committee did not express any concerns regarding usability of the measure.

5. Related and Competing Measures

- This measure is related to the following measures:
    - NQF #1551 Hospital-Level 30-Day Risk-Standardized Readmission Rate (RSRR) Following Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA)
    - NQF #3493 Risk-Standardized Complication Rate (RSCR) Following Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA) for Merit-Based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
    - NQF #3474 Hospital-Level, Risk-Standardized Payment Associated With a 90-Day Episode of Care for Elective Primary Total Hip and/or Total Knee Arthroplasty (THA/TKA)
- The developer stated that the measure specifications are harmonized to the extent possible. They noted that they focused on related outcome (mortality and readmissions) measures in their harmonization analysis. Their rationale for this was that clinical coherence of the measured cohort takes precedence over alignment with related non-outcome measures. They state that many process measures are limited due to the broader patient exclusions necessary to examine only a specific subset of patients who are eligible for that measure (for example, patients who receive a specific medication or undergo a specific procedure).
- The Standing Committee discussed related and competing measures during the post-comment web meeting on June 1, 2021. The Standing Committee did not highlight any comments or concerns.

6. Standing Committee Recommendation for Endorsement: Yes-17; No-1 (denominator = 18)

7. Public and Member Comment

- NQF received one comment on this measure. The commenter voiced concern about the measure's reliability, particularly at lower case counts, the decision to not include social risk adjustment, and whether the performance variation was sufficient to adequately distinguish performance.

  Committee Response:
  The Standing Committee notes the concerns raised. However, the comment does not provide additional concerns or information that would require a revote on the evaluation criteria.

  Measure Steward/Developer Response:
  RELIABILITY
  In the testing attachment for this measure, we provided both split sample and signal-to-noise reliability. Both the split-sample reliability and signal-to noise reliability results indicate sufficient measure score reliability. Both measures were deemed scientifically acceptable by both the Scientific Methods Panel and the Standing Committee.
  As a metric of agreement, we calculated the ICC for hospitals with 25 admissions or more. Using the Spearman-Brown prediction formula, the agreement between the two independent

assessments of the RSMR for each hospital was 0.524. The split-sample reliability score represents the lower bound of estimate of the true measure reliability. We calculated the signal-to-noise reliability score for each hospital with at least 25 admissions. We also calculated the signal-to-noise reliability score for each hospital with at least 25 admissions. The median reliability score was 0.87; the 25th and 75th percentiles were 0.74 and 0.94, respectively.

SOCIAL RISK FACTOR ADJUSTMENT

While there is a conceptual pathway by which patients with social risk factors could experience worse outcomes, the empiric evidence, and CMS's policy decision to adjust the measure at the payment/program level, do not support risk adjustment at the hospital level.

In our testing attachment we provided analyses showing that adjustment for social risk factors (dual eligibility and low AHRQ SES) did not have an appreciable impact on hospital measure scores: differences between adjusted and unadjusted measures scores were small, and correlations between adjusted and unadjusted measure scores were near 1. This suggests that existing clinical risk factors capture much of the risk related to social risk.

Importantly, we also found that both the patient-level and hospital-level dual eligibility, as well as low AHRQ SES Index effects, were significantly associated with THA/TKC readmission. The significance of the hospital-level effects indicates that if dual eligibility or low AHRQ SES Index variables were used to adjust for patient-level differences, then some of the differences between hospitals would also be adjusted for, potentially obscuring a signal of hospital quality.

In additional analyses we have examined the relationship between measure scores and the hospital-proportion of patients with social risk for the hospitals with the highest proportion of patients with social risk (the fifth quintile) and found that there is no significant correlation.

Given these empiric findings, and the recommendation from the Office of the Assistant Secretary for Planning and Evaluation (ASPE) that quality measures should not be adjusted for social risk factors (ASPE 2020), CMS chose not to adjust this measure for social risk factors at this time.

VARIATION IN MEASURE SCORE

The analyses submitting with our testing attachment show meaningful differences in performance and therefore substantial opportunity for improvement.

There are meaningful differences in the distribution – for example, hospitals in the 10th percentile are performing about 24% better than the average performer, and hospitals in the 90th percentile are performing about 20% worse than the average performer.

In addition, the median odds ratio (1.38) suggests a meaningful increase in the risk of complications if a patient has a THA/TKA procedure at a higher-risk hospital compared to a lower-risk hospital. A value of 1.38 indicates that a patient has a 38% increase in the odds of a complications at a higher-risk hospital compared to a lower-risk hospital, indicating the impact of quality on the outcome rate. This variation suggests there remain differences in the quality of care received across hospitals for THA/TKA procedures. This evidence supports continued measurement to reduce the variation.

References:

- Department of Health and Human Services, Office of the Assistant Secretary of Planning and Evaluation (ASPE). Second Report to Congress: Social Risk Factors and Performance in Medicare's Value-based Purchasing Programs. 2020;. Accessed May 4, 2021.

8. Consensus Standards Approval Committee (CSAC) Vote: Y-X; N-X

9. Appeals

NQF #1551 Hospital-Level 30-Day Risk-Standardized Readmission Rate (RSRR) Following Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA)

Submission | Specifications

Description: The measure estimates a hospital-level risk-standardized readmission rate (RSRR) following elective primary THA and/or TKA in Medicare Fee-For-Service (FFS) beneficiaries who are 65 years and older. The outcome (readmission) is defined as unplanned readmission for any cause within 30 days of the discharge date for the index admission (the admission included in the measure cohort). A specified set of planned readmissions do not count in the readmission outcome.

Numerator Statement: The outcome for this measure is 30-day readmissions. We define readmissions as inpatient admissions for any cause, with the exception of certain planned readmissions, within 30 days from the date of discharge of the index hospitalization. If a patient has more than one unplanned admission (for any reason) within 30 days after discharge from the index admission, only one is counted as a readmission. The measure looks for a dichotomous yes or no outcome of whether each admitted patient has an unplanned readmission within 30 days. However, if the first readmission after discharge is considered planned, any subsequent unplanned readmission is not counted as an outcome for that index admission, because the unplanned readmission could be related to care provided during the intervening planned readmission rather than during the index admission.

Denominator Statement: The target population for the publicly reported measure includes admissions for Medicare FFS beneficiaries who are at least 65 years of age undergoing elective primary THA and/or TKA procedures.

Additional details are provided in S.9 Denominator Details.

Exclusions: The THA/TKA readmission measure excludes admissions for patients in the following categories:

1. Without at least 30 days post-discharge enrollment in FFS Medicare
2. Discharged against medical advice (AMA)
3. Admitted for the index procedure and subsequently transferred to another acute care facility
4. Had more than two THA/TKA procedure codes during the index hospitalization
5. Had THA/TKA admissions within 30 days of a prior THA/TKA index admission

Adjustment/Stratification: Statistical risk model

Level of Analysis: Facility

Setting of Care: Inpatient/Hospital

Type of Measure: Outcome

Data Source: Claims, Enrollment Data

Measure Steward: Centers for Medicare & Medicaid Services

STANDING COMMITTEE MEETING February 16, 2021

1. Importance to Measure and Report: The measure meets the Importance criteria.

(1a. Evidence, 1b. Performance Gap)

1a. Evidence: **Pass-17; No Pass-0 (denominator = 17)**; 1b. Performance Gap: **H-1; M-16; L-0; I-0 (denominator = 17)**

Rationale:

- As part of the previous submission in 2017, the developer included a logic model that suggested that improved communication between providers involved at care transitions, prevention of and response to complications, patient safety, coordinated transitions to the outpatient environment, medication reconciliation, patient education, and disease management strategies leads to improved patient outcomes by decreasing the risk of readmissions following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA). The developer included empirical data and references from various studies supporting this logic model.

- In this submission, the developer provided updated citations and references for the rationale for measure development.
- The Standing Committee noted the evidence was directionally the same yet stronger than the evidence for the previous maintenance submission.
- The developers provided three-year, hospital-level, risk standardized readmission rates (RSRR) from July 1, 2016 to June 30, 2019 using Medicare administrative claims data (n= 992,016 admissions) from 3,412 hospitals. The RSRRs have a mean of 4.0% and range from 2.5-9.0% in the study cohort. The median risk-standardized rate is 4.0%.
- The developer also provided disparities data on THA/TKA risk-standardized readmission rate (RSRR) across hospitals by proportion of patients with social risk (dual-eligible patients and AHRQ SES Index Scores).
- The Standing Committee questioned whether the performance gap was sufficient to justify continued active endorsement, with 98% of facilities performing no different than expected. The developer shared that CMS has criteria for the removal of topped out measures from its programs and that this measure does not meet CMS criteria for being topped out.
- The Standing Committee observed that there was an appropriate measure performance gap and did not express any further concerns.

2. Scientific Acceptability of Measure Properties: The measure meets the Scientific Acceptability criteria.
(2a. Reliability precise specifications, testing; 2b. Validity testing, threats to validity
2a. Reliability: **H-1; M-15; L-0; I-0 (denominator = 16, due to SMP member recusal)**; 2b. Validity: **H-0; M-15; L-1; I-0 (denominator = 16, due to SMP member recusal)**

Rationale:

- This measure was deemed as complex and scientific acceptability was evaluated by the NQF Scientific Methods Panel (SMP). A summary of the SMP's review is included below.
- The developers conducted two types of reliability testing. The developers estimated measure score level by calculating the intraclass correlation coefficient (ICC) using a split sample (i.e., test-retest) method, and then estimated the facility-level reliability (signal-to-noise reliability) using Adams' Method.
    - For signal-to-noise analysis, the developers reported a median reliability of 0.77, ranging from 0.29 to 0.99 and a mean of 0.72. The 25th and 75th percentiles were 0.58 and 0.88, respectively.
    - Using the Spearman-Brown prediction formula, the developers estimated that the agreement between the two independent assessments of the RSRR for each hospital with 25 admissions was 0.454.
- The SMP reviewers generally agreed the testing approach and results were acceptable. The SMP rated this measure moderate for reliability: H-2; M-5; L-1; I-0.
- The Standing Committee noted that the reliability discussion for NQF #1550 also applies to NQF #1551.
- In addition to questions and concerns raised for NQF #1550, a Standing Committee member questioned whether the measure could be expanded to even lower-volume hospitals to provide feedback on their performance.
- A CMS representative clarified that all hospitals are included in the measure calculations and receive feedback reports from CMS. They shared that CMS' goal is to assess as many hospitals as

possible but that at very small numbers, one event influences the results, making it difficult to interpret results reliably.

- The Standing Committee expressed no further concerns. Because voting was conducted after the meeting using an online voting tool, the Standing Committee voted on the reliability criteria rather than on whether to accept the SMP's ratings.
- The developers conducted validity testing at the measure score level. The measure was compared to the Hospital Star Rating readmission group score, the Overall Hospital Star Rating, and Hospital THA/TKA Surgical Volume
    - The developers reported the correlation between THA/TKA RSRRs and Star-Rating readmissions score as -0.301, which suggests that hospitals with lower THA/TKA RSRRs are more likely to have higher Star-Rating readmission scores.
    - The developers reported the correlation between THA/TKA RSRRs and Star-Rating summary score is -0.239, which suggests that hospitals with lower THA/TKA RSRRs are more likely to have higher Star-Rating summary scores.
    - The developers reported the risk model discrimination and calibration as c statistic of 0.67. The developer reports good discrimination and predictive ability based on risk decile plot.
- The SMP reviewers generally accepted the validity testing results as an acceptable demonstration of validity. The SMP rated this measure moderate for validity: H-0; M-7; L-0; I-1.
- The Standing Committee noted that the entire validity discussion for NQF #1550 applies to NQF #1551 as well.
- In addition to comments shared for NQF #1550, the developer shared that for readmissions measures, such as this one, U.S. Congress has mandated that results be stratified into five categories by dual-eligible status.
- The Standing Committee expressed no further concerns. Because voting was conducted after the meeting using an online voting tool, the Standing Committee voted on the reliability criteria rather than on whether to accept the SMP's ratings.

3. Feasibility: H-3; M-13; L-1; I-0 (denominator = 17)

(3a. Clinical data generated during care delivery; 3b. Electronic sources; 3c. Susceptibility to inaccuracies/ unintended consequences identified 3d. Data collection strategy can be implemented)

Rationale:

- All the data elements for this measure originate from defined fields in electronic claims.
- The necessary data are coded by someone other than the person obtaining the original information.
- This measure uses administrative claims data and enrollment data and as such, it offers no data collection burden to hospitals or providers.
- The Standing Committee had no concerns regarding the feasibility of the measure.

4. Use and Usability

4a. Use; 4a1. Accountability and transparency; 4a2. Feedback on the measure by those being measured and others; 4b. Usability; 4b1. Improvement; 4b2. The benefits to patients outweigh evidence of unintended negative consequences to patients)

4a. Use: **Pass-17; No Pass-0 (denominator = 17)** *4b. Usability:* **H-0; M-17; L-0; I-0 (denominator = 17)**

Rationale:

- This measure is publicly reported on CMS' Care Compare website and used in CMS' Hospital Value-Based Purchasing (HVBP) Program.

- A Standing Committee member suggested providing context for the measure when it is publicly reported to help patients understand the impact and implication of a readmission. They also felt a low-volume indicator could be useful for the context of results.
- The developer provided information on their feedback loop for the measure, noting that CMS' QualityNet website gives facilities detailed patient-level results and benchmarks to assist in interpretation. The developer also maintains an email inbox for questions and feedback.
- Overall, the Standing Committee expressed no major concerns regarding use of the measure.
- The developers reported that the median hospital 30-day, all-cause, RSRR for the THA/TKA readmission measure for the 3-year period between July 1, 2016 and June 30, 2019 was 4.0%. The median RSRR decreased by 0.1 absolute percentage points from July 2016 – June 2017 (median RSRR: 4.0%) to July 2018 – June 2019 (median: RSRR: 3.9%).
- The developer noted that a potential unintended harm of this measure is that providers could inappropriately shift care, which could result in increased patient morbidity and mortality and other unintended consequences for patients. The developers monitor for this unintended consequence and have not seen any indications it is occurring.
- The Standing Committee did not express any concerns regarding usability of the measure.

5. Related and Competing Measures

- This measure is related to the following measures:
  - NQF #1550 Hospital-Level Risk-Standardized Complication Rate (RSCR) Following Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA)
  - NQF #3493 Risk-Standardized Complication Rate (RSCR) Following Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA) for Merit-Based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
  - NQF #3474 Hospital-Level, Risk-Standardized Payment Associated With a 90-Day Episode of Care for Elective Primary Total Hip and/or Total Knee Arthroplasty (THA/TKA)
- The developer stated that the measure specifications are harmonized to the extent possible. They noted that they focused on related outcome (mortality and readmissions) measures in their harmonization analysis. Their rationale for this was that clinical coherence of the measured cohort takes precedence over alignment with related non-outcome measures. They stated that many process measures are limited due to the broader patient exclusions necessary to examine only a specific subset of patients who are eligible for that measure (e.g., patients who receive a specific medication or undergo a specific procedure).
- The Standing Committee discussed related and competing measures during the post-comment web meeting on June 1, 2021. The Standing Committee did not highlight any comments or concerns.

6. Standing Committee Recommendation for Endorsement: Yes-17; No-0 (denominator = 17)

7. Public and Member Comment

- NQF received one comment on this measure. The commenter voiced concern about the measure's reliability, particularly at lower case counts, the decision to not include social risk adjustment, and whether the performance variation was sufficient to adequately distinguish performance.

  Committee Response:
  The Standing Committee notes the concerns raised. However, the comment does not provide additional concerns or information that would require a revote on the evaluation criteria.
  Measure Steward/Developer Response:

RELIABILITY

In the testing attachment for this measure, we provided both split sample and signal-to-noise reliability. Both the split-sample reliability and signal-to noise reliability results indicate sufficient measure score reliability. Both measures were deemed scientifically acceptable by both the Scientific Methods Panel and the Standing Committee.

As a metric of agreement, we calculated the ICC for hospitals with 25 admissions or more. Using the Spearman-Brown prediction formula, the agreement between the two independent assessments of the RSMR for each hospital was 0.454. The split-sample reliability score represents the lower bound of estimate of the true measure reliability.

We also calculated the signal-to-noise reliability score for each hospital with at least 25 admissions. The median reliability score was 0.77; the 25th and 75th percentiles were 0.58 and 0.88, respectively.

SOCIAL RISK FACTOR ADJUSTMENT

While there is a conceptual pathway by which patients with social risk factors could experience worse outcomes, the empiric evidence, and CMS's policy decision to adjust the measure at the payment/program level, do not support risk adjustment at the hospital level.

In our testing attachment we provided analyses showing that adjustment for social risk factors (dual eligibility and low AHRQ SES) did not have an appreciable impact on hospital measure scores: differences between adjusted and unadjusted measures scores were small, and correlations between adjusted and unadjusted measure scores were near 1. This suggests that existing clinical risk factors capture much of the risk related to social risk.

Importantly, we also found that both the patient-level and hospital-level dual eligibility, as well as low AHRQ SES Index effects, were significantly associated with THA/TKC readmission. The significance of the hospital-level effects indicates that if dual eligibility or low AHRQ SES Index variables were used to adjust for patient-level differences, then some of the differences between hospitals would also be adjusted for, potentially obscuring a signal of hospital quality. Finally, CMS adjusts for social risk (dual eligibility) within the Hospital Readmission Reduction Program (HRRP), which is consistent with recommendations from the Office of the Assistant Secretary for Planning and Evaluation (ASPE) that quality measures should not be adjusted for social risk factors (ASPE 2020). Given these empiric findings, ASPE's latest recommendations, and CMS' policy decision to adjust for social risk at the program/payment level, CMS chose not to adjust this measure for social risk factors at this time.

VARIATION IN MEASURE SCORE

The analyses submitting with our testing attachment show meaningful differences in performance and therefore substantial opportunity for improvement.

As presented in our submission form, the range of measure scores was 2.5%-9.0% with a mean of 4.0%. In addition, the median odds ratio of 1.25 suggests a meaningful increase in the risk of readmission if a patient is admitted with THA/TKA at a higher risk hospital compared to a lower risk hospital. A value of 1.25 indicates that a patient's risk of readmission is 25% greater in a higher-risk hospital than a lower-risk hospital. This variation in rates suggests there are differences in the quality of care received across hospitals performing THA/TKA procedures on Medicare FFS patients.

References:

Department of Health and Human Services, Office of the Assistant Secretary of Planning and Evaluation (ASPE). Second Report to Congress: Social Risk Factors and Performance in Medicare's Value-based Purchasing Programs. 2020. Accessed May 4, 2021.

8. **Consensus Standards Approval Committee (CSAC) Vote: Y-X; N-X**
9. **Appeals**

NQF #3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Submission | Specifications

Description: The STS Individual Surgeon Composite Measure for Adult Cardiac Surgery includes five major procedures (isolated CABG, isolated AVR, AVR+CABG, MVRR, MVRR+CABG) and comprises the following two domains:

Domain 1 – Risk-Adjusted Operative Mortality

Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Risk-Adjusted Major Morbidity

Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation,
2. Deep sternal wound infection,
3. Permanent stroke,
4. Renal failure, and
5. Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

All measures are based on audited clinical data collected in the STS Adult Cardiac Surgery Database. Individual surgeons with at least 100 eligible cases during the 3-year measurement window will receive a score for each domain and an overall composite score. In addition to calculating composite score point estimates with credible intervals, surgeons will be assigned rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Numerator Statement: Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes in detail this multiprocedural, multidimensional composite measure.

The STS Individual Surgeon Composite Measure for Adult Cardiac Surgery includes five major procedures, i.e., isolated coronary artery bypass grafting (CABG), isolated aortic valve replacement (AVR), AVR+CABG, isolated mitral valve repair or replacement (MVRR), and MVRR+CABG, and comprises the following two domains:

Domain 1 – Risk-Adjusted Operative Mortality

Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Risk-Adjusted Major Morbidity

Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation
2. Deep sternal wound infection
3. Permanent stroke
4. Renal failure and
5. Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons

Individual surgeons with at least 100 eligible cases during the 3-year measurement window will receive a score for each domain and an overall composite score. In addition to calculating composite score point estimates with credible intervals, surgeons will be assigned rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated CABG, isolated AVR, AVR+CABG, isolated MVRR, and MVRR+CABG.

Time Window: 3 years

By including composite performance scores for a portfolio of five procedures that account for nearly 80% of a typical STS Adult Cardiac Surgery Database participant surgeon's clinical activity, this metric provides a more balanced and comprehensive perspective than focusing on just one procedure or one end point. Recognizing that surgeons' practices vary, each surgeon's composite performance is implicitly "weighted" by the proportion of each type of procedure he or she performs. For instance, the results of surgeons who primarily perform mitral procedures are affected most by their mitral surgery results. This approach is especially relevant for surgeons with highly specialized practices who may do relatively few isolated CABG procedures and whose performance would thus be difficult to assess using a CABG measure only. Finally, performance on each of these procedures is estimated using risk models specific to those procedures, in most cases the exact or slightly modified versions of previously published models (references provided below).

Final Composite Score:

The overall composite score was calculated as a weighted sum of (1 minus risk-adjusted mortality rate) and (1 minus risk-adjusted major morbidity rate). Mortality and morbidity rates were weighted inversely by their respective standard deviations across surgeons. This procedure is equivalent to first rescaling mortality and morbidity rates by their respective standard deviations across surgeons and then assigning equal weighting to the rescaled mortality rate and rescaled morbidity rate. Standard deviations derived from the data were used to define the final composite measure as 0.81 x (1 minus risk-standardized mortality rate) + 0.19 x (1 minus risk-standardized complication rate).

Details regarding the current STS adult cardiac surgery risk models can be found in the following manuscripts:

- Shahian DM, O'Brien SM, Filardo G, Ferraris VA, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 1--coronary artery bypass grafting surgery. Ann Thorac Surg. 2009 Jul;88(1 Suppl):S2-22.
- O'Brien SM, Shahian DM, Filardo G, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 2—isolated valve surgery. Ann Thorac Surg 2009;88(1 Suppl):S23–42.
- Shahian DM, O'Brien SM, Filardo G, Ferraris VA, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 3--valve plus coronary artery bypass grafting surgery. Ann Thorac Surg 2009 Jul;88(1 Suppl):S43-62.

Additional details regarding the Individual Surgeon Composite Measure for Adult Cardiac Surgery are provided in the attached manuscript:

Shahian DM, He X, Jacobs JP, Kurlansky PA, Badhwar V, Cleveland JC Jr, Fazzalari FL, Filardo G, Normand SL, Furnary AP, Magee MJ, Rankin JS, Welke KF, Han J, O'Brien SM. The Society of Thoracic Surgeons Composite Measure of Individual Surgeon Performance for Adult Cardiac Surgery: A Report of The Society of Thoracic Surgeons Quality Measurement Task Force. Ann Thorac Surg. 2015;100:1315-25.

Denominator Statement: See response in S.4. Numerator Statement

Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated CABG, isolated AVR, AVR+CABG, isolated MVRR, and MVRR+CABG.

Exclusions: Measure exclusions: Individual surgeons who do not meet the minimum case requirement (i.e., at least 100 eligible cases during the 3-year measurement window) will not receive a score for each domain and an overall composite score.

Adjustment/Stratification: Statistical risk model

Level of Analysis: Clinician : Individual

Setting of Care: Inpatient/Hospital

Type of Measure: Composite

Data Source: Registry Data
Measure Steward: The Society of Thoracic Surgeons

STANDING COMMITTEE MEETING February 12, 2021

1. Importance to Measure and Report: The measure meets the Importance criteria.
(1a. Evidence, 1b. Performance Gap)
1a. Evidence: **Pass-18; No Pass-0 (denominator = 18)**; 1b. Performance Gap: **H-2; M-16; L-0; I-0 (denominator = 18);** 1c. Composite – Quality Construct and Rationale: **H-5; M-12; L-0; I-0 (denominator = 17)**
Rationale:

- As part of the previous submission in 2016, the developer provided information regarding services and/or care that a provider can undertake to influence mortality and each of the five morbidities included in this composite.
- The developer attested to no changes to the evidence for this submission.
- The Standing Committee agreed the evidence is unchanged and sufficient to tie the components of this composite to patient outcomes.
- The developer provided composite measure results for patients undergoing cardiac surgery during a three-year period, January 2017 – December 2019. The developer included surgeons with at least 10 eligible records during the study period in the hierarchical model for estimating composite scores and noted that while surgeons with 10 eligible cases are included in the hierarchical model procedure, composite scores will typically only be reported by the STS for surgeons with at least 100 cases during a three-year time period. The developer did not provide performance gap information for the individual component measures.
- The developer reports that 9.52% of surgeons with >100 cases (n = 1,841 surgeons with 584,571 operations) have lower than expected performance on the measure based on 98% Bayesian credible interval. In comparison, 9.51% of surgeons with >10 cases (n = 2,098 surgeons with 600,207 operations) have lower than expected performance.
- The developer provided disparities data via public comment, using logistic regression to study the associations of race, ethnicity, and insurance status with operative mortality and major morbidity. The only significant associations (p-value <.0001) were major morbidity and Medicare or Medicaid (for patients age <65 vs. commercial-HMO for patients age <65) and major morbidity and Black race.
- The Standing Committee had no issues or questions related to performance gap.
- The developer noted that this measure is based on a combination of risk-adjusted mortality and risk-adjusted major complications. To assess overall quality, the composite comprises two domains:
    - Domain 1 is risk-adjusted operative mortality (before hospital discharge or within 30 days of operation) for isolated coronary artery bypass grafting (CABG), isolated aortic valve replacement (AVR), AVR+CABG, isolated mitral valve repair or replacement (MVRR), and MVRR+CABG. This domain is calculated as a single measure.
    - Domain 2 is risk-adjusted major morbidity, which is an "any or none" measure of the following complications: (1) prolonged ventilation; (2) deep sternal wound infection; (3) permanent stroke; (4) renal failure; and (5) reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

- The developer states that the domains are rescaled by their respective standard deviation across surgeons and then assigned equal weighting to the rescaled rates. Using standard deviations derived from the data, the final composite measure is 0.81 x (1 minus risk-standardized mortality rate) + 0.19 x (1 minus risk-standardized complication rate).
- The developer's rationale for the composite is that differentiating performance based on mortality alone fails to account for the fact that not all operative survivors received equal quality care. By combining results from five of the most frequently performed procedures and risk-adjusted occurrences of any of the five major complications, this composite provides a more comprehensive quality assessment that should help surgeons identify potential areas for improvement. By aggregating the surgeries and rates, the composite yields a more comprehensive view of surgeon performance, which may be more useful for accountability purposes.
- The Standing Committee had no issues or questions related to composite construct and rationale.

2. Scientific Acceptability of Measure Properties: The measure meets the Scientific Acceptability criteria.
(2a. Reliability - precise specifications, testing; 2b. Validity - testing, threats to validity
2a. Reliability: **H-8; M-9; L-0; I-0 (denominator = 17)**; 2b. Validity: **H-2; M-15; L-0; I-0 (denominator = 17);** 2c. Composite Quality Construct**: H-5; M-12; L-0; I-0 (denominator = 17)**

Rationale:

- To demonstrate reliability, the developer conducted composite-score-level signal-to-noise analysis. They utilized a Bayesian approach to generate possible values for each surgeon's score and then estimated the true values by conducting Markov Chain Monte Carlo simulations. The data used in the simulation originated from a three-year period of July 2011 – June 2014, which is rather dated. The developer included results for a range of case counts and indicated that they intend to use a 100-case threshold for public reporting.
- The results of the reliability analysis range from a reliability of 0.77 (95% Prl 0.75 – 0.79) for 10 index cases to 0.82 (95% Prl 0.81 – 0.84) for 200 cases. At the planned public reporting threshold of 100 index cases, the reliability is 0.81 (95% Prl 0.79 – 0.82).
- The Standing Committee noted that the reliability testing methodology for this measure was very sophisticated and expressed appreciation for the innovative technique. They had no concerns with the reliability of the measure.
- The developer examined measure score validity using known-group analysis. Using data from July 2011 – June 2014, the surgeons were divided into three groups as follows:
    - Surgeons were labeled as having higher-than-expected performance if the 98% credible interval surrounding a surgeon's composite score fell entirely above the overall STS average composite score.
    - Surgeons were labeled as having lower-than-expected performance if the 98% credible interval surrounding a surgeon's composite score fell entirely below the overall STS average composite score.
    - Surgeons were labeled as higher-than-expected performance (3 stars), lower-than-expected performance (1 star), and indistinguishable from the average or as-expected performance (2 stars).

- Mortality (domain 1) and morbidity (domain 2) scores were then compared for each group of surgeons.
- The developers reported that compared to surgeons receiving 1 star, those with 3 stars had lower risk-adjusted mortality (1.2% vs. 4.2%) and lower risk-adjusted morbidity (8.8% vs. 22.6%) during July 2011 – June 2014. Thus, the differences in performance were clinically meaningful as well as statistically significant. STS surgeons deemed better by the composite scores have (on average) higher performance during the same time window on each individual domain of the composite measure.
- The Standing Committee expressed concerns with the circular reasoning in the validity testing, which compared performance on the composite component measures to the overall composite score. The developer shared that there are no external comparisons available for this measure.
- The developer indicated that they calculate a risk score for operative mortality and major complications for each patient and use these patient-level scores to adjust for case mix. The scores were calculated using existing and modified risk models from the measures on which this measure is based. Calculating a risk score using this method limited the number of baseline covariates to a feasible number.
- The developer stated that they validated this risk approach by performing sensitivity analyses comparing each surgeon's risk-adjusted mortality and complication rates in models adjusting for 41 and 47 individual covariates with models adjusting for a single composite risk score.
- A Standing Committee member asked for the rationale for including race in the clinical risk model. The developer shared that the model fit suffers if race is not included and while the exact mechanism is unclear, they suspect a genetic component is at work that contributes to poorer outcomes for non-White patients. They also shared that they are working on adding geocoding to patient records in the registry to allow for more exploration of the impact of social risk factors.
- The Standing Committee accepted the measure as valid.
- The developer used Pearson correlations to verify that each of the two domains of the measure contribute statistical information but do not dominate the composite. Data from July 2011 – June 2014 were used for the calculation. Results were 0.73 for mortality domain versus overall composite measure and 0.92 for morbidity domain score versus overall score. The developers interpret this to mean that risk-adjusted morbidity explains more of the variation in the overall composite score but does not dominate the score.
- The overall composite score was calculated as a weighted sum of (1 minus risk-adjusted mortality rate) and (1 minus risk-adjusted major morbidity rate). Mortality and morbidity rates were weighted inversely by their respective standard deviations across surgeons. Standard deviations derived from the data were used to define the final composite measure as 0.81 × (1 minus risk-standardized mortality rate) + 0.19 × (1 minus risk-standardized complication rate).
- Weighting was assessed by an Expert Panel. It was consistent with the panel's clinical assessment of each domain's relative importance. The developer stated that a one percentage point change in a surgeon's risk-adjusted mortality rate has the same impact on the overall score as a 4.3 percentage point change in the site's risk-adjusted morbidity rate.
- The Standing Committee had no issues or questions regarding the composite construct.

3. Feasibility: H-4; M-12; L-1; I-0 (denominator = 17)

(3a. Clinical data generated during care delivery; 3b. Electronic sources; 3c. Susceptibility to inaccuracies/ unintended consequences identified 3d. Data collection strategy can be implemented)

Rationale:

- The required data elements are collected and used by healthcare personnel during the provision of care and abstracted from a record by someone other than person obtaining original information. Some data elements are available through electronic sources. Local availability of data elements varies from full electronic health record (EHR) capability to no availability; however, all data elements are submitted to the STS database in an electronic format following a standard set of data specifications.
- STS Adult Cardiac Surgery Database participants (single or group of surgeons) pay annual participant fees of $3,500 if the majority of surgeons in the group are STS members and $4,750 if the majority are not STS members. In addition, there is a fee of $150 per member and $350 per non-member for surgeons listed on the database's Participation Agreement. STS analyses indicated that the STS database includes more than 90% of cardiothoracic programs in the U.S. There are no additional costs for data collection specific to the measure.
- The Standing Committee had no concerns regarding the feasibility of the measure.

4. Use and Usability

4a. Use; 4a1. Accountability and transparency; 4a2. Feedback on the measure by those being measured and others; 4b. Usability; 4b1. Improvement; 4b2. The benefits to patients outweigh evidence of unintended negative consequences to patients)

4a. Use: **Pass-17; No Pass-0 (denominator = 17)** *4b. Usability:* **H-2; M-14; L-0; I-1 (denominator = 17)**

Rationale:

- This measure was initially endorsed in 2017. It is not currently used in an accountability program. The developer provided plans for a path to public reporting, possibly as soon as this year. The developer stated that concerns regarding the confidentiality and formatting of surgeon-level results delayed distribution of confidential surgeon-level feedback reports until January 2020. Providing a private review period of measure results prior to public reporting is a best practice. The developer has a strong record of publicly reporting measure results.
- The developer shared that of the 2,098 surgeons who met the completeness and minimum procedure thresholds, 1,841 performed at least 100 eligible cases within the three-year measurement period. Of this subset of surgeons, approximately 400 opted in for receipt of their confidential, surgeon-level performance results in January 2020. The report includes overall results, results by domain, benchmarks, and information on how to interpret the results.
- A Standing Committee member asked for clarification on the use criterion, which requires a maintenance measure to be in an accountability program within three years of its initial endorsement.
- NQF staff explained that given the developer's strong track record of publicly reporting its measures, staff determined that the plan for publicly reporting the measure this year was highly credible and that the measure would be in an accountability program soon, likely before the completion of this endorsement cycle.
- The Standing Committee accepted this rationale and voted to pass the measure on use.
- The developer stated that they are unable to provide performance trends as performance data on this measure was only first distributed the consenting surgeons in January 2020.
- As a proxy for trend data on this measure, the developer provided 10 years of star rating trends for the five procedures aggregated within the composite. There is a general trend of reduction

in participants receiving one or three stars and an increase in participants receiving two stars. The developer stated that this is consistent with their performance improvement goal of reducing variation.

- The developer identified that potential harms related to the use of this measure include gaming and risk aversion. The developer stated that they control these through a careful audit process and a robust risk-adjustment methodology.
- The Standing Committee had no concerns regarding the usability of this measure.

5. Related and Competing Measures

- The developers identified the following related measures:
  - NQF #0696 STS CABG Composite
  - NQF #2561 Aortic Valve Replacement Composite Score
  - NQF #2563 Aortic Valve Replacement + CABG Composite Score
  - NQF #3031 Mitral Valve Repair/Replacement Composite Score
  - NQF #3032 Mitral Valve Repair/Replacement + CABG Composite Score

The developer stated that the measure specifications have been harmonized to the extent possible.

The Standing Committee discussed related and competing measures during the post-comment web meeting on June 1, 2021. The Standing Committee did not highlight any comments or concerns.

Standing Committee Recommendation for Endorsement: Y-17; N-0 (denominator = 17)

6. Public and Member Comment

NQF did not receive any public or member comments for this measure.

7. Consensus Standards Approval Committee (CSAC) Vote: Y-X; N-X

8. Appeals

NQF #3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Submission | Specifications

Description: The STS Mitral Valve Repair/Replacement (MVRR) Composite Score measures surgical performance for isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD). To assess overall quality, the STS MVRR Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation,
2. Deep sternal wound infection,
3. Permanent stroke,
4. Renal failure, and
5. Reoperations for bleeding, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Outcome data are collected on all patients and from all participants. For optimal measure reliability, participants meeting a volume threshold of at least 36 cases over 3 years (i.e., approximately one mitral case per month) receive a score for each of the two domains, plus an overall composite score. The overall composite score is

created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Numerator Statement: Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.

The STS Mitral Valve Repair/Replacement (MVRR) Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation
2. Deep sternal wound infection
3. Permanent stroke
4. Renal failure and
5. Reoperations for bleeding, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD).

Time Window: 3 years

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 36 isolated MVRR procedures in the patient population.

Estimation of Composite Scores and Star Ratings: The statistical methodology used to estimate the STS MVRR composite score and star rating for each participant site was similar to that used for the STS isolated CABG, isolated AVR, and AVR+CABG measures. As with previous composite scores, we first translated risk-standardized event rates into risk-standardized absence of event rates so that a higher score indicated better performance. We then rescaled the morbidity and mortality domains by dividing by their respective standard deviations and then added the two domains together.

Denominator Statement: See response in S.4. Numerator Statement for complete description of measure specifications.

Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD).

Exclusions: Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 36 isolated MVRR procedures in the patient population.

Adjustment/Stratification: Statistical risk model

Level of Analysis: Facility, Clinician : Group/Practice

Setting of Care: Inpatient/Hospital
Type of Measure: Composite
Data Source: Registry Data
Measure Steward: The Society of Thoracic Surgeons

STANDING COMMITTEE MEETING February 12, 2021

1. Importance to Measure and Report: The measure meets the Importance criteria.
(1a. Evidence, 1b. Performance Gap)
1a. Evidence: **Pass-16; No Pass-0 (denominator = 16)**; 1b. Performance Gap: **H-1; M-16; L-0; I-0 (denominator = 17);** 1c. Composite - Quality Construct and Rationale: **H-3; M-14; L-0; I-0 (denominator = 17)**
Rationale:

- As part of the previous submission in 2016, the developer provided information regarding services and/or care that a provider can undertake to influence mortality and each of the five morbidities included in this composite.
- The developer attested to no changes to the evidence for this submission.
- The Standing Committee agreed the evidence is unchanged and sufficient to tie the components of this composite to patient outcomes.

- The developer provided the distribution of results for this measure from two consecutive time periods, January 2016 – December 2018 and January 2017 – December 2019, for registry participants with at least 36 eligible cases.

Time Period	Jan 2016 – Dec 2018	Jan 2017 – Dec 2019
# of Participants	458	450
# Operations	57,114	57,373
Mean	0.938	0.942
STD	0.0149	0.01487
IQR	0.0196	0.0178
0%	0.881	0.871
10%	0.919	0.922
20%	0.926	0.932
30%	0.932	0.936
40%	0.937	0.940
50%	0.940	0.944
60%	0.944	0.950
70%	0.947	0.950
80%	0.950	0.954
90%	0.955	0.958
100%	0.972	0.974

The developer provided disparities data presented by domain for insurance status, race, and ethnicity. The only significant association (p-value <.0001) was major morbidity and Black race.

Risk-adjusted odds ratios	Mortality Adjusted Odd Ratio (95% CI)	p-value	Major Morbidity Adjusted Odd Ratio (95%CI)	p-value
Insurance status among patients age >=65 Medicare without Medicaid/Commercial-HNO	Ref	*	Ref	*
Insurance status among patients age >=65 Medicare + Medicaid dual eligible	0.73 (0.55, 0.97)	0.0298	1.07 (0.92, 1.24)	0.3701
Insurance status among patients age >=65 Medicare + Commercial-HMO without Medicaid	0.83 (0.72, 0.96)	0.0118	1.00 (0.93, 1.08)	0.9651
Insurance status among patients age >=65 Commercial-HMO without Medicare	1.01 (0.79, 1.30)	0.9101	0.99 (0.87, 1.13)	0.8680
Insurance status among patients age < 65 Commercial-HMO without Medicare/Medicaid	Ref	*	Ref	*
Insurance status among patients age < 65 Medicare or Medicaid	1.09 (0.91, 1.30)	0.3340	1.14 (1.05, 1.23)	0.0016
Insurance status among patients age < 65 None/Self Paid	1.11 (0.78, 1.59)	0.5700	0.94 (0.80, 1.09)	0.4055
Insurance status among patients age < 65 Other	1.13 (0.76, 1.70)	0.5387	0.98 (0.81, 1.18)	0.8101
Black race	0.82 (0.70, 0.97)	0.0240	**1.19 (1.09, 1.29)**	**<.0001**
Hispanic ethnicity	0.85 (0.70, 1.04)	0.1246	1.01 (0.90, 1.13)	0.8454

*Cell left intentionally blank

- The Standing Committee had no issues or questions related to performance gap.
- The developer's rationale for the composite is that differentiating performance based on mortality alone fails to account for the fact that not all operative survivors received equal quality care. By combining results of risk-adjusted mortality and the risk-adjusted occurrence of any of the five major complications, this composite provides a more comprehensive quality assessment that should help participants identify potential areas for improvement. By aggregating the surgeries and rates, the composite yields a more comprehensive view of participant performance, which may be more useful for accountability purposes.

The developer noted that this measure is constructed using two domains:

  - Domain 1 is the absence of operative mortality (before hospital discharge or within 30 days of operation) for patients undergoing MVRR. This domain is calculated as a single measure.
  - Domain 2 is the absence of major morbidity, which is a "none or any" measure of the following complications: (1) prolonged ventilation; (2) deep sternal wound infection; (3) permanent stroke; (4) renal failure; and (5) reoperations for bleeding, prosthetic or native valve dysfunction, or other cardiac reasons, but not for other non-cardiac reasons.
- The developer stated that the domains are rescaled by their respective standard deviation across surgeons and then assigned equal weighting to the rescaled rates. After the rescaling, the relative weights were 0.74 for mortality and 0.26 for morbidity. The developer stated that this weighting was consistent with their Expert Panel's clinical assessment of each domain's relative importance.
- The Standing Committee had no issues or questions related to composite construct and rationale.

2. Scientific Acceptability of Measure Properties: The measure meets the Scientific Acceptability criteria.

(2a. Reliability - precise specifications, testing; 2b. Validity - testing, threats to validity

2a. Reliability: **H-1; M-16; L-0; I-0 (denominator = 17)**; 2b. Validity: **H-1; M-16; L-0; I-0 (denominator = 17)**; 2c. Composite Quality Construct: **H-3; M-14; L-0; I-0 (denominator = 17)**

Rationale:

- The developer conducted one set of testing for clinician group and facility. For the adult cardiac database, 92% of the participants are surgical groups with a one-to-one relationship to an individual facility.
- To demonstrate reliability, the developer conducted composite-score-level signal-to-noise analysis. They utilized a Bayesian approach to generate possible values for each participant's score and then estimated the true values by conducting Markov Chain Monte Carlo simulations. The data used in the simulation are from a three-year period of July 2011 – June 2014, which is rather dated. The developer included results for a range of case counts and indicated that they use a 36-case threshold for public reporting.
- The results of the reliability analysis range from a reliability of 0.55 (95% Prl 0.49 – 0.60) for 25 index cases to 0.69 (95% Prl 0.62 – 0.76) for 100 cases. At the planned public reporting threshold of 36 index cases, the reliability is 0.58 (95% Prl 0.52 – 0.64).

- The Standing Committee noted that this measure submission is very similar to the submission for NQF #3030. The Standing Committee agreed that the discussion for that measure applied to this measure as well and did not need to be repeated.
- The Standing Committee had no concerns with the reliability of the measure.
- The developer examined measure score validity using known-group analysis. Participants were divided into three groups as follows:
    - Participants were labeled as having higher-than-expected performance if the 95% credible interval surrounding a participant's composite score fell entirely above the overall STS average composite score.
    - Participants were labeled as having lower-than-expected performance if the 95% credible interval surrounding a participant's composite score fell entirely below the overall STS average composite score.
    - Participants were labeled as higher-than-expected performance (3 stars), lower-than-expected performance (1 star), and indistinguishable from the average or as-expected performance (2 stars).
- Mortality (domain 1) and morbidity (domain 2) scores were then compared for each group of participants.
- The developers reported that compared to participants receiving 1 star, those with 3 stars had lower risk-adjusted mortality (1.2% vs. 6.8%) and lower risk-adjusted morbidity (11.4% vs. 31.2%) during the period of July 2011 – June 2014. Thus, differences in performance were clinically meaningful as well as statistically significant. STS participants deemed better by the composite scores have (on average) higher performance during the same time window on each individual domain of the composite measure.
- The developers also examined measure score validity using predictive validity/stability of measure score results over time. Stability could be considered a test of reliability versus a test of validity of a measure. This methodology has been accepted to demonstrate validity in previous submissions.
- For the data periods of July 2011 – June 2014 and July 2012 – June 2015, the Pearson correlation between composite scores was 0.83.
- To adjust for case mix in this measure, the developer modified and re-estimated the previously published 2008 STS isolated valve model. The need for modification was due to broader inclusion criteria for this measure and to account for the major morbidity component.
- The bootstrap-adjusted estimated c-statistic was 0.746 for the morbidity model and 0.807 for the mortality model. The developer interprets this to demonstrate well-calibrated risk models with good discrimination power.
- The Standing Committee accepted the measure as valid.
- The developer used Pearson correlations to verify that each of the two domains of the measure contribute statistical information but do not dominate the composite. Data from July 2011 – June 2014 were used for the calculation. The results were 0.74 for mortality domain versus overall composite measure and 0.89 for morbidity domain score versus overall score. The developers interpreted this to mean that risk-adjusted morbidity explains more of the variation in the overall composite score but does not dominate the score.

- The developer stated that the domains were rescaled by dividing their respective standard deviation across STS participants and then added together. After the rescaling, the relative weights were 0.74 for mortality and 0.26 for morbidity.
- Weighting was assessed by an Expert Panel. It was consistent with the panel's clinical assessment of each domain's relative importance. The developer states that a one percentage point change in a participant's risk-adjusted mortality rate has the same impact on the overall score as a 2.8 percentage point change in the site's risk-adjusted morbidity rate.
- The Standing Committee had no issues or questions regarding the composite construct.

3. Feasibility: H-6; M-10; L-1; I-0 (denominator = 17)

(3a. Clinical data generated during care delivery; 3b. Electronic sources; 3c. Susceptibility to inaccuracies/ unintended consequences identified 3d. Data collection strategy can be implemented)

Rationale:

- The required data elements are collected and used by healthcare personnel during the provision of care and abstracted from a record by someone other than the person obtaining the original information. Some data elements are available through electronic sources. Local availability of data elements varies from full electronic health record (EHR) capability to no availability; however, all data elements are submitted to the STS database in an electronic format following a standard set of data specifications.
- STS Adult Cardiac Surgery Database participants (single or group of surgeons) pay annual participant fees of $3,500 if the majority of surgeons in the group are STS members and $4,750 if the majority are not STS members. In addition, there is a fee of $150 per member and $350 per non-member for surgeons listed on the database's Participation Agreement. STS analyses indicated that the STS database includes more than 90% of cardiothoracic programs in the U.S. There are no additional costs for data collection specific to the measure.
- The Standing Committee had no concerns regarding the feasibility of the measure.

4. Use and Usability

4a. Use; 4a1. Accountability and transparency; 4a2. Feedback on the measure by those being measured and others; 4b. Usability; 4b1. Improvement; 4b2. The benefits to patients outweigh evidence of unintended negative consequences to patients)

4a. Use: **Pass-17; No Pass-0 (denominator = 17)** *4b. Usability:* **H-1; M-16; L-0; I-0 (denominator = 17)**

Rationale:

- The composite is publicly reported through the STS Public Reporting Program.
- All Adult Cardiac Surgery Database participants receive quarterly feedback reports providing a detailed analysis of the participant's performance, including benchmarking. Dashboard-type reporting on STS.org has been provided for real-time, online data updates to STS surgeon members. Participants also have access to a guide to help interpret performance results.
- The Standing Committee had no questions or issues regarding use of the measure.
- The developer stated there has been a decrease in 1-star and 3-star ratings over time, which they stated is consistent with their quality goal of reducing variation among participants.

Star ratings in percentages, 2017-2019

Stars	2019	2018	2017
*	1.85	2.41	3.64

Stars	2019	2018	2017
**	91.81	87.06	85.65
***	6.34	10.53	10.71

- The developer identified the potential harms related to the use of this measure: gaming and risk aversion. The developer stated that they control these through a careful audit process and a robust risk-adjustment methodology.
- The Standing Committee had no concerns regarding the usability of this measure.

5. **Related and Competing Measures**
   - The developers identified the following related measures:
     - NQF #0696 STS CABG Composite
     - NQF #2561 Aortic Valve Replacement Composite Score
     - NQF #2563 Aortic Valve Replacement + CABG Composite Score
     - NQF #3032 Mitral Valve Repair/Replacement + CABG Composite Score
   - The identified measures are all developed by STS and the developer indicated that they are harmonized.
   - The Standing Committee discussed related and competing measures during the post-comment web meeting on June 1, 2021. The Standing Committee did not highlight any comments or concerns.
6. **Standing Committee Recommendation for Endorsement**: **Yes-17; No-0 (denominator = 17)**

7. **Public and Member Comment**

   NQF did not receive any public or member comments for this measure.
8. **Consensus Standards Approval Committee (CSAC) Vote: Y-X; N-X**
9. **Appeals**

NQF #3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Submission | Specifications

Description: The STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score measures surgical performance for MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF). To assess overall quality, the STS MVRR + CABG Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation,
2. Deep sternal wound infection,
3. Permanent stroke,
4. Renal failure, and
5. Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Outcome data are collected on all patients and from all participants. For optimal measure reliability, participants meeting a volume threshold of at least 25 cases over 3 years receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Numerator Statement: Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.

The STS Mitral Valve Repair/Replacement (MVRR) Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation,
2. Deep sternal wound infection,
3. Permanent stroke,
4. Renal failure, and
5. Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Patient Population: The analysis population consists of patients aged 18 years or older who MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF).

Time Window: 3 years

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 25 MVRR + CABG procedures in the patient population.

Estimation of Composite Scores and Star Ratings:

To be consistent with the conventions of previous composite measures, risk-adjusted event rates were first converted into risk-adjusted absence-of-event rates. To calculate the composite, participant-specific absence of mortality rates and absence of morbidity rates were weighted inversely by their respective standard deviations across participants. This procedure was equivalent to first rescaling the absence of mortality rates and absence of morbidity rates by their respective standard deviations across participants, and then assigning equal weighting to the rescaled rates. Finally, in order to draw statistical inferences about participant performance, a Bayesian credible interval surrounding each participant's composite score was calculated. Unlike frequentist confidence intervals, Bayesian credible intervals have an intuitively direct interpretation as an interval containing the true value of the composite score with a specified probability (e.g., 95%). To determine star ratings for each participant, the credible interval of its composite score was compared with the STS average. Participants whose intervals were entirely above the STS average were classified as 3-star (higher than expected performance), and participants whose intervals were entirely below the STS average were classified as1-star (lower than expected performance).

Credible intervals based on different probability levels (90%, 95%, 98%) were explored, and the resulting percentages of 1, 2, and 3-star programs were calculated.

Denominator Statement: See response in S.4. Numerator Statement for complete description of measure specifications.

Patient Population: The analysis population consists of patients aged 18 years or older who MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF).

Exclusions: Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 25 MVRR + CABG procedures in the patient population.

Adjustment/Stratification: Statistical risk model

Level of Analysis: Facility, Clinician : Group/Practice

Setting of Care: Inpatient/Hospital

Type of Measure: Composite

Data Source: Registry Data

Measure Steward: The Society of Thoracic Surgeons

STANDING COMMITTEE MEETING February 12, 2021

1. Importance to Measure and Report: The measure meets the Importance criteria.

(1a. Evidence, 1b. Performance Gap)

1a. Evidence: **Pass-17; No Pass-0 (denominator = 17)**; 1b. Performance Gap: **H-1; M-16; L-0; I-0 (denominator = 17)**; 1c. Composite - Quality Construct and Rationale: **H-3; M-14; L-0; I-0 (denominator = 17)**

Rationale:

- As part of the previous submission in 2016, the developer provided information regarding services and/or care that a provider can undertake to influence mortality and each of the five morbidities included in this composite.
- The developer attested to no changes to the evidence for this submission.
- The Standing Committee agreed the evidence is unchanged and sufficient to tie the components of this composite to patient outcomes.

- The developer provided the distribution of STS mitral valve repair/replacement (MVRR) + CABG measure results from two consecutive time periods, January 2016 – December 2018 and January 2017 – December 2019 for registry participants with at least 25 eligible cases.

Time Period	Jan 2016 – Dec 2018	Jan 2017 – Dec 2019
# of Participants	289	272
# Operations	16,175	15,087
Mean	0.866	0.864
STD	0.02745	0.02595
IQR	0.352	0.328
0%	0.741	0.768
10%	0.831	0.831
20%	0.845	0.844
30%	0.854	0.854
40%	0.863	0.861
50%	0.869	0.866
60%	0.875	0.871
70%	0.882	0.878
80%	0.889	0.885
90%	0.897	0.894

Time Period	Jan 2016 – Dec 2018	Jan 2017 – Dec 2019
100%	0.936	0.921

The developer provided disparities data presented by domain for insurance status, race, and ethnicity. The only significant association (p-value <.0001) was major morbidity and Black race.

Risk-adjusted odds ratios	Mortality Adjusted Odd Ratio (95% CI)	p-value	Major Morbidity Adjusted Odd Ratio (95%CI)	p-value
Insurance status among patients age >= 65 Medicare without Medicaid/Commercial-HNO	Ref	*	Ref	*
Insurance status among patients age >= 65 Medicare + Medicaid dual eligible	0.94 (0.71, 1.24)	0.6578	0.81 (0.68, 0.98)	0.0287
Insurance status among patients age >= 65 Medicare + Commercial-HMO without Medicaid	0.97 (0.84, 1.13)	0.7131	0.98 (0.90, 1.07)	0.6597
Insurance status among patients age >= 65 Commercial-HMO without Medicare	0.84 (.064, 1.09)	0.1880	1.04 (0.88, 1.22)	0.6680
Insurance status among patients age < 65 Commercial-HMO without Medicare/Medicaid	Ref	*	Ref	*
Insurance status among patients age < 65 Medicare or Medicaid	1.17 (0.96, 1.42)	0.1265	1.09 (0.98, 1.22)	0.1148
Insurance status among patients age < 65 None/Self Paid	0.97 (0.65, 1.45)	0.8796	1.02 (0.83, 1.25)	0.8393
Insurance status among patients age < 65 Other	1.23 (0.77, 1.97)	0.3833	1.00 (0.76, 1.31)	0.9743
Black race	0.91 (0.75, 1.11)	0.3471	**1.28 (1.15, 1.43)**	**<.0001**
Hispanic ethnicity	1.13 (0.92, 1.39)	0.2510	1.10 (0.97, 1.24)	0.1558

*Cell left intentionally blank

- The Standing Committee had no issues or questions related to performance gap.
- The developer's rationale for the composite is that differentiating performance based on mortality alone fails to account for the fact that not all operative survivors received equal quality care. By combining the results of risk-adjusted mortality and the risk-adjusted occurrence of any of five major complications, this composite provides a more comprehensive quality assessment that should help participants identify potential areas for improvement. By aggregating the surgeries and rates, the composite yields a more comprehensive view of participant performance, which may be more useful for accountability purposes.
- The developer notes that this measure is constructed using two domains:
    - Domain 1 is the absence of operative mortality (before hospital discharge or within 30 days of operation) for patients undergoing MVRR + CABG. This domain is calculated as a single measure.
    - Domain 2 is the absence of major morbidity, which is a "none or any" measure of the following complications: (1) prolonged ventilation; (2) deep sternal wound infection; (3) permanent stroke; (4) renal failure; and (5) re-operations for bleeding, prosthetic or native valve dysfunction, or other cardiac reasons, but not for other non-cardiac reasons.
- The developer stated that the domains were rescaled by dividing their respective standard deviation across STS participants and then added together. After the rescaling, the relative weights were 0.74 for mortality and 0.26 for morbidity. The developer stated that this weighting was consistent with their Expert Panel's clinical assessment of each domain's relative importance.
- The Standing Committee had no issues or questions related to composite construct and rationale.

2. Scientific Acceptability of Measure Properties: The measure meets the Scientific Acceptability criteria.
(2a. Reliability - precise specifications, testing; 2b. Validity - testing, threats to validity
2a. Reliability: **H-0; M-16; L-0; I-0 (denominator = 16)**; 2b. Validity: **H-0; M-16; L-0; I-0 (denominator = 16)**; 2c. Composite Quality Construct: **H-1; M-16; L-0; I-0 (denominator = 17)**

Rationale:

- The developer conducted one set of testing for clinician group and facility. For the adult cardiac database, 92% of the participants are surgical groups with a one-to-one relationship to an individual facility.
- To demonstrate reliability, the developer conducted composite-score-level signal-to-noise analysis. They utilized a Bayesian approach to generate possible values for each participant's score and then estimated the true values by conducting Markov Chain Monte Carlo simulations. The data used in the simulation are from a three-year period of July 2011 – June 2014, which is rather dated. The developer included results for a range of case counts and indicated that they intend to use a 25-case threshold for public reporting.
- The results range from a reliability of 0.42 (95% Prl 0.0.35 – 0.0.48) to 0.62 (95% Prl 0.52 – 0.70) for 50 cases. At the planned public reporting threshold of 25 index cases, the reliability is 0.0.50 (95% Prl 0.44 – 0.57).
- The Standing Committee had no questions or concerns regarding the reliability of the measure.

The developer examined measure score validity using known-group analysis. Participants were divided into three groups as follows:

  - Participants were labeled as having higher-than-expected performance if the 95% credible interval surrounding a participant's composite score fell entirely above the overall STS average composite score.
  - Participants were labeled as having lower-than-expected performance if the 95% credible interval surrounding a participant's composite score fell entirely below the overall STS average composite score.
  - Participants were labeled as higher-than-expected performance (3 stars), lower-than-expected performance (1 star), and indistinguishable from the average or as-expected performance (2 stars).
- Mortality (domain 1) and morbidity (domain 2) scores were then compared for each group of participants.
- The developers reported that compared to participants receiving 1 star, those with 3 stars had lower risk-adjusted mortality (3.0% vs. 11.2%) and lower risk-adjusted morbidity (20.9% vs. 52.3%) during July 2011 – June 2014. Thus, differences in performance were clinically meaningful as well as statistically significant. STS participants deemed better by the composite scores have (on average) higher performance during the same time window on each individual domain of the composite measure.
- The developers also examined measure score validity using predictive validity/stability of the measure score results over time. Stability could be considered a test of reliability versus a test of validity of a measure. This methodology has been accepted to demonstrate validity in previous submissions.
- For the data periods of July 2011 – June 2014 and July 2012 – June 2015, the Pearson correlation between composite scores was 0.79.
- To adjust for case mix in this measure, the developer modified and re-estimated the previously published 2008 STS valve+CABG model. The need for modification was due to broader inclusion criteria for this measure and to account for the major morbidity component.
- The bootstrap-adjusted estimated c-statistic was 0.708 for the morbidity model and 0.738 for the mortality model. The developer interprets this to demonstrate well-calibrated risk models with good discrimination power.
- The Standing Committee noted that the discussion from NQF #3030 applies to this measure and accepted the measure as valid.
- The developer used Pearson correlations to verify that each of the two domains of the measure contribute statistical information but do not dominate the composite. Data from July 2011 – June 2014 were used for the calculation. Results were 0.60 for mortality domain versus overall composite measure and 0.91 for morbidity domain score versus overall score. The developers interpret this to mean that risk-adjusted morbidity explains more of the variation in the overall composite score but does not dominate the score.
- The developer stated that the domains were rescaled by dividing their respective standard deviation across STS participants and then added together. After the rescaling, the relative weights were 0.74 for mortality and 0.26 for morbidity.

- Weighting was assessed by an Expert Panel. It was consistent with the panel's clinical assessment of each domain's relative importance. The developer stated that a one percentage point change in a participant's risk-adjusted mortality rate has the same impact on the overall score as a 2.8 percentage point change in the site's risk-adjusted morbidity rate.
- The Standing Committee had no issues or questions regarding the composite construct.

3. Feasibility: H-6; M-10; L-1; I-0 (denominator = 17)

(3a. Clinical data generated during care delivery; 3b. Electronic sources; 3c. Susceptibility to inaccuracies/ unintended consequences identified 3d. Data collection strategy can be implemented)

Rationale:

- The required data elements are collected and used by healthcare personnel during the provision of care and abstracted from a record by someone other than person obtaining original information. Some data elements are available through electronic sources. Local availability of data elements varies from full electronic health record (EHR) capability to no availability; however, all data elements are submitted to the STS database in an electronic format following a standard set of data specifications.
- STS Adult Cardiac Surgery Database participants (single or group of surgeons) pay annual participant fees of $3,500 if the majority of surgeons in the group are STS members and $4,750 if the majority are not STS members. In addition, there is a fee of $150 per member and $350 per non-member for surgeons listed on the database's Participation Agreement. STS analyses indicated that the STS database includes more than 90% of cardiothoracic programs in the U.S. There are no additional costs for data collection specific to the measure.
- The Standing Committee had no concerns regarding the feasibility of the measure.

4. Use and Usability

4a. Use; 4a1. Accountability and transparency; 4a2. Feedback on the measure by those being measured and others; 4b. Usability; 4b1. Improvement; 4b2. The benefits to patients outweigh evidence of unintended negative consequences to patients)

4a. Use: **Pass-17; No Pass-0 (denominator = 17)***4b. Usability:* **H-1; M-16; L-0; I-0 (denominator = 17)**

Rationale:

- This composite is publicly reported through the STS Public Reporting Program.
- All Adult Cardiac Surgery Database participants receive quarterly feedback reports providing a detailed analysis of the participant's performance, including benchmarking. Dashboard-type reporting on STS.org has been provided for real-time, online data updates to STS surgeon members. Participants also have access to a guide to help interpret performance results.
- The Standing Committee had no concerns regarding use of the measure.
- The developer stated that there has been a decrease in 1-star and 3-star ratings over time, which they stated is consistent with their quality goal of reducing variation among participants.

Star ratings in percentages, 2017-2019

Stars	2019	2018	2017
*	2.55	2.08	2.74
**	88.0	89.97	91.78
***	9.45	7.96	5.48

- The developer identified the potential harms related to the use of this measure: gaming and risk aversion. The developer stated that they control these through a careful audit process and a robust risk-adjustment methodology.
- The Standing Committee had no concerns regarding the usability of this measure.

5. **Related and Competing Measures**

The developers identified the following related measures:

  - NQF #0696 STS CABG Composite
  - NQF #2561 Aortic Valve Replacement Composite Score
  - NQF #2563 Aortic Valve Replacement + CABG Composite Score
  - NQF #3031 Mitral Valve Repair/Replacement Composite Score

- The identified measures are all developed by STS and the developer indicated that they are harmonized.
- The Standing Committee discussed related and competing measures during the post-comment web meeting on June 1, 2021. The Standing Committee did not highlight any comments or concerns.

6. **Standing Committee Recommendation for Endorsement**: **Yes-17; No-0 (denominator = 17)**

7. **Public and Member Comment**

NQF received one comment for this measure, correcting a typographical error in the submission materials.

8. **Consensus Standards Approval Committee (CSAC) Vote: Y-X; N-X**
9. **Appeals**

Measures Recommended for Inactive Endorsement With Reserve Status

NQF #0117 Beta Blockade at Discharge

Submission | Specifications

Description: Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on beta blockers

Numerator Statement: Number of patients undergoing isolated CABG who were discharged on beta blockers

Denominator Statement: Patients aged 18 years and older undergoing isolated CABG

Exclusions: Cases are removed from the denominator if there was an in-hospital mortality or if discharge beta blocker was contraindicated.

Adjustment/Stratification: No risk-adjustment or stratification

Level of Analysis: Facility, Clinician : Group/Practice

Setting of Care: Inpatient/Hospital

Type of Measure: Process

Data Source: Registry Data

Measure Steward: The Society of Thoracic Surgeons

STANDING COMMITTEE MEETING February 12, 2021

1. **Importance to Measure and Report: The measure does not meet the Importance criteria.**

(1a. Evidence, 1b. Performance Gap)

1a. Evidence: **H-0; M-18; L-0; I-0 (denominator = 18)**; 1b. Performance Gap: **H-2; M-4; L-12; I-0 (denominator = 18)**

Rationale:

- As part of the previous submission in 2016, the developer included the 2011 ACCF/AHA Guideline for Coronary Artery Bypass Graft Surgery. The recommendation stated that the beta

blockers should be prescribed to all CABG patients without contraindications at the time of hospital discharge (Class I Recommendation, Level of Evidence: C).

- The developer also provided a summary of peer-reviewed literature during the last maintenance review in 2016, which supported that the utilization of beta-blockers at discharge confers a strong risk reduction in mortality.
- The developer attested to no changes to the evidence for this submission.
- The Standing Committee noted that the evidence was largely unchanged from the previous submission in 2016. A Standing Committee member mentioned that a large new study was recently published this year (2021) that strengthened the existing evidence for postoperative use of beta blockers.
- The Standing Committee concluded that the measure meets the evidence criterion.
- As part of the previous review in 2016, the Standing Committee had asked the developer to include the number of patients included in the measure to help inform discussion of the performance gap. The developer included the number of operations in this submission along with measure results calculated using registry data for January-December 2018 (1037 participants and 151,805 operations) and January-December 2019 (999 participants and 150,773 operations).

Year	Mean	STD	IQR	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
2018	0.98	0.034	0.019	0.66	0.95	0.98	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00
2019	0.98	0.043	0.016	0.00	0.96	0.98	0.99	0.99	1.00	1.00	1.00	1.00	1.00	1.00

The developer also provided disparities data for January 2016 – December 2019. Each year in the table below represents January-December.

Year	2016	2017	2018	2019
All	98.60%	98.64%	98.79%	98.95%
Male	98.67%	98.67%	98.84%	98.99%
Female	98.39%	98.53%	98.65%	98.79%
Age<75	98.69%	98.70%	98.89%	99.00%
Age>=75	98.23%	98.36%	98.39%	98.74%
White	98.73%	98.70%	98.86%	98.97%
Black	98.72%	98.75%	98.89%	98.95%
Other	97.56%	98.06%	98.21%	98.76%
Insurance, Age >=65 Medicare + Medicaid	98.42%	98.15%	98.45%	98.67%
Insurance, Age >=65 Medicare + Commercial without Medicaid	98.70%	98.75%	98.78%	98.85%
Insurance, Age >=65	98.13%	98.28%	98.59%	98.89%

Year	2016	2017	2018	2019
Medicare without Medicaid/Commercial Insurance, Age<65	98.62%	98.67%	98.64%	98.83%
Medicare/Medicaid Insurance, Age<65	98.80%	98.86%	99.07%	99.17%
Commercial/HMO Insurance, Age<65	99.17%	98.79%	99.04%	99.03%
None/Self Paid Insurance, Age<65	98.79%	98.48%	99.12%	99.08%
Other				

- The Standing Committee questioned what constitutes a meaningful performance gap and the implications of placing a measure on reserve status. The Standing Committee noted that the performance appears fairly topped out, with median rates of 100% and little variation by insurance type, gender, or race. Standing Committee members also shared that with performance rates this high, a great deal of resources are required to achieve a small gain and that those resources may be better spent on more impactful areas.
- A Standing Committee member raised a concern that when the overall performance is this high, a participant needs to perform perfectly to score well. Another Standing Committee member raised a concern regarding whether performance would remain high if the measure were to be placed on reserve status.
- The developer acknowledged and agreed with this concern; however, they added that they viewed cardiothoracic surgery as the ultimate high-reliability surgery and that all participants should achieve 100% on this measure. They also clarified that they do not penalize small volume programs unless there was a statistically significant gap in performance. The developer also stated that they will continue to collect and use this measure; therefore, the benefit to reserve status may be limited.
- The Standing Committee voted and reached consensus that the measure did not have a sufficient performance gap to warrant maintaining active endorsement.
- When improvement in performance on an endorsed measure has closed the performance gap and the measure continues to meet all other endorsement criteria, the Standing Committee can recommend that the measure remain endorsed with reserve status. Reserve status results in measures maintaining endorsement, thereby remaining in the measure portfolio, while indicating that the measure may not have a sufficient gap to make it a priority for adoption. NQF staff described the process, criteria, and rationale for reserve status.
- Because the Standing Committee agreed that reserve status should be considered for this measure, discussion and voting continued on the remaining criteria.

2. Scientific Acceptability of Measure Properties: The measure meets the Scientific Acceptability criteria.
(2a. Reliability - precise specifications, testing; 2b. Validity - testing, threats to validity
2a. Reliability: **H-1; M-15; L-1; I-0 (denominator = 17)**; 2b. Validity: **H-2; M-11; L-2; I-2 (denominator = 17)**

Rationale:

- The developer conducted performance measure score reliability testing using a beta-binomial model of signal-to-noise ratio.
- The developer highlighted that the reliability of the measure varies by number of eligible patients (denominator). In this case, 95% of the STS participants meet the 27-patient sample size necessary for 0.50 reliability and 76% meet the 62-patient sample size necessary for 0.70 reliability.
- Similar to the discussion for measure NQF #0127, the Standing Committee questioned the reliability of the measure for participants with a low sample size. The developer clarified that all STS process measures are binary results (i.e., meets/does not meet) with a confidence interval. They noted, in general, the smaller the sample size, the larger the confidence interval, which results in most small groups receiving two stars.
- A Standing Committee member stated that they appreciated the testing for demonstrating different reliabilities at different case counts, noting that there was a range of reliability for each count. The same Standing Committee member also noted that reliability of distribution was helpful and that reliability of "binning" providers into scores would also be helpful.
- The Standing Committee ultimately agreed that the measure was reliable.
- The developer conducted data element validity testing using the STS Adult Cardiac Surgery Database Audit, which randomly selected 10% of participating sites to evaluate the accuracy, consistency, and comprehensiveness of data collection. The audit process involved re-abstraction of data for 20 cases and a comparison of 82 individual data elements with those submitted to the data warehouse. The results presented are from the 2015 audit.
    - The data element validity results provided demonstrate an overall agreement rate of 96.17%, with most elements in the high 90% agreement range.
- The developer also examined measure score validity using known-group analysis. For the measure score, three performance groups were calculated and compared. The three groups had different proportions.
    - Known-group validity testing demonstrated that low-performance groups had lower observed rates and that high-performance groups had higher observed rates (91.1% vs 99.9%).
- The developers also conducted measure score validity using predictive validity/stability of measure score results over time for October 2013 – September 2014 and October 2014 – September 2015 periods.
    - Predicted validity/stability analysis demonstrated that among participants that were high performers during the first period, 76.1% were also high performance in the second period. In addition, 90% of mid-performers remained in the mid-performer category. Low performance showed more changes, with 49% remaining in the low-performer category in the second performance period.
- The developer reported that for the period of October 2014 – September 2014, around 80% of participants had performance indistinguishable from the STS average (95% CI), and the remaining participants performed differently.
    - 859 (82.9%) performed as expected
    - 94 (9.1%) had lower-than-expected performance
    - 83 (8%) had higher-than-expected performance

- The Standing Committee had no issues or concerns regarding validity.

3. Feasibility: H-7; M-10; L-1; I-0 (denominator = 18)

(3a. Clinical data generated during care delivery; 3b. Electronic sources; 3c. Susceptibility to inaccuracies/ unintended consequences identified 3d. Data collection strategy can be implemented)

Rationale:

- The required data elements are collected and used by healthcare personnel during the provision of care and abstracted from a record by someone other than the person obtaining the original information. Some data elements are available through electronic sources. Local availability of data elements varies from full electronic health record (EHR) capability to no availability; however, all data elements are submitted to the STS database in an electronic format following a standard set of data specifications.
- STS Adult Cardiac Surgery Database participants (single or group of surgeons) pay annual participant fees of $3,500 if the majority of surgeons in the group are STS members and $4,750 if the majority are not STS members. In addition, there is a fee of $150 per member and $350 per non-member for surgeons listed on the database's Participation Agreement. STS analyses indicated that the STS database includes more than 90% of cardiothoracic programs in the U.S. There are no additional costs for data collection specific to the measure.
- The Standing Committee discussed a high rating versus a moderate rating for feasibility, noting that the measure is automatically calculated for providers using the STS Adult Cardiac Registry. Standing Committee members noted that data submission to the registry requires staff to abstract the data for entry into the registry and that this requirement led to their consideration of feasibility as moderate instead of high.

4. Use and Usability

4a. Use; 4a1. Accountability and transparency; 4a2. Feedback on the measure by those being measured and others; 4b. Usability; 4b1. Improvement; 4b2. The benefits to patients outweigh evidence of unintended negative consequences to patients)

4a. Use: **Pass-18; No Pass-0 (denominator = 18)***4b. Usability:* **H-7; M-10; L-1; I-0 (denominator = 18)**

Rationale:

- This measure is part of a publicly reported composite: the Perioperative Medications domain of the isolated CABG composite.
- The developer noted that the STS Adult Cardiac Surgery Database (ACSD) Participant Feedback Reports provide performance results for this measure to the participants on a quarterly basis.
- The Standing Committee questioned whether publicly reporting as part of a composite meets the intent of the use criterion. NQF Staff shared that the Standing Committee had previously discussed this at length and at that time, they had concluded that this did meet the use criterion. The Standing Committee agreed with this previous conclusion and had no additional questions or concerns regarding the use of the measure.
- In the 2016 submission, the developer provided a performance rate of 97.96% for the period October 2011 – September 2012. For this submission, the developer provided overall rates of 98.62%, 98.80%, and 98.94%, for calendar years 2017, 2018, and 2019, respectively.
- The Standing Committee had no questions regarding the usability of the measure.

5. Related and Competing Measures

This measure is related to the following measures:

- NQF #0114 Risk-Adjusted Postoperative Renal Failure
- NQF #0115 Risk-Adjusted Surgical Re-exploration
- NQF #0116 Anti-Platelet Medication at Discharge
- NQF #0118 Anti-Lipid Treatment Discharge
- NQF #0119 Risk-Adjusted Operative Mortality for CABG
- NQF #0127 Preoperative Beta Blockade
- NQF #0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)
- NQF #0130 Risk-Adjusted Deep Sternal Wound Infection
- NQF #0131 Risk-Adjusted Stroke/Cerebrovascular Accident
- NQF #0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
- NQF #0696 STS CABG Composite

- The developer stated that the measure specifications are harmonized to the extent possible. They noted that the related measures identified are NQF-endorsed measures developed by or with STS. All these measures are either components of NQF #0696 or are the overall composite NQF #0696.
- The Standing Committee discussed related and competing measures during the post-comment web meeting on June 1, 2021. The Standing Committee did not highlight any concerns or questions.

6. **Standing Committee Recommendation for Endorsement**: **Voted to recommend the measure for 'Inactive Endorsement With Reserve Status,' Yes-17; No-0 (denominator = 17)**

Rationale

The Standing Committee recommended the measure for inactive endorsement with reserve status.

7. **Public and Member Comment**

NQF received one comment for this measure. The commenter voiced concern that placing the measure on reserve status would be counterproductive.

8. **Consensus Standards Approval Committee (CSAC) Vote: Y-X; N-X**
9. **Appeals**

Appendix B: Surgery Portfolio—Use in Federal Programs[a]

NQF #	Title	Federal Programs: Finalized or Implemented as of June 22, 2020
0114	Risk-Adjusted Postoperative Renal Failure	Merit-Based Incentive Payment System (MIPS) Program (Implemented)
0115	Risk-Adjusted Surgical Re-exploration	MIPS Program (Implemented)
0117	Beta Blockade at Discharge	None
0118	Anti-Lipid Treatment Discharge	None
0119	Risk-Adjusted Operative Mortality for CABG	MIPS Program (Implemented)
0120	Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR)	None
0121	Risk-Adjusted Operative Mortality for Mitral Valve (MV) Replacement	None
0122	Risk-Adjusted Operative Mortality for Mitral Valve (MV) Replacement + CABG Surgery	None
0123	Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) + CABG Surgery	None
0127	Preoperative Beta Blockade	None
0129	Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)	MIPS Program (Implemented)
0130	Risk-Adjusted Deep Sternal Wound Infection	None
0131	Risk-Adjusted Stroke/Cerebrovascular Accident	None
0134	Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)	None
0236	Coronary Artery Bypass Graft (CABG): Preoperative Beta-Blocker in Patients With Isolated CABG Surgery	MIPS Program (Implemented)
0340	RACHS-1 Pediatric Heart Surgery Volume (PDI 7)	None
0354	Hip Fracture Mortality Rate (IQI 19)	None

[a] Per CMS Measures Inventory Tool, last accessed 02/11/2021

NQF #	Title	Federal Programs: Finalized or Implemented as of June 22, 2020
0357	Abdominal Aortic Aneurysm (AAA) Repair Volume (IQI 4)	None
0359	Abdominal Aortic Aneurysm (AAA) Repair Mortality Rate (IQI 11)	None
0365	Pancreatic Resection Mortality Rate (IQI 9)	None
0366	Pancreatic Resection Volume (IQI 2)	None
0456	Participation in a Systematic National Database for General Thoracic Surgery	None
0465	Perioperative Anti-platelet Therapy for Patients Undergoing Carotid Endarterectomy	None
0533	Postoperative Respiratory Failure Rate (PSI 11)	None
0564/0564e	Cataracts: Complications Within 30 Days Following Cataract Surgery Requiring Additional Surgical Procedures	None
0565/0565e	Cataracts: 20/40 or Better Visual Acuity Within 90 Days Following Cataract Surgery	MIPS Program (Implemented); Medicaid Promoting Interoperability Program for Eligible Professionals (Implemented)
0696	STS CABG Composite Score	None
0697	Risk-Adjusted Case Mix-Adjusted Elderly Surgery Outcomes Measure	None
0706	Risk-Adjusted Colon Surgery Outcome Measure	None
0732	Surgical Volume for Pediatric and Congenital Heart Surgery: Total Programmatic Volume and Programmatic Volume Stratified by the 5 STAT Mortality Categories	None
0733	Operative Mortality Stratified by the 5 STAT Mortality Categories	None
0734	Participation in a National Database for Pediatric and Congenital Heart Surgery	None
1501	Risk-Adjusted Operative Mortality for Mitral Valve (MV) Repair	None

NQF #	Title	Federal Programs: Finalized or Implemented as of June 22, 2020
1502	Risk-Adjusted Operative Mortality for Mitral Valve (MV) Repair + CABG Surgery	None
1519	Statin Therapy at Discharge After Lower Extremity Bypass (LEB)	None
1523	Rate of Open Repair of Abdominal Aortic Aneurysms (AAA) Where Patients Are Discharged Alive	None
1534	In-Hospital Mortality Following Elective EVAR of AAAs	None
1540	Postoperative Stroke or Death in Asymptomatic Patients Undergoing Carotid Endarterectomy	None
1543	Postoperative Stroke or Death in Asymptomatic Patients Undergoing Carotid Artery Stenting (CAS)	None
1550	Hospital-Level Risk-Standardized Complication Rate (RSCR) Following Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA)	None
1551	Hospital-Level 30-Day, All-Cause Risk-Standardized Readmission Rate (RSRR) Following Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA)	Hospital Readmissions Reduction Program (HRRP) (Implemented)
1790	Risk-Adjusted Morbidity and Mortality for Lung Resection for Lung Cancer	None
2038	Performing Vaginal Apical Suspension at the Time of Hysterectomy to Address Pelvic Organ Prolapse	None
2063	Performing Cystoscopy at the Time of Hysterectomy for Pelvic Organ Prolapse to Detect Lower Urinary Tract Injury	MIPS Program (Implemented)
2558	Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Coronary Artery Bypass Graft (CABG) Surgery	Hospital VBP (Finalized)
2561	STS Aortic Valve Replacement (AVR) Composite Score	None

NQF #	Title	Federal Programs: Finalized or Implemented as of June 22, 2020
2563	STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	None
2677	Preoperative Evaluation for Stress Urinary Incontinence Prior to Hysterectomy for Pelvic Organ Prolapse	None
2683	Risk-Adjusted Operative Mortality for Pediatric and Congenital Heart Surgery	None
2687	Hospital Visits After Hospital Outpatient Surgery	Hospital Outpatient Quality Reporting (Hospital OQR) (Implemented)
3030	STS Individual Surgeon Composite Measure for Adult Surgery	None
3031	STS Mitral Valve Repair/Replacement (MVRR) Composite Score	None
3032	STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score	None
3294	STS Lobectomy for Lung Cancer Composite Score	None
3357	Facility-Level 7-Day Hospital Visits After General Surgery Procedures Performed at Ambulatory Surgical Centers	Ambulatory Surgical Center Quality Reporting (Finalized)
3493	Risk-Standardized Complication Rate (RSCR) Following Elective Primary Total Hip Arthroplasty (THA) and/or Total Knee Arthroplasty (TKA) for Merit-Based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups	MIPS Program (Finalized)
3494	Hospital 90-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Coronary Artery Bypass Graft (CABG) Surgery	None

Appendix C: Surgery Standing Committee and NQF Staff

STANDING COMMITTEE

William Gunnar, MD, JD (Co-Chair)
Director, National Center for Patient Safety, Veterans Health Administration Ann Arbor, MI

Alex Sox-Harris, PhD, MS (Co-Chair)
Associate Professor, Department of Surgery, Stanford University
Stanford, California

Ashrith Amarnath, MD
Patient Safety Officer, Sutter Valley Medical Foundation
Sacramento, California

Sherry Bernardo, CRNA
Director of Anesthesia Quality and Practice, Atrium Health
Charlotte, NC

Richard D'Agostino, MD
Cardiothoracic Surgery Specialist, Lahey Clinic Medical Center
Burlington, MA

TeMaya Eatmon
Atlanta, Georgia

Elisabeth Erekson, MD, MPH, FACOG, FACS
Interim Chair, Obstetrics and Gynecology
Manchester, New Hampshire

Michael Firstenberg, MD, FACC, FAIM
Chief of Cardiothoracic and Vascular Surgery, The Medical Center of Aurora
Aurora, CO

Linda Groah, MSN, RN, CNOR, NEA-BC FAAN
CEO-Executive Director, Association of periOperative Registered Nurses
Denver, CO

Vilma Joseph, MD, MPH, FASA
Professor of Anesthesiology, Albert Einstein College of Medicine/Montefiore Medical Center
Bronx, New York

Miklos Kertai, MD, PhD
Professor, Division of Cardiothoracic Anesthesiology, Vanderbilt
Brentwood, TN

Barbara Levy, MD, FACOG, FACS
Clinical Professor, Obstetrics and Gynecology
Washington, DC

Jaime Ortiz, MD, MBA, FASA
Professor of Anesthesiology, Baylor College of Medicine
Houston, TX

Shawn Rangel, MD, MSCE
Senior Surgical Advisor for Quality and Safety, Boston Children's Hospital
Boston, Massachusetts

Kimberly Richardson
Advocate Leader for the Ovarian Cancer Research Alliance (OCRA)
Chicago, IL

Christopher Saigal, MD, MPH
Professor, UCLA
Los Angeles, California

Rajdeep Sandhu, MD, MMM, FACS, FSVS
Director of Medical Affairs, Becton Dickinson
Warwick, RI

Salvatore T. Scali, MD, FACS, DFSVS, RPVI
Associate Professor of Surgery, University of Florida
Gainesville, Florida

Allan Siperstein, MD
Chairman Endocrine Surgery, Cleveland Clinic
Cleveland, Ohio

Kevin Wang, MHA
Senior Director, Performance Programs, Hospital for Special Surgery
New York, New York

Mark A. Wilson, MD, PhD
National Director of Surgery, Department of Veterans Affairs
Washington, DC

NQF STAFF
Sheri Winsper, RN, MSN, MSHA
Senior Vice President, Quality Measurement

Michael Katherine Haynie
Senior Managing Director, Quality Measurement

Amy Moyer, MS, PMP
Senior Director, Quality Measurement

Janaki Panchal, MSPH
Manager, Quality Measurement

Karri Albanese, BA
Analyst, Quality Measurement

Mike DiVecchia, MBA, PMP
Senior Project Manager, Quality Measurement

Appendix D: Measure Specifications

NQF #0117 Beta Blockade at Discharge

STEWARD

The Society of Thoracic Surgeons

DESCRIPTION

Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on beta blockers

TYPE

Process

DATA SOURCE

Registry Data STS Adult Cardiac Surgery Database Version 4.20

LEVEL

Facility, Clinician : Group/Practice

SETTING

Inpatient/Hospital

NUMERATOR STATEMENT

Number of patients undergoing isolated CABG who were discharged on beta blockers

NUMERATOR DETAILS

Number of isolated CABG procedures in which discharge beta blockers [DCBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"

DENOMINATOR STATEMENT

Patients aged 18 years and older undergoing isolated CABG

DENOMINATOR DETAILS

Number of isolated CABG procedures excluding cases with an in-hospital mortality or cases for which discharge beta blocker use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

EXCLUSIONS

Cases are removed from the denominator if there was an in-hospital mortality or if discharge beta blocker was contraindicated.

EXCLUSION DETAILS

Mortality Discharge Status (DischMortStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; discharge beta blocker (DCBeta) marked as “Contraindicated”

RISK ADJUSTMENT

No risk adjustment or risk stratification

STRATIFICATION

N/A

TYPE SCORE

Rate/proportion better quality = higher score

ALGORITHM

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 141010| 114638| 150289| 152617

COPYRIGHT / DISCLAIMER

N/A

NQF #0127 Preoperative Beta Blockade

STEWARD

The Society of Thoracic Surgeons

DESCRIPTION

Percent of patients aged 18 years and older undergoing isolated CABG who received beta blockers within 24 hours preceding surgery.

TYPE

Process

DATA SOURCE

Registry Data STS Adult Cardiac Surgery Database Version 4.20

LEVEL

Facility, Clinician : Group/Practice

SETTING

Inpatient/Hospital

NUMERATOR STATEMENT

Number of patients undergoing isolated CABG who received beta blockers within 24 hours preceding surgery

NUMERATOR DETAILS

Number of isolated CABG procedures in which preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"

DENOMINATOR STATEMENT

Patients aged 18 years and older undergoing isolated CABG

DENOMINATOR DETAILS

Number of isolated CABG procedures excluding cases for which preoperative beta blockers were contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

EXCLUSIONS

Cases are removed from the denominator if preoperative beta blocker was contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room.

EXCLUSION DETAILS

Procedures with preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] marked as "Contraindicated" or procedures with Status [Status(STS Adult Cardiac Surgery Database Version 2.81)] marked "Emergent" or "Emergent Salvage"

RISK ADJUSTMENT

No risk adjustment or risk stratification

STRATIFICATION

N/A

TYPE SCORE

Rate/proportion better quality = higher score

ALGORITHM

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 152617

COPYRIGHT / DISCLAIMER

N/A

NQF #0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

STEWARD

The Society of Thoracic Surgeons

DESCRIPTION

Percentage of patients aged 18 years and older undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft

TYPE

Process

DATA SOURCE

Registry Data STS Adult Cardiac Surgery Database Version 4.20

LEVEL

Facility, Clinician : Group/Practice

SETTING

Inpatient/Hospital

NUMERATOR STATEMENT

Number of patients undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft

NUMERATOR DETAILS

Number of isolated CABG procedures in which IMA Artery Used [IMAUsed(STS Adult Cardiac Surgery Database Version 4.20] is marked "Left IMA" and/or "Right IMA"

DENOMINATOR STATEMENT

Patients aged 18 years and older undergoing isolated CABG

DENOMINATOR DETAILS

Number of isolated CABG procedures excluding cases that were a previous CABG prior to the current admission or if IMA was not used and one of the acceptable reasons was provided. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

EXCLUSIONS

Cases are removed from the denominator if the patient had a previous CABG prior to the current admission or if IMA was not used and one of the following reasons was provided:

Subclavian stenosis

Previous cardiac or thoracic surgery

Previous mediastinal radiation

Emergent or salvage procedure

No (bypassable) LAD disease

EXCLUSION DETAILS

Patients with previous CABG, identified where PrCAB is marked "yes"

or

IMA Artery Used (IMAUsed) is marked “no” and primary reason for no IMA (NoIMARsn) is marked as any of the following:

1. Subclavian stenosis
2. Previous cardiac or thoracic surgery
3. Previous mediastinal radiation
4. Emergent or salvage procedure
5. No (bypassable) LAD disease

RISK ADJUSTMENT

No risk adjustment or risk stratification

STRATIFICATION

N/A

TYPE SCORE

Rate/proportion better quality = higher score

ALGORITHM

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 152617

COPYRIGHT / DISCLAIMER

N/A

NQF #1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

STEWARD

Centers for Medicare & Medicaid Services

DESCRIPTION

The measure estimates a hospital-level risk-standardized complication rate (RSCR) associated with elective primary THA and TKA in Medicare Fee-For-Service beneficiaries who are age 65 and older. The outcome (complication) is defined as any one of the specified complications occurring from the date of index admission to 90 days post date of the index admission (the admission included in the measure cohort).

TYPE

Outcome

DATA SOURCE

Claims, Enrollment Data Data sources for the Medicare FFS measure:

Medicare Part A Inpatient and Part B Outpatient Claims: This data source contains claims data for FFS inpatient and outpatient services including Medicare inpatient hospital care, outpatient hospital services, as well as inpatient and outpatient physician claims for the 12 months prior to an index admission.

Medicare Enrollment Database (EDB): This database contains Medicare beneficiary demographic, benefit/coverage, and vital status information. This data source was used to obtain information on several inclusion/exclusion indicators such as Medicare status on admission as well as vital status. These data have previously been shown to accurately reflect patient vital status (Fleming et al., 1992). The Master Beneficiary Summary File (MBSF) is an annually created file derived the EDB that contains enrollment information for all Medicare beneficiaries including dual eligible status. Years 2016-2019 were used.

The American Community Survey (2013-2017): We used the American Community Survey (2013-2017) to derive an updated Agency for Healthcare Research and Quality (AHRQ) Socioeconomic (SES) index score at the patient nine-digit zip code level for use in studying the association between our measure and social risk factors (SRFs).

References:

Fleming C., Fisher ES, Chang CH, Bubolz D, Malenda J. Studying outcomes and hospital utilization in the elderly: The advantages of a merged data base for Medicare and Veterans Affairs Hospitals. Medical Care. 1992; 30(5): 377-91.

LEVEL

Facility

SETTING

Inpatient/Hospital

NUMERATOR STATEMENT

The outcome for this measure is any complication occurring during the index admission (not coded present on arrival) to 90 days post-date of the index admission. Complications are counted in the measure only if they occur during the index hospital admission or during a readmission. The complication outcome is a dichotomous (yes/no) outcome. If a patient experiences one or more of these complications in the applicable time period, the complication outcome for that patient is counted in the measure as a “yes”.

NUMERATOR DETAILS

The composite complication is a dichotomous outcome (yes for any complication(s); no for no complications). Therefore, if a patient experiences one or more complications, the outcome variable will get coded as a "yes". Complications are counted in the measure only if they occur during the index hospital admission (and are not present on admission) or during a readmission.

The complications captured in the numerator are identified during the index admission OR associated with a readmission up to 90 days post-date of index admission, depending on the complication. The follow-up period for complications from date of index admission is as follows:

The follow-up period for AMI, pneumonia, and sepsis/septicemia/shock is seven days from the date of index admission because these conditions are more likely to be attributable to the procedure if they occur within the first week after the procedure. Additionally, analyses indicated a sharp decrease in the rate of these complications after seven days.

Death, surgical site bleeding, and pulmonary embolism are followed for 30 days following admission because clinical experts agree these complications are still likely attributable to the hospital performing the procedure during this period and rates for these complications remained elevated until roughly 30 days post admission.

The measure follow-up period is 90 days after admission for mechanical complications and periprosthetic joint infection/wound infection. Experts agree that mechanical complications and periprosthetic joint infection/wound infections due to the index THA/TKA occur up to 90 days following THA/TKA.

The measure counts all complications occurring during the index admission regardless of when they occur. For example, if a patient experiences an AMI on day 10 of the index admission, the measure will count the AMI as a complication, although the specified follow-up period for AMI is seven days. Clinical experts agree with this approach, as such complications likely represent the quality of care provided during the index admission.

As of 2014 reporting, the measure does not count complications in the complications outcome that are coded as present on admission (POA) during the index admission; this prevents identifying a condition as a complication of care if it was present on admission for the THA/TKA procedure.

For full list of codes defining complications, see the Data Dictionary attached in field S.2b.

DENOMINATOR STATEMENT

The target population for the publicly reported measure includes admissions for Medicare FFS beneficiaries who are at least 65 years of age undergoing elective primary THA and/or TKA procedures.

Additional details are provided in S.7 Denominator Details.

DENOMINATOR DETAILS

To be included in the measure cohort used in public reporting, patients must meet the following additional inclusion criteria:

1. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of admission; and enrolled in Part A during the index admission;
2. Aged 65 or older
3. Having a qualifying elective primary THA/TKA procedure; elective primary THA/TKA procedures are defined as those procedures without any of the following:
    1. Fracture of the pelvis or lower limbs coded in the principal or secondary discharge diagnosis fields on the index admission claim (Note: Periprosthetic fractures must be additionally coded as present on admission [POA] in order to disqualify a THA/TKA from cohort inclusion, unless exempt from POA reporting.);
    2. A concurrent partial hip or knee arthroplasty procedure;
    3. A concurrent revision, resurfacing, or implanted device/prosthesis removal procedure;
    4. Mechanical complication coded in the principal discharge diagnosis field on the index admission claim;
    5. Malignant neoplasm of the pelvis, sacrum, coccyx, lower limbs, or bone/bone marrow or a disseminated malignant neoplasm coded in the principal discharge diagnosis field on the index admission claim; or,
    6. Transfer from another acute care facility for the THA/TKA.

        Patients are eligible for inclusion in the denominator if they had an elective primary THA and/or a TKA AND had continuous enrollment in Part A and Part B Medicare fee-for-service (FFS) 12 months prior to the date of index admission.

This measure can also be used for an all-payer population aged 18 years and older. We have explicitly tested the measure in both patients aged 18+ years and those aged 65+ years (see Testing Attachment for details).

EXCLUSIONS

This measure excludes index admissions for patients:

1. Without at least 90 days post-discharge enrollment in FFS Medicare;
2. Who were discharged against medical advice (AMA); or,
3. Who had more than two THA/TKA procedure codes during the index hospitalization.

After applying these exclusion criteria, we randomly select one index admission for patients with multiple index admissions in a calendar year. We therefore exclude the other eligible index admissions in that year.

EXCLUSION DETAILS

This measure excludes index admissions for patients:

1. Without at least 90 days post-discharge enrollment in FFS Medicare

Rationale: The 90-day complication outcome cannot be assessed in this group since claims data are used to determine whether a complication of care occurred.

2. Who were discharged against medical advice (AMA); or,

Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.

3. Who had more than two THA/TKA procedure codes during the index hospitalization

Rationale: Although clinically possible, it is highly unlikely that patients would receive more than two elective THA/TKA procedures in one hospitalization, which may reflect a coding error.

RISK ADJUSTMENT

Statistical risk model

STRATIFICATION

N/A

TYPE SCORE

Rate/proportion better quality = lower score

ALGORITHM

The measure estimates hospital-level RSCRs following elective primary THA/TKA using hierarchical logistic regression models. In brief, the approach simultaneously models data at the patient and hospital levels to account for variance in patient outcomes within and between hospitals (Normand and Shahian, 2007). At the patient level, it models the log-odds of a complication occurring within 90 days of the index admission using age, sex, selected clinical covariates, and a hospital-specific intercept. At the hospital level, it models the hospital-specific intercepts as arising from a normal distribution. The hospital intercept represents the underlying risk of a complication at the hospital, after accounting for patient risk. The hospital-specific intercepts are given a distribution to account for the clustering (non-independence) of patients within the same hospital. If there were no differences among hospitals, then after adjusting for patient risk, the hospital intercepts should be identical across all hospitals.

The RSCR is calculated as the ratio of the number of "predicted" to the number of "expected" admissions with a complication at a given hospital, multiplied by the national observed complication rate. For each hospital, the numerator of the ratio is the number of complications within 90 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of complications expected based on the nation's performance with that hospital's case mix. This approach is analogous to a ratio of "observed" to "expected" used in other types of statistical analyses. It conceptually allows for a comparison of a particular hospital's performance given its case mix to an average hospital's performance with the same case mix. Thus, a lower ratio indicates lower-than-expected complication rates or better quality, and a higher ratio indicates higher-than-expected complication rates or worse quality.

The "predicted" number of admissions with a complication (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of having an admission with a complication. The estimated hospital-specific intercept is added to the sum of the estimated regression coefficients multiplied by the patient characteristics. The results are log transformed and summed over all patients attributed to a hospital to get a predicted value. The "expected" number of admissions with a complication (the denominator) is obtained in the same manner, but a common intercept using all hospitals in our

sample is added in place of the hospital-specific effect. The results are log transformed and summed over all patients in the hospital to get an expected value. To assess hospital performance for each reporting period, we re-estimate the model coefficients using the years of data in that period.

This calculation transforms the ratio of predicted over expected into a rate that is compared to the national observed complication rate. The hierarchical logistic regression models are described fully in the original methodology report posted on QualityNet.

References:

Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 112469| 118210| 137301| 146637| 141015

COPYRIGHT / DISCLAIMER

NQF #1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

STEWARD

Centers for Medicare & Medicaid Services

DESCRIPTION

The measure estimates a hospital-level risk-standardized readmission rate (RSRR) following elective primary THA and/or TKA in Medicare Fee-For-Service (FFS) beneficiaries who are 65 years and older. The outcome (readmission) is defined as unplanned readmission for any cause within 30 days of the discharge date for the index admission (the admission included in the measure cohort). A specified set of planned readmissions do not count in the readmission outcome.

TYPE

Outcome

DATA SOURCE

Claims, Enrollment Data Data sources for the Medicare FFS measure:

Medicare Part A Inpatient and Part B Outpatient Claims: This data source contains claims data for FFS inpatient and outpatient services including Medicare inpatient hospital care, outpatient hospital services, as well as inpatient and outpatient physician claims for the 12 months prior to an index admission.

Medicare Enrollment Database (EDB): This database contains Medicare beneficiary demographic, benefit/coverage, and vital status information. This data source was used to obtain information on several inclusion/exclusion indicators such as Medicare status on admission as well as vital status. These data have previously been shown to accurately reflect patient vital status (Fleming et al., 1992). The Master Beneficiary Summary File (MBSF) is an annually created file derived from the EDB that contains enrollment information for all Medicare beneficiaries including dual eligible status. Years 2016-2019 were used.

The American Community Survey (2013-2017): We used the American Community Survey (2013-2017) to derive an updated Agency for Healthcare Research and Quality(AHRQ) Socioeconomic

Status (SES) index score at the patient nine-digit zip code level for use in studying the association between our measure and social risk factors (SRFs).

Reference:

Fleming C., Fisher ES, Chang CH, Bubolz D, Malenda J. Studying outcomes and hospital utilization in the elderly: The advantages of a merged data base for Medicare and Veterans Affairs Hospitals. Medical Care. 1992; 30(5): 377-91.

LEVEL

Facility

SETTING

Inpatient/Hospital

NUMERATOR STATEMENT

The outcome for this measure is 30-day readmissions. We define readmissions as inpatient admissions for any cause, with the exception of certain planned readmissions, within 30 days from the date of discharge of the index hospitalization. If a patient has more than one unplanned admission (for any reason) within 30 days after discharge from the index admission, only one is counted as a readmission. The measure looks for a dichotomous yes or no outcome of whether each admitted patient has an unplanned readmission within 30 days. However, if the first readmission after discharge is considered planned, any subsequent unplanned readmission is not counted as an outcome for that index admission, because the unplanned readmission could be related to care provided during the intervening planned readmission rather than during the index admission.

NUMERATOR DETAILS

The measure counts readmissions to any acute care hospital for any cause within 30 days of the date of discharge of the index THA and/or TKA hospitalization, excluding planned readmissions as defined below.

Planned Readmission Algorithm (Version 4.0)

The Planned Readmission Algorithm is a set of criteria for classifying readmissions as planned among the general Medicare population using Medicare administrative claims data. The algorithm identifies admissions that are typically planned and may occur within 30 days of discharge from the hospital.

The Planned Readmission Algorithm has three fundamental principles:

1. A few specific, limited types of care are always considered planned (transplant surgery, maintenance chemotherapy/immunotherapy, and rehabilitation);
2. Otherwise, a planned readmission is defined as a non-acute readmission for a scheduled procedure; and
3. Admissions for acute illness or for complications of care are never planned.

The algorithm was developed in 2011 as part of the Hospital-Wide Readmission measure. In 2013, CMS applied the algorithm to its other readmission measures. In applying the algorithm to condition- and procedure-specific measures, teams of clinical experts reviewed the algorithm in the context of each measure-specific patient cohort and, where clinically indicated, adapted the content of the algorithm to better reflect the likely clinical experience of each measure's patient cohort. The planned readmission algorithm is applied to the THA/TKA readmission measure with small modifications.

The Planned Readmission Algorithm and associated code tables are attached in data field S.2b (Data Dictionary or Code Table).

DENOMINATOR STATEMENT

The target population for the publicly reported measure includes admissions for Medicare FFS beneficiaries who are at least 65 years of age undergoing elective primary THA and/or TKA procedures.

Additional details are provided in S.9 Denominator Details.

DENOMINATOR DETAILS

To be included in the measure cohort used in public reporting, patients must meet the following additional inclusion criteria:

Enrolled in Medicare FFS Part A and Part B Medicare for the 12 months prior to the date of admission; and enrolled in Part A during the index admission;

Aged 65 or over;

Discharged alive from a non-federal acute care hospital; and

Have a qualifying elective primary THA/TKA procedure; elective primary THA/TKA procedures defined as those procedures without any of the following:

- Femur, hip, or pelvic fractures coded in principal or secondary discharge diagnosis fields of the index admission;
- Partial hip arthroplasty (PHA) procedures with a concurrent THA/TKA;
- Revision procedures with a concurrent THA/TKA;
- Resurfacing procedures with a concurrent THA/TKA;
- Mechanical complication coded in the principal discharge diagnosis field;
- Malignant neoplasm of the pelvis, sacrum, coccyx, lower limbs, or bone/bone marrow or a disseminated malignant neoplasm coded in the principal discharge diagnosis field;
- Removal of implanted devices/prostheses; or
- Transfer from another acute care facility for the THA/TKA

This measure can also be used for an all-payer population aged 18 years and older. We have explicitly tested the measure in both patients aged 18 years and older and those aged 65 years or older (see Testing Attachment for details, 2b4.11).

EXCLUSIONS

The THA/TKA readmission measure excludes admissions for patients:

1. Without at least 30 days post-discharge enrollment in FFS Medicare;
2. Who were discharged against medical advice (AMA);
3. Admitted for the index procedure and subsequently transferred to another acute care facility;
4. Who had more than two THA/TKA procedure codes during the index hospitalization; or
5. Who had THA/TKA admissions within 30 days of a prior THA/TKA index admission.

EXCLUSION DETAILS

This measure excludes index admissions for patients:

1. Without at least 30 days of post-discharge enrollment in FFS Medicare as determined by examining the Medicare Enrollment Database (EDB).

Rationale: The 30-day readmission outcome cannot be assessed in this group since claims data are used to determine whether a patient was readmitted.

2. Discharges against medical advice (AMA) are identified using the discharge disposition indicator in claims data.

Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.

3. Admitted for the index procedure and subsequently transferred to another acute care facility, which are defined as when a patient with an inpatient hospital admission (with at least one qualifying THA/TKA procedure) is discharged from an acute care hospital and admitted to another acute care hospital on the same or next day.

Rationale: Patients admitted for the index procedure and subsequently transferred to another acute care facility are excluded, as determining which hospital the readmission outcome should be attributed to is difficult.

4. Who had more than two THA/TKA procedure codes during the index hospitalization, which is identified by examining procedure codes in the claims data.

Rationale: Although clinically possible, it is highly unlikely that patients would receive more than two elective THA/TKA procedures in one hospitalization, which may reflect a coding error.

5. Who had THA/TKA admissions within 30 days prior to THA/TKA index admission.

Rationale: Additional THA/TKA admissions within 30 days are excluded as index admissions because they are part of the outcome. A single admission does not count as both an index admission and a readmission for another index admission.

RISK ADJUSTMENT

Statistical risk model

STRATIFICATION

N/A

TYPE SCORE

Rate/proportion better quality = lower score

ALGORITHM

The measure estimates hospital-level 30-day all-cause RSRRs following elective primary THA/TKA using hierarchical logistic regression models. In brief, the approach simultaneously models data at the patient and hospital levels to account for variance in patient outcomes within and between hospitals (Normand and Shahian, 2007). At the patient level, it models the log-odds of readmission within 30 days of discharge using age, sex, selected clinical covariates, and a hospital-specific intercept. At the hospital level, it models the hospital-specific intercepts as arising from a normal distribution. The hospital intercept represents the underlying risk of a readmission at the hospital, after accounting for patient risk. The hospital-specific intercepts are given a distribution to account for the clustering (non-independence) of patients within the same hospital. If there were no differences among hospitals after adjusting for patient risk, the hospital intercepts should be identical across all hospitals.

The RSRR is calculated as the ratio of the number of "predicted" to the number of "expected" readmission at a given hospital, multiplied by the national observed readmission rate. For each hospital, the numerator of the ratio is the number of readmissions within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the

number of readmissions expected based on the nation's performance with that hospital's case mix. This approach is analogous to a ratio of "observed" to "expected" used in other types of statistical analyses. It conceptually allows for a comparison of a particular hospital's performance given its case mix to an average hospital's performance with the same case mix. Thus, a lower ratio indicates lower-than-expected readmission rates or better quality, and a higher ratio indicates higher-than-expected readmission rates or worse quality.

The "predicted" number of readmissions (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of readmission. The estimated hospital-specific intercept is added to the sum of the estimated regression coefficients multiplied by the patient characteristics. The results are transformed and summed over all patients attributed to a hospital to get a predicted value. The "expected" number of readmissions (the denominator) is obtained in the same manner, but a common intercept using all hospitals in our sample is added in place of the hospital-specific intercept. The results are transformed and summed over all patients in the hospital to get an expected value. To assess hospital performance for each reporting period, we re-estimate the model coefficients using the years of data in that period.

This calculation transforms the ratio of predicted over expected into a rate that is compared to the national observed readmission rate. The hierarchical logistic regression models are described fully in the original methodology report (Grosso et al., 2012), which is also posted on QualityNet.

References:

Grosso L, Curtis J, Geary L, et al. Hospital-level 30-Day All-Cause Risk-Standardized Readmission Rate Following Elective Primary Total Hip Arthroplasty (THA) And/Or Total Knee Arthroplasty (TKA) Measure Methodology Report. 2012.

Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 112469| 109921| 118210| 135810| 117446| 146637| 141015

COPYRIGHT / DISCLAIMER

N/A

NQF #3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

STEWARD

The Society of Thoracic Surgeons

DESCRIPTION

The STS Individual Surgeon Composite Measure for Adult Cardiac Surgery includes five major procedures (isolated CABG, isolated AVR, AVR+CABG, MVRR, MVRR+CABG) and comprises the following two domains:

Domain 1 – Risk-Adjusted Operative Mortality

Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Risk-Adjusted Major Morbidity

Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation,

2. Deep sternal wound infection,
3. Permanent stroke,
4. Renal failure, and
5. Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

All measures are based on audited clinical data collected in the STS Adult Cardiac Surgery Database. Individual surgeons with at least 100 eligible cases during the 3-year measurement window will receive a score for each domain and an overall composite score. In addition to calculating composite score point estimates with credible intervals, surgeons will be assigned rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

TYPE

Composite

DATA SOURCE

Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.81 went live on July 1, 2014; STS Adult Cardiac Surgery Database – Version 2.9 went live on July 1st, 2017 and STS Adult Cardiac Surgery Database version 4.20 went live on June 30, 2020.

The URL provided under S.1 is for the latest data collection form that is currently in use.

LEVEL

Clinician : Individual

SETTING

Inpatient/Hospital

NUMERATOR STATEMENT

Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes in detail this multiprocedural, multidimensional composite measure.

The STS Individual Surgeon Composite Measure for Adult Cardiac Surgery includes five major procedures, i.e., isolated coronary artery bypass grafting (CABG), isolated aortic valve replacement (AVR), AVR+CABG, isolated mitral valve repair or replacement (MVRR), and MVRR+CABG, and comprises the following two domains:

Domain 1 – Risk-Adjusted Operative Mortality

Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Risk-Adjusted Major Morbidity

Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation
2. Deep sternal wound infection

3. Permanent stroke
4. Renal failure and
5. Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons

Individual surgeons with at least 100 eligible cases during the 3-year measurement window will receive a score for each domain and an overall composite score. In addition to calculating composite score point estimates with credible intervals, surgeons will be assigned rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated CABG, isolated AVR, AVR+CABG, isolated MVRR, and MVRR+CABG.

Time Window: 3 years

By including composite performance scores for a portfolio of five procedures that account for nearly 80% of a typical STS Adult Cardiac Surgery Database participant surgeon's clinical activity, this metric provides a more balanced and comprehensive perspective than focusing on just one procedure or one end point. Recognizing that surgeons' practices vary, each surgeon's composite performance is implicitly "weighted" by the proportion of each type of procedure he or she performs. For instance, the results of surgeons who primarily perform mitral procedures are affected most by their mitral surgery results. This approach is especially relevant for surgeons with highly specialized practices who may do relatively few isolated CABG procedures and whose performance would thus be difficult to assess using a CABG measure only. Finally, performance on each of these procedures is estimated using risk models specific to those procedures, in most cases the exact or slightly modified versions of previously published models (references provided below).

Final Composite Score:

The overall composite score was calculated as a weighted sum of (1 minus risk-adjusted mortality rate) and (1 minus risk-adjusted major morbidity rate). Mortality and morbidity rates were weighted inversely by their respective standard deviations across surgeons. This procedure is equivalent to first rescaling mortality and morbidity rates by their respective standard deviations across surgeons and then assigning equal weighting to the rescaled mortality rate and rescaled morbidity rate. Standard deviations derived from the data were used to define the final composite measure as 0.81 x (1 minus risk-standardized mortality rate) + 0.19 x (1 minus risk-standardized complication rate).

Details regarding the current STS adult cardiac surgery risk models can be found in the following manuscripts:

- Shahian DM, O'Brien SM, Filardo G, Ferraris VA, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 1--coronary artery bypass grafting surgery. Ann Thorac Surg. 2009 Jul;88(1 Suppl):S2-22.
- O'Brien SM, Shahian DM, Filardo G, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 2—isolated valve surgery. Ann Thorac Surg 2009;88(1 Suppl):S23–42.
- Shahian DM, O'Brien SM, Filardo G, Ferraris VA, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 3--valve plus coronary artery bypass grafting surgery. Ann Thorac Surg 2009 Jul;88(1 Suppl):S43-62.

Additional details regarding the Individual Surgeon Composite Measure for Adult Cardiac Surgery are provided in the attached manuscript:

Shahian DM, He X, Jacobs JP, Kurlansky PA, Badhwar V, Cleveland JC Jr, Fazzalari FL, Filardo G, Normand SL, Furnary AP, Magee MJ, Rankin JS, Welke KF, Han J, O'Brien SM. The Society of Thoracic Surgeons Composite Measure of Individual Surgeon Performance for Adult Cardiac Surgery: A Report of The Society of Thoracic Surgeons Quality Measurement Task Force. Ann Thorac Surg. 2015;100:1315-25.

NUMERATOR DETAILS

See response in S.4. Numerator Statement

DENOMINATOR STATEMENT

See response in S.4. Numerator Statement

Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated CABG, isolated AVR, AVR+CABG, isolated MVRR, and MVRR+CABG.

DENOMINATOR DETAILS

See response in S.6. Denominator Statement

EXCLUSIONS

Measure exclusions: Individual surgeons who do not meet the minimum case requirement (i.e., at least 100 eligible cases during the 3-year measurement window) will not receive a score for each domain and an overall composite score.

EXCLUSION DETAILS

See response in S.8. Denominator Exclusions

RISK ADJUSTMENT

Statistical risk model

STRATIFICATION

N/A

TYPE SCORE

Rate/proportion better quality = higher score

ALGORITHM

Please see discussion under section S.4 and attached manuscripts. 111855| 114638| 152617| 150289

COPYRIGHT / DISCLAIMER

N/A

NQF #3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

STEWARD

The Society of Thoracic Surgeons

DESCRIPTION

The STS Mitral Valve Repair/Replacement (MVRR) Composite Score measures surgical performance for isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD). To assess overall quality, the STS MVRR Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation,
2. Deep sternal wound infection,
3. Permanent stroke,
4. Renal failure, and
5. Reoperations for bleeding, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Outcome data are collected on all patients and from all participants. For optimal measure reliability, participants meeting a volume threshold of at least 36 cases over 3 years (i.e., approximately one mitral case per month) receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

TYPE

Composite

DATA SOURCE

Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.81 went live on July 1, 2014; STS Adult Cardiac Surgery Database – Version 2.9 went live on July 1st, 2017 and STS Adult Cardiac Surgery Database version 4.20 went live on June 30, 2020.

The URL provided under S.1 is for the latest data collection form that is currently in use.

LEVEL

Facility, Clinician : Group/Practice

SETTING

Inpatient/Hospital

NUMERATOR STATEMENT

Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.

The STS Mitral Valve Repair/Replacement (MVRR) Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation
2. Deep sternal wound infection
3. Permanent stroke
4. Renal failure and
5. Reoperations for bleeding, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD).

Time Window: 3 years

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 36 isolated MVRR procedures in the patient population.

Estimation of Composite Scores and Star Ratings: The statistical methodology used to estimate the STS

MVRR composite score and star rating for each participant site was similar to that used for the STS isolated CABG, isolated AVR, and AVR+CABG measures. As with previous composite scores, we first translated risk-standardized event rates into risk-standardized absence of event rates so that a higher score indicated better performance. We then rescaled the morbidity and mortality domains by dividing by their respective standard deviations and then added the two domains together.

NUMERATOR DETAILS

See response in S.4. Numerator Statement

DENOMINATOR STATEMENT

See response in S.4. Numerator Statement for complete description of measure specifications.

Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD).

DENOMINATOR DETAILS

See response in S.6 Denominator Statement

EXCLUSIONS

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 36 isolated MVRR procedures in the patient population.

EXCLUSION DETAILS

See response in S.8. Denominator Exclusions

RISK ADJUSTMENT

Statistical risk model

STRATIFICATION

N/A

TYPE SCORE

Rate/proportion better quality = higher score

ALGORITHM

Please see discussion under section S.4 and attached manuscripts. 111855| 114638| 152617

COPYRIGHT / DISCLAIMER

N/A

NQF #3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

STEWARD

The Society of Thoracic Surgeons

DESCRIPTION

The STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score measures surgical performance for MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF). To assess overall quality, the STS MVRR +CABG Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation,
2. Deep sternal wound infection,
3. Permanent stroke,
4. Renal failure, and
5. Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Outcome data are collected on all patients and from all participants. For optimal measure reliability, participants meeting a volume threshold of at least 25 cases over 3 years receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

TYPE

Composite

DATA SOURCE

Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.81 went live on July 1, 2014; STS Adult Cardiac Surgery Database – Version 2.9 went live on July 1st, 2017 and STS Adult Cardiac Surgery Database version 4.20 went live on June 30, 2020.

The URL provided under S.1 is for the latest data collection form that is currently in use.

LEVEL

Facility, Clinician : Group/Practice

SETTING

Inpatient/Hospital

NUMERATOR STATEMENT

Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.

The STS Mitral Valve Repair/Replacement (MVRR) Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation,
2. Deep sternal wound infection,
3. Permanent stroke,

4. Renal failure, and
5. Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Patient Population: The analysis population consists of patients aged 18 years or older who MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF).

Time Window: 3 years

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 25 MVRR + CABG procedures in the patient population.

Estimation of Composite Scores and Star Ratings:

To be consistent with the conventions of previous composite measures, risk-adjusted event rates were first converted into risk-adjusted absence-of-event rates. To calculate the composite, participant-specific absence of mortality rates and absence of morbidity rates were weighted inversely by their respective standard deviations across participants. This procedure was equivalent to first rescaling the absence of mortality rates and absence of morbidity rates by their respective standard deviations across participants, and then assigning equal weighting to the rescaled rates. Finally, in order to draw statistical inferences about participant performance, a Bayesian credible interval surrounding each participant's composite score was calculated. Unlike frequentist confidence intervals, Bayesian credible intervals have an intuitively direct interpretation as an interval containing the true value of the composite score with a specified probability (e.g., 95%). To determine star ratings for each participant, the credible interval of its composite score was compared with the STS average. Participants whose intervals were entirely above the STS average were classified as 3-star (higher than expected performance), and participants whose intervals were entirely below the STS average were classified as1-star (lower than expected performance). Credible intervals based on different probability levels (90%, 95%, 98%) were explored, and the resulting percentages of 1, 2, and 3-star programs were calculated.

NUMERATOR DETAILS

See response in S.4. Numerator Statement

DENOMINATOR STATEMENT

See response in S.4. Numerator Statement for complete description of measure specifications.

Patient Population: The analysis population consists of patients aged 18 years or older who MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF).

DENOMINATOR DETAILS

See response in S.7. Denominator Statement

EXCLUSIONS

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 25 MVRR + CABG procedures in the patient population.

EXCLUSION DETAILS

See response in S.8. Denominator Exclusions

RISK ADJUSTMENT

Statistical risk model

STRATIFICATION

N/A

TYPE SCORE

Rate/proportion better quality = higher score

ALGORITHM

Please see discussion under section S.4 and attached manuscripts. 111855| 114638| 152617

COPYRIGHT / DISCLAIMER

N/A

Appendix E1: Related and Competing Measures (tabular)

Comparison of NQF #0117, NQF #0114, and NQF #0115

Measure	0117 Beta Blockade at Discharge	0114 Risk-Adjusted Postoperative Renal Failure	0115 Risk-Adjusted Surgical Re-exploration
Steward	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons
Description	Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on beta blockers	Percent of patients aged 18 years and older undergoing isolated CABG (without pre-existing renal failure) who develop postoperative renal failure or require dialysis	Percent of patients aged 18 years and older undergoing isolated CABG who require a re-intervention during the current hospitalization for mediastinal bleeding with or without tamponade, graft occlusion, valve dysfunction, or other cardiac reason
Type	Process	Outcome	Outcome
Data Source	Registry Data STS Adult Cardiac Surgery Database Version 4.20 Available at measure-specific web page URL identified in S.1 No data dictionary	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 Attachment	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 Attachment
Level	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice
Setting	Inpatient/Hospital	Inpatient/Hospital	Inpatient/Hospital
Numerator Statement	Number of patients undergoing isolated CABG who were discharged on beta blockers	Number of patients undergoing isolated CABG who develop postoperative renal failure or require dialysis	Number of patients undergoing isolated CABG who require a re-intervention during the current hospitalization for mediastinal bleeding with or without tamponade, graft occlusion, valve dysfunction, or other cardiac reason

Measure	0117 Beta Blockade at Discharge	0114 Risk-Adjusted Postoperative Renal Failure	0115 Risk-Adjusted Surgical Re-exploration
Numerator Details	Number of isolated CABG procedures in which discharge beta blockers [DCBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"	Definition of renal failure/dialysis requirement – Patients with acute renal failure or worsening renal function resulting in one or both of the following: • Increase of serum creatinine to 4.0 or higher, or 3x the most recent preoperative creatinine level • New requirement for dialysis postoperatively Number of isolated CABG procedures in which postoperative renal failure [CRenFail (STS Adult Cardiac Surgery Database Version 2.9)] is marked as "yes"	Number of isolated CABG procedures in which any of the following are marked "yes" – ReOp for Bleeding [COpReBld (STS Adult Cardiac Surgery Database Version 2.73)], Reintervention for Graft Occlusion (COpReGft), ReOp for Valve Dysfunction (COpReVlv), ReOp for Other Cardiac Reason (COpReOth)
Denominator Statement	Patients aged 18 years and older undergoing isolated CABG	All patients undergoing isolated CABG	All patients undergoing isolated CABG
Denominator Details	Number of isolated CABG procedures excluding cases with an in-hospital mortality or cases for which discharge beta blocker use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.	Number of isolated CABG procedures including re-operations; the SQL code used to create the function to identify cardiac procedures is provided in the appendix.	Number of isolated CABG procedures. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.
Exclusions	Cases are removed from the denominator if there was an in-hospital mortality or if discharge beta blocker was contraindicated.	Patients with documented history of renal failure, baseline serum creatinine of 4.0 or higher; prior renal transplants are not considered preoperative renal failure unless since transplantation their Cr has been or is 4.0 or higher	N/A
Exclusion Details	Mortality Discharge Status (DischMortStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; discharge beta blocker (DCBeta) marked as "Contraindicated"	(Dialysis) is marked yes; Last Creatinine Level (CreatLst) is 4.0 or higher	N/A

Measure	0117 Beta Blockade at Discharge	0114 Risk-Adjusted Postoperative Renal Failure	0115 Risk-Adjusted Surgical Re-exploration
Risk Adjustment	No risk adjustment or risk stratification 111855| 137290| 141010| 114638| 150289| 152617 111855| 137290| 141010| 114638| 150289| 152617	Statistical risk model 111855| 137290| 114638| 141015 111855| 137290| 114638| 141015	Statistical risk model 111855| 137290| 114638 111855| 137290| 114638
Stratification	N/A	N/A	N/A
Type Score	Rate/proportion better quality = higher score	Rate/proportion better quality = lower score	Rate/proportion better quality = lower score
Algorithm	Please refer to numerator and denominator sections for detailed information. 111855| 137290| 141010| 114638| 150289| 152617	Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 141015	Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638

Measure	0117 Beta Blockade at Discharge	0114 Risk-Adjusted Postoperative Renal Failure	0115 Risk-Adjusted Surgical Re-exploration
Submission items	5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 0119 : Risk-Adjusted Operative Mortality for CABG 0118 : Anti-Lipid Treatment Discharge 0116 : Anti-Platelet Medication at Discharge 0115 : Risk-Adjusted Surgical Re-exploration 0114 : Risk-Adjusted Postoperative Renal Failure 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0130 : Risk-Adjusted Deep Sternal Wound Infection 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0127 : Preoperative Beta Blockade 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: 0115 : Risk-Adjusted Surgical Re-exploration 0116 : Anti-Platelet Medication at Discharge 0117 : Beta Blockade at Discharge 0118 : Anti-Lipid Treatment Discharge 0127 : Preoperative Beta Blockade 0119 : Risk-Adjusted Operative Mortality for CABG 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0130 : Risk-Adjusted Deep Sternal Wound Infection 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure 0116 : Anti-Platelet Medication at Discharge 0117 : Beta Blockade at Discharge 0118 : Anti-Lipid Treatment Discharge 0119 : Risk-Adjusted Operative Mortality for CABG 0127 : Preoperative Beta Blockade 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0130 : Risk-Adjusted Deep Sternal Wound Infection 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #0117, NQF #0116, and NQF #0118

	0117 Beta Blockade at Discharge	0116 Anti-Platelet Medication at Discharge	0118 Anti-Lipid Treatment Discharge
Steward	The Society of Thoracic Surgeons	DeLaine | Schmitz | dschmitz@sts.org | 312-202-5827-	The Society of Thoracic Surgeons
Description	Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on beta blockers	Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on anti-platelet medication	Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on a lipid lowering statin
Type	Process	Process	Process
Data Source	Registry Data STS Adult Cardiac Surgery Database Version 4.20 Available at measure-specific web page URL identified in S.1 No data dictionary	Facility, Clinician : Group/Practice Hospital No data dictionary	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 No data dictionary
Level	Facility, Clinician : Group/Practice	N/A	Facility, Clinician : Group/Practice
Setting	Inpatient/Hospital	Attachment on measure URL	Inpatient/Hospital
Numerator Statement	Number of patients undergoing isolated CABG who were discharged on beta blockers	Number of isolated CABG procedures excluding cases with in-hospital mortality or cases for which discharge aspirin use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.	Number of patients undergoing isolated CABG who were discharged on a lipid lowering statin
Numerator Details	Number of isolated CABG procedures in which discharge beta blockers [DCBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"	Cases are removed from the denominator if there was an in-hospital mortality or if discharge aspirin was contraindicated.	Number of isolated CABG procedures in which discharge lipid lowering medication [DCLipid (STS Adult Cardiac Surgery Database Version 2.73)] is marked "yes" and lipid lowering discharge medication type [DCLipMT (STS Adult Cardiac Surgery Database Version 2.73)] is marked "statin"
Denominator Statement	Patients aged 18 years and older undergoing isolated CABG	Mortality Discharge Status (MtDCStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; discharge aspirin (DCASA) is marked as “Contraindicated”	All patients undergoing isolated CABG

	0117 Beta Blockade at Discharge	0116 Anti-Platelet Medication at Discharge	0118 Anti-Lipid Treatment Discharge
Denominator Details	Number of isolated CABG procedures excluding cases with an in-hospital mortality or cases for which discharge beta blocker use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.	N/A	Number of isolated CABG procedures excluding cases with an in-hospital mortality or cases for which discharge anti-lipid treatment use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.
Exclusions	Cases are removed from the denominator if there was an in-hospital mortality or if discharge beta blocker was contraindicated.	No risk adjustment or risk stratification	Cases are removed from the denominator if there was an in-hospital mortality or if discharge anti-lipid treatment was contraindicated.
Exclusion Details	Mortality Discharge Status (DischMortStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; discharge beta blocker (DCBeta) marked as "Contraindicated"		Mortality Discharge Status (MtDCStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; DCLipid is marked as "Contraindicated"
Risk Adjustment	No risk adjustment or risk stratification 111855| 137290| 141010| 114638| 150289| 152617 111855| 137290| 141010| 114638| 150289| 152617	better quality = higher score 111855| 137290| 114638 111855| 137290| 114638	No risk adjustment or risk stratification 111855| 137290| 114638 111855| 137290| 114638
Stratification	N/A	Rate/proportion	N/A
Type Score	Rate/proportion better quality = higher score	Please refer to numerator and denominator sections for detailed information. N/A N/A	Rate/proportion better quality = higher score
Algorithm	Please refer to numerator and denominator sections for detailed information. 111855| 137290| 141010| 114638| 150289| 152617	Registry 111855| 137290| 114638	Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638

	0117 Beta Blockade at Discharge	0116 Anti-Platelet Medication at Discharge	0118 Anti-Lipid Treatment Discharge
Submission items	5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 0119 : Risk-Adjusted Operative Mortality for CABG 0118 : Anti-Lipid Treatment Discharge 0116 : Anti-Platelet Medication at Discharge 0115 : Risk-Adjusted Surgical Re-exploration 0114 : Risk-Adjusted Postoperative Renal Failure 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0130 : Risk-Adjusted Deep Sternal Wound Infection 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0127 : Preoperative Beta Blockade 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: N/A 5a.1 Are specs completely harmonized? Attachment 5a.2 If not completely harmonized, identify difference, rationale, impact: Attachment at measure URL 5b.1 If competing, why superior or rationale for additive value: The Society of Thoracic Surgeons	5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure 0115 : Risk-Adjusted Surgical Re-exploration 0116 : Anti-Platelet Medication at Discharge 0117 : Beta Blockade at Discharge 0119 : Risk-Adjusted Operative Mortality for CABG 0127 : Preoperative Beta Blockade 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0130 : Risk-Adjusted Deep Sternal Wound Infection 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #0117, NQF #0119, and NQF #0127

	0117 Beta Blockade at Discharge	0119 Risk-Adjusted Operative Mortality for CABG	0127 Preoperative Beta Blockade
Steward	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons
Description	Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on beta blockers	Percent of patients aged 18 years and older undergoing isolated CABG who die, including both 1) all deaths occurring during the hospitalization in which the CABG was performed, even if after 30 days, and 2) those deaths occurring after discharge from the hospital, but within 30 days of the procedure	Percent of patients aged 18 years and older undergoing isolated CABG who received beta blockers within 24 hours preceding surgery.
Type	Process	Outcome	Process
Data Source	Registry Data STS Adult Cardiac Surgery Database Version 4.20 Available at measure-specific web page URL identified in S.1 No data dictionary	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 Attachment	Registry Data STS Adult Cardiac Surgery Database Version 4.20 Available at measure-specific web page URL identified in S.1 No data dictionary
Level	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice
Setting	Inpatient/Hospital	Inpatient/Hospital	Inpatient/Hospital
Numerator Statement	Number of patients undergoing isolated CABG who were discharged on beta blockers	Number of patients undergoing isolated CABG who die, including both 1) all deaths occurring during the hospitalization in which the operation was performed, even if after 30 days, and 2) those deaths occurring after discharge from the hospital, but within 30 days of the procedure	Number of patients undergoing isolated CABG who received beta blockers within 24 hours preceding surgery
Numerator Details	Number of isolated CABG procedures in which discharge beta blockers [DCBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"	Number of isolated CABG procedures with an operative mortality; Number of isolated CABG procedures in which Mortality [Mortalty (STS Adult Cardiac Surgery Database Version 2.9)] and Mortality Operative Death (MtOpD) are marked "yes." Operative mortality is further verified by the following variables: Mortality Status at 30 days (Mt30Stat), Mortality Date (MtDate), Mortality Discharge Status (MtDCStat)	Number of isolated CABG procedures in which preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"

	0117 Beta Blockade at Discharge	0119 Risk-Adjusted Operative Mortality for CABG	0127 Preoperative Beta Blockade
Denominator Statement	Patients aged 18 years and older undergoing isolated CABG	All patients undergoing isolated CABG	Patients aged 18 years and older undergoing isolated CABG
Denominator Details	Number of isolated CABG procedures excluding cases with an in-hospital mortality or cases for which discharge beta blocker use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.	Number of isolated CABG procedures. The SQL code used to create the function to identify cardiac procedures is provided in the appendix.	Number of isolated CABG procedures excluding cases for which preoperative beta blockers were contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.
Exclusions	Cases are removed from the denominator if there was an in-hospital mortality or if discharge beta blocker was contraindicated.	N/A	Cases are removed from the denominator if preoperative beta blocker was contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room.
Exclusion Details	Mortality Discharge Status (DischMortStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; discharge beta blocker (DCBeta) marked as “Contraindicated”	N/A	Procedures with preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] marked as "Contraindicated" or procedures with Status [Status(STS Adult Cardiac Surgery Database Version 2.81)] marked "Emergent" or "Emergent Salvage"
Risk Adjustment	No risk adjustment or risk stratification 111855| 137290| 141010| 114638| 150289| 152617 111855| 137290| 141010| 114638| 150289| 152617	Statistical risk model 111855| 137290| 114638| 141015 111855| 137290| 114638| 141015	No risk adjustment or risk stratification 111855| 137290| 114638| 152617 111855| 137290| 114638| 152617
Stratification	N/A	N/A	N/A
Type Score	Rate/proportion better quality = higher score	Rate/proportion better quality = lower score	Rate/proportion better quality = higher score
Algorithm	Please refer to numerator and denominator sections for detailed information. 111855| 137290| 141010| 114638| 150289| 152617	Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 141015	Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 152617

	0117 Beta Blockade at Discharge	0119 Risk-Adjusted Operative Mortality for CABG	0127 Preoperative Beta Blockade
Submission items	5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 0119 : Risk-Adjusted Operative Mortality for CABG 0118 : Anti-Lipid Treatment Discharge 0116 : Anti-Platelet Medication at Discharge 0115 : Risk-Adjusted Surgical Re-exploration 0114 : Risk-Adjusted Postoperative Renal Failure 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0130 : Risk-Adjusted Deep Sternal Wound Infection 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0127 : Preoperative Beta Blockade 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure 0115 : Risk-Adjusted Surgical Re-exploration 0116 : Anti-Platelet Medication at Discharge 0117 : Beta Blockade at Discharge 0118 : Anti-Lipid Treatment Discharge 0120 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) 0127 : Preoperative Beta Blockade 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0130 : Risk-Adjusted Deep Sternal Wound Infection 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 0123 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) + CABG Surgery 0121 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Replacement 0122 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Replacement + CABG Surgery 1501 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Repair 1502 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Repair + CABG Surgery 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact:	5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 0119 : Risk-Adjusted Operative Mortality for CABG 0118 : Anti-Lipid Treatment Discharge 0117 : Beta Blockade at Discharge 0116 : Anti-Platelet Medication at Discharge 0115 : Risk-Adjusted Surgical Re-exploration 0114 : Risk-Adjusted Postoperative Renal Failure 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0130 : Risk-Adjusted Deep Sternal Wound Infection 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: 5b.1 If competing, why superior or rationale for additive value: N/A

	0117 Beta Blockade at Discharge	0119 Risk-Adjusted Operative Mortality for CABG	0127 Preoperative Beta Blockade
		5b.1 If competing, why superior or rationale for additive value: N/A	

Comparison of NQF #0117, NQF #0129, and NQF #0130

Measure	0117 Beta Blockade at Discharge	0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)	0130 Risk-Adjusted Deep Sternal Wound Infection
Steward	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons
Description	Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on beta blockers	Percent of patients aged 18 years and older undergoing isolated CABG who require intubation for more than 24 hours postoperatively	Percent of patients aged 18 years and older undergoing isolated CABG for whom mediastinitis or deep sternal wound infection is diagnosed within 30 days postoperatively or at any time during the hospitalization for surgery
Type	Process	Outcome	Outcome
Data Source	Registry Data STS Adult Cardiac Surgery Database Version 4.20 Available at measure-specific web page URL identified in S.1 No data dictionary	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 Attachment	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 Attachment
Level	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice
Setting	Inpatient/Hospital	Inpatient/Hospital	Inpatient/Hospital
Numerator Statement	Number of patients undergoing isolated CABG who were discharged on beta blockers	Number of patients undergoing isolated CABG who require intubation > 24 hours following exit from the operating room	Number of patients aged 18 years and older undergoing isolated CABG for whom mediastinitis or deep sternal wound infection is diagnosed within 30 days postoperatively or at any time during the hospitalization for surgery
Numerator Details	Number of isolated CABG procedures in which discharge beta blockers [DCBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"	Number of isolated CABG procedures in which Prolonged Ventilation (CPVntLng) is marked "yes" (STS Adult Cardiac Surgery Database Version 2.9) The hours of postoperative ventilation time include OR exit until extubation, plus any additional hours following reintubation.	Numerator time period: Within 30 days postoperatively or at any time during the hospitalization for surgery Number of isolated CABG procedures in which deep sternal infection/mediastinitis [DeepSternInf (STS Adult Cardiac Surgery Database Version 2.9)] is marked "yes" DeepSternInf

Measure	0117 Beta Blockade at Discharge	0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)	0130 Risk-Adjusted Deep Sternal Wound Infection
			Deep incisional SSI: Must meet the following criteria Infection occurs within 30 days after the operative procedure, and involves deep soft tissues of the incision (e.g., fascial and muscle layers) and patient has at least one of the following: Purulent drainage from the deep incision. **A deep incision that spontaneously dehisces or is deliberately opened by a surgeon, attending physician or other designee and is culture-positive or not cultured, and patient has at least one of the following signs or symptoms:** ○ Fever (>38°C) ○ Localized pain or tenderness ○ An abscess or other evidence of infection involving the deep incision that is detected on direct examination, during invasive procedure, or by histopathologic examination or imaging test. • A culture with negative findings does not meet this criterion. • There are two specific types of deep incisional SSIs: • Deep Incisional Primary (DIP)– a deep incisional SSI that is identified in a primary incision in a patient that has had an operation with one or more incisions (e.g., chest incision for CABG) • Deep Incisional Secondary (DIS) – a deep incisional SSI that is identified in the secondary incision in a patient that has had

Measure	0117 Beta Blockade at Discharge	0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)	0130 Risk-Adjusted Deep Sternal Wound Infection
			an operation with more than one incision (e.g., donor site incision for CABG) MED-Mediastinitis: Must meet the following criteria *Mediastinitis must meet at least 1 of the following criteria:* *Patient has organisms cultured from mediastinal tissue or fluid obtained during an invasive procedure.* *Patient has evidence of mediastinitis seen during an invasive procedure or histopathologic examination.* *Patient has at least 1 of the following signs or symptoms:* Fever (>38°C) Chest pain (with no other recognized cause) Sternal instability (with no other recognized cause) and at least 1 of the following: Purulent discharge from mediastinal area Organisms cultured from blood or discharge from mediastinal area - Mediastinal widening on imaging test.
Denominator Statement	Patients aged 18 years and older undergoing isolated CABG	All patients undergoing isolated CABG	All patients undergoing isolated CABG

Measure	0117 Beta Blockade at Discharge	0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)	0130 Risk-Adjusted Deep Sternal Wound Infection
Denominator Details	Number of isolated CABG procedures excluding cases with an in-hospital mortality or cases for which discharge beta blocker use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.	Number of isolated CABG procedures. The SQL code used to create the function to identify cardiac procedures is provided in the appendix.	Number of isolated CABG procedures. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.
Exclusions	Cases are removed from the denominator if there was an in-hospital mortality or if discharge beta blocker was contraindicated.	N/A	N/A
Exclusion Details	Mortality Discharge Status (DischMortStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; discharge beta blocker (DCBeta) marked as "Contraindicated"	N/A	N/A
Risk Adjustment	No risk adjustment or risk stratification 111855| 137290| 141010| 114638| 150289| 152617 111855| 137290| 141010| 114638| 150289| 152617	Statistical risk model 111855| 137290| 114638| 141015 111855| 137290| 114638| 141015	Statistical risk model 111855| 137290| 114638 111855| 137290| 114638
Stratification	N/A	N/A	N/A
Type Score	Rate/proportion better quality = higher score	Rate/proportion better quality = lower score	Rate/proportion better quality = lower score
Algorithm	Please refer to numerator and denominator sections for detailed information. 111855| 137290| 141010| 114638| 150289| 152617	Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 141015	Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638

Measure	0117 Beta Blockade at Discharge	0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)	0130 Risk-Adjusted Deep Sternal Wound Infection
Submission items	5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 0119 : Risk-Adjusted Operative Mortality for CABG 0118 : Anti-Lipid Treatment Discharge 0116 : Anti-Platelet Medication at Discharge 0115 : Risk-Adjusted Surgical Re-exploration 0114 : Risk-Adjusted Postoperative Renal Failure 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0130 : Risk-Adjusted Deep Sternal Wound Infection 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0127 : Preoperative Beta Blockade 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure 0115 : Risk-Adjusted Surgical Re-exploration 0116 : Anti-Platelet Medication at Discharge 0117 : Beta Blockade at Discharge 0118 : Anti-Lipid Treatment Discharge 0119 : Risk-Adjusted Operative Mortality for CABG 0127 : Preoperative Beta Blockade 0130 : Risk-Adjusted Deep Sternal Wound Infection 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure 0115 : Risk-Adjusted Surgical Re-exploration 0116 : Anti-Platelet Medication at Discharge 0117 : Beta Blockade at Discharge 0118 : Anti-Lipid Treatment Discharge 0119 : Risk-Adjusted Operative Mortality for CABG 0127 : Preoperative Beta Blockade 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #0117, NQF #0131, and NQF #0134

Measure	0117 Beta Blockade at Discharge	0131 Risk-Adjusted Stroke/Cerebrovascular Accident	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
Steward	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons
Description	Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on beta blockers	Percent of patients aged 18 years and older undergoing isolated CABG who have a postoperative stroke (i.e., any confirmed neurological deficit of abrupt onset caused by a disturbance in blood supply to the brain) that did not resolve within 24 hours	Percentage of patients aged 18 years and older undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft
Type	Process	Outcome	Process
Data Source	Registry Data STS Adult Cardiac Surgery Database Version 4.20 Available at measure-specific web page URL identified in S.1 No data dictionary	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 Attachment	Registry Data STS Adult Cardiac Surgery Database Version 4.20 Available at measure-specific web page URL identified in S.1 No data dictionary
Level	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice
Setting	Inpatient/Hospital	Inpatient/Hospital	Inpatient/Hospital
Numerator Statement	Number of patients undergoing isolated CABG who were discharged on beta blockers	Number of patients undergoing isolated CABG who have a postoperative stroke (i.e., any confirmed neurological deficit of abrupt onset caused by a disturbance in blood supply to the brain) that did not resolve within 24 hours	Number of patients undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft
Numerator Details	Number of isolated CABG procedures in which discharge beta blockers [DCBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"	Number of isolated CABG procedures in which postoperative stroke [CNStrokP (STS Adult Cardiac Surgery Database Version 2.9)] is marked "yes"	Number of isolated CABG procedures in which IMA Artery Used [IMAUsed(STS Adult Cardiac Surgery Database Version 4.20] is marked "Left IMA" and/or "Right IMA"
Denominator Statement	Patients aged 18 years and older undergoing isolated CABG	All patients undergoing isolated CABG	Patients aged 18 years and older undergoing isolated CABG

Measure	0117 Beta Blockade at Discharge	0131 Risk-Adjusted Stroke/Cerebrovascular Accident	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
Denominator Details	Number of isolated CABG procedures excluding cases with an in-hospital mortality or cases for which discharge beta blocker use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.	Number of isolated CABG procedures. The SQL code used to create the function to identify cardiac procedures is provided in the appendix.	Number of isolated CABG procedures excluding cases that were a previous CABG prior to the current admission or if IMA was not used and one of the acceptable reasons was provided. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.
Exclusions	Cases are removed from the denominator if there was an in-hospital mortality or if discharge beta blocker was contraindicated.	N/A	Cases are removed from the denominator if the patient had a previous CABG prior to the current admission or if IMA was not used and one of the following reasons was provided: - Subclavian stenosis - Previous cardiac or thoracic surgery - Previous mediastinal radiation - Emergent or salvage procedure - No (bypassable) LAD disease
Exclusion Details	Mortality Discharge Status (DischMortStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; discharge beta blocker (DCBeta) marked as “Contraindicated”	N/A	Patients with previous CABG, identified where PrCAB is marked "yes" or IMA Artery Used (IMAUsed) is marked “no” and primary reason for no IMA (NoIMARsn) is marked as any of the following: - Subclavian stenosis - Previous cardiac or thoracic surgery - Previous mediastinal radiation - Emergent or salvage procedure - No (bypassable) LAD disease
Risk Adjustment	No risk adjustment or risk stratification 111855| 137290| 141010| 114638| 150289| 152617 111855| 137290| 141010| 114638| 150289| 152617	Statistical risk model 111855| 137290| 114638| 141015 111855| 137290| 114638| 141015	No risk adjustment or risk stratification 111855| 137290| 114638| 152617 111855| 137290| 114638| 152617
Stratification	N/A	N/A	N/A

Measure	0117 Beta Blockade at Discharge	0131 Risk-Adjusted Stroke/Cerebrovascular Accident	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
Type Score	Rate/proportion better quality = higher score	Rate/proportion better quality = lower score	Rate/proportion better quality = higher score
Algorithm	Please refer to numerator and denominator sections for detailed information. 111855| 137290| 141010| 114638| 150289| 152617	Please refer to numerator and denominator sections for detailed information. 111855 | 137290| 114638| 141015	Please refer to numerator and denominator sections for detailed information. 111855 | 137290| 114638| 152617

Measure	0117 Beta Blockade at Discharge	0131 Risk-Adjusted Stroke/Cerebrovascular Accident	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
Submission items	5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 0119 : Risk-Adjusted Operative Mortality for CABG 0118 : Anti-Lipid Treatment Discharge 0116 : Anti-Platelet Medication at Discharge 0115 : Risk-Adjusted Surgical Re-exploration 0114 : Risk-Adjusted Postoperative Renal Failure 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0130 : Risk-Adjusted Deep Sternal Wound Infection 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0127 : Preoperative Beta Blockade 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure 0115 : Risk-Adjusted Surgical Re-exploration 0116 : Anti-Platelet Medication at Discharge 0117 : Beta Blockade at Discharge 0118 : Anti-Lipid Treatment Discharge 0119 : Risk-Adjusted Operative Mortality for CABG 0127 : Preoperative Beta Blockade 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0130 : Risk-Adjusted Deep Sternal Wound Infection 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: 0119 : Risk-Adjusted Operative Mortality for CABG 0118 : Anti-Lipid Treatment Discharge 0117 : Beta Blockade at Discharge 0116 : Anti-Platelet Medication at Discharge 0115 : Risk-Adjusted Surgical Re-exploration 0114 : Risk-Adjusted Postoperative Renal Failure 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0130 : Risk-Adjusted Deep Sternal Wound Infection 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0127 : Preoperative Beta Blockade 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: 5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #0127, NQF #0114, and NQF #0115

Measure	0127 Preoperative Beta Blockade	0114 Risk-Adjusted Postoperative Renal Failure	0115 Risk-Adjusted Surgical Re-exploration
Steward	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons
Description	Percent of patients aged 18 years and older undergoing isolated CABG who received beta blockers within 24 hours preceding surgery.	Percent of patients aged 18 years and older undergoing isolated CABG (without pre-existing renal failure) who develop postoperative renal failure or require dialysis	Percent of patients aged 18 years and older undergoing isolated CABG who require a re-intervention during the current hospitalization for mediastinal bleeding with or without tamponade, graft occlusion, valve dysfunction, or other cardiac reason
Type	Process	Outcome	Outcome
Data Source	Registry Data STS Adult Cardiac Surgery Database Version 4.20 Available at measure-specific web page URL identified in S.1 No data dictionary	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 Attachment	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 Attachment
Level	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice
Setting	Inpatient/Hospital	Inpatient/Hospital	Inpatient/Hospital
Numerator Statement	Number of patients undergoing isolated CABG who received beta blockers within 24 hours preceding surgery	Number of patients undergoing isolated CABG who develop postoperative renal failure or require dialysis	Number of patients undergoing isolated CABG who require a re-intervention during the current hospitalization for mediastinal bleeding with or without tamponade, graft occlusion, valve dysfunction, or other cardiac reason
Numerator Details	Number of isolated CABG procedures in which preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"	Definition of renal failure/dialysis requirement – Patients with acute renal failure or worsening renal function resulting in one or both of the following: - Increase of serum creatinine to 4.0 or higher, or 3x the most recent preoperative creatinine level - New requirement for dialysis postoperatively Number of isolated CABG procedures in which postoperative renal failure [CRenFail (STS Adult Cardiac Surgery Database Version 2.9)] is marked as "yes"	Number of isolated CABG procedures in which any of the following are marked "yes" – ReOp for Bleeding [COpReBld (STS Adult Cardiac Surgery Database Version 2.73)], Reintervention for Graft Occlusion (COpReGft), ReOp for Valve Dysfunction (COpReVlv), ReOp for Other Cardiac Reason (COpReOth)

Measure	0127 Preoperative Beta Blockade	0114 Risk-Adjusted Postoperative Renal Failure	0115 Risk-Adjusted Surgical Re-exploration
Denominator Statement	Patients aged 18 years and older undergoing isolated CABG	All patients undergoing isolated CABG	All patients undergoing isolated CABG
Denominator Details	Number of isolated CABG procedures excluding cases for which preoperative beta blockers were contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.	Number of isolated CABG procedures including re-operations; the SQL code used to create the function to identify cardiac procedures is provided in the appendix.	Number of isolated CABG procedures. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.
Exclusions	Cases are removed from the denominator if preoperative beta blocker was contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room.	Patients with documented history of renal failure, baseline serum creatinine of 4.0 or higher; prior renal transplants are not considered preoperative renal failure unless since transplantation their Cr has been or is 4.0 or higher	N/A
Exclusion Details	Procedures with preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] marked as "Contraindicated" or procedures with Status [Status(STS Adult Cardiac Surgery Database Version 2.81)] marked "Emergent" or "Emergent Salvage"	(Dialysis) is marked yes; Last Creatinine Level (CreatLst) is 4.0 or higher	N/A
Risk Adjustment	No risk adjustment or risk stratification 111855| 137290| 114638| 152617 111855| 137290| 114638| 152617	Statistical risk model 111855| 137290| 114638| 141015 111855| 137290| 114638| 141015	Statistical risk model 111855| 137290| 114638 111855| 137290| 114638
Stratification	N/A	N/A	N/A
Type Score	Rate/proportion better quality = higher score	Rate/proportion better quality = lower score	Rate/proportion better quality = lower score

Measure	0127 Preoperative Beta Blockade	0114 Risk-Adjusted Postoperative Renal Failure	0115 Risk-Adjusted Surgical Re-exploration
Algorithm	Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 152617	Please refer to numerator and denominator sections for detailed information. 111855 | 137290| 114638 | 141015	Please refer to numerator and denominator sections for detailed information. 111855 | 137290| 114638
Submission items	5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 0119 : Risk-Adjusted Operative Mortality for CABG 0118 : Anti-Lipid Treatment Discharge 0117 : Beta Blockade at Discharge 0116 : Anti-Platelet Medication at Discharge 0115 : Risk-Adjusted Surgical Re-exploration 0114 : Risk-Adjusted Postoperative Renal Failure 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0130 : Risk-Adjusted Deep Sternal Wound Infection 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: 0115 : Risk-Adjusted Surgical Re-exploration 0116 : Anti-Platelet Medication at Discharge 0117 : Beta Blockade at Discharge 0118 : Anti-Lipid Treatment Discharge 0127 : Preoperative Beta Blockade 0119 : Risk-Adjusted Operative Mortality for CABG 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0130 : Risk-Adjusted Deep Sternal Wound Infection 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure 0116 : Anti-Platelet Medication at Discharge 0117 : Beta Blockade at Discharge 0118 : Anti-Lipid Treatment Discharge 0119 : Risk-Adjusted Operative Mortality for CABG 0127 : Preoperative Beta Blockade 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0130 : Risk-Adjusted Deep Sternal Wound Infection 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #0127, NQF #0116, and NQF #0117

	0127 Preoperative Beta Blockade	0116 Anti-Platelet Medication at Discharge	0117 Beta Blockade at Discharge
Steward	The Society of Thoracic Surgeons	DeLaine | Schmitz | dschmitz@sts.org | 312-202-5827-	The Society of Thoracic Surgeons
Description	Percent of patients aged 18 years and older undergoing isolated CABG who received beta blockers within 24 hours preceding surgery.	Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on anti-platelet medication	Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on beta blockers
Type	Process	Process	Process
Data Source	Registry Data STS Adult Cardiac Surgery Database Version 4.20 Available at measure-specific web page URL identified in S.1 No data dictionary	Facility, Clinician : Group/Practice Hospital No data dictionary	Registry Data STS Adult Cardiac Surgery Database Version 4.20 Available at measure-specific web page URL identified in S.1 No data dictionary
Level	Facility, Clinician : Group/Practice	N/A	Facility, Clinician : Group/Practice
Setting	Inpatient/Hospital	Attachment at measure URL	Inpatient/Hospital
Numerator Statement	Number of patients undergoing isolated CABG who received beta blockers within 24 hours preceding surgery	Number of isolated CABG procedures excluding cases with in-hospital mortality or cases for which discharge aspirin use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.	Number of patients undergoing isolated CABG who were discharged on beta blockers
Numerator Details	Number of isolated CABG procedures in which preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"	Cases are removed from the denominator if there was an in-hospital mortality or if discharge aspirin was contraindicated.	Number of isolated CABG procedures in which discharge beta blockers [DCBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"
Denominator Statement	Patients aged 18 years and older undergoing isolated CABG	Mortality Discharge Status (MtDCStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; discharge aspirin (DCASA) is marked as "Contraindicated"	Patients aged 18 years and older undergoing isolated CABG

	0127 Preoperative Beta Blockade	0116 Anti-Platelet Medication at Discharge	0117 Beta Blockade at Discharge
Denominator Details	Number of isolated CABG procedures excluding cases for which preoperative beta blockers were contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.	N/A	Number of isolated CABG procedures excluding cases with an in-hospital mortality or cases for which discharge beta blocker use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.
Exclusions	Cases are removed from the denominator if preoperative beta blocker was contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room.	No risk adjustment or risk stratification	Cases are removed from the denominator if there was an in-hospital mortality or if discharge beta blocker was contraindicated.
Exclusion Details	Procedures with preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] marked as "Contraindicated" or procedures with Status [Status(STS Adult Cardiac Surgery Database Version 2.81)] marked "Emergent" or "Emergent Salvage"		Mortality Discharge Status (DischMortStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; discharge beta blocker (DCBeta) marked as “Contraindicated”
Risk Adjustment	No risk adjustment or risk stratification 111855| 137290| 114638| 152617 111855| 137290| 114638| 152617	better quality = higher score 111855| 137290| 114638 111855| 137290| 114638	No risk adjustment or risk stratification 111855| 137290| 141010| 114638| 150289| 152617 111855| 137290| 141010| 114638| 150289| 152617
Stratification	N/A	Rate/proportion	N/A
Type Score	Rate/proportion better quality = higher score	Please refer to numerator and denominator sections for detailed information. N/A N/A	Rate/proportion better quality = higher score
Algorithm	Please refer to numerator and denominator sections for detailed information. 111855 | 137290| 114638| 152617	Registry 111855| 137290| 114638	Please refer to numerator and denominator sections for detailed information. 111855 | 137290| 141010| 114638| 150289| 152617

	0127 Preoperative Beta Blockade	0116 Anti-Platelet Medication at Discharge	0117 Beta Blockade at Discharge
Submission items	5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 0119 : Risk-Adjusted Operative Mortality for CABG 0118 : Anti-Lipid Treatment Discharge 0117 : Beta Blockade at Discharge 0116 : Anti-Platelet Medication at Discharge 0115 : Risk-Adjusted Surgical Re-exploration 0114 : Risk-Adjusted Postoperative Renal Failure 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0130 : Risk-Adjusted Deep Sternal Wound Infection 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: N/A 5a.1 Are specs completely harmonized? Attachment 5a.2 If not completely harmonized, identify difference, rationale, impact: Attachment at measure URL 5b.1 If competing, why superior or rationale for additive value: The Society of Thoracic Surgeons	5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 0119 : Risk-Adjusted Operative Mortality for CABG 0118 : Anti-Lipid Treatment Discharge 0116 : Anti-Platelet Medication at Discharge 0115 : Risk-Adjusted Surgical Re-exploration 0114 : Risk-Adjusted Postoperative Renal Failure 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0130 : Risk-Adjusted Deep Sternal Wound Infection 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0127 : Preoperative Beta Blockade 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: 5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #0127, NQF #0118, and NQF #0119

Measure	0127 Preoperative Beta Blockade	0118 Anti-Lipid Treatment Discharge	0119 Risk-Adjusted Operative Mortality for CABG
Steward	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons

Measure	0127 Preoperative Beta Blockade	0118 Anti-Lipid Treatment Discharge	0119 Risk-Adjusted Operative Mortality for CABG
Description	Percent of patients aged 18 years and older undergoing isolated CABG who received beta blockers within 24 hours preceding surgery.	Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on a lipid lowering statin	Percent of patients aged 18 years and older undergoing isolated CABG who die, including both 1) all deaths occurring during the hospitalization in which the CABG was performed, even if after 30 days, and 2) those deaths occurring after discharge from the hospital, but within 30 days of the procedure
Type	Process	Process	Outcome
Data Source	Registry Data STS Adult Cardiac Surgery Database Version 4.20 Available at measure-specific web page URL identified in S.1 No data dictionary	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 No data dictionary	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 Attachment
Level	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice
Setting	Inpatient/Hospital	Inpatient/Hospital	Inpatient/Hospital
Numerator Statement	Number of patients undergoing isolated CABG who received beta blockers within 24 hours preceding surgery	Number of patients undergoing isolated CABG who were discharged on a lipid lowering statin	Number of patients undergoing isolated CABG who die, including both 1) all deaths occurring during the hospitalization in which the operation was performed, even if after 30 days, and 2) those deaths occurring after discharge from the hospital, but within 30 days of the procedure
Numerator Details	Number of isolated CABG procedures in which preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"	Number of isolated CABG procedures in which discharge lipid lowering medication [DCLipid (STS Adult Cardiac Surgery Database Version 2.73)] is marked "yes" and lipid lowering discharge medication type [DCLipMT (STS Adult Cardiac Surgery Database Version 2.73)] is marked "statin"	Number of isolated CABG procedures with an operative mortality; Number of isolated CABG procedures in which Mortality [Mortalty (STS Adult Cardiac Surgery Database Version 2.9)] and Mortality Operative Death (MtOpD) are marked "yes." Operative mortality is further verified by the following variables: Mortality Status at 30 days (Mt30Stat), Mortality Date (MtDate), Mortality Discharge Status (MtDCStat)
Denominator Statement	Patients aged 18 years and older undergoing isolated CABG	All patients undergoing isolated CABG	All patients undergoing isolated CABG

Measure	0127 Preoperative Beta Blockade	0118 Anti-Lipid Treatment Discharge	0119 Risk-Adjusted Operative Mortality for CABG
Denominator Details	Number of isolated CABG procedures excluding cases for which preoperative beta blockers were contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.	Number of isolated CABG procedures excluding cases with an in-hospital mortality or cases for which discharge anti-lipid treatment use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.	Number of isolated CABG procedures. The SQL code used to create the function to identify cardiac procedures is provided in the appendix.
Exclusions	Cases are removed from the denominator if preoperative beta blocker was contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room.	Cases are removed from the denominator if there was an in-hospital mortality or if discharge anti-lipid treatment was contraindicated.	N/A
Exclusion Details	Procedures with preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] marked as "Contraindicated" or procedures with Status [Status(STS Adult Cardiac Surgery Database Version 2.81)] marked "Emergent" or "Emergent Salvage"	Mortality Discharge Status (MtDCStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; DCLipid is marked as "Contraindicated"	N/A
Risk Adjustment	No risk adjustment or risk stratification 111855| 137290| 114638| 152617 111855| 137290| 114638| 152617	No risk adjustment or risk stratification 111855| 137290| 114638 111855| 137290| 114638	Statistical risk model 111855| 137290| 114638| 141015 111855| 137290| 114638| 141015
Stratification	N/A	N/A	N/A
Type Score	Rate/proportion better quality = higher score	Rate/proportion better quality = higher score	Rate/proportion better quality = lower score
Algorithm	Please refer to numerator and denominator sections for detailed information. 111855 | 137290| 114638 | 152617	Please refer to numerator and denominator sections for detailed information. 111855 | 137290| 114638	Please refer to numerator and denominator sections for detailed information. 111855 | 137290| 114638 | 141015
Submission items	5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 0119 : Risk-Adjusted Operative Mortality for CABG	5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure 0115 : Risk-Adjusted Surgical Re-exploration 0116 : Anti-Platelet Medication at Discharge	5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure 0115 : Risk-Adjusted Surgical Re-exploration 0116 : Anti-Platelet Medication at Discharge

Measure	0127 Preoperative Beta Blockade	0118 Anti-Lipid Treatment Discharge	0119 Risk-Adjusted Operative Mortality for CABG
	0118 : Anti-Lipid Treatment Discharge 0117 : Beta Blockade at Discharge 0116 : Anti-Platelet Medication at Discharge 0115 : Risk-Adjusted Surgical Re-exploration 0114 : Risk-Adjusted Postoperative Renal Failure 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0130 : Risk-Adjusted Deep Sternal Wound Infection 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: 5b.1 If competing, why superior or rationale for additive value: N/A	0117 : Beta Blockade at Discharge 0119 : Risk-Adjusted Operative Mortality for CABG 0127 : Preoperative Beta Blockade 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0130 : Risk-Adjusted Deep Sternal Wound Infection 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A	0117 : Beta Blockade at Discharge 0118 : Anti-Lipid Treatment Discharge 0120 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) 0127 : Preoperative Beta Blockade 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0130 : Risk-Adjusted Deep Sternal Wound Infection 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 0123 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) + CABG Surgery 0121 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Replacement 0122 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Replacement + CABG Surgery 1501 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Repair 1502 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Repair + CABG Surgery 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: 5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #0127, NQF #0129, and NQF #0130

Measure	0127 Preoperative Beta Blockade	0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)	0130 Risk-Adjusted Deep Sternal Wound Infection
Steward	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons
Description	Percent of patients aged 18 years and older undergoing isolated CABG who received beta blockers within 24 hours preceding surgery.	Percent of patients aged 18 years and older undergoing isolated CABG who require intubation for more than 24 hours postoperatively	Percent of patients aged 18 years and older undergoing isolated CABG for whom mediastinitis or deep sternal wound infection is diagnosed within 30 days postoperatively or at any time during the hospitalization for surgery
Type	Process	Outcome	Outcome
Data Source	Registry Data STS Adult Cardiac Surgery Database Version 4.20 Available at measure-specific web page URL identified in S.1 No data dictionary	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 Attachment	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 Attachment
Level	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice
Setting	Inpatient/Hospital	Inpatient/Hospital	Inpatient/Hospital
Numerator Statement	Number of patients undergoing isolated CABG who received beta blockers within 24 hours preceding surgery	Number of patients undergoing isolated CABG who require intubation > 24 hours following exit from the operating room	Number of patients aged 18 years and older undergoing isolated CABG for whom mediastinitis or deep sternal wound infection is diagnosed within 30 days postoperatively or at any time during the hospitalization for surgery
Numerator Details	Number of isolated CABG procedures in which preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"	Number of isolated CABG procedures in which Prolonged Ventilation (CPVntLng) is marked "yes" (STS Adult Cardiac Surgery Database Version 2.9) The hours of postoperative ventilation time include OR exit until extubation, plus any additional hours following reintubation.	Numerator time period: Within 30 days postoperatively or at any time during the hospitalization for surgery Number of isolated CABG procedures in which deep sternal infection/mediastinitis [DeepSternInf (STS Adult Cardiac Surgery Database Version 2.9)] is marked "yes" DeepSternInf Deep incisional SSI: Must meet the following criteria - Infection occurs within 30 days after the operative procedure, and involves deep soft tissues of the incision (e.g., fascial and

Measure	0127 Preoperative Beta Blockade	0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)	0130 Risk-Adjusted Deep Sternal Wound Infection
			muscle layers) and patient has at least one of the following: - Purulent drainage from the deep incision. - A deep incision that spontaneously dehisces or is deliberately opened by a surgeon, attending physician or other designee and is culture-positive or not cultured, and patient has at least one of the following signs or symptoms: o Fever (>38°C) o Localized pain or tenderness o An abscess or other evidence of infection involving the deep incision that is detected on direct examination, during invasive procedure, or by histopathologic examination or imaging test. - A culture with negative findings does not meet this criterion. - There are two specific types of deep incisional SSIs: - Deep Incisional Primary (DIP) – a deep incisional SSI that is identified in a primary incision in a patient that has had an operation with one or more incisions (e.g., chest incision for CABG) - Deep Incisional Secondary (DIS) – a deep incisional SSI that is identified in the secondary incision in a patient that has had an operation with more than one incision (e.g., donor site incision for CABG) MED-Mediastinitis: Must meet the following criteria

Measure	0127 Preoperative Beta Blockade	0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)	0130 Risk-Adjusted Deep Sternal Wound Infection
			- Mediastinitis must meet at least 1 of the following criteria: - Patient has organisms cultured from mediastinal tissue or fluid obtained during an invasive procedure. - Patient has evidence of mediastinitis seen during an invasive procedure or histopathologic examination. - Patient has at least 1 of the following signs or symptoms: o Fever (>38°C) o Chest pain (with no other recognized cause) o Sternal instability (with no other recognized cause) and at least 1 of the following: o Purulent discharge from mediastinal area o Organisms cultured from blood or discharge from mediastinal area o Mediastinal widening on imaging test.
Denominator Statement	Patients aged 18 years and older undergoing isolated CABG	All patients undergoing isolated CABG	All patients undergoing isolated CABG
Denominator Details	Number of isolated CABG procedures excluding cases for which preoperative beta blockers were contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.	Number of isolated CABG procedures. The SQL code used to create the function to identify cardiac procedures is provided in the appendix.	Number of isolated CABG procedures. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

Measure	0127 Preoperative Beta Blockade	0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)	0130 Risk-Adjusted Deep Sternal Wound Infection
Exclusions	Cases are removed from the denominator if preoperative beta blocker was contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room.	N/A	N/A
Exclusion Details	Procedures with preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] marked as "Contraindicated" or procedures with Status [Status(STS Adult Cardiac Surgery Database Version 2.81)] marked "Emergent" or "Emergent Salvage"	N/A	N/A
Risk Adjustment	No risk adjustment or risk stratification 111855| 137290| 114638| 152617 111855| 137290| 114638| 152617	Statistical risk model 111855| 137290| 114638| 141015 111855| 137290| 114638| 141015	Statistical risk model 111855| 137290| 114638 111855| 137290| 114638
Stratification	N/A	N/A	N/A
Type Score	Rate/proportion better quality = higher score	Rate/proportion better quality = lower score	Rate/proportion better quality = lower score
Algorithm	Please refer to numerator and denominator sections for detailed information. 111855 | 137290| 114638 | 152617	Please refer to numerator and denominator sections for detailed information. 111855 | 137290| 114638 | 141015	Please refer to numerator and denominator sections for detailed information. 111855 | 137290| 114638
Submission items	5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 0119 : Risk-Adjusted Operative Mortality for CABG 0118 : Anti-Lipid Treatment Discharge 0117 : Beta Blockade at Discharge 0116 : Anti-Platelet Medication at Discharge 0115 : Risk-Adjusted Surgical Re-exploration	5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure 0115 : Risk-Adjusted Surgical Re-exploration 0116 : Anti-Platelet Medication at Discharge 0117 : Beta Blockade at Discharge 0118 : Anti-Lipid Treatment Discharge 0119 : Risk-Adjusted Operative Mortality for CABG 0127 : Preoperative Beta Blockade 0130 : Risk-Adjusted Deep Sternal Wound Infection	5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure 0115 : Risk-Adjusted Surgical Re-exploration 0116 : Anti-Platelet Medication at Discharge 0117 : Beta Blockade at Discharge 0118 : Anti-Lipid Treatment Discharge 0119 : Risk-Adjusted Operative Mortality for CABG 0127 : Preoperative Beta Blockade 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Measure	0127 Preoperative Beta Blockade	0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)	0130 Risk-Adjusted Deep Sternal Wound Infection
	0114 : Risk-Adjusted Postoperative Renal Failure 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0130 : Risk-Adjusted Deep Sternal Wound Infection 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: 5b.1 If competing, why superior or rationale for additive value: N/A	0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A	0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #0134, NQF #0116, and NQF #0117

Measure	0127 Preoperative Beta Blockade	0131 Risk-Adjusted Stroke/Cerebrovascular Accident	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
Steward	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons
Description	Percent of patients aged 18 years and older undergoing isolated CABG who received beta blockers within 24 hours preceding surgery.	Percent of patients aged 18 years and older undergoing isolated CABG who have a postoperative stroke (i.e., any confirmed neurological deficit of abrupt onset caused by a disturbance in blood supply to the brain) that did not resolve within 24 hours	Percentage of patients aged 18 years and older undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft
Type	Process	Outcome	Process

Measure	0127 Preoperative Beta Blockade	0131 Risk-Adjusted Stroke/Cerebrovascular Accident	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
Data Source	Registry Data STS Adult Cardiac Surgery Database Version 4.20 Available at measure-specific web page URL identified in S.1 No data dictionary	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 Attachment	Registry Data STS Adult Cardiac Surgery Database Version 4.20 Available at measure-specific web page URL identified in S.1 No data dictionary
Level	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice
Setting	Inpatient/Hospital	Inpatient/Hospital	Inpatient/Hospital
Numerator Statement	Number of patients undergoing isolated CABG who received beta blockers within 24 hours preceding surgery	Number of patients undergoing isolated CABG who have a postoperative stroke (i.e., any confirmed neurological deficit of abrupt onset caused by a disturbance in blood supply to the brain) that did not resolve within 24 hours	Number of patients undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft
Numerator Details	Number of isolated CABG procedures in which preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"	Number of isolated CABG procedures in which postoperative stroke [CNStrokP (STS Adult Cardiac Surgery Database Version 2.9)] is marked "yes"	Number of isolated CABG procedures in which IMA Artery Used [IMAUsed (STS Adult Cardiac Surgery Database Version 4.20] is marked "Left IMA" and/or "Right IMA"
Denominator Statement	Patients aged 18 years and older undergoing isolated CABG	All patients undergoing isolated CABG	Patients aged 18 years and older undergoing isolated CABG
Denominator Details	Number of isolated CABG procedures excluding cases for which preoperative beta blockers were contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.	Number of isolated CABG procedures. The SQL code used to create the function to identify cardiac procedures is provided in the appendix.	Number of isolated CABG procedures excluding cases that were a previous CABG prior to the current admission or if IMA was not used and one of the acceptable reasons was provided. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

Measure	0127 Preoperative Beta Blockade	0131 Risk-Adjusted Stroke/Cerebrovascular Accident	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
Exclusions	Cases are removed from the denominator if preoperative beta blocker was contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room.	N/A	Cases are removed from the denominator if the patient had a previous CABG prior to the current admission or if IMA was not used and one of the following reasons was provided: - Subclavian stenosis - Previous cardiac or thoracic surgery - Previous mediastinal radiation - Emergent or salvage procedure - No (bypassable) LAD disease
Exclusion Details	Procedures with preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] marked as "Contraindicated" or procedures with Status [Status(STS Adult Cardiac Surgery Database Version 2.81)] marked "Emergent" or "Emergent Salvage"	N/A	Patients with previous CABG, identified where PrCAB is marked "yes" or IMA Artery Used (IMAUsed) is marked “no” and primary reason for no IMA (NoIMARsn) is marked as any of the following: - Subclavian stenosis - Previous cardiac or thoracic surgery - Previous mediastinal radiation - Emergent or salvage procedure - No (bypassable) LAD disease
Risk Adjustment	No risk adjustment or risk stratification 111855| 137290| 114638| 152617 111855| 137290| 114638| 152617	Statistical risk model 111855| 137290| 114638| 141015 111855| 137290| 114638| 141015	No risk adjustment or risk stratification 111855| 137290| 114638| 152617 111855| 137290| 114638| 152617
Stratification	N/A	N/A	N/A
Type Score	Rate/proportion better quality = higher score	Rate/proportion better quality = lower score	Rate/proportion better quality = higher score
Algorithm	Please refer to numerator and denominator sections for detailed information. 111855 | 137290| 114638 | 152617	Please refer to numerator and denominator sections for detailed information. 111855 | 137290| 114638 | 141015	Please refer to numerator and denominator sections for detailed information. 111855 | 137290| 114638 | 152617

Measure	0127 Preoperative Beta Blockade	0131 Risk-Adjusted Stroke/Cerebrovascular Accident	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
Submission items	5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 0119 : Risk-Adjusted Operative Mortality for CABG 0118 : Anti-Lipid Treatment Discharge 0117 : Beta Blockade at Discharge 0116 : Anti-Platelet Medication at Discharge 0115 : Risk-Adjusted Surgical Re-exploration 0114 : Risk-Adjusted Postoperative Renal Failure 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0130 : Risk-Adjusted Deep Sternal Wound Infection 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure 0115 : Risk-Adjusted Surgical Re-exploration 0116 : Anti-Platelet Medication at Discharge 0117 : Beta Blockade at Discharge 0118 : Anti-Lipid Treatment Discharge 0119 : Risk-Adjusted Operative Mortality for CABG 0127 : Preoperative Beta Blockade 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0130 : Risk-Adjusted Deep Sternal Wound Infection 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: 0119 : Risk-Adjusted Operative Mortality for CABG 0118 : Anti-Lipid Treatment Discharge 0117 : Beta Blockade at Discharge 0116 : Anti-Platelet Medication at Discharge 0115 : Risk-Adjusted Surgical Re-exploration 0114 : Risk-Adjusted Postoperative Renal Failure 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0130 : Risk-Adjusted Deep Sternal Wound Infection 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0127 : Preoperative Beta Blockade 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: 5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #0134, NQF #0114, and NQF #0115

Measure	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)	0114 Risk-Adjusted Postoperative Renal Failure	0115 Risk-Adjusted Surgical Re-exploration
Steward	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons

Measure	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)	0114 Risk-Adjusted Postoperative Renal Failure	0115 Risk-Adjusted Surgical Re-exploration
Description	Percentage of patients aged 18 years and older undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft	Percent of patients aged 18 years and older undergoing isolated CABG (without pre-existing renal failure) who develop postoperative renal failure or require dialysis	Percent of patients aged 18 years and older undergoing isolated CABG who require a re-intervention during the current hospitalization for mediastinal bleeding with or without tamponade, graft occlusion, valve dysfunction, or other cardiac reason
Type	Process	Outcome	Outcome
Data Source	Registry Data STS Adult Cardiac Surgery Database Version 4.20 Available at measure-specific web page URL identified in S.1 No data dictionary	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 Attachment	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 Attachment
Level	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice
Setting	Inpatient/Hospital	Inpatient/Hospital	Inpatient/Hospital
Numerator Statement	Number of patients undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft	Number of patients undergoing isolated CABG who develop postoperative renal failure or require dialysis	Number of patients undergoing isolated CABG who require a re-intervention during the current hospitalization for mediastinal bleeding with or without tamponade, graft occlusion, valve dysfunction, or other cardiac reason
Numerator Details	Number of isolated CABG procedures in which IMA Artery Used [IMA Used (STS Adult Cardiac Surgery Database Version 4.20] is marked "Left IMA" and/or "Right IMA"	- Definition of renal failure/dialysis requirement – Patients with acute renal failure or worsening renal function resulting in one or both of the following: - Increase of serum creatinine to 4.0 or higher, or 3x the most recent preoperative creatinine level - New requirement for dialysis postoperatively Number of isolated CABG procedures in which postoperative renal failure [CRenFail (STS Adult Cardiac Surgery Database Version 2.9)] is marked as "yes"	Number of isolated CABG procedures in which any of the following are marked "yes" ReOp for Bleeding [COpReBld (STS Adult Cardiac Surgery Database Version 2.73)], Reintervention for Graft Occlusion (COpReGft), ReOp for Valve Dysfunction (COpReVlv), ReOp for Other Cardiac Reason (COpReOth)

Measure	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)	0114 Risk-Adjusted Postoperative Renal Failure	0115 Risk-Adjusted Surgical Re-exploration
Denominator Statement	Patients aged 18 years and older undergoing isolated CABG	All patients undergoing isolated CABG	All patients undergoing isolated CABG
Denominator Details	Number of isolated CABG procedures excluding cases that were a previous CABG prior to the current admission or if IMA was not used and one of the acceptable reasons was provided. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.	Number of isolated CABG procedures including re-operations; the SQL code used to create the function to identify cardiac procedures is provided in the appendix.	Number of isolated CABG procedures. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.
Exclusions	Cases are removed from the denominator if the patient had a previous CABG prior to the current admission or if IMA was not used and one of the following reasons was provided: - Subclavian stenosis - Previous cardiac or thoracic surgery - Previous mediastinal radiation - Emergent or salvage procedure - No (bypassable) LAD disease	Patients with documented history of renal failure, baseline serum creatinine of 4.0 or higher; prior renal transplants are not considered preoperative renal failure unless since transplantation their Cr has been or is 4.0 or higher	N/A
Exclusion Details	Patients with previous CABG, identified where PrCAB is marked "yes" or IMA Artery Used (IMAUsed) is marked “no” and primary reason for no IMA (NoIMARsn) is marked as any of the following: - Subclavian stenosis - Previous cardiac or thoracic surgery - Previous mediastinal radiation - Emergent or salvage procedure - No (bypassable) LAD disease	(Dialysis) is marked yes; Last Creatinine Level (CreatLst) is 4.0 or higher	N/A
Risk Adjustment	No risk adjustment or risk stratification 111855| 137290| 114638| 152617 111855| 137290| 114638| 152617	Statistical risk model 111855| 137290| 114638| 141015 111855| 137290| 114638| 141015	Statistical risk model 111855| 137290| 114638 111855| 137290| 114638
Stratification	N/A	N/A	N/A

Measure	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)	0114 Risk-Adjusted Postoperative Renal Failure	0115 Risk-Adjusted Surgical Re-exploration
Type Score	Rate/proportion better quality = higher score	Rate/proportion better quality = lower score	Rate/proportion better quality = lower score
Algorithm	Please refer to numerator and denominator sections for detailed information. 111855 | 137290| 114638 | 152617	Please refer to numerator and denominator sections for detailed information. 111855 | 137290| 114638 | 141015	Please refer to numerator and denominator sections for detailed information. 111855 | 137290| 114638
Submission items	5.1 Identified measures: 0119 : Risk-Adjusted Operative Mortality for CABG 0118 : Anti-Lipid Treatment Discharge 0117 : Beta Blockade at Discharge 0116 : Anti-Platelet Medication at Discharge 0115 : Risk-Adjusted Surgical Re-exploration 0114 : Risk-Adjusted Postoperative Renal Failure 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0130 : Risk-Adjusted Deep Sternal Wound Infection 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0127 : Preoperative Beta Blockade 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: 0115 : Risk-Adjusted Surgical Re-exploration 0116 : Anti-Platelet Medication at Discharge 0117 : Beta Blockade at Discharge 0118 : Anti-Lipid Treatment Discharge 0127 : Preoperative Beta Blockade 0119 : Risk-Adjusted Operative Mortality for CABG 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0130 : Risk-Adjusted Deep Sternal Wound Infection 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure 0116 : Anti-Platelet Medication at Discharge 0117 : Beta Blockade at Discharge 0118 : Anti-Lipid Treatment Discharge 0119 : Risk-Adjusted Operative Mortality for CABG 0127 : Preoperative Beta Blockade 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0130 : Risk-Adjusted Deep Sternal Wound Infection 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #0134, NQF #0116, and NQF #0117

Measure	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)	0116 Anti-Platelet Medication at Discharge	0117 Beta Blockade at Discharge
Steward	The Society of Thoracic Surgeons	DeLaine | Schmitz | dschmitz@sts.org | 312-202-5827-	The Society of Thoracic Surgeons
Description	Percentage of patients aged 18 years and older undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft	Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on anti-platelet medication	Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on beta blockers
Type	Process	Process	Process
Data Source	Registry Data STS Adult Cardiac Surgery Database Version 4.20 Available at measure-specific web page URL identified in S.1 No data dictionary	Facility, Clinician : Group/Practice Hospital No data dictionary	Registry Data STS Adult Cardiac Surgery Database Version 4.20 Available at measure-specific web page URL identified in S.1 No data dictionary
Level	Facility, Clinician : Group/Practice	N/A	Facility, Clinician : Group/Practice
Setting	Inpatient/Hospital	Attachment at measure URL	Inpatient/Hospital
Numerator Statement	Number of patients undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft	Number of isolated CABG procedures excluding cases with in-hospital mortality or cases for which discharge aspirin use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.	Number of patients undergoing isolated CABG who were discharged on beta blockers
Numerator Details	Number of isolated CABG procedures in which IMA Artery Used [IMAUsed (STS Adult Cardiac Surgery Database Version 4.20] is marked "Left IMA" and/or "Right IMA"	Cases are removed from the denominator if there was an in-hospital mortality or if discharge aspirin was contraindicated.	Number of isolated CABG procedures in which discharge beta blockers [DCBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"
Denominator Statement	Patients aged 18 years and older undergoing isolated CABG	Mortality Discharge Status (MtDCStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; discharge aspirin (DCASA) is marked as “Contraindicated”	Patients aged 18 years and older undergoing isolated CABG

Measure	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)	0116 Anti-Platelet Medication at Discharge	0117 Beta Blockade at Discharge
Denominator Details	Number of isolated CABG procedures excluding cases that were a previous CABG prior to the current admission or if IMA was not used and one of the acceptable reasons was provided. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.	N/A	Number of isolated CABG procedures excluding cases with an in-hospital mortality or cases for which discharge beta blocker use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.
Exclusions	Cases are removed from the denominator if the patient had a previous CABG prior to the current admission or if IMA was not used and one of the following reasons was provided: - Subclavian stenosis - Previous cardiac or thoracic surgery - Previous mediastinal radiation - Emergent or salvage procedure - No (bypassable) LAD disease	No risk adjustment or risk stratification	Cases are removed from the denominator if there was an in-hospital mortality or if discharge beta blocker was contraindicated.
Exclusion Details	Patients with previous CABG, identified where PrCAB is marked "yes" or IMA Artery Used (IMAUsed) is marked “no” and primary reason for no IMA (NoIMARsn) is marked as any of the following: - Subclavian stenosis - Previous cardiac or thoracic surgery - Previous mediastinal radiation - Emergent or salvage procedure - No (bypassable) LAD disease		Mortality Discharge Status (DischMortStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; discharge beta blocker (DCBeta) marked as “Contraindicated”
Risk Adjustment	No risk adjustment or risk stratification 111855| 137290| 114638| 152617 111855| 137290| 114638| 152617	better quality = higher score 111855| 137290| 114638 111855| 137290| 114638	No risk adjustment or risk stratification 111855| 137290| 141010| 114638| 150289| 152617 111855| 137290| 141010| 114638| 150289| 152617
Stratification	N/A	Rate/proportion	N/A

Measure	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)	0116 Anti-Platelet Medication at Discharge	0117 Beta Blockade at Discharge
Type Score	Rate/proportion better quality = higher score	Please refer to numerator and denominator sections for detailed information. N/A N/A	Rate/proportion better quality = higher score
Algorithm	Please refer to numerator and denominator sections for detailed information. 111855 | 137290| 114638 | 152617	Registry 111855 | 137290| 114638	Please refer to numerator and denominator sections for detailed information. 111855 | 137290| 141010 | 114638| 150289 | 152617
Submission items	5.1 Identified measures: 0119 : Risk-Adjusted Operative Mortality for CABG 0118 : Anti-Lipid Treatment Discharge 0117 : Beta Blockade at Discharge 0116 : Anti-Platelet Medication at Discharge 0115 : Risk-Adjusted Surgical Re-exploration 0114 : Risk-Adjusted Postoperative Renal Failure 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0130 : Risk-Adjusted Deep Sternal Wound Infection 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0127 : Preoperative Beta Blockade 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: N/A 5a.1 Are specs completely harmonized? Attachment 5a.2 If not completely harmonized, identify difference, rationale, impact: Attachment at measure URL 5b.1 If competing, why superior or rationale for additive value: The Society of Thoracic Surgeons	5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 0119 : Risk-Adjusted Operative Mortality for CABG 0118 : Anti-Lipid Treatment Discharge 0116 : Anti-Platelet Medication at Discharge 0115 : Risk-Adjusted Surgical Re-exploration 0114 : Risk-Adjusted Postoperative Renal Failure 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0130 : Risk-Adjusted Deep Sternal Wound Infection 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0127 : Preoperative Beta Blockade 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: 5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #0134, NQF #0118, and NQF #0119

Measure	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)	0118 Anti-Lipid Treatment Discharge	0119 Risk-Adjusted Operative Mortality for CABG
Steward	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons
Description	Percentage of patients aged 18 years and older undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft	Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on a lipid lowering statin	Percent of patients aged 18 years and older undergoing isolated CABG who die, including both 1) all deaths occurring during the hospitalization in which the CABG was performed, even if after 30 days, and 2) those deaths occurring after discharge from the hospital, but within 30 days of the procedure
Type	Process	Process	Outcome
Data Source	Registry Data STS Adult Cardiac Surgery Database Version 4.20 Available at measure-specific web page URL identified in S.1 No data dictionary	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 No data dictionary	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 Attachment
Level	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice
Setting	Inpatient/Hospital	Inpatient/Hospital	Inpatient/Hospital
Numerator Statement	Number of patients undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft	Number of patients undergoing isolated CABG who were discharged on a lipid lowering statin	Number of patients undergoing isolated CABG who die, including both 1) all deaths occurring during the hospitalization in which the operation was performed, even if after 30 days, and 2) those deaths occurring after discharge from the hospital, but within 30 days of the procedure
Numerator Details	Number of isolated CABG procedures in which IMA Artery Used [IMA Used (STS Adult Cardiac Surgery Database Version 4.20] is marked "Left IMA" and/or "Right IMA"	Number of isolated CABG procedures in which discharge lipid lowering medication [DCLipid (STS Adult Cardiac Surgery Database Version 2.73)] is marked "yes" and lipid lowering discharge medication type [DCLipMT (STS Adult Cardiac Surgery Database Version 2.73)] is marked "statin"	Number of isolated CABG procedures with an operative mortality; Number of isolated CABG procedures in which Mortality [Mortalty (STS Adult Cardiac Surgery Database Version 2.9)] and Mortality Operative Death (MtOpD) are marked "yes." Operative mortality is further verified by the following variables: Mortality Status at 30 days (Mt30Stat), Mortality Date (MtDate), Mortality Discharge Status (MtDCStat)

Measure	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)	0118 Anti-Lipid Treatment Discharge	0119 Risk-Adjusted Operative Mortality for CABG
Denominator Statement	Patients aged 18 years and older undergoing isolated CABG	All patients undergoing isolated CABG	All patients undergoing isolated CABG
Denominator Details	Number of isolated CABG procedures excluding cases that were a previous CABG prior to the current admission or if IMA was not used and one of the acceptable reasons was provided. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.	Number of isolated CABG procedures excluding cases with an in-hospital mortality or cases for which discharge anti-lipid treatment use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.	Number of isolated CABG procedures. The SQL code used to create the function to identify cardiac procedures is provided in the appendix.
Exclusions	Cases are removed from the denominator if the patient had a previous CABG prior to the current admission or if IMA was not used and one of the following reasons was provided: - Subclavian stenosis - Previous cardiac or thoracic surgery - Previous mediastinal radiation - Emergent or salvage procedure - No (bypassable) LAD disease	Cases are removed from the denominator if there was an in-hospital mortality or if discharge anti-lipid treatment was contraindicated.	N/A
Exclusion Details	Patients with previous CABG, identified where PrCAB is marked "yes" or IMA Artery Used (IMAUsed) is marked “no” and primary reason for no IMA (NoIMARsn) is marked as any of the following: - Subclavian stenosis - Previous cardiac or thoracic surgery - Previous mediastinal radiation - Emergent or salvage procedure - No (bypassable) LAD disease	Mortality Discharge Status (MtDCStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; DCLipid is marked as "Contraindicated"	N/A
Risk Adjustment	No risk adjustment or risk stratification 111855| 137290| 114638| 152617 111855| 137290| 114638| 152617	No risk adjustment or risk stratification 111855| 137290| 114638 111855| 137290| 114638	Statistical risk model 111855| 137290| 114638| 141015 111855| 137290| 114638| 141015

Measure	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)	0118 Anti-Lipid Treatment Discharge	0119 Risk-Adjusted Operative Mortality for CABG
Stratification	N/A	N/A	N/A
Type Score	Rate/proportion better quality = higher score	Rate/proportion better quality = higher score	Rate/proportion better quality = lower score
Algorithm	Please refer to numerator and denominator sections for detailed information. 111855 | 137290| 114638 | 152617	Please refer to numerator and denominator sections for detailed information. 111855 | 137290| 114638	Please refer to numerator and denominator sections for detailed information. 111855 | 137290| 114638 | 141015
Submission items	5.1 Identified measures: 0119 : Risk-Adjusted Operative Mortality for CABG 0118 : Anti-Lipid Treatment Discharge 0117 : Beta Blockade at Discharge 0116 : Anti-Platelet Medication at Discharge 0115 : Risk-Adjusted Surgical Re-exploration 0114 : Risk-Adjusted Postoperative Renal Failure 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0130 : Risk-Adjusted Deep Sternal Wound Infection 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0127 : Preoperative Beta Blockade 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure 0115 : Risk-Adjusted Surgical Re-exploration 0116 : Anti-Platelet Medication at Discharge 0117 : Beta Blockade at Discharge 0119 : Risk-Adjusted Operative Mortality for CABG 0127 : Preoperative Beta Blockade 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0130 : Risk-Adjusted Deep Sternal Wound Infection 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure 0115 : Risk-Adjusted Surgical Re-exploration 0116 : Anti-Platelet Medication at Discharge 0117 : Beta Blockade at Discharge 0118 : Anti-Lipid Treatment Discharge 0120 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) 0127 : Preoperative Beta Blockade 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0130 : Risk-Adjusted Deep Sternal Wound Infection 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 0123 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) + CABG Surgery 0121 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Replacement 0122 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Replacement + CABG Surgery 1501 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Repair 1502 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Repair + CABG Surgery

Measure	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)	0118 Anti-Lipid Treatment Discharge	0119 Risk-Adjusted Operative Mortality for CABG
			5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: 5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #0134, NQF #0127, and NQF #0129

Measure	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)	0127 Preoperative Beta Blockade	0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)
Steward	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons
Description	Percentage of patients aged 18 years and older undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft	Percent of patients aged 18 years and older undergoing isolated CABG who received beta blockers within 24 hours preceding surgery.	Percent of patients aged 18 years and older undergoing isolated CABG who require intubation for more than 24 hours postoperatively
Type	Process	Process	Outcome
Data Source	Registry Data STS Adult Cardiac Surgery Database Version 4.20 Available at measure-specific web page URL identified in S.1 No data dictionary	Registry Data STS Adult Cardiac Surgery Database Version 4.20 Available at measure-specific web page URL identified in S.1 No data dictionary	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 Attachment
Level	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice
Setting	Inpatient/Hospital	Inpatient/Hospital	Inpatient/Hospital
Numerator Statement	Number of patients undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft	Number of patients undergoing isolated CABG who received beta blockers within 24 hours preceding surgery	Number of patients undergoing isolated CABG who require intubation > 24 hours following exit from the operating room

Measure	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)	0127 Preoperative Beta Blockade	0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)
Numerator Details	Number of isolated CABG procedures in which IMA Artery Used [IMA Used (STS Adult Cardiac Surgery Database Version 4.20] is marked "Left IMA" and/or "Right IMA"	Number of isolated CABG procedures in which preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"	Number of isolated CABG procedures in which Prolonged Ventilation (CPVntLng) is marked "yes" (STS Adult Cardiac Surgery Database Version 2.9) The hours of postoperative ventilation time include OR exit until extubation, plus any additional hours following reintubation.
Denominator Statement	Patients aged 18 years and older undergoing isolated CABG	Patients aged 18 years and older undergoing isolated CABG	All patients undergoing isolated CABG
Denominator Details	Number of isolated CABG procedures excluding cases that were a previous CABG prior to the current admission or if IMA was not used and one of the acceptable reasons was provided. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.	Number of isolated CABG procedures excluding cases for which preoperative beta blockers were contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.	Number of isolated CABG procedures. The SQL code used to create the function to identify cardiac procedures is provided in the appendix.
Exclusions	Cases are removed from the denominator if the patient had a previous CABG prior to the current admission or if IMA was not used and one of the following reasons was provided: - Subclavian stenosis - Previous cardiac or thoracic surgery - Previous mediastinal radiation - Emergent or salvage procedure - No (bypassable) LAD disease	Cases are removed from the denominator if preoperative beta blocker was contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room.	N/A
Exclusion Details	Patients with previous CABG, identified where PrCAB is marked "yes" or IMA Artery Used (IMA Used) is marked “no” and primary reason for no IMA (NoIMARsn) is marked as any of the following: - Subclavian stenosis - Previous cardiac or thoracic surgery	Procedures with preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] marked as "Contraindicated" or procedures with Status [Status(STS Adult Cardiac Surgery Database Version 2.81)] marked "Emergent" or "Emergent Salvage"	N/A

Measure	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)	0127 Preoperative Beta Blockade	0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)
	- Previous mediastinal radiation - Emergent or salvage procedure - No (bypassable) LAD disease		
Risk Adjustment	No risk adjustment or risk stratification 111855| 137290| 114638| 152617 111855| 137290| 114638| 152617	No risk adjustment or risk stratification 111855| 137290| 114638| 152617 111855| 137290| 114638| 152617	Statistical risk model 111855| 137290| 114638| 141015 111855| 137290| 114638| 141015
Stratification	N/A	N/A	N/A
Type Score	Rate/proportion better quality = higher score	Rate/proportion better quality = higher score	Rate/proportion better quality = lower score
Algorithm	Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 152617	Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 152617	Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 141015

Measure	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)	0127 Preoperative Beta Blockade	0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)
Submission items	5.1 Identified measures: 0119 : Risk-Adjusted Operative Mortality for CABG 0118 : Anti-Lipid Treatment Discharge 0117 : Beta Blockade at Discharge 0116 : Anti-Platelet Medication at Discharge 0115 : Risk-Adjusted Surgical Re-exploration 0114 : Risk-Adjusted Postoperative Renal Failure 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0130 : Risk-Adjusted Deep Sternal Wound Infection 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0127 : Preoperative Beta Blockade 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 0119 : Risk-Adjusted Operative Mortality for CABG 0118 : Anti-Lipid Treatment Discharge 0117 : Beta Blockade at Discharge 0116 : Anti-Platelet Medication at Discharge 0115 : Risk-Adjusted Surgical Re-exploration 0114 : Risk-Adjusted Postoperative Renal Failure 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0130 : Risk-Adjusted Deep Sternal Wound Infection 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure 0115 : Risk-Adjusted Surgical Re-exploration 0116 : Anti-Platelet Medication at Discharge 0117 : Beta Blockade at Discharge 0118 : Anti-Lipid Treatment Discharge 0119 : Risk-Adjusted Operative Mortality for CABG 0127 : Preoperative Beta Blockade 0130 : Risk-Adjusted Deep Sternal Wound Infection 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #0134, NQF #0130, and NQF #0131

Measure	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)	0130 Risk-Adjusted Deep Sternal Wound Infection	0131 Risk-Adjusted Stroke/Cerebrovascular Accident
Steward	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons

Measure	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)	0130 Risk-Adjusted Deep Sternal Wound Infection	0131 Risk-Adjusted Stroke/Cerebrovascular Accident
Description	Percentage of patients aged 18 years and older undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft	Percent of patients aged 18 years and older undergoing isolated CABG for whom mediastinitis or deep sternal wound infection is diagnosed within 30 days postoperatively or at any time during the hospitalization for surgery	Percent of patients aged 18 years and older undergoing isolated CABG who have a postoperative stroke (i.e., any confirmed neurological deficit of abrupt onset caused by a disturbance in blood supply to the brain) that did not resolve within 24 hours
Type	Process	Outcome	Outcome
Data Source	Registry Data STS Adult Cardiac Surgery Database Version 4.20 Available at measure-specific web page URL identified in S.1 No data dictionary	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 Attachment	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 Attachment
Level	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice
Setting	Inpatient/Hospital	Inpatient/Hospital	Inpatient/Hospital
Numerator Statement	Number of patients undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft	Number of patients aged 18 years and older undergoing isolated CABG for whom mediastinitis or deep sternal wound infection is diagnosed within 30 days postoperatively or at any time during the hospitalization for surgery	Number of patients undergoing isolated CABG who have a postoperative stroke (i.e., any confirmed neurological deficit of abrupt onset caused by a disturbance in blood supply to the brain) that did not resolve within 24 hours
Numerator Details	Number of isolated CABG procedures in which IMA Artery Used [IMAUsed(STS Adult Cardiac Surgery Database Version 4.20] is marked "Left IMA" and/or "Right IMA"	Numerator time period: Within 30 days postoperatively or at any time during the hospitalization for surgery Number of isolated CABG procedures in which deep sternal infection/mediastinitis [DeepSternInf (STS Adult Cardiac Surgery Database Version 2.9)] is marked "yes" DeepSternInf Deep incisional SSI: Must meet the following criteria	Number of isolated CABG procedures in which postoperative stroke [CNStrokP (STS Adult Cardiac Surgery Database Version 2.9)] is marked "yes"

Measure	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)	0130 Risk-Adjusted Deep Sternal Wound Infection	0131 Risk-Adjusted Stroke/Cerebrovascular Accident
		- Infection occurs within 30 days after the operative procedure, and involves deep soft tissues of the incision (e.g., fascial and muscle layers) and patient has at least one of the following: - Purulent drainage from the deep incision. - A deep incision that spontaneously dehisces or is deliberately opened by a surgeon, attending physician or other designee and is culture-positive or not cultured, and patient has at least one of the following signs or symptoms: o Fever (>38°C) o Localized pain or tenderness o An abscess or other evidence of infection involving the deep incision that is detected on direct examination, during invasive procedure, or by histopathologic examination or imaging test. o A culture with negative findings does not meet this criterion. - There are two specific types of deep incisional SSIs:	

Measure	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)	0130 Risk-Adjusted Deep Sternal Wound Infection	0131 Risk-Adjusted Stroke/Cerebrovascular Accident
		○ Deep Incisional Primary (DIP) – a deep incisional SSI that is identified in a primary incision in a patient that has had an operation with one or more incisions (e.g., chest incision for CABG) ○ Deep Incisional Secondary (DIS) – a deep incisional SSI that is identified in the secondary incision in a patient that has had an operation with more than one incision (e.g., donor site incision for CABG) MED-Mediastinitis: Must meet the following criteria - Mediastinitis must meet at least 1 of the following criteria: - Patient has organisms cultured from mediastinal tissue or fluid obtained during an invasive procedure. - Patient has evidence of mediastinitis seen during an invasive procedure or histopathologic examination. - Patient has at least 1 of the following signs or symptoms: ○ Fever (>38°C)	

Measure	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)	0130 Risk-Adjusted Deep Sternal Wound Infection	0131 Risk-Adjusted Stroke/Cerebrovascular Accident
		○ Chest pain (with no other recognized cause) ○ Sternal instability (with no other recognized cause) and at least 1 of the following: ○ Purulent discharge from mediastinal area ○ Organisms cultured from blood or discharge from mediastinal area ○ - Mediastinal widening on imaging test.	
Denominator Statement	Patients aged 18 years and older undergoing isolated CABG	All patients undergoing isolated CABG	All patients undergoing isolated CABG
Denominator Details	Number of isolated CABG procedures excluding cases that were a previous CABG prior to the current admission or if IMA was not used and one of the acceptable reasons was provided. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.	Number of isolated CABG procedures. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.	Number of isolated CABG procedures. The SQL code used to create the function to identify cardiac procedures is provided in the appendix.
Exclusions	Cases are removed from the denominator if the patient had a previous CABG prior to the current admission or if IMA was not used and one of the following reasons was provided: - Subclavian stenosis - Previous cardiac or thoracic surgery - Previous mediastinal radiation - Emergent or salvage procedure - No (bypassable) LAD disease	N/A	N/A

Measure	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)	0130 Risk-Adjusted Deep Sternal Wound Infection	0131 Risk-Adjusted Stroke/Cerebrovascular Accident
Exclusion Details	Patients with previous CABG, identified where PrCAB is marked "yes" or IMA Artery Used (IMAUsed) is marked "no" and primary reason for no IMA (NoIMARsn) is marked as any of the following: - Subclavian stenosis - Previous cardiac or thoracic surgery - Previous mediastinal radiation - Emergent or salvage procedure - No (bypassable) LAD disease	N/A	N/A
Risk Adjustment	No risk adjustment or risk stratification 111855| 137290| 114638| 152617 111855| 137290| 114638| 152617	Statistical risk model 111855| 137290| 114638 111855| 137290| 114638	Statistical risk model 111855| 137290| 114638| 141015 111855| 137290| 114638| 141015
Stratification	N/A	N/A	N/A
Type Score	Rate/proportion better quality = higher score	Rate/proportion better quality = lower score	Rate/proportion better quality = lower score
Algorithm	Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 152617	Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638	Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 141015
Submission items	5.1 Identified measures: 0119 : Risk-Adjusted Operative Mortality for CABG 0118 : Anti-Lipid Treatment Discharge 0117 : Beta Blockade at Discharge 0116 : Anti-Platelet Medication at Discharge 0115 : Risk-Adjusted Surgical Re-exploration 0114 : Risk-Adjusted Postoperative Renal Failure 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0130 : Risk-Adjusted Deep Sternal Wound Infection 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0127 : Preoperative Beta Blockade	5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure 0115 : Risk-Adjusted Surgical Re-exploration 0116 : Anti-Platelet Medication at Discharge 0117 : Beta Blockade at Discharge 0118 : Anti-Lipid Treatment Discharge 0119 : Risk-Adjusted Operative Mortality for CABG 0127 : Preoperative Beta Blockade	5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure 0115 : Risk-Adjusted Surgical Re-exploration 0116 : Anti-Platelet Medication at Discharge 0117 : Beta Blockade at Discharge 0118 : Anti-Lipid Treatment Discharge 0119 : Risk-Adjusted Operative Mortality for CABG 0127 : Preoperative Beta Blockade 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Measure	0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)	0130 Risk-Adjusted Deep Sternal Wound Infection	0131 Risk-Adjusted Stroke/Cerebrovascular Accident
	5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: 5b.1 If competing, why superior or rationale for additive value: N/A	0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A	0130 : Risk-Adjusted Deep Sternal Wound Infection 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #1550, NQF #1551, and NQF #3493

Measure	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
Steward	Centers for Medicare & Medicaid Services	Centers for Medicare & Medicaid Services	Centers for Medicare & Medicaid Services

Measure	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
Description	The measure estimates a hospital-level risk-standardized complication rate (RSCR) associated with elective primary THA and TKA in Medicare Fee-For-Service beneficiaries who are age 65 and older. The outcome (complication) is defined as any one of the specified complications occurring from the date of index admission to 90 days post date of the index admission (the admission included in the measure cohort).	The measure estimates a hospital-level risk-standardized readmission rate (RSRR) following elective primary THA and/or TKA in Medicare Fee-For-Service (FFS) beneficiaries who are 65 years and older. The outcome (readmission) is defined as unplanned readmission for any cause within 30 days of the discharge date for the index admission (the admission included in the measure cohort). A specified set of planned readmissions do not count in the readmission outcome.	This measure is a re-specified version of the measure, "Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)" (NQF 1550), which was developed for patients 65 years and older using Medicare claims data. This re-specified measure attributes outcomes to MIPS participating Eligible Clinicians and/or Eligible Clinician Groups ("providers"), rather than to hospitals, and assesses each provider's complication rate, defined as any one of the specified complications occurring from the date of index admission to 90 days post date of the index admission (the admission included in the measure cohort).
Type	Outcome	Outcome	Outcome
Data Source	Claims, Enrollment Data Data sources for the Medicare FFS measure: Medicare Part A Inpatient and Part B Outpatient Claims: This data source contains claims data for FFS inpatient and outpatient services including Medicare inpatient hospital care, outpatient hospital services, as well as inpatient and outpatient physician claims for the 12 months prior to an index admission. Medicare Enrollment Database (EDB): This database contains Medicare beneficiary demographic, benefit/coverage, and vital	Claims, Enrollment Data Data sources for the Medicare FFS measure: Medicare Part A Inpatient and Part B Outpatient Claims: This data source contains claims data for FFS inpatient and outpatient services including Medicare inpatient hospital care, outpatient hospital services, as well as inpatient and outpatient physician claims for the 12 months prior to an index admission. Medicare Enrollment Database (EDB): This database contains Medicare beneficiary demographic, benefit/coverage, and vital status information. This data source was used to	Claims, Enrollment Data Medicare administrative claims and enrollment data No data collection instrument provided Attachment

Measure	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
	status information. This data source was used to obtain information on several inclusion/exclusion indicators such as Medicare status on admission as well as vital status. These data have previously been shown to accurately reflect patient vital status (Fleming et al., 1992). The Master Beneficiary Summary File (MBSF) is an annually created file derived the EDB that contains enrollment information for all Medicare beneficiaries including dual eligible status. Years 2016-2019 were used. The American Community Survey (2013-2017): We used the American Community Survey (2013-2017) to derive an updated Agency for Healthcare Research and Quality (AHRQ) Socioeconomic (SES) index score at the patient nine-digit zip code level for use in studying the association between our measure and social risk factors (SRFs). References: Fleming C., Fisher ES, Chang CH, Bubolz D, Malenda J. Studying outcomes and hospital utilization in the elderly: The advantages of a merged data base for Medicare and Veterans Affairs Hospitals. Medical Care. 1992; 30(5): 377-91. No data collection instrument provided Attachment	obtain information on several inclusion/exclusion indicators such as Medicare status on admission as well as vital status. These data have previously been shown to accurately reflect patient vital status (Fleming et al., 1992). The Master Beneficiary Summary File (MBSF) is an annually created file derived from the EDB that contains enrollment information for all Medicare beneficiaries including dual eligible status. Years 2016-2019 were used. The American Community Survey (2013-2017): We used the American Community Survey (2013-2017) to derive an updated Agency for Healthcare Research and Quality(AHRQ) Socioeconomic Status (SES) index score at the patient nine-digit zip code level for use in studying the association between our measure and social risk factors (SRFs). Reference: Fleming C., Fisher ES, Chang CH, Bubolz D, Malenda J. Studying outcomes and hospital utilization in the elderly: The advantages of a merged data base for Medicare and Veterans Affairs Hospitals. Medical Care. 1992; 30(5): 377-91. No data collection instrument provided Attachment	
Level	Facility	Facility	Clinician : Group/Practice, Clinician : Individual
Setting	Inpatient/Hospital	Inpatient/Hospital	Inpatient/Hospital, Outpatient Services

Measure	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
Numerator Statement	The outcome for this measure is any complication occurring during the index admission (not coded present on arrival) to 90 days post-date of the index admission. Complications are counted in the measure only if they occur during the index hospital admission or during a readmission. The complication outcome is a dichotomous (yes/no) outcome. If a patient experiences one or more of these complications in the applicable time period, the complication outcome for that patient is counted in the measure as a “yes”.	The outcome for this measure is 30-day readmissions. We define readmissions as inpatient admissions for any cause, with the exception of certain planned readmissions, within 30 days from the date of discharge of the index hospitalization. If a patient has more than one unplanned admission (for any reason) within 30 days after discharge from the index admission, only one is counted as a readmission. The measure looks for a dichotomous yes or no outcome of whether each admitted patient has an unplanned readmission within 30 days. However, if the first readmission after discharge is considered planned, any subsequent unplanned readmission is not counted as an outcome for that index admission, because the unplanned readmission could be related to care provided during the intervening planned readmission rather than during the index admission.	The outcome for this measure is any complication occurring during the index admission (not coded present on arrival) to 90 days post-date of the index admission. Complications other than mortality are counted in the measure only if they occur during the index hospital admission or during a readmission. This outcome is identical to that of the original hospital measure. Additional details are provided in S.5 Numerator Details.
Numerator Details	The composite complication is a dichotomous outcome (yes for any complication(s); no for no complications). Therefore, if a patient experiences one or more complications, the outcome variable will get coded as a "yes". Complications are counted in the measure only if they occur during the index hospital admission (and are not present on admission) or during a readmission. The complications captured in the numerator are identified during the index admission OR associated with a readmission	The measure counts readmissions to any acute care hospital for any cause within 30 days of the date of discharge of the index THA and/or TKA hospitalization, excluding planned readmissions as defined below. Planned Readmission Algorithm (Version 4.0) The Planned Readmission Algorithm is a set of criteria for classifying readmissions as planned among the general Medicare population using Medicare administrative claims data. The algorithm identifies admissions that are typically planned and may occur within 30 days of discharge from the hospital.	Outcome Definition The composite complication is a dichotomous outcome (yes for any complication(s); no for no complications) occurring within 90 days post-date of the index admission. Therefore, if a patient experiences one or more complications, the outcome variable will get coded as a "yes." The measure includes the following surgical complications: surgical site bleeding, mechanical complications, periprosthetic joint infection/wound infection; and also includes death as a complication. The measure also includes the following medical complications, as they are

Measure	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
	up to 90 days post-date of index admission, depending on the complication. The follow-up period for complications from date of index admission is as follows: The follow-up period for AMI, pneumonia, and sepsis/septicemia/shock is seven days from the date of index admission because these conditions are more likely to be attributable to the procedure if they occur within the first week after the procedure. Additionally, analyses indicated a sharp decrease in the rate of these complications after seven days. Death, surgical site bleeding, and pulmonary embolism are followed for 30 days following admission because clinical experts agree these complications are still likely attributable to the hospital performing the procedure during this period and rates for these complications remained elevated until roughly 30 days post admission. The measure follow-up period is 90 days after admission for mechanical complications and periprosthetic joint infection/wound infection. Experts agree that mechanical complications and periprosthetic joint infection/wound infections due to the index THA/TKA occur up to 90 days following THA/TKA. The measure counts all complications occurring during the index admission regardless of when they occur. For example, if a patient experiences an AMI on day 10 of	The Planned Readmission Algorithm has three fundamental principles: 1. A few specific, limited types of care are always considered planned (transplant surgery, maintenance chemotherapy/immunotherapy, and rehabilitation); 2. Otherwise, a planned readmission is defined as a non-acute readmission for a scheduled procedure; and 3. Admissions for acute illness or for complications of care are never planned. The algorithm was developed in 2011 as part of the Hospital-Wide Readmission measure. In 2013, CMS applied the algorithm to its other readmission measures. In applying the algorithm to condition- and procedure-specific measures, teams of clinical experts reviewed the algorithm in the context of each measure-specific patient cohort and, where clinically indicated, adapted the content of the algorithm to better reflect the likely clinical experience of each measure's patient cohort. The planned readmission algorithm is applied to the THA/TKA readmission measure with small modifications. The Planned Readmission Algorithm and associated code tables are attached in data field S.2b (Data Dictionary or Code Table).	important in measuring overall quality: acute myocardial infarction (AMI), pneumonia, pulmonary embolism, and sepsis/septicemia/shock. Complications are counted in the measure only if they occur during the index hospital admission (and are not present on admission) or during a readmission. This outcome definition is identical to the Hospital-level RSCR following elective primary THA and/or TKA" (NQF 1550). The measure assesses a dichotomous yes or no outcome of whether each admitted patient experiences one or more of the complications defined below. Complications other than mortality are counted in the measure only if they occur during the index admission or require a readmission. The measure does not count complications that occur in the outpatient setting and do not require a readmission. The outcome is aligned with CMS's hospital-level THA/TKA complication measure. The measure defines a "complication" as: • Acute myocardial infarction (AMI), pneumonia, or sepsis/septicemia/shock during the index admission or a subsequent inpatient admission that occurs within 7 days from the start of the index admission; • Surgical site bleeding or pulmonary embolism during the index admission or a subsequent inpatient admission within 30 days from the start of the index admission; • Death during the index admission or within 30 days from the start of the index admission;

Measure	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
	the index admission, the measure will count the AMI as a complication, although the specified follow-up period for AMI is seven days. Clinical experts agree with this approach, as such complications likely represent the quality of care provided during the index admission. As of 2014 reporting, the measure does not count complications in the complications outcome that are coded as present on admission (POA) during the index admission; this prevents identifying a condition as a complication of care if it was present on admission for the THA/TKA procedure. For full list of codes defining complications, see the Data Dictionary attached in field S.2b.		• Mechanical complication or periprosthetic joint infection/wound infection during the index admission or a subsequent inpatient admission that occurs within 90 days from the start of the index admission. (See attached Data Dictionary for list of ICD-9 and 10 codes used to define complications). The measure counts all complications occurring during the index admission regardless of when they occur. For example, if a patient experiences an AMI on day 10 of the index admission, the measure will count the AMI as a complication, although the specified follow-up period for AMI is seven days. Clinical experts agree with this approach, as such complications likely represent the quality of care provided during the index admission. For the full list of ICD-9 and ICD-10 codes defining complications, see the Data Dictionary attached in field S.2b., sheets HK Complications I10-Outcome" and "Complication Codes ICD9."
Denominator Statement	The target population for the publicly reported measure includes admissions for Medicare FFS beneficiaries who are at least 65 years of age undergoing elective primary THA and/or TKA procedures. Additional details are provided in S.7 Denominator Details.	The target population for the publicly reported measure includes admissions for Medicare FFS beneficiaries who are at least 65 years of age undergoing elective primary THA and/or TKA procedures. Additional details are provided in S.9 Denominator Details.	The target population for the measure includes admissions for Medicare FFS beneficiaries who are at least 65 years of age who have undergone elective primary THA and/or TKA procedures. Attribution of Index Admissions to Eligible Clinicians Each patient index admission (the admission during which the patient has the eligible THA/TKA procedure), and therefore their outcome (complication or no complication) is attributed to the Eligible Clinician who bills for the procedure (Billing Surgeon). Conceptually, the Billing Surgeon

Measure	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
			is the Clinician with the primary responsibility for the procedure and procedure related care. In practice, patients may have different claims for the same procedure, and so the billing surgeon is assigned through an algorithm that resolves ambiguities in billing. The algorithm uses billing claims to identify the clinician(s) who bills for a THA (CPT® code 27130) or TKA (CPT®® code 27447 or CPT® code 27446) (steps 1-3 below). These CPT® codes are representative of the THA and/or TKA procedures included in the measure cohort. 1. If only one clinician bills for a THA (CPT® code 27130) or TKA (CPT® code 27446 or 27447) for a patient, the algorithm identifies and assigns this individual as the Billing Surgeon. 2. If two or more clinicians bill for THA/TKA procedures (CPT® 27130, 27447, or 27446), the algorithm seeks to identify a 'key' physician among them. The algorithm identifies and excludes assignment to clinicians who were assistants-at-surgery (assistant surgeon with CPT® modifier 80 or 82, minimum assistant surgeon with CPT® modifier 81). In this step, the algorithm assigns the Billing Surgeon as the clinician who billed for a THA or TKA procedure and is not an assistant-at-surgery. 3. If a single clinician who is not an assistant-at-surgery could not be identified for assignment, then the algorithm identifies whether there is a single clinician who was an orthopedic surgeon (Medicare Specialty Code 20) and assigns this as the Billing Surgeon.

Measure	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
			4. If the algorithm cannot identify a Billing Surgeon, it identifies whether an Operator is listed on the institutional claim. The algorithm then defaults assignment to the Operator listed on the institutional claim. Finally, if a Billing Surgeon or Operator cannot be identified with the steps above, the patient is not assigned to a clinician or group and is excluded from the measure. Attribution of Index Admissions to an Eligible Clinician Group CMS needs the flexibility to assign each eligible patient index admission to at least one Eligible Clinician and at least one Eligible Clinician group. This allows them the ability to report at either the Eligible Clinician or the Eligible Clinician Group level. Conceptually, these assignments should represent a consistent group of clinicians. That is, it would be confusing to assign a patient to Eligible Clinician A and also to Eligible Clinician Group B if Eligible Clinician A is not in that Group. The attribution methodology addresses this by using both individual and group identifiers. Every Medicare Eligible Clinician has a unique National Provider Identifier (NPI). Similarly, every Medicare Eligible Clinician Group has one or more Tax Identification Numbers (TINs), reflecting their practice setting(s). Each Eligible Clinician claim should include both their NPI and a TIN which identifies their "group" (which may consist only of that clinician if they are solo providers). Therefore, we identify clinicians for each patient index admission through the unique National Provider ID

Measure	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
			(NPI) and Tax ID (TIN) combination listed on a patient's claim. For a Billing Surgeon, the NPI and TIN are those on the procedure claim used to attribute the patient index admission. To identify the unique TIN/NPI combination for the Operator, the Operator's NPI is matched to the TIN with the most Part B allowed charges during the index admission or during the measurement year if the Operator did not bill during the index admission. Most NPIs are associated with only one TIN. A Clinician Group is set of Clinicians (NPI-TIN combinations) assigned to the same TIN. Additional details are provided in S.7 Denominator Details.
Denominator Details	To be included in the measure cohort used in public reporting, patients must meet the following additional inclusion criteria: 1. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of admission; and enrolled in Part A during the index admission; 2. Aged 65 or older 3. Having a qualifying elective primary THA/TKA procedure; elective primary THA/TKA procedures are defined as those procedures without any of the following: • Fracture of the pelvis or lower limbs coded in the principal or secondary discharge diagnosis fields on the index admission claim (Note: Periprosthetic fractures	To be included in the measure cohort used in public reporting, patients must meet the following additional inclusion criteria: 1. Enrolled in Medicare FFS Part A and Part B Medicare for the 12 months prior to the date of admission; and enrolled in Part A during the index admission; 2. Aged 65 or over; 3. Discharged alive from a non-federal acute care hospital; and 4. Have a qualifying elective primary THA/TKA procedure; elective primary THA/TKA procedures defined as those procedures without any of the following: • Femur, hip, or pelvic fractures coded in principal or secondary discharge diagnosis fields of the index admission;	To be included in the measure cohort used, patients must meet the following additional inclusion criteria: 1. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of admission; and enrolled in Part A during the index admission and for 90 days after discharge; 2. Aged 65 or older; and 3. Having a qualifying elective primary THA/TKA procedure. Elective primary THA/TKA procedures are defined as those procedures without any of the following: 1. Femur, hip, or pelvic fractures coded in the principal or secondary discharge diagnosis field of the index admission 2. Partial hip arthroplasty (PHA) procedures (with a concurrent THA/TKA); partial knee

Measure	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
	must be additionally coded as present on admission [POA] in order to disqualify a THA/TKA from cohort inclusion, unless exempt from POA reporting.); • A concurrent partial hip or knee arthroplasty procedure; • A concurrent revision, resurfacing, or implanted device/prosthesis removal procedure; • Mechanical complication coded in the principal discharge diagnosis field on the index admission claim; • Malignant neoplasm of the pelvis, sacrum, coccyx, lower limbs, or bone/bone marrow or a disseminated malignant neoplasm coded in the principal discharge diagnosis field on the index admission claim; or, • Transfer from another acute care facility for the THA/TKA. Patients are eligible for inclusion in the denominator if they had an elective primary THA and/or a TKA AND had continuous enrollment in Part A and Part B Medicare fee-for-service (FFS) 12 months prior to the date of index admission. This measure can also be used for an all-payer population aged 18 years and older. We have explicitly tested the measure in both patients aged 18+ years and those	• Partial hip arthroplasty (PHA) procedures with a concurrent THA/TKA; • Revision procedures with a concurrent THA/TKA; • Resurfacing procedures with a concurrent THA/TKA; • Mechanical complication coded in the principal discharge diagnosis field; • Malignant neoplasm of the pelvis, sacrum, coccyx, lower limbs, or bone/bone marrow or a disseminated malignant neoplasm coded in the principal discharge diagnosis field; • Removal of implanted devices/prostheses; or • Transfer from another acute care facility for the THA/TKA This measure can also be used for an all-payer population aged 18 years and older. We have explicitly tested the measure in both patients aged 18 years and older and those aged 65 years or older (see Testing Attachment for details, 2b4.11).	arthroplasty procedures are not distinguished by ICD9 codes and are currently captured by the THA/TKA measure 3. Revision procedures with a concurrent THA/TKA 4. Resurfacing procedures with a concurrent THA/TKA 5. Mechanical complication coded in the principal discharge 6. Malignant neoplasm of the pelvis, sacrum, coccyx, lower limbs, or bone/bone marrow or a disseminated malignant neoplasm coded in the principal discharge diagnosis field 7. Removal of implanted devises/prostheses 8. Transfer status from another acute care facility for the THA/TKA Patients are eligible for inclusion in the denominator if they had an elective primary THA and/or a TKA AND had continuous enrollment in Part A and Part B Medicare fee-for-service (FFS) 12 months prior to the date of index admission. Elective primary THA/TKA procedures are defined as those procedures without any of the 8 associated conditions or finding noted above. For a full list of ICD-9 and ICD-10 codes defining the following see attached Data Dictionary, sheets "I-10 Cohort Codes" and "I9 Cohort Codes." Additional details are provided in S.9 Denominator Details.

Measure	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
	aged 65+ years (see Testing Attachment for details).		
Exclusions	This measure excludes index admissions for patients: 1. Without at least 90 days post-discharge enrollment in FFS Medicare; 2. Who were discharged against medical advice (AMA); or, 3. Who had more than two THA/TKA procedure codes during the index hospitalization. After applying these exclusion criteria, we randomly select one index admission for patients with multiple index admissions in a calendar year. We therefore exclude the other eligible index admissions in that year.	The THA/TKA readmission measure excludes admissions for patients: 1. Without at least 30 days post-discharge enrollment in FFS Medicare; 2. Who were discharged against medical advice (AMA); 3. Admitted for the index procedure and subsequently transferred to another acute care facility; 4. Who had more than two THA/TKA procedure codes during the index hospitalization; or 5. 5. Who had THA/TKA admissions within 30 days of a prior THA/TKA index admission.	This measure excludes index admissions for patients: 1. Who survived the index admission but without 90-day Medicare part A enrollment post discharge; 2. Who were transferred in to the index hospital; 3. Who leave the hospital against medical advice (AMA); 4. With more than two THA/TKA procedures codes during the index hospitalization; or 5. Who cannot be attributed to a billing surgeon or operator using claims data After applying the exclusion criteria above, we randomly select one index admission for patients with multiple index admissions in a calendar year. We therefore exclude the other eligible index admissions in that year.
Exclusion Details	This measure excludes index admissions for patients: 1. Without at least 90 days post-discharge enrollment in FFS Medicare Rationale: The 90-day complication outcome cannot be assessed in this group since claims data are used to determine whether a complication of care occurred. 2. Who were discharged against medical advice (AMA); or,	This measure excludes index admissions for patients: 1. Without at least 30 days of post-discharge enrollment in FFS Medicare as determined by examining the Medicare Enrollment Database (EDB). Rationale: The 30-day readmission outcome cannot be assessed in this group since claims data are used to determine whether a patient was readmitted. 2. Discharges against medical advice (AMA) are identified using the discharge disposition indicator in claims data.	The measure excludes admissions for patients: 1. Who survived the index admission but without 90-day Medicare part A enrollment post discharge Rationale: Only patients with adequate claims data for attribution should be included in risk-adjustment model and the measure. 2. Who were transferred in to the index hospital Rationale: If the patient is transferred from another acute care facility to the hospital where the index procedure occurs, it is likely that the

Measure	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
	Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge. 3. Who had more than two THA/TKA procedure codes during the index hospitalization Rationale: Although clinically possible, it is highly unlikely that patients would receive more than two elective THA/TKA procedures in one hospitalization, which may reflect a coding error.	Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge. 3. Admitted for the index procedure and subsequently transferred to another acute care facility, which are defined as when a patient with an inpatient hospital admission (with at least one qualifying THA/TKA procedure) is discharged from an acute care hospital and admitted to another acute care hospital on the same or next day. Rationale: Patients admitted for the index procedure and subsequently transferred to another acute care facility are excluded, as determining which hospital the readmission outcome should be attributed to is difficult. 4. Who had more than two THA/TKA procedure codes during the index hospitalization, which is identified by examining procedure codes in the claims data. Rationale: Although clinically possible, it is highly unlikely that patients would receive more than two elective THA/TKA procedures in one hospitalization, which may reflect a coding error. 5. Who had THA/TKA admissions within 30 days prior to THA/TKA index admission. Rationale: Additional THA/TKA admissions within 30 days are excluded as index admissions because they are part of the outcome. A single admission does not count as	procedure is not elective, or that the admission is associated with an acute condition. 3. Who leave the hospital against medical advice (AMA) Rationale: Clinicians have limited opportunity to implement high quality care. 4. With more than two THA/TKA procedures codes during the index hospitalization Rationale: Although clinically possible, it is highly unlikely that patients would receive more than two elective THA/TKA procedures in one hospitalization, and this may reflect a coding error. 5. Who cannot be attributed to a billing surgeon or operator using claims data Rationale: Only patients with adequate clinician claims for attribution should be included in risk-adjustment model and the measure.

Measure	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
		both an index admission and a readmission for another index admission.	
Risk Adjustment	Statistical risk model 112469| 118210| 137301| 146637| 141015 112469| 118210| 137301| 146637| 141015	Statistical risk model 112469| 109921| 118210| 135810| 117446| 146637| 141015 112469| 109921| 118210| 135810| 117446| 146637| 141015	Statistical risk model 146637| 110639| 146313 146637| 110639| 146313
Stratification	N/A	N/A	N/a
Type Score	Rate/proportion better quality = lower score	Rate/proportion better quality = lower score	Rate/proportion better quality = lower score
Algorithm	The measure estimates hospital-level RSCRs following elective primary THA/TKA using hierarchical logistic regression models. In brief, the approach simultaneously models data at the patient and hospital levels to account for variance in patient outcomes within and between hospitals (Normand and Shahian, 2007). At the patient level, it models the log-odds of a complication occurring within 90 days of the index admission using age, sex, selected clinical covariates, and a hospital-specific intercept. At the hospital level, it models the hospital-specific intercepts as arising from a normal distribution. The hospital intercept represents the underlying risk of a complication at the hospital, after accounting for patient risk. The hospital-specific intercepts are given a distribution to account for the clustering (non-independence) of patients within the same hospital. If there were no differences among	The measure estimates hospital-level 30-day all-cause RSRRs following elective primary THA/TKA using hierarchical logistic regression models. In brief, the approach simultaneously models data at the patient and hospital levels to account for variance in patient outcomes within and between hospitals (Normand and Shahian, 2007). At the patient level, it models the log-odds of readmission within 30 days of discharge using age, sex, selected clinical covariates, and a hospital-specific intercept. At the hospital level, it models the hospital-specific intercepts as arising from a normal distribution. The hospital intercept represents the underlying risk of a readmission at the hospital, after accounting for patient risk. The hospital-specific intercepts are given a distribution to account for the clustering (non-independence) of patients within the same hospital. If there were no differences among hospitals after adjusting for patient risk, the	In Dataset April 2013 to March 2016 (prior to exclusions being applied): We started with the hospital HKC measure cohort, with an initial index cohort size of 982,436 index admissions with an elective primary THA/TKA procedure. After applying exclusion criteria 1 through 4 listed in the table below, we have a cohort sample size of 935,029 index admissions. Our previous NQF filing for hospital HKC showed no bias introduced through the exclusion process for hospitals for this same cohort of 935,029 index admissions. We then further excluded 10,243 (1.0%) index admissions (criteria 5 and 6 below) which cannot be attributed to physician/physician group to create our final measure cohort. The measure estimates eligible clinician or clinician group ("provider")-level RSCRs following elective primary THA/TKA using hierarchical logistic regression models. In brief, the approach simultaneously models data at the patient and provider levels to account for variance in patient outcomes within and between hospitals (Normand

Measure	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
	hospitals, then after adjusting for patient risk, the hospital intercepts should be identical across all hospitals. The RSCR is calculated as the ratio of the number of "predicted" to the number of "expected" admissions with a complication at a given hospital, multiplied by the national observed complication rate. For each hospital, the numerator of the ratio is the number of complications within 90 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of complications expected based on the nation's performance with that hospital's case mix. This approach is analogous to a ratio of "observed" to "expected" used in other types of statistical analyses. It conceptually allows for a comparison of a particular hospital's performance given its case mix to an average hospital's performance with the same case mix. Thus, a lower ratio indicates lower-than-expected complication rates or better quality, and a higher ratio indicates higher-than-expected complication rates or worse quality. The "predicted" number of admissions with a complication (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of having an admission with a complication. The estimated hospital-specific intercept is	hospital intercepts should be identical across all hospitals. The RSRR is calculated as the ratio of the number of "predicted" to the number of "expected" readmission at a given hospital, multiplied by the national observed readmission rate. For each hospital, the numerator of the ratio is the number of readmissions within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of readmissions expected based on the nation's performance with that hospital's case mix. This approach is analogous to a ratio of "observed" to "expected" used in other types of statistical analyses. It conceptually allows for a comparison of a particular hospital's performance given its case mix to an average hospital's performance with the same case mix. Thus, a lower ratio indicates lower-than-expected readmission rates or better quality, and a higher ratio indicates higher-than-expected readmission rates or worse quality. The "predicted" number of readmissions (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of readmission. The estimated hospital-specific intercept is added to the sum of the estimated regression coefficients multiplied by the patient characteristics. The results are transformed and summed over all patients attributed to a hospital to get a predicted value.	and Shahian, 2007). At the patient level, it models the log-odds of a complication occurring within 90 days of the index admission using age, sex, selected clinical covariates, and a provider-specific intercept. At the provider level, it models the provider-specific intercepts as arising from a normal distribution. The provider intercept represents the underlying risk of a complication for patients treated by the provider, after accounting for patient risk. The provider-specific intercepts are given a distribution to account for the clustering (non-independence) of patients treated by the same provider. If there were no differences among providers, then after adjusting for patient risk, the provider intercepts should be identical across all providers. The RSCR is calculated as the ratio of the number of "predicted" to the number of "expected" admissions with a complication at a given provider, multiplied by the national observed complication rate. The "predicted" number of admissions with a complication (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the provider-specific intercept on the risk of having an admission with a complication. The estimated provider-specific intercept is added to the sum of the estimated regression coefficients multiplied by the patient characteristics. The results are log transformed and summed over all patients attributed to a provider to get a predicted value. The "expected" number of admissions with a complication (the denominator) is obtained in the same manner, but a common intercept using all providers in our sample is added in place of the

Measure	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
	added to the sum of the estimated regression coefficients multiplied by the patient characteristics. The results are log transformed and summed over all patients attributed to a hospital to get a predicted value. The "expected" number of admissions with a complication (the denominator) is obtained in the same manner, but a common intercept using all hospitals in our sample is added in place of the hospital-specific effect. The results are log transformed and summed over all patients in the hospital to get an expected value. To assess hospital performance for each reporting period, we re-estimate the model coefficients using the years of data in that period. This calculation transforms the ratio of predicted over expected into a rate that is compared to the national observed complication rate. The hierarchical logistic regression models are described fully in the original methodology report posted on QualityNet References: Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 112469 | 118210| 137301 | 146637| 141015	The "expected" number of readmissions (the denominator) is obtained in the same manner, but a common intercept using all hospitals in our sample is added in place of the hospital-specific intercept. The results are transformed and summed over all patients in the hospital to get an expected value. To assess hospital performance for each reporting period, we re-estimate the model coefficients using the years of data in that period. This calculation transforms the ratio of predicted over expected into a rate that is compared to the national observed readmission rate. The hierarchical logistic regression models are described fully in the original methodology report (Grosso et al., 2012), which is also posted on QualityNet References: Grosso L, Curtis J, Geary L, et al. Hospital-level 30-Day All-Cause Risk-Standardized Readmission Rate Following Elective Primary Total Hip Arthroplasty (THA) And/Or Total Knee Arthroplasty (TKA) Measure Methodology Report. 2012. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 112469 | 109921| 118210 | 135810| 117446 | 146637| 141015	provider-specific effect. The results are log transformed and summed over all patients in the provider to get an expected value. To assess provider performance for each reporting period, we re-estimate the model coefficients using the years of data in that period. For each provider, the numerator of the ratio is the number of complications within 90 days predicted on the basis of the provider's performance with its observed case mix, and the denominator is the number of complications expected based on the nation's performance with that provider's case mix. This approach is analogous to a ratio of "observed" to "expected" used in other types of statistical analyses. It conceptually allows for a comparison of a particular provider's performance given its case mix to an average provider's performance with the same case mix. Thus, a lower ratio indicates lower-than-expected complication rates or better quality, and a higher ratio indicates higher-than-expected complication rates or worse quality. This calculation transforms the ratio of predicted over expected into a rate that is compared to the national observed complication rate. The hierarchical logistic regression models are described fully in the original methodology report (Grosso et al., 2012). References: Grosso L, Curtis J, Geary L, et al. Hospital-level Risk-Standardized Complication Rate Following Elective Primary Total Hip Arthroplasty (THA) And/Or Total

Measure	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
			Knee Arthroplasty (TKA) Measure Methodology Report. 2012. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226 146637| 110639 | 146313
Submission items	5.1 Identified measures: 1551 : Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) 3493 : Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: We did not include in our list of related measures any non-outcome measures (for example, process measures) with the same target population as our measure. Because this is an outcome measure, clinical coherence of the cohort takes precedence over alignment with related non-outcome measures. Furthermore, non-outcome measures are limited due to broader patient exclusions. This is because they typically only include a specific subset of patients who are eligible for that measure (for example, patients who	5.1 Identified measures: 0505 : Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization. 0506 : Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization 1550 : Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) 1789 : Hospital-Wide All-Cause Unplanned Readmission Measure (HWR) 3493 : Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: We did not include in our list of related measures any non-outcome measures (for example, process measures) with the same target population as	5.1 Identified measures: 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: The measure is fully harmonized with NQF #1550 regarding cohort definition, outcome, and risk adjustment approach. The only discrepancy is the attribution approach, which assigns each index admission to a clinician rather than a hospital, and the exclusion of patients for which no billing surgeon or operator can be identified. 5b.1 If competing, why superior or rationale for additive value: Clinicians, particularly the surgeon performing the procedure, can influence the outcome of surgery for better or worse, both through their technical skill and through their influence on the care team and hospital safety culture. Therefore, many of the strategies and best practices used by hospitals to reduce the risk of complications can also be adopted by individual clinicians and groups of clinicians to improve patient outcomes. Further evidence of surgeons' influence are data indicating that increasing surgeon volume is associated with reductions in

Measure	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
	receive a specific medication or undergo a specific procedure). 5b.1 If competing, why superior or rationale for additive value: N/A	our measure. Because this is an outcome measure, clinical coherence of the cohort takes precedence over alignment with related non-outcome measures. Furthermore, non-outcome measures are limited due to broader patient exclusions. This is because they typically only include a specific subset of patients who are eligible for that measure (for example, patients who receive a specific medication or undergo a specific procedure). 5b.1 If competing, why superior or rationale for additive value: N/A	adverse surgical outcomes (Battaglia TC et al., 2006; Shervin et al., 2007). The THA/TKA risk-standardized complication rate (RSCR) measure for clinicians is thus intended to inform quality-of-care improvement efforts, as individual process-based performance measures cannot encompass all the complex and critical aspects of care that contribute to patient outcomes. It also complements the hospital measure as a proportion of surgeons have very different performance quality than the institutions in which they perform surgery; this measure provides a transparent reflection of these discordances to further support quality improvement. References: Battaglia TC, Mulhall KJ, Brown TE, Saleh KJ. Increased surgical volume is associated with lower THA dislocation rates. Clin Orthop Relat Res. 2006 Jun;447:28-33. Shervin N, Rubash HE, Katz JN. Orthopaedic procedure volume and patient outcomes: a systematic literature review. Clin Orthop Relat Res. 2007 Apr;457:35-41.

Comparison of NQF #1551, NQF #0505, and NQF #0506

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization
Steward	Centers for Medicare & Medicaid Services	Centers for Medicare & Medicaid Services	Centers for Medicare & Medicaid Services

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization
Description	The measure estimates a hospital-level risk-standardized readmission rate (RSRR) following elective primary THA and/or TKA in Medicare Fee-For-Service (FFS) beneficiaries who are 65 years and older. The outcome (readmission) is defined as unplanned readmission for any cause within 30 days of the discharge date for the index admission (the admission included in the measure cohort). A specified set of planned readmissions do not count in the readmission outcome.	The measure estimates a hospital-level 30-day, all-cause, risk-standardized readmission rate (RSRR) for patients age 65 and older discharged from the hospital with a principal diagnosis of acute myocardial infarction (AMI). Readmission is defined as unplanned readmission for any cause within 30 days of the discharge date for the index admission. Readmissions are classified as planned and unplanned by applying the planned readmission algorithm. CMS annually reports the measure for patients who are 65 years or older and enrolled in fee-for-service (FFS) Medicare and hospitalized in non-federal hospitals or are patients hospitalized in Veterans Health Administration (VA) facilities.	The measure estimates a hospital-level 30-day, all-cause, risk-standardized readmission rate (RSRR) for patients age 65 and older discharged from the hospital with either a principal discharge diagnosis of pneumonia (including aspiration pneumonia) or a principal discharge diagnosis of sepsis (not severe sepsis) with a secondary diagnosis of pneumonia (including aspiration pneumonia) coded as present on admission (POA). Readmission is defined as an unplanned readmission for any cause within 30 days of the discharge date for the index admission. Readmissions are classified as planned and unplanned by applying the planned readmission algorithm. CMS annually reports the measure for patients who are 65 years or older and enrolled in fee-for-service (FFS) Medicare and hospitalized in non-federal hospitals or are patients hospitalized in Veterans Health Administration (VA) facilities.
Type	Outcome	Outcome	Outcome
Data Source	Claims, Enrollment Data Data sources for the Medicare FFS measure: Medicare Part A Inpatient and Part B Outpatient Claims: This data source contains claims data for FFS inpatient and outpatient services including Medicare inpatient hospital care, outpatient hospital services, as well as inpatient and outpatient physician claims for the 12 months prior to an index admission. Medicare Enrollment Database (EDB): This database contains Medicare beneficiary demographic, benefit/coverage, and vital	Claims, Enrollment Data, Other Data sources for the Medicare FFS measure: Medicare Part A Inpatient and Part B Outpatient claims: This data source contains claims data for FFS inpatient and outpatient services including Medicare inpatient hospital care, outpatient hospital services, as well as inpatient and outpatient physician claims for the 12 months prior to an index admission. Medicare Enrollment Database (EDB): This database contains Medicare beneficiary demographic, benefit/coverage, and vital status information. This data source was used to obtain	Claims, Enrollment Data, Other Data sources for the Medicare FFS measure: Medicare Part A Inpatient and Part B Outpatient Claims: This data source contains claims data for FFS inpatient and outpatient services including Medicare inpatient hospital care, outpatient hospital services, as well as inpatient and outpatient physician claims for the 12 months prior to an index admission. Medicare Enrollment Database (EDB): This database contains Medicare beneficiary demographic, benefit/coverage, and vital status information. This data source was used to obtain

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization
	status information. This data source was used to obtain information on several inclusion/exclusion indicators such as Medicare status on admission as well as vital status. These data have previously been shown to accurately reflect patient vital status (Fleming et al., 1992). The Master Beneficiary Summary File (MBSF) is an annually created file derived from the EDB that contains enrollment information for all Medicare beneficiaries including dual eligible status. Years 2016-2019 were used. The American Community Survey (2013-2017): We used the American Community Survey (2013-2017) to derive an updated Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) index score at the patient nine-digit zip code level for use in studying the association between our measure and social risk factors (SRFs). Reference: Fleming C., Fisher ES, Chang CH, Bubolz D, Malenda J. Studying outcomes and hospital utilization in the elderly: The advantages of a merged data base for Medicare and Veterans Affairs Hospitals. Medical Care. 1992; 30(5): 377-91. No data collection instrument provided Attachment	information on several inclusion/exclusion indicators such as Medicare status on admission as well as vital status. These data have previously been shown to accurately reflect patient vital status (Fleming et al., 1992). The Master Beneficiary Summary File (MBSF) is an annually created file derived the EDB that contains enrollment information for all Medicare beneficiaries including dual eligible status. Years 2016-2019 were used. Veterans Health Administration (VA) Data: This data source contains administrative data for VA inpatient and outpatient services including: inpatient hospital care, outpatient hospital services, skilled nursing facility care, some home health agency services, as well as inpatient and outpatient physician data for the 12 months prior to and including each index admission. Unlike Medicare FFS patients, VA patients are not required to have been enrolled in Part A and Part B Medicare for the 12 months prior to the date of admission. The American Community Survey (2013-2017): We used the American Community Survey (2013-2017) to derive an updated AHRQ SES index score at the patient nine-digit zip code level for use in studying the association between our measure and SRFs. References Fleming C., Fisher ES, Chang CH, Bubolz D, Malenda J. Studying outcomes and hospital utilization in the elderly: The advantages of a merged data base for Medicare and Veterans	information on several inclusion/exclusion indicators such as Medicare status on admission as well as vital status. These data have previously been shown to accurately reflect patient vital status (Fleming et al., 1992). The Master Beneficiary Summary File (MBSF) is an annually created file derived from the EDB that contains enrollment information for all Medicare beneficiaries including dual eligible status. Years 2016-2019 were used. Veterans Health Administration (VA) Data: This data source contains data for VA inpatient and outpatient services including: inpatient hospital care, outpatient hospital services, skilled nursing facility care, some home health agency services, as well as inpatient and outpatient physician data for the 12 months prior to and including each index admission. Unlike Medicare FFS patients, VA patients are not required to have been enrolled in Part A and Part B Medicare for the 12 months prior to the date of admission. The American Community Survey (2013-2017): We used the American Community Survey (2013-2017) to derive an updated Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) index score at the patient nine-digit zip code level for use in studying the association between our measure and social risk factors (SRFs). References Fleming C., Fisher ES, Chang CH, Bubolz D, Malenda J. Studying outcomes and hospital utilization in the elderly: The advantages of a merged data base for Medicare and Veterans

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization
		Affairs Hospitals. Medical Care. 1992; 30(5): 377-91. No data collection instrument provided Attachment	Affairs Hospitals. Medical Care. 1992; 30(5): 377-91. No data collection instrument provided Attachment
Level	Facility	Facility	Facility
Setting	Inpatient/Hospital	Inpatient/Hospital	Inpatient/Hospital
Numerator Statement	The outcome for this measure is 30-day readmissions. We define readmissions as inpatient admissions for any cause, with the exception of certain planned readmissions, within 30 days from the date of discharge of the index hospitalization. If a patient has more than one unplanned admission (for any reason) within 30 days after discharge from the index admission, only one is counted as a readmission. The measure looks for a dichotomous yes or no outcome of whether each admitted patient has an unplanned readmission within 30 days. However, if the first readmission after discharge is considered planned, any subsequent unplanned readmission is not counted as an outcome for that index admission, because the unplanned readmission could be related to care provided during the intervening planned readmission rather than during the index admission.	The outcome for this measure is 30-day all-cause readmissions. We define readmission as an inpatient acute care admission for any cause, with the exception of certain planned readmissions, within 30 days from the date of discharge from the index for patients 65 and older discharged from the hospital with a principal discharge diagnosis of AMI. If a patient has more than one unplanned admission (for any reason) within 30 days after discharge from the index admission, only the first one is counted as a readmission. The measure looks for a dichotomous yes or no outcome of whether each admitted patient has an unplanned readmission within 30 days. However, if the first readmission after discharge is considered planned, any subsequent unplanned readmission is not counted as an outcome for that index admission because the unplanned readmission could be related to care provided during the intervening planned readmission rather than during the index admission. Additional details are provided in S.5 Numerator Details.	The outcome for this measure is 30-day readmissions. We define readmission as an inpatient acute care admission for any cause, with the exception of certain planned readmissions, within 30 days from the date of discharge from the index admission for patients 65 and older discharged from the hospital with a principal diagnosis of pneumonia, including aspiration pneumonia or a principal diagnosis of sepsis (not severe sepsis) with a secondary diagnosis of pneumonia (including aspiration pneumonia) coded as POA and no secondary diagnosis of severe sepsis. If a patient has more than one unplanned admission (for any reason) within 30 days after discharge from the index admission, only the first one is counted as a readmission. The measure looks for a dichotomous yes or no outcome of whether each admitted patient has an unplanned readmission within 30 days. However, if the first readmission after discharge is considered planned, any subsequent unplanned readmission is not counted as an outcome for that index admission because the unplanned readmission could be related to care provided during the intervening planned readmission rather than during the index admission.

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization
Numerator Details	The measure counts readmissions to any acute care hospital for any cause within 30 days of the date of discharge of the index THA and/or TKA hospitalization, excluding planned readmissions as defined below. Planned Readmission Algorithm (Version 4.0) The Planned Readmission Algorithm is a set of criteria for classifying readmissions as planned among the general Medicare population using Medicare administrative claims data. The algorithm identifies admissions that are typically planned and may occur within 30 days of discharge from the hospital. The Planned Readmission Algorithm has three fundamental principles: 1. A few specific, limited types of care are always considered planned (transplant surgery, maintenance chemotherapy/immunotherapy, and rehabilitation); 2. Otherwise, a planned readmission is defined as a non-acute readmission for a scheduled procedure; and 3. Admissions for acute illness or for complications of care are never planned. The algorithm was developed in 2011 as part of the Hospital-Wide Readmission measure. In 2013, CMS applied the algorithm to its other readmission measures. In applying the algorithm to	The measure counts readmissions to any acute care hospital for any cause within 30 days of the date of discharge of the index AMI admission, excluding planned readmissions as defined below. Planned Readmission Algorithm (Version 4.0) The planned readmission algorithm is a set of criteria for classifying readmissions as planned using Medicare and VA administrative claims data. The algorithm identifies admissions that are typically planned and may occur within 30 days of discharge from the hospital. The planned readmission algorithm has three fundamental principles: 1. A few specific, limited types of care are always considered planned (transplant surgery, maintenance chemotherapy/ immunotherapy, rehabilitation); 2. Otherwise, a planned readmission is defined as a non-acute readmission for a scheduled procedure; and, 3. Admissions for acute illness or for complications of care are never planned. The algorithm was developed in 2011 as part of the Hospital-Wide Readmission measure. In 2013, CMS applied the algorithm to its other readmission measures. In applying the algorithm to condition- and procedure-specific measures, teams of clinical experts reviewed the algorithm in the context of each measure-specific patient cohort and, where clinically indicated, adapted the content of the algorithm to better reflect the likely clinical experience of each measure's patient cohort. The	The measure counts readmissions to any acute care hospital for any cause within 30 days of the date of discharge of the index pneumonia admission, excluding planned readmissions as defined below. Planned Readmission Algorithm (Version 4.0) The planned readmission algorithm is a set of criteria for classifying readmissions as planned using Medicare claims and VA administrative data. The algorithm identifies admissions that are typically planned and may occur within 30 days of discharge from the hospital. The planned readmission algorithm has three fundamental principles: 1. A few specific, limited types of care are always considered planned (transplant surgery, maintenance chemotherapy/immunotherapy, rehabilitation); 2. Otherwise, a planned readmission is defined as a non-acute readmission for a scheduled procedure; and, 3. Admissions for acute illness or for complications of care are never planned. The algorithm was developed in 2011 as part of the Hospital-Wide Readmission measure. In 2013, CMS applied the algorithm to its other readmission measures. In applying the algorithm to condition- and procedure-specific measures, teams of clinical experts reviewed the algorithm in the context of each measure-specific patient cohort and, where clinically indicated, adapted the content of the

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization
	condition- and procedure-specific measures, teams of clinical experts reviewed the algorithm in the context of each measure-specific patient cohort and, where clinically indicated, adapted the content of the algorithm to better reflect the likely clinical experience of each measure's patient cohort. The planned readmission algorithm is applied to the THA/TKA readmission measure with small modifications. The Planned Readmission Algorithm and associated code tables are attached in data field S.2b (Data Dictionary or Code Table).	planned readmission algorithm is applied to the AMI measure without modifications. The planned readmission algorithm and associated code tables are attached in data field S.2b (Data Dictionary or Code Table).	algorithm to better reflect the likely clinical experience of each measure's patient cohort. The planned readmission algorithm is applied to the pneumonia measure without modifications. The planned readmission algorithm and associated code tables are attached in data field S.2b (Data Dictionary or Code Table).
Denominator Statement	The target population for the publicly reported measure includes admissions for Medicare FFS beneficiaries who are at least 65 years of age undergoing elective primary THA and/or TKA procedures. Additional details are provided in S.9 Denominator Details.	The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal diagnosis of AMI; and with a complete claims history for the 12 months prior to admission. Additional details are provided in S.7 Denominator Details.	The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of pneumonia, including aspiration pneumonia or a principal discharge diagnosis of sepsis (not severe sepsis) with a secondary discharge diagnosis of pneumonia (including aspiration pneumonia) coded as POA and no secondary discharge diagnosis of severe sepsis; and with a complete claims history for the 12 months prior to admission. The measure is publicly reported by CMS for those patients 65 years and older who are Medicare FFS or VA beneficiaries admitted to non-federal or VA hospitals, respectively. Additional details are provided in S.7 Denominator Details.
Denominator Details	To be included in the measure cohort used in public reporting, patients must meet the following additional inclusion criteria:	To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria: 1. Principal discharge diagnosis of AMI;	To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria:

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization
	• Enrolled in Medicare FFS Part A and Part B Medicare for the 12 months prior to the date of admission; and enrolled in Part A during the index admission; • Aged 65 or over; • Discharged alive from a non-federal acute care hospital; and • Have a qualifying elective primary THA/TKA procedure; elective primary THA/TKA procedures defined as those procedures without any of the following: o Femur, hip, or pelvic fractures coded in principal or secondary discharge diagnosis fields of the index admission; o Partial hip arthroplasty (PHA) procedures with a concurrent THA/TKA; o Revision procedures with a concurrent THA/TKA; o Resurfacing procedures with a concurrent THA/TKA; o Mechanical complication coded in the principal discharge diagnosis field; o Malignant neoplasm of the pelvis, sacrum, coccyx, lower limbs, or bone/bone marrow or a disseminated malignant neoplasm coded in the principal discharge diagnosis field;	Enrolled in Medicare fee-for-service (FFS) Part A and B for the 12 months prior to the date of admission, and enrolled in Part A during the index admission, or those who are VA beneficiaries; Aged 65 or over; Discharged alive from a non-federal short-term acute care hospital or VA hospital; and, 5. Not transferred to another acute care facility.	1. Principal discharge diagnosis of pneumonia, including aspiration pneumonia; or principal discharge diagnosis of sepsis (not including severe sepsis), with a secondary discharge diagnosis of pneumonia (including aspiration pneumonia) coded as POA but no secondary discharge diagnosis of severe sepsis; 2. Enrolled in Medicare fee-for-service (FFS) in Part A and Part B for the 12 months prior to the date of admission, and enrolled in Part A during the index admission, or those who are VA beneficiaries; 3. Aged 65 or over; 4. Discharged alive from a non-federal short-term acute care hospital or VA hospital; and, 5. 5. Not transferred from another acute care facility.

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization
	Removal of implanted devices/prostheses; or Transfer from another acute care facility for the THA/TKA This measure can also be used for an all-payer population aged 18 years and older. We have explicitly tested the measure in both patients aged 18 years and older and those aged 65 years or older (see Testing Attachment for details, 2b4.11).		
Exclusions	The THA/TKA readmission measure excludes admissions for patients: 1. Without at least 30 days post-discharge enrollment in FFS Medicare; 2. Who were discharged against medical advice (AMA); 3. Admitted for the index procedure and subsequently transferred to another acute care facility; 4. Who had more than two THA/TKA procedure codes during the index hospitalization; or 5. 5. Who had THA/TKA admissions within 30 days of a prior THA/TKA index admission.	The 30-day AMI readmission measure excludes index admissions for patients: 1. Without at least 30 days of post-discharge enrollment in Medicare FFS (in the case of patients who are not VA beneficiaries); 2. Discharged against medical advice (AMA); 3. Same-day discharges; or 4. 4) Admitted within 30 days of a prior index admission for AMI.	The 30-day pneumonia (PN) readmission measure excludes index admissions for patients: 1. Discharged against medical advice (AMA); 2. Without at least 30 days post-discharge enrollment in FFS Medicare (in the case of patients who are not VA beneficiaries); 3. 3. Admitted within 30 days of a prior index admission for pneumonia.
Exclusion Details	This measure excludes index admissions for patients: *Without at least 30 days of post-discharge enrollment in FFS Medicare as determined by examining the Medicare Enrollment Database (EDB).* Rationale: The 30-day readmission outcome cannot be assessed in this group since	The AMI readmission measure excludes index admissions for patients: *Without at least 30 days of post-discharge enrollment in Medicare FFS (in the case of patients who are not VA beneficiaries), which is identified with enrollment data from the Medicare Enrollment Database.*	The pneumonia readmission measure excludes index admissions for patients: *Discharges against medical advice (AMA) are identified using the discharge disposition indicator in claims data.* Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization
	claims data are used to determine whether a patient was readmitted. *Discharges against medical advice (AMA) are identified using the discharge disposition indicator in claims data.* Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge. *Admitted for the index procedure and subsequently transferred to another acute care facility, which are defined as when a patient with an inpatient hospital admission (with at least one qualifying THA/TKA procedure) is discharged from an acute care hospital and admitted to another acute care hospital on the same or next day.* Rationale: Patients admitted for the index procedure and subsequently transferred to another acute care facility are excluded, as determining which hospital the readmission outcome should be attributed to is difficult. *Who had more than two THA/TKA procedure codes during the index hospitalization, which is identified by examining procedure codes in the claims data.* Rationale: Although clinically possible, it is highly unlikely that patients would receive more than two elective THA/TKA procedures in one hospitalization, which may reflect a coding error. *Who had THA/TKA admissions within 30 days prior to THA/TKA index admission.*	Rationale: The 30-day readmission outcome cannot be assessed in this group since claims data are used to determine whether a patient was readmitted. *Discharged against medical advice (AMA) are identified using the discharge disposition indicator in claims data.* Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge. *Same-day discharges. This information is identified in claims data.* Rationale: Patients admitted and then discharged on the same day are not included as an index admission because it is unlikely that these patients had clinically significant AMIs. *AMI admissions within 30 days of discharge from a qualifying AMI index admission are identified by comparing the discharge date from the index admission with subsequent admission dates.* Rationale: Additional AMI admissions within 30 days are excluded as index admissions because they are part of the outcome. A single admission does not count as both an index admission and a readmission for another index admission.	*Without at least 30 days of post-discharge enrollment in Medicare FFS (in the case of patients who are not VA beneficiaries), which is identified with enrollment data from the Medicare Enrollment Database.* Rationale: The 30-day readmission outcome cannot be assessed in this group since claims data are used to determine whether a patient was readmitted. *Pneumonia admissions within 30 days of discharge from a qualifying pneumonia index admission are identified by comparing the discharge date from the index admission with subsequent admission dates.* Rationale: Additional pneumonia admissions within 30 days are excluded as index admissions because they are part of the outcome. A single admission does not count as both an index admission and a readmission for another index admission.

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization
	Rationale: Additional THA/TKA admissions within 30 days are excluded as index admissions because they are part of the outcome. A single admission does not count as both an index admission and a readmission for another index admission.		
Risk Adjustment	Statistical risk model 112469| 109921 | 118210| 135810 | 117446| 146637 | 141015 112469| 109921 | 118210| 135810 | 117446| 146637 | 141015	Statistical risk model 118210| 112469 | 146637 118210| 112469 | 146637	Statistical risk model 141973| 112469 | 146637 141973| 112469 | 146637
Stratification	N/A	N/A	N/A
Type Score	Rate/proportion better quality = lower score	Rate/proportion better quality = lower score	Rate/proportion better quality = lower score
Algorithm	The measure estimates hospital-level 30-day all-cause RSRRs following elective primary THA/TKA using hierarchical logistic regression models. In brief, the approach simultaneously models data at the patient and hospital levels to account for variance in patient outcomes within and between hospitals (Normand and Shahian, 2007). At the patient level, it models the log-odds of readmission within 30 days of discharge using age, sex, selected clinical covariates, and a hospital-specific intercept. At the hospital level, it models the hospital-specific intercepts as arising from a normal distribution. The hospital intercept represents the underlying risk of a readmission at the hospital, after accounting for patient risk. The hospital-specific intercepts are given a distribution to	The measure estimates hospital-level 30-day, all-cause, RSRRs following hospitalization for AMI using hierarchical logistic regression models. In brief, the approach simultaneously models data at the patient and hospital levels to account for variance in patient outcomes within and between hospitals (Normand and Shahian, 2007). At the patient level, it models the log-odds of readmission within 30 days of index admission using age, sex, selected clinical covariates, and a hospital-specific intercept. At the hospital level, it models the hospital-specific intercepts as arising from a normal distribution. The hospital intercept represents the underlying risk of a readmission at the hospital, after accounting for patient risk. The hospital-specific intercepts are given a distribution to account for the clustering (non-independence) of patients within the same hospital. If there were no differences among	The measure estimates hospital-level 30-day, all-cause, RSRRs following hospitalization for pneumonia using hierarchical logistic regression models. In brief, the approach simultaneously models data at the patient and hospital levels to account for variance in patient outcomes within and between hospitals (Normand and Shahian, 2007). At the patient level, it models the log-odds of readmission within 30 days of index admission using age, sex, selected clinical covariates, and a hospital-specific intercept. At the hospital level, it models the hospital-specific intercepts as arising from a normal distribution. The hospital intercept represents the underlying risk of a readmission at the hospital, after accounting for patient risk. The hospital-specific intercepts are given a distribution to account for the clustering (non-independence) of patients within the same hospital. If there were no

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization
	account for the clustering (non-independence) of patients within the same hospital. If there were no differences among hospitals after adjusting for patient risk, the hospital intercepts should be identical across all hospitals. The RSRR is calculated as the ratio of the number of "predicted" to the number of "expected" readmission at a given hospital, multiplied by the national observed readmission rate. For each hospital, the numerator of the ratio is the number of readmissions within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of readmissions expected based on the nation's performance with that hospital's case mix. This approach is analogous to a ratio of "observed" to "expected" used in other types of statistical analyses. It conceptually allows for a comparison of a particular hospital's performance given its case mix to an average hospital's performance with the same case mix. Thus, a lower ratio indicates lower-than-expected readmission rates or better quality, and a higher ratio indicates higher-than-expected readmission rates or worse quality. The "predicted" number of readmissions (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of readmission. The estimated	hospitals, then after adjusting for patient risk, the hospital intercepts should be identical across all hospitals. The RSRR is calculated as the ratio of the number of "predicted" to the number of "expected" readmissions at a given hospital, multiplied by the national observed readmission rate. For each hospital, the numerator of the ratio is the number of readmissions within 30 days predicted on the basis of the hospital's performance with its observed case mix; and the denominator is the number of readmissions expected based on the nation's performance with that hospital's case mix. This approach is analogous to a ratio of "observed" to "expected" used in other types of statistical analyses. It conceptually allows for a comparison of a particular hospital's performance given its case mix to an average hospital's performance with the same case mix. Thus, a lower ratio indicates lower-than-expected readmission rates or better quality, and a higher ratio indicates higher-than-expected readmission rates or worse quality. The "predicted" number of readmissions (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of readmission. The estimated hospital-specific intercept is added to the sum of the estimated regression coefficients multiplied by the patient characteristics. The results are transformed and summed over all patients attributed to a hospital to get a predicted value. The "expected" number of readmissions (the denominator) is obtained in	differences among hospitals, then after adjusting for patient risk, the hospital intercepts should be identical across all hospitals. The RSRR is calculated as the ratio of the number of "predicted" to the number of "expected" readmissions at a given hospital, multiplied by the national observed readmission rate. For each hospital, the numerator of the ratio is the number of readmissions within 30 days predicted on the basis of the hospital's performance with its observed case mix; and the denominator is the number of readmissions expected based on the nation's performance with that hospital's case mix. This approach is analogous to a ratio of "observed" to "expected" used in other types of statistical analyses. It conceptually allows for a comparison of a particular hospital's performance given its case mix to an average hospital's performance with the same case mix. Thus, a lower ratio indicates lower-than-expected readmission rates or better quality, and a higher ratio indicates higher-than-expected readmission rates or worse quality. The "predicted" number of readmissions (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of readmission. The estimated hospital-specific intercept is added to the sum of the estimated regression coefficients multiplied by the patient characteristics. The results are transformed and summed over all patients attributed to a hospital to get a predicted value. The "expected" number of readmissions (the denominator) is obtained in

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization
	hospital-specific intercept is added to the sum of the estimated regression coefficients multiplied by the patient characteristics. The results are transformed and summed over all patients attributed to a hospital to get a predicted value. The "expected" number of readmissions (the denominator) is obtained in the same manner, but a common intercept using all hospitals in our sample is added in place of the hospital-specific intercept. The results are transformed and summed over all patients in the hospital to get an expected value. To assess hospital performance for each reporting period, we re-estimate the model coefficients using the years of data in that period. This calculation transforms the ratio of predicted over expected into a rate that is compared to the national observed readmission rate. The hierarchical logistic regression models are described fully in the original methodology report (Grosso et al., 2012), which is also posted on QualityNet. References: Grosso L, Curtis J, Geary L, et al. Hospital-level 30-Day All-Cause Risk-Standardized Readmission Rate Following Elective Primary Total Hip Arthroplasty (THA) And/Or Total Knee Arthroplasty (TKA) Measure Methodology Report. 2012. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 112469|	the same manner, but a common intercept using all hospitals in our sample is added in place of the hospital-specific intercept. The results are transformed and summed over all patients in the hospital to get an expected value. To assess hospital performance for each reporting period, we re-estimate the model coefficients using the years of data in that period. This calculation transforms the ratio of predicted over expected into a rate that is compared to the national observed readmission rate. The hierarchical logistic regression models are described fully and in the original methodology reports posted on QualityNet References Normand S-LT, Shahian D, M,. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Statistical Science. 2007;22(2):206-226 118210| 112469| 146637	the same manner, but a common intercept using all hospitals in our sample is added in place of the hospital-specific intercept. The results are transformed and summed over all patients in the hospital to get an expected value. To assess hospital performance for each reporting period, we re-estimate the model coefficients using the years of data in that period. This calculation transforms the ratio of predicted over expected into a rate that is compared to the national observed readmission rate. The hierarchical logistic regression models are described fully in the original methodology report posted on QualityNet References: Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 141973| 112469| 146637

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization
	109921| 118210| 135810| 117446| 146637| 141015		
Submission items	5.1 Identified measures: 0505 : Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization. 0506 : Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization 1550 : Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) 1789 : Hospital-Wide All-Cause Unplanned Readmission Measure (HWR) 3493 : Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: We did not include in our list of related measures any non-outcome measures (for example, process measures) with the same target population as our measure. Because this is an outcome measure, clinical coherence of the cohort takes precedence over alignment with related non-outcome measures.	5.1 Identified measures: 0730 : Acute Myocardial Infarction (AMI) Mortality Rate 0330 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization 0230 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization 1789 : Hospital-Wide All-Cause Unplanned Readmission Measure (HWR) 2431 : Hospital-level, risk-standardized payment associated with a 30-day episode-of-care for Acute Myocardial Infarction (AMI) 2473 : Hybrid hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) 2879 : Hybrid Hospital-Wide Readmission (HWR) Measure with Claims and Electronic Health Record Data 2881 : Excess days in acute care (EDAC) after hospitalization for acute myocardial infarction (AMI) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: We did not include in our list of related measures any non-outcome (e.g., process) measures with the same target population as our measure. Because this is an outcome measure, clinical coherence of the	5.1 Identified measures: 0231 : Pneumonia Mortality Rate (IQI #20) 0279 : Community Acquired Pneumonia Admission Rate (PQI 11) 1789 : Hospital-Wide All-Cause Unplanned Readmission Measure (HWR) 2579 : Hospital-level, risk-standardized payment associated with a 30-day episode of care for pneumonia (PN) 2882 : Excess days in acute care (EDAC) after hospitalization for pneumonia 5a.1 Are specs completely harmonized? No 5a.2 If not completely harmonized, identify difference, rationale, impact: We did not include in our list of related measures any non-outcome (e.g., process) measures with the same target population as our measure. Because this is an outcome measure, clinical coherence of the cohort takes precedence over alignment with related non-outcome measures. Furthermore, non-outcome measures are limited due to broader patient exclusions. This is because they typically only include a specific subset of patients who are eligible for that measure (for example, patients who receive a specific medication or undergo a specific procedure). 5b.1 If competing, why superior or rationale for additive value: N/A

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization
	Furthermore, non-outcome measures are limited due to broader patient exclusions. This is because they typically only include a specific subset of patients who are eligible for that measure (for example, patients who receive a specific medication or undergo a specific procedure). 5b.1 If competing, why superior or rationale for additive value: N/A	cohort takes precedence over alignment with related non-outcome measures. Furthermore, non-outcome measures are limited due to broader patient exclusions. This is because they typically only include a specific subset of patients who are eligible for that measure (for example, patients who receive a specific medication or undergo a specific procedure). 5b.1 If competing, why superior or rationale for additive value: N/A	

Comparison of NQF #1551, NQF #1550, and NQF #1789

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
Steward	Centers for Medicare & Medicaid Services	Centers for Medicare & Medicaid Services	Centers for Medicare & Medicaid Services
Description	The measure estimates a hospital-level risk-standardized readmission rate (RSRR) following elective primary THA and/or TKA in Medicare Fee-For-Service (FFS) beneficiaries who are 65 years and older. The outcome (readmission) is defined as unplanned readmission for any cause within 30 days of the discharge date for the index admission (the admission included in the measure cohort). A specified set of planned readmissions do not count in the readmission outcome.	The measure estimates a hospital-level risk-standardized complication rate (RSCR) associated with elective primary THA and TKA in Medicare Fee-For-Service beneficiaries who are age 65 and older. The outcome (complication) is defined as any one of the specified complications occurring from the date of index admission to 90 days post date of the index admission (the admission included in the measure cohort).	This measure estimates a hospital-level, risk-standardized readmission rate (RSRR) of unplanned, all-cause readmission within 30 days of discharge from an index admission with an eligible condition or procedure. The measure reports a single summary RSRR, derived from the volume-weighted results of five different models, one for each of the following specialty cohorts based on groups of discharge condition categories or procedure categories: surgery/gynecology, general medicine, cardiorespiratory, cardiovascular, and neurology. The measure also indicates the hospital-level standardized readmission ratios (SRR) for each of these five

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
			specialty cohorts. The outcome is defined as unplanned readmission for any cause within 30 days of the discharge date from the index admission (the admission included in the measure cohort). A specified set of readmissions are planned and do not count in the readmission outcome. CMS annually reports the measure for Medicare fee-for-service (FFS) patients who are 65 years or older and are hospitalized in non-federal short-term acute care hospitals. For the All-Cause Readmission (ACR) measure version used in the Shared Savings Program (SSP) beginning in 2017, the measure estimates an Accountable Care Organization (ACO) facility-level RSRR of unplanned, all-cause readmission after admission for any eligible condition or procedure within 30 days of hospital discharge. The ACR measure is calculated using the same five specialty cohorts and estimates an ACO-level standardized risk ratio for each. CMS annually reports the measure for patients who are 65 years or older, are enrolled in Medicare FFS, and are ACO assigned beneficiaries. The updates in this form reflect changes both to the original HWR measure and the ACS measure version. For instances where the two versions differ, we provide additional clarifications below the original description.
Type	Outcome	Outcome	Outcome
Data Source	Claims, Enrollment Data Data sources for the Medicare FFS measure: Medicare Part A Inpatient and Part B Outpatient Claims: This data source contains claims data for FFS inpatient and outpatient	Claims, Enrollment Data Data sources for the Medicare FFS measure: Medicare Part A Inpatient and Part B Outpatient Claims: This data source contains claims data for FFS inpatient and outpatient services including	Claims Data sources for the Medicare FFS measure: HWR 1. Medicare Part A claims data for calendar years 2007 and 2008 were combined and

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
	services including Medicare inpatient hospital care, outpatient hospital services, as well as inpatient and outpatient physician claims for the 12 months prior to an index admission. Medicare Enrollment Database (EDB): This database contains Medicare beneficiary demographic, benefit/coverage, and vital status information. This data source was used to obtain information on several inclusion/exclusion indicators such as Medicare status on admission as well as vital status. These data have previously been shown to accurately reflect patient vital status (Fleming et al., 1992). The Master Beneficiary Summary File (MBSF) is an annually created file derived from the EDB that contains enrollment information for all Medicare beneficiaries including dual eligible status. Years 2016-2019 were used. The American Community Survey (2013-2017): We used the American Community Survey (2013-2017) to derive an updated Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) index score at the patient nine-digit zip code level for use in studying the association between our measure and social risk factors (SRFs). Reference: Fleming C., Fisher ES, Chang CH, Bubolz D, Malenda J. Studying outcomes and hospital utilization in the elderly: The advantages of a merged data base for Medicare and	Medicare inpatient hospital care, outpatient hospital services, as well as inpatient and outpatient physician claims for the 12 months prior to an index admission. Medicare Enrollment Database (EDB): This database contains Medicare beneficiary demographic, benefit/coverage, and vital status information. This data source was used to obtain information on several inclusion/exclusion indicators such as Medicare status on admission as well as vital status. These data have previously been shown to accurately reflect patient vital status (Fleming et al., 1992). The Master Beneficiary Summary File (MBSF) is an annually created file derived the EDB that contains enrollment information for all Medicare beneficiaries including dual eligible status. Years 2016-2019 were used. The American Community Survey (2013-2017): We used the American Community Survey (2013-2017) to derive an updated Agency for Healthcare Research and Quality (AHRQ) Socioeconomic (SES) index score at the patient nine-digit zip code level for use in studying the association between our measure and social risk factors (SRFs). References: Fleming C., Fisher ES, Chang CH, Bubolz D, Malenda J. Studying outcomes and hospital utilization in the elderly: The advantages of a merged data base for Medicare and Veterans Affairs Hospitals. Medical Care. 1992; 30(5): 377-91.	then randomly split into two equal subsets (development sample and validation sample). Risk variable selection was done using the development sample, the risk models for each of the five specialty cohorts in the measure were applied to the validation sample and the models' performance was compared. In addition we re-tested the models in Medicare Part A claims data from calendar year 2009 to look for temporal stability in the models' performance. The number of measured entities and index admissions are listed below by specialty cohort. 2. Medicare Enrollment Database (EDB): This database contains Medicare beneficiary demographic, benefit/coverage, and vital status information. This data source was used to obtain information on several inclusion/exclusion indicators such as Medicare status on admission and following discharge from index admission ACR 1. Medicare Part A claims data for calendar years 2013, 2014, and 2015. 2. Medicare Enrollment Database (EDB). Reference: Fleming C., Fisher ES, Chang CH, Bubolz D, Malenda J. Studying outcomes and hospital utilization in the elderly: The advantages of a merged data base for Medicare and Veterans Affairs Hospitals. Medical Care. 1992; 30(5): 377-91.

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
	Veterans Affairs Hospitals. Medical Care. 1992; 30(5): 377-91. No data collection instrument provided Attachment	No data collection instrument provided Attachment	Available in attached appendix at A.1 Attachment
Level	Facility	Facility	Facility
Setting	Inpatient/Hospital	Inpatient/Hospital	Inpatient/Hospital, Outpatient Services
Numerator Statement	The outcome for this measure is 30-day readmissions. We define readmissions as inpatient admissions for any cause, with the exception of certain planned readmissions, within 30 days from the date of discharge of the index hospitalization. If a patient has more than one unplanned admission (for any reason) within 30 days after discharge from the index admission, only one is counted as a readmission. The measure looks for a dichotomous yes or no outcome of whether each admitted patient has an unplanned readmission within 30 days. However, if the first readmission after discharge is considered planned, any subsequent unplanned readmission is not counted as an outcome for that index admission, because the unplanned readmission could be related to care provided during the intervening planned readmission rather than during the index admission.	The outcome for this measure is any complication occurring during the index admission (not coded present on arrival) to 90 days post-date of the index admission. Complications are counted in the measure only if they occur during the index hospital admission or during a readmission. The complication outcome is a dichotomous (yes/no) outcome. If a patient experiences one or more of these complications in the applicable time period, the complication outcome for that patient is counted in the measure as a "yes".	The outcome for both the original HWR and ACR measures is 30-day readmission. We define readmission as an inpatient admission for any cause, except for certain planned readmissions, within 30 days from the date of discharge from an eligible index admission. If a patient has more than one unplanned admission (for any reason) within 30 days after discharge from the index admission, only one is counted as a readmission. The measure looks for a dichotomous yes or no outcome of whether each admitted patient has an unplanned readmission within 30 days. However, if the first readmission after discharge is considered planned, any subsequent unplanned readmission is not counted as an outcome for that index admission because the unplanned readmission could be related to care provided during the intervening planned readmission rather than during the index admission.
Numerator Details	The measure counts readmissions to any acute care hospital for any cause within 30 days of the date of discharge of the index THA and/or TKA hospitalization, excluding planned readmissions as defined below.	The composite complication is a dichotomous outcome (yes for any complication(s); no for no complications). Therefore, if a patient experiences one or more complications, the outcome variable will get coded as a "yes".	Outcome definition The measure counts readmissions to any short-term acute care hospital for any cause within 30 days of the date of discharge from an eligible

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
	Planned Readmission Algorithm (Version 4.0) The Planned Readmission Algorithm is a set of criteria for classifying readmissions as planned among the general Medicare population using Medicare administrative claims data. The algorithm identifies admissions that are typically planned and may occur within 30 days of discharge from the hospital. The Planned Readmission Algorithm has three fundamental principles: 1. A few specific, limited types of care are always considered planned (transplant surgery, maintenance chemotherapy/immunotherapy, and rehabilitation); 2. Otherwise, a planned readmission is defined as a non-acute readmission for a scheduled procedure; and 3. Admissions for acute illness or for complications of care are never planned. The algorithm was developed in 2011 as part of the Hospital-Wide Readmission measure. In 2013, CMS applied the algorithm to its other readmission measures. In applying the algorithm to condition- and procedure-specific measures, teams of clinical experts reviewed the algorithm in the context of each measure-specific patient cohort and, where clinically indicated, adapted the content of the algorithm to better reflect the likely clinical	Complications are counted in the measure only if they occur during the index hospital admission (and are not present on admission) or during a readmission. The complications captured in the numerator are identified during the index admission OR associated with a readmission up to 90 days post-date of index admission, depending on the complication. The follow-up period for complications from date of index admission is as follows: The follow-up period for AMI, pneumonia, and sepsis/septicemia/shock is seven days from the date of index admission because these conditions are more likely to be attributable to the procedure if they occur within the first week after the procedure. Additionally, analyses indicated a sharp decrease in the rate of these complications after seven days. Death, surgical site bleeding, and pulmonary embolism are followed for 30 days following admission because clinical experts agree these complications are still likely attributable to the hospital performing the procedure during this period and rates for these complications remained elevated until roughly 30 days post admission. The measure follow-up period is 90 days after admission for mechanical complications and periprosthetic joint infection/wound infection. Experts agree that mechanical complications and periprosthetic joint infection/wound infections due to the index THA/TKA occur up to 90 days following THA/TKA.	index admission, excluding planned readmissions as defined below. Rationale From a patient perspective, an unplanned readmission from any cause is an adverse event. Outcomes occurring within 30 days of discharge can be influenced by hospital care and the early transition to the non-acute care setting. The 30-day time frame is a clinically meaningful period for hospitals to collaborate with their communities to reduce readmissions. However, planned readmissions are generally not a signal of quality of care. Including planned readmissions in a readmission measure could create a disincentive to provide appropriate care to patients who are scheduled for elective or necessary procedures within 30 days of discharge. It is important to note that for the HWR measure, a readmission is included as an index admission if it meets all other eligibility criteria. This differs from the publicly reported condition-specific and procedure-specific readmission measures, which do not consider a readmission as a new index admission within the same measure. Planned Readmission Algorithm (Version 4.0) The Planned Readmission Algorithm is a set of criteria for classifying readmissions as planned among the general Medicare population using Medicare administrative claims data. The algorithm identifies admissions that are typically planned and may occur within 30 days of discharge from the hospital. The Planned Readmission Algorithm has three fundamental principles:

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
	experience of each measure's patient cohort. The planned readmission algorithm is applied to the THA/TKA readmission measure with small modifications. The Planned Readmission Algorithm and associated code tables are attached in data field S.2b (Data Dictionary or Code Table).	The measure counts all complications occurring during the index admission regardless of when they occur. For example, if a patient experiences an AMI on day 10 of the index admission, the measure will count the AMI as a complication, although the specified follow-up period for AMI is seven days. Clinical experts agree with this approach, as such complications likely represent the quality of care provided during the index admission. As of 2014 reporting, the measure does not count complications in the complications outcome that are coded as present on admission (POA) during the index admission; this prevents identifying a condition as a complication of care if it was present on admission for the THA/TKA procedure. For full list of codes defining complications, see the Data Dictionary attached in field S.2b.	1. A few specific, limited types of care are always considered planned (obstetric delivery, transplant surgery, maintenance chemotherapy/radiotherapy/immunotherapy, rehabilitation); 2. Otherwise, a planned readmission is defined as a non-acute readmission for a scheduled procedure; and 3. Admissions for acute illness or for complications of care are never planned. The algorithm was developed in 2011 as part of the HWR measure. In 2013, CMS applied the algorithm to its other readmission measures. For more details on the Planned Readmission Algorithm, please see Appendix E of the report titled "2019 All-Cause Hospital-Wide Measure Updates and Specifications Report: Hospital-Wide Readmission" Wallace Lori, Grady J, Djordjevic Darinka, et al. 2019 All-Cause Hospital Wide Measure Updates and Specifications Report.
Denominator Statement	The target population for the publicly reported measure includes admissions for Medicare FFS beneficiaries who are at least 65 years of age undergoing elective primary THA and/or TKA procedures. Additional details are provided in S.9 Denominator Details.	The target population for the publicly reported measure includes admissions for Medicare FFS beneficiaries who are at least 65 years of age undergoing elective primary THA and/or TKA procedures. Additional details are provided in S.7 Denominator Details.	The measure includes admissions for Medicare beneficiaries who are 65 years and older and are discharged from all non-federal, acute care inpatient US hospitals (including territories) with a complete claims history for the 12 months prior to admission. ACR-Specific: The measure at the ACO level includes all relevant admissions for ACO assigned beneficiaries who are 65 and older, and are discharged from all non-Federal short-stay acute care hospitals, including critical access hospitals.

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
			Additional details are provided in S.7 Denominator Details.
Denominator Details	To be included in the measure cohort used in public reporting, patients must meet the following additional inclusion criteria: *Enrolled in Medicare FFS Part A and Part B Medicare for the 12 months prior to the date of admission; and enrolled in Part A during the index admission;* *Aged 65 or over;* *Discharged alive from a non-federal acute care hospital; and* *Have a qualifying elective primary THA/TKA procedure; elective primary THA/TKA procedures defined as those procedures without any of the following:* • Femur, hip, or pelvic fractures coded in principal or secondary discharge diagnosis fields of the index admission; • Partial hip arthroplasty (PHA) procedures with a concurrent THA/TKA; • Revision procedures with a concurrent THA/TKA; • Resurfacing procedures with a concurrent THA/TKA; • Mechanical complication coded in the principal discharge diagnosis field; • Malignant neoplasm of the pelvis, sacrum, coccyx, lower limbs, or bone/bone marrow or a	To be included in the measure cohort used in public reporting, patients must meet the following additional inclusion criteria: *Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of admission; and enrolled in Part A during the index admission;* *Aged 65 or older* *Having a qualifying elective primary THA/TKA procedure; elective primary THA/TKA procedures are defined as those procedures without any of the following:* • Fracture of the pelvis or lower limbs coded in the principal or secondary discharge diagnosis fields on the index admission claim (Note: Periprosthetic fractures must be additionally coded as present on admission [POA] in order to disqualify a THA/TKA from cohort inclusion, unless exempt from POA reporting.); • A concurrent partial hip or knee arthroplasty procedure; • A concurrent revision, resurfacing, or implanted device/prosthesis removal procedure; • Mechanical complication coded in the principal discharge diagnosis field on the index admission claim; • Malignant neoplasm of the pelvis, sacrum, coccyx, lower limbs, or	To be included in the measure cohort, patients must meet the following inclusion criteria: *Enrolled in Medicare FFS Part A for the 12 months prior to the date of admission and during the index admission;* *Aged 65 or older;* *Discharged alive from a non-federal short-term acute care hospital; and* *Not transferred to another acute care facility.* ACR- Specific: An additional criterion for the ACO version of this measure is that only hospitalizations for ACO-assigned beneficiaries that meet all of the other criteria listed above are included. The cohort definition is otherwise identical to that of the HWR described below. The measure first assigns admissions with qualifying Agency for Healthcare Research and Quality (AHRQ) Clinical Classifications Software (CCS) procedure categories to the Surgery/Gynecology Cohort. This cohort includes admissions likely cared for by surgical or gynecological teams. The measure then sorts admissions into one of the four remaining specialty cohorts based on the AHRQ CCS diagnosis category of the principal discharge diagnosis: The Cardiorespiratory Cohort includes several condition categories with very high readmission rates such as pneumonia, chronic obstructive pulmonary disease, and heart failure. These admissions are combined into a single cohort

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
	disseminated malignant neoplasm coded in the principal discharge diagnosis field; • Removal of implanted devices/prostheses; or • Transfer from another acute care facility for the THA/TKA This measure can also be used for an all-payer population aged 18 years and older. We have explicitly tested the measure in both patients aged 18 years and older and those aged 65 years or older (see Testing Attachment for details, 2b4.11).	bone/bone marrow or a disseminated malignant neoplasm coded in the principal discharge diagnosis field on the index admission claim; or, • Transfer from another acute care facility for the THA/TKA. Patients are eligible for inclusion in the denominator if they had an elective primary THA and/or a TKA AND had continuous enrollment in Part A and Part B Medicare fee-for-service (FFS) 12 months prior to the date of index admission. This measure can also be used for an all-payer population aged 18 years and older. We have explicitly tested the measure in both patients aged 18+ years and those aged 65+ years (see Testing Attachment for details).	because they are often clinically indistinguishable, and patients are often simultaneously treated for several of these diagnoses. The Cardiovascular Cohort includes condition categories such as acute myocardial infarction that in large hospitals might be cared for by a separate cardiac or cardiovascular team. The Neurology Cohort includes neurologic condition categories such as stroke that in large hospitals might be cared for by a separate neurology team. The Medicine Cohort includes all non-surgical patients who were not assigned to any of the other cohorts. The full list of the specific diagnosis and procedure AHRQ CCS categories used to define the specialty cohorts can be found in the attached data dictionary.
Exclusions	The THA/TKA readmission measure excludes admissions for patients: 1. Without at least 30 days post-discharge enrollment in FFS Medicare; 2. Who were discharged against medical advice (AMA); 3. Admitted for the index procedure and subsequently transferred to another acute care facility; 4. Who had more than two THA/TKA procedure codes during the index hospitalization; or 5. Who had THA/TKA admissions within 30 days of a prior THA/TKA index admission.	This measure excludes index admissions for patients: 1. Without at least 90 days post-discharge enrollment in FFS Medicare; 2. Who were discharged against medical advice (AMA); or, 3. Who had more than two THA/TKA procedure codes during the index hospitalization. 4. After applying these exclusion criteria, we randomly select one index admission for patients with multiple index admissions in a calendar year. We therefore exclude the other eligible index admissions in that year.	Both the original HWR and ACR versions of the measure exclude index admissions for patients: 1. Admitted to Prospective Payment System (PPS)-exempt cancer hospitals; 2. Without at least 30 days post-discharge enrollment in Medicare FFS; 3. Discharged against medical advice; 4. Admitted for primary psychiatric diagnoses; 5. Admitted for rehabilitation; or 6. Admitted for medical treatment of cancer.

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
Exclusion Details	This measure excludes index admissions for patients: Without at least 30 days of post-discharge enrollment in FFS Medicare as determined by examining the Medicare Enrollment Database (EDB). Rationale: The 30-day readmission outcome cannot be assessed in this group since claims data are used to determine whether a patient was readmitted. Discharges against medical advice (AMA) are identified using the discharge disposition indicator in claims data. Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge. Admitted for the index procedure and subsequently transferred to another acute care facility, which are defined as when a patient with an inpatient hospital admission (with at least one qualifying THA/TKA procedure) is discharged from an acute care hospital and admitted to another acute care hospital on the same or next day. Rationale: Patients admitted for the index procedure and subsequently transferred to another acute care facility are excluded, as determining which hospital the readmission outcome should be attributed to is difficult.	This measure excludes index admissions for patients: Without at least 90 days post-discharge enrollment in FFS Medicare Rationale: The 90-day complication outcome cannot be assessed in this group since claims data are used to determine whether a complication of care occurred. Who were discharged against medical advice (AMA); or, Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge. Who had more than two THA/TKA procedure codes during the index hospitalization Rationale: Although clinically possible, it is highly unlikely that patients would receive more than two elective THA/TKA procedures in one hospitalization, which may reflect a coding error.	Both the original HWR and ACR versions of the measure exclude index admissions for patients: Admitted to PPS-exempt cancer hospitals; identified by the Medicare provider ID Rationale: These hospitals care for a unique population of patients that cannot reasonably be compared to patients admitted to other hospitals. Without at least 30 days of post-discharge enrollment in Medicare FFS; determined using data captured in the Medicare Enrollment Database (EDB) Rationale: The 30-day readmission outcome cannot be assessed in this group since claims data are used to determine whether a patient was readmitted. Discharged against medical advice; identified using the discharge disposition indicator in claims data. Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge. Admitted for primary psychiatric diagnoses Rationale: Patients admitted for psychiatric treatment are typically cared for in separate psychiatric or rehabilitation centers that are not comparable to short-term acute care hospitals. Admitted for rehabilitation Rationale: These admissions are not typically to a short-term acute care hospital and are not for acute care. Admitted for medical treatment of cancer Rationale: These admissions have a different mortality and readmission profile than the rest of

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
	Who had more than two THA/TKA procedure codes during the index hospitalization, which is identified by examining procedure codes in the claims data. Rationale: Although clinically possible, it is highly unlikely that patients would receive more than two elective THA/TKA procedures in one hospitalization, which may reflect a coding error. Who had THA/TKA admissions within 30 days prior to THA/TKA index admission. Rationale: Additional THA/TKA admissions within 30 days are excluded as index admissions because they are part of the outcome. A single admission does not count as both an index admission and a readmission for another index admission.		the Medicare population, and outcomes for these admissions do not correlate well with outcomes for other admissions. Patients with cancer admitted for other diagnoses or for surgical treatment of their cancer remain in the measure.
Risk Adjustment	Statistical risk model 112469| 109921| 118210| 135810| 117446| 146637| 141015 112469| 109921| 118210| 135810| 117446| 146637| 141015	Statistical risk model 112469| 118210| 137301| 146637| 141015 112469| 118210| 137301| 146637| 141015	Statistical risk model 112469| 118210| 135810| 141973| 146637| 146313 112469| 118210| 135810| 141973| 146637| 146313
Stratification	N/A	N/A	N/A
Type Score	Rate/proportion better quality = lower score	Rate/proportion better quality = lower score	Rate/proportion better quality = lower score
Algorithm	The measure estimates hospital-level 30-day all-cause RSRRs following elective primary THA/TKA using hierarchical logistic regression models. In brief, the approach simultaneously models data at the patient and hospital levels to account for variance in patient outcomes within and between	The measure estimates hospital-level RSCRs following elective primary THA/TKA using hierarchical logistic regression models. In brief, the approach simultaneously models data at the patient and hospital levels to account for variance in patient outcomes within and between hospitals (Normand and Shahian,	The measure estimates hospital-level 30-day all-cause RSRRs using hierarchical logistic regression models. In brief, the approach simultaneously models data at the patient and hospital levels to account for variance in patient outcomes within and between hospitals (Normand et al., 2007). At the patient level, it models the log-odds of

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
	hospitals (Normand and Shahian, 2007). At the patient level, it models the log-odds of readmission within 30 days of discharge using age, sex, selected clinical covariates, and a hospital-specific intercept. At the hospital level, it models the hospital-specific intercepts as arising from a normal distribution. The hospital intercept represents the underlying risk of a readmission at the hospital, after accounting for patient risk. The hospital-specific intercepts are given a distribution to account for the clustering (non-independence) of patients within the same hospital. If there were no differences among hospitals after adjusting for patient risk, the hospital intercepts should be identical across all hospitals. The RSRR is calculated as the ratio of the number of "predicted" to the number of "expected" readmission at a given hospital, multiplied by the national observed readmission rate. For each hospital, the numerator of the ratio is the number of readmissions within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of readmissions expected based on the nation's performance with that hospital's case mix. This approach is analogous to a ratio of "observed" to "expected" used in other types of statistical analyses. It conceptually allows for a comparison of a particular hospital's performance given its case mix to an	2007). At the patient level, it models the log-odds of a complication occurring within 90 days of the index admission using age, sex, selected clinical covariates, and a hospital-specific intercept. At the hospital level, it models the hospital-specific intercepts as arising from a normal distribution. The hospital intercept represents the underlying risk of a complication at the hospital, after accounting for patient risk. The hospital-specific intercepts are given a distribution to account for the clustering (non-independence) of patients within the same hospital. If there were no differences among hospitals, then after adjusting for patient risk, the hospital intercepts should be identical across all hospitals. The RSCR is calculated as the ratio of the number of "predicted" to the number of "expected" admissions with a complication at a given hospital, multiplied by the national observed complication rate. For each hospital, the numerator of the ratio is the number of complications within 90 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of complications expected based on the nation's performance with that hospital's case mix. This approach is analogous to a ratio of "observed" to "expected" used in other types of statistical analyses. It conceptually allows for a comparison of a particular hospital's performance given its case mix to an average hospital's performance with the same case mix. Thus, a lower ratio indicates lower-than-expected complication rates or better quality,	hospital readmission within 30 days of discharge using age, selected clinical covariates, and a hospital-specific effect. At the hospital level, the approach models the hospital-specific effects as arising from a normal distribution. The hospital effect represents the underlying risk of a readmission at the hospital, after accounting for patient risk. The hospital-specific effects are given a distribution to account for the clustering (non-independence) of patients within the same hospital (Normand et al., 2007). If there were no differences among hospitals, then after adjusting for patient risk, the hospital effects should be identical across all hospitals. Admissions are assigned to one of five mutually exclusive specialty cohort groups consisting of related conditions or procedures. For each specialty cohort group, the SRR is calculated as the ratio of the number of "predicted" readmissions to the number of "expected" readmissions at a given hospital. For each hospital, the numerator of the ratio is the number of readmissions within 30 days, predicted based on the hospital's performance with its observed case mix and service mix, and the denominator is the number of readmissions expected based on the nation's performance with that hospital's case mix and service mix. This approach is analogous to a ratio of "observed" to "expected" used in other types of statistical analyses. It conceptually allows a particular hospital's performance, given its case mix and service mix, to be compared to an average hospital's performance with the same case mix and service mix. Thus, a lower ratio indicates lower-than-expected readmission rates

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
	average hospital's performance with the same case mix. Thus, a lower ratio indicates lower-than-expected readmission rates or better quality, and a higher ratio indicates higher-than-expected readmission rates or worse quality. The "predicted" number of readmissions (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of readmission. The estimated hospital-specific intercept is added to the sum of the estimated regression coefficients multiplied by the patient characteristics. The results are transformed and summed over all patients attributed to a hospital to get a predicted value. The "expected" number of readmissions (the denominator) is obtained in the same manner, but a common intercept using all hospitals in our sample is added in place of the hospital-specific intercept. The results are transformed and summed over all patients in the hospital to get an expected value. To assess hospital performance for each reporting period, we re-estimate the model coefficients using the years of data in that period. This calculation transforms the ratio of predicted over expected into a rate that is compared to the national observed readmission rate. The hierarchical logistic regression models are described fully in the original methodology report (Grosso et al., 2012), which is also posted on QualityNet.	and a higher ratio indicates higher-than-expected complication rates or worse quality. The "predicted" number of admissions with a complication (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of having an admission with a complication. The estimated hospital-specific intercept is added to the sum of the estimated regression coefficients multiplied by the patient characteristics. The results are log transformed and summed over all patients attributed to a hospital to get a predicted value. The "expected" number of admissions with a complication (the denominator) is obtained in the same manner, but a common intercept using all hospitals in our sample is added in place of the hospital-specific effect. The results are log transformed and summed over all patients in the hospital to get an expected value. To assess hospital performance for each reporting period, we re-estimate the model coefficients using the years of data in that period. This calculation transforms the ratio of predicted over expected into a rate that is compared to the national observed complication rate. The hierarchical logistic regression models are described fully in the original methodology report posted on QualityNet:. References: Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 112469| 118210| 137301| 146637| 141015	or better quality, while a higher ratio indicates higher-than-expected readmission rates or worse quality. For each specialty cohort, the "predicted" number of readmissions (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific effect on the risk of readmission. The estimated hospital-specific effect for each cohort is added to the sum of the estimated regression coefficients multiplied by patient characteristics. The results are log-transformed and summed over all patients attributed to a hospital to calculate a predicted value. The "expected" number of readmissions (the denominator) is obtained in the same manner, but a common effect using all hospitals in our sample is added in place of the hospital-specific effect. The results are log-transformed and summed over all patients attributed to a hospital to calculate an expected value. To assess hospital performance for each reporting period, we re-estimate the model coefficients using the data in that period. The specialty cohort SRRs are then pooled for each hospital using a volume-weighted geometric mean to create a hospital-wide combined SRR. The combined SRR is multiplied by the national observed readmission rate to produce the RSRR. The statistical modeling approach is described fully in the original methodology report (Horwitz et al., 2012). ACR-specific: The ACR quality measure was adapted from the HWR quality measure. The unit of analysis was changed from the hospital to the

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
	References: Grosso L, Curtis J, Geary L, et al. Hospital-level 30-Day All-Cause Risk-Standardized Readmission Rate Following Elective Primary Total Hip Arthroplasty (THA) And/Or Total Knee Arthroplasty (TKA) Measure Methodology Report. 2012. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 112469 | 109921| 118210 | 135810| 117446 | 146637| 141015		ACO. This was possible because both the HWR and ACR measures assess readmission performance for a population that clusters patients together (either in hospitals or in ACOs). The goal is to isolate the effects of beneficiary characteristics on the probability that a patient will be readmitted from the effects of being in a specific hospital or ACO. In addition, planned readmissions are excluded for the ACR quality measure in the same way that they are excluded for the HWR measure. The ACR measure is calculated identically to what is described above for the HWR measure. References: Horwitz L, Partovian C, Lin Z, et al. Hospital-Wide All-Cause Unplanned Readmission Measure: Final Technical Report. 2012; Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 112469| 118210| 135810| 141973 | 146637| 146313
Submission items	5.1 Identified measures: 0505 : Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization. 0506 : Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization 1550 : Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	5.1 Identified measures: 1551 : Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) 3493 : Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups 5a.1 Are specs completely harmonized? Yes	5.1 Identified measures: 0695 : Hospital 30-Day Risk-Standardized Readmission Rates following Percutaneous Coronary Intervention (PCI) 0329 : Risk-Adjusted 30-Day All-Cause Readmission Rate 0330 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization 0505 : Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
	1789 : Hospital-Wide All-Cause Unplanned Readmission Measure (HWR) 3493 : Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: We did not include in our list of related measures any non-outcome measures (for example, process measures) with the same target population as our measure. Because this is an outcome measure, clinical coherence of the cohort takes precedence over alignment with related non-outcome measures. Furthermore, non-outcome measures are limited due to broader patient exclusions. This is because they typically only include a specific subset of patients who are eligible for that measure (for example, patients who receive a specific medication or undergo a specific procedure). 5b.1 If competing, why superior or rationale for additive value: N/A	5a.2 If not completely harmonized, identify difference, rationale, impact: We did not include in our list of related measures any non-outcome measures (for example, process measures) with the same target population as our measure. Because this is an outcome measure, clinical coherence of the cohort takes precedence over alignment with related non-outcome measures. Furthermore, non-outcome measures are limited due to broader patient exclusions. This is because they typically only include a specific subset of patients who are eligible for that measure (for example, patients who receive a specific medication or undergo a specific procedure). 5b.1 If competing, why superior or rationale for additive value: N/A	0506 : Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization 1551 : Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) 1768 : Plan All-Cause Readmissions (PCR) 1891 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following chronic obstructive pulmonary disease (COPD) hospitalization 5a.1 Are specs completely harmonized? No 5a.2 If not completely harmonized, identify difference, rationale, impact: This measure and the National Committee for Quality Assurance (NCQA) Plan All-Cause Readmissions (PCR) Measure #1768 are related measures, but are not competing because they don't have the same measure focus and same target population. In addition, both have been previously harmonized to the extent possible under the guidance of the National Quality Forum Steering Committee in 2011. Each of these measures has different specifications. NCQA's Measure #1768 counts the number of inpatient stays for patients aged 18 and older during a measurement year that were followed by an acute readmission for any diagnosis to any hospital within 30 days. It contrasts this count with a calculation of the predicted probability of an acute readmission. NCQA's measure is intended for quality

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
			monitoring and accountability at the health plan level. This measure estimates the risk-standardized rate of unplanned, all-cause readmissions to a hospital or ACO for any eligible condition within 30 days of hospital discharge for patients aged 18 and older. The measure will result in a single summary risk-adjusted readmission rate for conditions or procedures that fall under five specialties: surgery/gynecology, general medicine, cardiorespiratory, cardiovascular, and neurology. This measure is specified for evaluating hospital or ACO performance. However, despite these differences in cohort specifications, both measures under NQF guidance have been harmonized to the extent possible through modifications such as exclusion of planned readmissions. We did not include in our list of related measures any non-outcome (e.g., process) measures with the same target population as our measure. Because this is an outcome measure, clinical coherence of the cohort takes precedence over alignment with related non-outcome measures. Furthermore, non-outcome measures are limited due to broader patient exclusions. This is because they typically only include a specific subset of patients who are eligible for that measure (for example, patients who receive a specific medication or undergo a specific procedure). 5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #1551 and NQF #3493

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
Steward	Centers for Medicare & Medicaid Services	Centers for Medicare & Medicaid Services
Description	The measure estimates a hospital-level risk-standardized readmission rate (RSRR) following elective primary THA and/or TKA in Medicare Fee-For-Service (FFS) beneficiaries who are 65 years and older. The outcome (readmission) is defined as unplanned readmission for any cause within 30 days of the discharge date for the index admission (the admission included in the measure cohort). A specified set of planned readmissions do not count in the readmission outcome.	This measure is a re-specified version of the measure, "Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)" (NQF 1550), which was developed for patients 65 years and older using Medicare claims data. This re-specified measure attributes outcomes to MIPS participating Eligible Clinicians and/or Eligible Clinician Groups ("providers"), rather than to hospitals, and assesses each provider's complication rate, defined as any one of the specified complications occurring from the date of index admission to 90 days post date of the index admission (the admission included in the measure cohort).
Type	Outcome	Outcome
Data Source	Claims, Enrollment Data Data sources for the Medicare FFS measure: Medicare Part A Inpatient and Part B Outpatient Claims: This data source contains claims data for FFS inpatient and outpatient services including Medicare inpatient hospital care, outpatient hospital services, as well as inpatient and outpatient physician claims for the 12 months prior to an index admission. Medicare Enrollment Database (EDB): This database contains Medicare beneficiary demographic, benefit/coverage, and vital status information. This data source was used to obtain information on several inclusion/exclusion indicators such as Medicare status on admission as well as vital status. These data have previously been shown to accurately reflect patient vital status (Fleming et al., 1992). The Master Beneficiary Summary File (MBSF) is an annually created file derived from the EDB that contains enrollment information for all Medicare beneficiaries including dual eligible status. Years 2016-2019 were used. The American Community Survey (2013-2017): We used the American Community Survey (2013-2017) to derive an updated Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES)	Claims, Enrollment Data Medicare administrative claims and enrollment data No data collection instrument provided Attachment

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
	index score at the patient nine-digit zip code level for use in studying the association between our measure and social risk factors (SRFs). Reference: Fleming C., Fisher ES, Chang CH, Bubolz D, Malenda J. Studying outcomes and hospital utilization in the elderly: The advantages of a merged data base for Medicare and Veterans Affairs Hospitals. Medical Care. 1992; 30(5): 377-91. No data collection instrument provided Attachment	
Level	Facility	Clinician : Group/Practice, Clinician : Individual
Setting	Inpatient/Hospital	Inpatient/Hospital, Outpatient Services
Numerator Statement	The outcome for this measure is 30-day readmissions. We define readmissions as inpatient admissions for any cause, with the exception of certain planned readmissions, within 30 days from the date of discharge of the index hospitalization. If a patient has more than one unplanned admission (for any reason) within 30 days after discharge from the index admission, only one is counted as a readmission. The measure looks for a dichotomous yes or no outcome of whether each admitted patient has an unplanned readmission within 30 days. However, if the first readmission after discharge is considered planned, any subsequent unplanned readmission is not counted as an outcome for that index admission, because the unplanned readmission could be related to care provided during the intervening planned readmission rather than during the index admission.	The outcome for this measure is any complication occurring during the index admission (not coded present on arrival) to 90 days post-date of the index admission. Complications other than mortality are counted in the measure only if they occur during the index hospital admission or during a readmission. This outcome is identical to that of the original hospital measure. Additional details are provided in S.5 Numerator Details.
Numerator Details	The measure counts readmissions to any acute care hospital for any cause within 30 days of the date of discharge of the index THA and/or TKA hospitalization, excluding planned readmissions as defined below. Planned Readmission Algorithm (Version 4.0) The Planned Readmission Algorithm is a set of criteria for classifying readmissions as planned among the general Medicare population using Medicare administrative claims data. The algorithm identifies admissions that are typically planned and may occur within 30 days of discharge from the hospital. The Planned Readmission Algorithm has three fundamental principles:	Outcome Definition The composite complication is a dichotomous outcome (yes for any complication(s); no for no complications) occurring within 90 days post-date of the index admission. Therefore, if a patient experiences one or more complications, the outcome variable will get coded as a "yes." The measure includes the following surgical complications: surgical site bleeding, mechanical complications, periprosthetic joint infection/wound infection; and also includes death as a complication. The measure also includes the following medical complications, as they are important in measuring overall quality: acute myocardial infarction

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
	A few specific, limited types of care are always considered planned (transplant surgery, maintenance chemotherapy/immunotherapy, and rehabilitation); *Otherwise, a planned readmission is defined as a non-acute readmission for a scheduled procedure; and* *Admissions for acute illness or for complications of care are never planned.* The algorithm was developed in 2011 as part of the Hospital-Wide Readmission measure. In 2013, CMS applied the algorithm to its other readmission measures. In applying the algorithm to condition- and procedure-specific measures, teams of clinical experts reviewed the algorithm in the context of each measure-specific patient cohort and, where clinically indicated, adapted the content of the algorithm to better reflect the likely clinical experience of each measure's patient cohort. The planned readmission algorithm is applied to the THA/TKA readmission measure with small modifications. The Planned Readmission Algorithm and associated code tables are attached in data field S.2b (Data Dictionary or Code Table).	(AMI), pneumonia, pulmonary embolism, and sepsis/septicemia/shock. Complications are counted in the measure only if they occur during the index hospital admission (and are not present on admission) or during a readmission. This outcome definition is identical to the Hospital-level RSCR following elective primary THA and/or TKA" (NQF 1550). The measure assesses a dichotomous yes or no outcome of whether each admitted patient experiences one or more of the complications defined below. Complications other than mortality are counted in the measure only if they occur during the index admission or require a readmission. The measure does not count complications that occur in the outpatient setting and do not require a readmission. The outcome is aligned with CMS's hospital-level THA/TKA complication measure. The measure defines a "complication" as: • Acute myocardial infarction (AMI), pneumonia, or sepsis/septicemia/shock during the index admission or a subsequent inpatient admission that occurs within 7 days from the start of the index admission; • Surgical site bleeding or pulmonary embolism during the index admission or a subsequent inpatient admission within 30 days from the start of the index admission; • Death during the index admission or within 30 days from the start of the index admission; • Mechanical complication or periprosthetic joint infection/wound infection during the index admission or a subsequent inpatient admission that occurs within 90 days from the start of the index admission. (See attached Data Dictionary for list of ICD-9 and 10 codes used to define complications). The measure counts all complications occurring during the index admission regardless of when they occur. For example, if a patient experiences an AMI on day 10 of the index admission, the measure will count the AMI as a complication, although the specified follow-up period for AMI is seven days. Clinical experts agree with this approach, as such complications likely represent the quality of care provided during the index admission.

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
		For the full list of ICD-9 and ICD-10 codes defining complications, see the Data Dictionary attached in field S.2b., sheets HK Complications I10-Outcome" and "Complication Codes ICD9."
Denominator Statement	The target population for the publicly reported measure includes admissions for Medicare FFS beneficiaries who are at least 65 years of age undergoing elective primary THA and/or TKA procedures. Additional details are provided in S.9 Denominator Details.	The target population for the measure includes admissions for Medicare FFS beneficiaries who are at least 65 years of age who have undergone elective primary THA and/or TKA procedures. Attribution of Index Admissions to Eligible Clinicians Each patient index admission (the admission during which the patient has the eligible THA/TKA procedure), and therefore their outcome (complication or no complication) is attributed to the Eligible Clinician who bills for the procedure (Billing Surgeon). Conceptually, the Billing Surgeon is the Clinician with the primary responsibility for the procedure and procedure related care. In practice, patients may have different claims for the same procedure, and so the billing surgeon is assigned through an algorithm that resolves ambiguities in billing. The algorithm uses billing claims to identify the clinician(s) who bills for a THA (CPT® code 27130) or TKA (CPT®® code 27447 or CPT® code 27446) (steps 1-3 below). These CPT® codes are representative of the THA and/or TKA procedures included in the measure cohort. If only one clinician bills for a THA (CPT® code 27130) or TKA (CPT® code 27446 or 27447) for a patient, the algorithm identifies and assigns this individual as the Billing Surgeon. If two or more clinicians bill for THA/TKA procedures (CPT® 27130, 27447, or 27446), the algorithm seeks to identify a 'key' physician among them. The algorithm identifies and excludes assignment to clinicians who were assistants-at-surgery (assistant surgeon with CPT® modifier 80 or 82, minimum assistant surgeon with CPT® modifier 81). In this step, the algorithm assigns the Billing Surgeon as the clinician who billed for a THA or TKA procedure and is not an assistant-at-surgery. If a single clinician who is not an assistant-at-surgery could not be identified for assignment, then the algorithm identifies whether there is

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
		a single clinician who was an orthopedic surgeon (Medicare Specialty Code 20) and assigns this as the Billing Surgeon. If the algorithm cannot identify a Billing Surgeon, it identifies whether an Operator is listed on the institutional claim. The algorithm then defaults assignment to the Operator listed on the institutional claim. Finally, if a Billing Surgeon or Operator cannot be identified with the steps above, the patient is not assigned to a clinician or group and is excluded from the measure. Attribution of Index Admissions to an Eligible Clinician Group CMS needs the flexibility to assign each eligible patient index admission to at least one Eligible Clinician and at least one Eligible Clinician group. This allows them the ability to report at either the Eligible Clinician or the Eligible Clinician Group level. Conceptually, these assignments should represent a consistent group of clinicians. That is, it would be confusing to assign a patient to Eligible Clinician A and also to Eligible Clinician Group B if Eligible Clinician A is not in that Group. The attribution methodology addresses this by using both individual and group identifiers. Every Medicare Eligible Clinician has a unique National Provider Identifier (NPI). Similarly, every Medicare Eligible Clinician Group has one or more Tax Identification Numbers (TINs), reflecting their practice setting(s). Each Eligible Clinician claim should include both their NPI and a TIN which identifies their "group" (which may consist only of that clinician if they are solo providers). Therefore, we identify clinicians for each patient index admission through the unique National Provider ID (NPI) and Tax ID (TIN) combination listed on a patient's claim. For a Billing Surgeon, the NPI and TIN are those on the procedure claim used to attribute the patient index admission. To identify the unique TIN/NPI combination for the Operator, the Operator's NPI is matched to the TIN with the most Part B allowed charges during the index admission or during the measurement year if the Operator did not bill during the index admission. Most NPIs are associated with only one TIN. A Clinician Group is set of Clinicians (NPI-TIN combinations) assigned to the same TIN.

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
		Additional details are provided in S.7 Denominator Details.
Denominator Details	To be included in the measure cohort used in public reporting, patients must meet the following additional inclusion criteria: Enrolled in Medicare FFS Part A and Part B Medicare for the 12 months prior to the date of admission; and enrolled in Part A during the index admission; Aged 65 or over; Discharged alive from a non-federal acute care hospital; and Have a qualifying elective primary THA/TKA procedure; elective primary THA/TKA procedures defined as those procedures without any of the following: • Femur, hip, or pelvic fractures coded in principal or secondary discharge diagnosis fields of the index admission; • Partial hip arthroplasty (PHA) procedures with a concurrent THA/TKA; • Revision procedures with a concurrent THA/TKA; • Resurfacing procedures with a concurrent THA/TKA; • Mechanical complication coded in the principal discharge diagnosis field; • Malignant neoplasm of the pelvis, sacrum, coccyx, lower limbs, or bone/bone marrow or a disseminated malignant neoplasm coded in the principal discharge diagnosis field; • Removal of implanted devices/prostheses; or • Transfer from another acute care facility for the THA/TKA This measure can also be used for an all-payer population aged 18 years and older. We have explicitly tested the measure in both patients aged 18 years and older and those aged 65 years or older (see Testing Attachment for details, 2b4.11).	To be included in the measure cohort used, patients must meet the following additional inclusion criteria: Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of admission; and enrolled in Part A during the index admission and for 90 days after discharge; Aged 65 or older; and Having a qualifying elective primary THA/TKA procedure. Elective primary THA/TKA procedures are defined as those procedures without any of the following: • Femur, hip, or pelvic fractures coded in the principal or secondary discharge diagnosis field of the index admission • Partial hip arthroplasty (PHA) procedures (with a concurrent THA/TKA); partial knee arthroplasty procedures are not distinguished by ICD9 codes and are currently captured by the THA/TKA measure • Revision procedures with a concurrent THA/TKA • Resurfacing procedures with a concurrent THA/TKA • Mechanical complication coded in the principal discharge • Malignant neoplasm of the pelvis, sacrum, coccyx, lower limbs, or bone/bone marrow or a disseminated malignant neoplasm coded in the principal discharge diagnosis field • Removal of implanted devises/prostheses • Transfer status from another acute care facility for the THA/TKA Patients are eligible for inclusion in the denominator if they had an elective primary THA and/or a TKA AND had continuous enrollment in Part A and Part B Medicare fee-for-service (FFS) 12 months prior to the date of index admission. Elective primary THA/TKA procedures are defined as those procedures without any of the 8 associated conditions or finding noted above.

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
		For a full list of ICD-9 and ICD-10 codes defining the following see attached Data Dictionary, sheets "I-10 Cohort Codes" and "I9 Cohort Codes." Additional details are provided in S.9 Denominator Details.
Exclusions	The THA/TKA readmission measure excludes admissions for patients: Without at least 30 days post-discharge enrollment in FFS Medicare; Who were discharged against medical advice (AMA); Admitted for the index procedure and subsequently transferred to another acute care facility; Who had more than two THA/TKA procedure codes during the index hospitalization; or 5. Who had THA/TKA admissions within 30 days of a prior THA/TKA index admission.	This measure excludes index admissions for patients: Who survived the index admission but without 90-day Medicare part A enrollment post discharge; Who were transferred in to the index hospital; Who leave the hospital against medical advice (AMA); With more than two THA/TKA procedures codes during the index hospitalization; or Who cannot be attributed to a billing surgeon or operator using claims data After applying the exclusion criteria above, we randomly select one index admission for patients with multiple index admissions in a calendar year. We therefore exclude the other eligible index admissions in that year.
Exclusion Details	This measure excludes index admissions for patients: 1. Without at least 30 days of post-discharge enrollment in FFS Medicare as determined by examining the Medicare Enrollment Database (EDB). 2. Rationale: The 30-day readmission outcome cannot be assessed in this group since claims data are used to determine whether a patient was readmitted. 3. Discharges against medical advice (AMA) are identified using the discharge disposition indicator in claims data. 4. Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge. 5. Admitted for the index procedure and subsequently transferred to another acute care facility, which are defined as when a patient with an inpatient hospital admission (with at least one qualifying THA/TKA procedure) is discharged from an	The measure excludes admissions for patients: 1. Who survived the index admission but without 90-day Medicare part A enrollment post discharge Rationale: Only patients with adequate claims data for attribution should be included in risk-adjustment model and the measure. 2. Who were transferred in to the index hospital Rationale: If the patient is transferred from another acute care facility to the hospital where the index procedure occurs, it is likely that the procedure is not elective, or that the admission is associated with an acute condition. 3. Who leave the hospital against medical advice (AMA) Rationale: Clinicians have limited opportunity to implement high quality care. 4. With more than two THA/TKA procedures codes during the index hospitalization

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
	acute care hospital and admitted to another acute care hospital on the same or next day. Rationale: Patients admitted for the index procedure and subsequently transferred to another acute care facility are excluded, as determining which hospital the readmission outcome should be attributed to is difficult. 1. Who had more than two THA/TKA procedure codes during the index hospitalization, which is identified by examining procedure codes in the claims data. Rationale: Although clinically possible, it is highly unlikely that patients would receive more than two elective THA/TKA procedures in one hospitalization, which may reflect a coding error. 2. Who had THA/TKA admissions within 30 days prior to THA/TKA index admission. Rationale: Additional THA/TKA admissions within 30 days are excluded as index admissions because they are part of the outcome. A single admission does not count as both an index admission and a readmission for another index admission.	Rationale: Although clinically possible, it is highly unlikely that patients would receive more than two elective THA/TKA procedures in one hospitalization, and this may reflect a coding error. 5. Who cannot be attributed to a billing surgeon or operator using claims data Rationale: Only patients with adequate clinician claims for attribution should be included in risk-adjustment model and the measure.
Risk Adjustment	Statistical risk model 112469| 109921| 118210| 135810| 117446| 146637| 141015 112469| 109921| 118210| 135810| 117446| 146637| 141015	Statistical risk model 146637| 110639| 146313 146637| 110639| 146313
Stratification	N/A	N/a
Type Score	Rate/proportion better quality = lower score	Rate/proportion better quality = lower score
Algorithm	The measure estimates hospital-level 30-day all-cause RSRRs following elective primary THA/TKA using hierarchical logistic regression models. In brief, the approach simultaneously models data at the patient and hospital levels to account for variance in patient outcomes within and between hospitals (Normand and Shahian, 2007). At the patient level, it models the log-odds of readmission within 30 days of discharge using age, sex, selected clinical covariates, and a hospital-specific intercept. At the hospital level, it models the hospital-specific intercepts as arising from a normal distribution. The hospital intercept represents the	In Dataset April 2013 to March 2016 (prior to exclusions being applied): We started with the hospital HKC measure cohort, with an initial index cohort size of 982,436 index admissions with an elective primary THA/TKA procedure. After applying exclusion criteria 1 through 4 listed in the table below, we have a cohort sample size of 935,029 index admissions. Our previous NQF filing for hospital HKC showed no bias introduced through the exclusion process for hospitals for this same cohort of 935,029 index admissions. We then further excluded 10,243 (1.0%) index admissions (criteria 5 and 6 below) which cannot be

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
	underlying risk of a readmission at the hospital, after accounting for patient risk. The hospital-specific intercepts are given a distribution to account for the clustering (non-independence) of patients within the same hospital. If there were no differences among hospitals after adjusting for patient risk, the hospital intercepts should be identical across all hospitals. The RSRR is calculated as the ratio of the number of "predicted" to the number of "expected" readmission at a given hospital, multiplied by the national observed readmission rate. For each hospital, the numerator of the ratio is the number of readmissions within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of readmissions expected based on the nation's performance with that hospital's case mix. This approach is analogous to a ratio of "observed" to "expected" used in other types of statistical analyses. It conceptually allows for a comparison of a particular hospital's performance given its case mix to an average hospital's performance with the same case mix. Thus, a lower ratio indicates lower-than-expected readmission rates or better quality, and a higher ratio indicates higher-than-expected readmission rates or worse quality. The "predicted" number of readmissions (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of readmission. The estimated hospital-specific intercept is added to the sum of the estimated regression coefficients multiplied by the patient characteristics. The results are transformed and summed over all patients attributed to a hospital to get a predicted value. The "expected" number of readmissions (the denominator) is obtained in the same manner, but a common intercept using all hospitals in our sample is added in place of the hospital-specific intercept. The results are transformed and summed over all patients in the hospital to get an expected value. To assess hospital performance for each reporting period, we re-estimate the model coefficients using the years of data in that period.	attributed to physician/physician group to create our final measure cohort. The measure estimates eligible clinician or clinician group ("provider")-level RSCRs following elective primary THA/TKA using hierarchical logistic regression models. In brief, the approach simultaneously models data at the patient and provider levels to account for variance in patient outcomes within and between hospitals (Normand and Shahian, 2007). At the patient level, it models the log-odds of a complication occurring within 90 days of the index admission using age, sex, selected clinical covariates, and a provider-specific intercept. At the provider level, it models the provider-specific intercepts as arising from a normal distribution. The provider intercept represents the underlying risk of a complication for patients treated by the provider, after accounting for patient risk. The provider-specific intercepts are given a distribution to account for the clustering (non-independence) of patients treated by the same provider. If there were no differences among providers, then after adjusting for patient risk, the provider intercepts should be identical across all providers. The RSCR is calculated as the ratio of the number of "predicted" to the number of "expected" admissions with a complication at a given provider, multiplied by the national observed complication rate. The "predicted" number of admissions with a complication (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the provider-specific intercept on the risk of having an admission with a complication. The estimated provider-specific intercept is added to the sum of the estimated regression coefficients multiplied by the patient characteristics. The results are log transformed and summed over all patients attributed to a provider to get a predicted value. The "expected" number of admissions with a complication (the denominator) is obtained in the same manner, but a common intercept using all providers in our sample is added in place of the provider-specific effect. The results are log transformed and summed over all patients in the provider to get an expected value. To assess provider performance

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
	This calculation transforms the ratio of predicted over expected into a rate that is compared to the national observed readmission rate. The hierarchical logistic regression models are described fully in the original methodology report (Grosso et al., 2012), which is also posted on QualityNet. References: Grosso L, Curtis J, Geary L, et al. Hospital-level 30-Day All-Cause Risk-Standardized Readmission Rate Following Elective Primary Total Hip Arthroplasty (THA) And/Or Total Knee Arthroplasty (TKA) Measure Methodology Report. 2012. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 112469| 109921| 118210| 135810| 117446| 146637| 141015	for each reporting period, we re-estimate the model coefficients using the years of data in that period. For each provider, the numerator of the ratio is the number of complications within 90 days predicted on the basis of the provider's performance with its observed case mix, and the denominator is the number of complications expected based on the nation's performance with that provider's case mix. This approach is analogous to a ratio of "observed" to "expected" used in other types of statistical analyses. It conceptually allows for a comparison of a particular provider's performance given its case mix to an average provider's performance with the same case mix. Thus, a lower ratio indicates lower-than-expected complication rates or better quality, and a higher ratio indicates higher-than-expected complication rates or worse quality. This calculation transforms the ratio of predicted over expected into a rate that is compared to the national observed complication rate. The hierarchical logistic regression models are described fully in the original methodology report (Grosso et al., 2012). References: Grosso L, Curtis J, Geary L, et al. Hospital-level Risk-Standardized Complication Rate Following Elective Primary Total Hip Arthroplasty (THA) And/Or Total Knee Arthroplasty (TKA) Measure Methodology Report. 2012. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226 146637| 110639| 146313
Submission items	5.1 Identified measures: 0505 : Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization. 0506 : Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization 1550 : Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	5.1 Identified measures: 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: The measure is fully harmonized with NQF #1550 regarding cohort definition, outcome, and risk adjustment approach. The only discrepancy is the attribution approach, which assigns each index admission to a

Measure	1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups
	1789 : Hospital-Wide All-Cause Unplanned Readmission Measure (HWR) 3493 : Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: We did not include in our list of related measures any non-outcome measures (for example, process measures) with the same target population as our measure. Because this is an outcome measure, clinical coherence of the cohort takes precedence over alignment with related non-outcome measures. Furthermore, non-outcome measures are limited due to broader patient exclusions. This is because they typically only include a specific subset of patients who are eligible for that measure (for example, patients who receive a specific medication or undergo a specific procedure). 5b.1 If competing, why superior or rationale for additive value: N/A	clinician rather than a hospital, and the exclusion of patients for which no billing surgeon or operator can be identified. 5b.1 If competing, why superior or rationale for additive value: Clinicians, particularly the surgeon performing the procedure, can influence the outcome of surgery for better or worse, both through their technical skill and through their influence on the care team and hospital safety culture. Therefore, many of the strategies and best practices used by hospitals to reduce the risk of complications can also be adopted by individual clinicians and groups of clinicians to improve patient outcomes. Further evidence of surgeons' influence are data indicating that increasing surgeon volume is associated with reductions in adverse surgical outcomes (Battaglia TC et al., 2006; Shervin et al., 2007). The THA/TKA risk-standardized complication rate (RSCR) measure for clinicians is thus intended to inform quality-of-care improvement efforts, as individual process-based performance measures cannot encompass all the complex and critical aspects of care that contribute to patient outcomes. It also complements the hospital measure as a proportion of surgeons have very different performance quality than the institutions in which they perform surgery; this measure provides a transparent reflection of these discordances to further support quality improvement. References: Battaglia TC, Mulhall KJ, Brown TE, Saleh KJ. Increased surgical volume is associated with lower THA dislocation rates. Clin Orthop Relat Res. 2006 Jun;447:28-33. Shervin N, Rubash HE, Katz JN. Orthopaedic procedure volume and patient outcomes: a systematic literature review. Clin Orthop Relat Res. 2007 Apr;457:35-41.

Comparison of NQF #3030, NQF #0696, and NQF #2561

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
Steward	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons
Description	The STS Individual Surgeon Composite Measure for Adult Cardiac Surgery includes five major procedures (isolated CABG, isolated AVR, AVR+CABG, MVRR, MVRR+CABG) and comprises the following two domains: Domain 1 – Risk-Adjusted Operative Mortality Operative mortality is defined as death before hospital discharge or within 30 days of the operation. Domain 2 – Risk-Adjusted Major Morbidity Major morbidity is defined as the occurrence of any one or more of the following major complications: 1. Prolonged ventilation, 2. Deep sternal wound infection, 3. Permanent stroke, 4. Renal failure, and 5. Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons. All measures are based on audited clinical data collected in the STS Adult Cardiac Surgery Database. Individual surgeons with at least 100 eligible cases during the 3-year measurement window will receive a score for each domain and an overall composite score. In addition to calculating	The STS CABG Composite Score comprises four domains consisting of 11 individually NQF-endorsed cardiac surgery measures: Domain 1) Absence of Operative Mortality – Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death during the same hospitalization as surgery or after discharge but within 30 days of the procedure; Domain 2) Absence of Major Morbidity – Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as having at least one of the following adverse outcomes: 1. reoperations for any cardiac reason, 2. renal failure, 3. deep sternal wound infection, 4. prolonged ventilation/intubation, 5. cerebrovascular accident/permanent stroke; Domain 3) Use of Internal Mammary Artery (IMA) – Proportion of first-time CABG patients who receive at least one IMA graft; Domain 4) Use of All Evidence-based Perioperative Medications – Proportion of patients who receive all required perioperative medications for which they are eligible. The required perioperative medications are: 1. preoperative beta blockade therapy, 2. discharge anti-platelet medication, 3. discharge beta blockade therapy, and 4. discharge anti-lipid medication. All measures are based on audited clinical data collected in a prospective registry. Participants receive a score for each of the domains, plus an overall composite score. The overall composite	STS AVR Composite Score comprises two domains consisting of six measures: Domain 1) Absence of Operative Mortality – Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death during the same hospitalization as surgery or after discharge but within 30 days of the procedure; and Domain 2) Absence of Major Morbidity – Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as having at least one of the following adverse outcomes: 1. reoperations for any cardiac reason, 2. renal failure, 3. deep sternal wound infection, 4. prolonged ventilation/intubation, and 5. cerebrovascular accident/permanent stroke. All measures are based on audited clinical data collected in a prospective registry and are risk-adjusted. Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). Star ratings are publicly reported on the STS website and are also currently reported on the Consumer Reports website.

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
	composite score point estimates with credible intervals, surgeons will be assigned rating categories designated by the following: 1 star – lower-than-expected performance 2 stars – as-expected performance 3 stars – higher-than-expected performance	score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). For consenting participants, scores and star ratings are publicly reported on the STS website.	
Type	Composite	Composite	Composite
Data Source	Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.81 went live on July 1, 2014; STS Adult Cardiac Surgery Database – Version 2.9 went live on July 1st, 2017 and STS Adult Cardiac Surgery Database version 4.20 went live on June 30, 2020. The URL provided under S.1 is for the latest data collection form that is currently in use. Available at measure-specific web page URL identified in S.1 No data dictionary	Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.8 went live on July 1, 2014; STS Adult Cardiac Surgery Database Version 2.9 went live on July 1, 2017. Available at measure-specific web page URL identified in S.1 Attachment	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 Attachment
Level	Clinician : Individual	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice
Setting	Inpatient/Hospital	Inpatient/Hospital	Inpatient/Hospital
Numerator Statement	Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes in detail this multiprocedural, multidimensional composite measure. The STS Individual Surgeon Composite Measure for Adult Cardiac Surgery includes five major procedures, i.e.,	Please see Appendix	Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score. The STS AVR Composite Score comprises two domains consisting of six individual measures: 1. Absence of Operative Mortality

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
	isolated coronary artery bypass grafting (CABG), isolated aortic valve replacement (AVR), AVR+CABG, isolated mitral valve repair or replacement (MVRR), and MVRR+CABG, and comprises the following two domains: Domain 1 – Risk-Adjusted Operative Mortality Operative mortality is defined as death before hospital discharge or within 30 days of the operation. Domain 2 – Risk-Adjusted Major Morbidity Major morbidity is defined as the occurrence of any one or more of the following major complications: 1. Prolonged ventilation 2. Deep sternal wound infection 3. Permanent stroke 4. Renal failure and 5. Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons Individual surgeons with at least 100 eligible cases during the 3-year measurement window will receive a score for each domain and an overall composite score. In addition to calculating composite score point estimates with credible intervals, surgeons will be assigned rating categories designated by the following: 1 star – lower-than-expected performance 2 stars – as-expected performance		NQF # 0120 Risk-Adjusted Operative Mortality for AVR 2. Absence of Major Morbidity, scored any-or-none. The measures used are the same morbidity outcomes included in NQF #0696 STS CABG Composite Score. Risk-Adjusted Postoperative Stroke/Cerebrovascular Accident Risk-Adjusted Postoperative Surgical Re-exploration Risk-Adjusted Postoperative Deep Sternal Wound Infection Rate Risk-Adjusted Postoperative Renal Failure Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). Patient Population: The analysis population consists of adult patients aged 18 years or older who undergo isolated AVR surgery Time Period: 3 years Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 10 isolated AVR procedures in the patient population. Technical Details The unit of measurement for the STS AVR Composite Score can be either a participant (most

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
	3 stars – higher-than-expected performance Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated CABG, isolated AVR, AVR+CABG, isolated MVRR, and MVRR+CABG. Time Window: 3 years By including composite performance scores for a portfolio of five procedures that account for nearly 80% of a typical STS Adult Cardiac Surgery Database participant surgeon's clinical activity, this metric provides a more balanced and comprehensive perspective than focusing on just one procedure or one end point. Recognizing that surgeons' practices vary, each surgeon's composite performance is implicitly "weighted" by the proportion of each type of procedure he or she performs. For instance, the results of surgeons who primarily perform mitral procedures are affected most by their mitral surgery results. This approach is especially relevant for surgeons with highly specialized practices who may do relatively few isolated CABG procedures and whose performance would thus be difficult to assess using a CABG measure only. Finally, performance on each of these procedures is estimated using risk models specific to those procedures, in most cases the exact or slightly modified versions of previously published models (references provided below). Final Composite Score:		often a cardiac surgical practice but occasionally an individual surgeon) or a hospital. For the Absence of Operative Mortality domain, the NUMERATOR is: Number of patients undergoing isolated AVR who survived until after discharge and >30 days post-surgery For the Absence of Major Morbidity domain, the NUMERATOR is: Number of patients undergoing isolated AVR who did not experience any of the five specified major morbidity endpoints* *Morbidity endpoints consist of postoperative stroke/cerebrovascular accident, surgical re-exploration, deep sternal wound infection, renal failure, prolonged intubation (ventilation). Patients with documented history of renal failure (i.e., dialysis or baseline serum creatinine of 4.0 or higher) are excluded when counting renal failure outcomes. STS AVR risk models are used to estimate expected rates of mortality and any-or-none morbidity (Reference: O'Brien SM, Shahian DM, Filardo G, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 2—isolated valve surgery. Ann Thorac Surg 2009;88(1 Suppl):S23–42). To enhance interpretation, mortality rates are converted to survival rates (risk-standardized survival rate = 100 – risk-standardized mortality rate), and morbidity rates are converted to "absence of morbidity" rates (risk-standardized absence of morbidity rate =100 – risk-standardized morbidity rate). Defining scores in this manner ensures that increasingly positive values reflect better performance, which is easier for consumers to interpret.

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
	The overall composite score was calculated as a weighted sum of (1 minus risk-adjusted mortality rate) and (1 minus risk-adjusted major morbidity rate). Mortality and morbidity rates were weighted inversely by their respective standard deviations across surgeons. This procedure is equivalent to first rescaling mortality and morbidity rates by their respective standard deviations across surgeons and then assigning equal weighting to the rescaled mortality rate and rescaled morbidity rate. Standard deviations derived from the data were used to define the final composite measure as 0.81 x (1 minus risk-standardized mortality rate) + 0.19 x (1 minus risk-standardized complication rate). Details regarding the current STS adult cardiac surgery risk models can be found in the following manuscripts: Shahian DM, O'Brien SM, Filardo G, Ferraris VA, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 1--coronary artery bypass grafting surgery. Ann Thorac Surg. 2009 Jul;88(1 Suppl):S2-22. O'Brien SM, Shahian DM, Filardo G, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 2—isolated valve surgery. Ann Thorac Surg 2009;88(1 Suppl):S23–42. Shahian DM, O'Brien SM, Filardo G, Ferraris VA, et al. The Society of		(Please see the appendix for the formula used to calculate the overall composite score.) The method is equivalent to calculating a weighted average, with weights proportional to the inverse of the SD. In the most recent production of the STS AVR Composite Score based on data from July 2010 – June 2013, wtmort=0.79 and wtmorb = 0.21. Star Rating: Star ratings are derived by testing whether the participant's composite or domain score is significantly different from the overall STS average. For instance, if for each of the 2 composite score domains, a participant's estimated score is lower than the overall STS average, but the difference between the participant and STS is not statistically significant, the ratings would each be 2 stars. If however, for the overall composite, the point estimate is lower than the STS average, AND this difference is statistically significant, the overall participant star rating is 1 star. The fact that statistical significance was achieved for the composite score but not the individual domains reflects the greater precision of the composite score compared to individual endpoints. This precision is achieved by aggregating information across multiple endpoints instead of a single endpoint. Additional details regarding the AVR Composite Score are provided in the attached manuscript: Shahian DM, He X, Jacobs JP, et al. The Society of Thoracic Surgeons Isolated Aortic Valve Replacement (AVR) Composite Score: a report of the STS Quality Measurement Task Force. Ann Thorac Surg 2012;94:2166-71.

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
	Thoracic Surgeons 2008 cardiac surgery risk models: part 3--valve plus coronary artery bypass grafting surgery. Ann Thorac Surg 2009 Jul;88(1 Suppl):S43-62. Additional details regarding the Individual Surgeon Composite Measure for Adult Cardiac Surgery are provided in the attached manuscript: Shahian DM, He X, Jacobs JP, Kurlansky PA, Badhwar V, Cleveland JC Jr, Fazzalari FL, Filardo G, Normand SL, Furnary AP, Magee MJ, Rankin JS, Welke KF, Han J, O'Brien SM. The Society of Thoracic Surgeons Composite Measure of Individual Surgeon Performance for Adult Cardiac Surgery: A Report of The Society of Thoracic Surgeons Quality Measurement Task Force. Ann Thorac Surg. 2015;100:1315-25.		
Numerator Details	See response in S.4. Numerator Statement	Please see Appendix	Please see S.4 above
Denominator Statement	See response in S.4. Numerator Statement Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated CABG, isolated AVR, AVR+CABG, isolated MVRR, and MVRR+CABG.	Please see Appendix	Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score. The STS AVR Composite Score comprises two domains consisting of six individual measures: 1. Absence of Operative Mortality NQF # 0120 Risk-Adjusted Operative Mortality for AVR 2. Absence of Major Morbidity, scored any-or-none. The measures used are the same

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
			morbidity outcomes included in NQF #0696 STS CABG Composite Score. Risk-Adjusted Postoperative Stroke/Cerebrovascular Accident Risk-Adjusted Postoperative Surgical Re-exploration Risk-Adjusted Postoperative Deep Sternal Wound Infection Rate Risk-Adjusted Postoperative Renal Failure Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). Patient Population: The analysis population consists of adult patients aged 18 years or older who undergo isolated AVR surgery Time Period: 3 years Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 10 isolated AVR procedures in the patient population. Technical Details The unit of measurement for the STS AVR Composite Score can be either a participant (most often a cardiac surgical practice but occasionally an individual surgeon) or a hospital. For the Absence of Operative Mortality domain AND the Absence of Major Morbidity domain, the DENOMINATOR is:

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
			Number of patients undergoing isolated AVR during the measurement period STS AVR risk models are used to estimate expected rates of mortality and any-or-none morbidity (Reference: O'Brien SM, Shahian DM, Filardo G, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 2—isolated valve surgery. Ann Thorac Surg 2009;88(1 Suppl):S23–42). To enhance interpretation, mortality rates are converted to survival rates (risk-standardized survival rate = 100 – risk-standardized mortality rate), and morbidity rates are converted to "absence of morbidity" rates (risk-standardized absence of morbidity rate =100 – risk-standardized morbidity rate). Defining scores in this manner ensures that increasingly positive values reflect better performance, which is easier for consumers to interpret. (Please see the appendix for the formula used to calculate the overall composite score.) The method is equivalent to calculating a weighted average, with weights proportional to the inverse of the SD. In the most recent production of the STS AVR Composite Score based on data from July 2010 – June 2013, wtmort=0.79 and wtmorb = 0.21. Star Rating: Star ratings are derived by testing whether the participant's composite or domain score is significantly different from the overall STS average. For instance, if for each of the 2 composite score domains, a participant's estimated score is lower than the overall STS average, but the difference between the participant and STS is not statistically significant, the ratings would each be 2 stars. If however, for the overall composite, the point estimate is lower than the STS average, AND this difference is statistically significant, the overall

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
			participant star rating is 1 star. The fact that statistical significance was achieved for the composite score but not the individual domains reflects the greater precision of the composite score compared to individual endpoints. This precision is achieved by aggregating information across multiple endpoints instead of a single endpoint. Additional details regarding the AVR Composite Score are provided in the attached manuscript: Shahian DM, He X, Jacobs JP, et al. The Society of Thoracic Surgeons Isolated Aortic Valve Replacement (AVR) Composite Score: a report of the STS Quality Measurement Task Force. Ann Thorac Surg 2012;94:2166-71.
Denominator Details	See response in S.6. Denominator Statement	Please see Appendix	Please see S.6 above
Exclusions	Measure exclusions: Individual surgeons who do not meet the minimum case requirement (i.e., at least 100 eligible cases during the 3-year measurement window) will not receive a score for each domain and an overall composite score.	Please see Appendix	Please see S.6 above
Exclusion Details	See response in S.8. Denominator Exclusions	Please see Appendix	Please see S.6 above
Risk Adjustment	Statistical risk model 111855| 114638| 152617| 150289 111855| 114638| 152617| 150289	Statistical risk model 111855| 137290| 114638| 135810 111855| 137290| 114638| 135810	Statistical risk model 111855| 137290| 114638| 141015 111855| 137290| 114638| 141015
Stratification	N/A	N/A	N/A
Type Score	Rate/proportion better quality = higher score	Rate/proportion better quality = higher score	Rate/proportion better quality = higher score
Algorithm	Please see discussion under section S.4 and attached manuscripts. 111855| 114638| 152617| 150289	Please see discussion under section S.4 (Appendix) and attached articles. 111855| 137290| 114638| 135810	Please see S.4 and S.6 above 111855| 137290| 114638| 141015

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
Submission items	5.1 Identified measures: 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 0123 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) + CABG Surgery 0122 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Replacement + CABG Surgery 0121 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Replacement 0120 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) 0119 : Risk-Adjusted Operative Mortality for CABG 0118 : Anti-Lipid Treatment Discharge 0117 : Beta Blockade at Discharge 0116 : Anti-Platelet Medication at Discharge 0115 : Risk-Adjusted Surgical Re-exploration 0114 : Risk-Adjusted Postoperative Renal Failure 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0130 : Risk-Adjusted Deep Sternal Wound Infection 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0127 : Preoperative Beta Blockade 1501 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Repair 1502 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Repair + CABG Surgery 2514 : Risk-Adjusted Coronary Artery Bypass Graft (CABG) Readmission Rate 2683 : Risk-Adjusted Operative Mortality for Pediatric and Congenital Heart Surgery	5.1 Identified measures: 0120 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0115 : Risk-Adjusted Surgical Re-exploration 0130 : Risk-Adjusted Deep Sternal Wound Infection 0114 : Risk-Adjusted Postoperative Renal Failure 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
		5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A	

Comparison of NQF #3030, NQF #2563, and NQF #3031

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score
Steward	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons
Description	The STS Individual Surgeon Composite Measure for Adult Cardiac Surgery includes five major procedures (isolated CABG, isolated AVR, AVR+CABG, MVRR, MVRR+CABG) and comprises the following two domains: Domain 1 – Risk-Adjusted Operative Mortality Operative mortality is defined as death before hospital discharge or within 30 days of the operation. Domain 2 – Risk-Adjusted Major Morbidity Major morbidity is defined as the occurrence of any one or more of the following major complications: Prolonged ventilation, Deep sternal wound infection, Permanent stroke, Renal failure, and	The STS AVR+CABG Composite Score comprises two domains consisting of six measures: Domain 1) Absence of Operative Mortality – Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death during the same hospitalization as surgery or after discharge but within 30 days of the procedure; and Domain 2) Absence of Major Morbidity – Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as having at least one of the following adverse outcomes: 1. reoperations for any cardiac reason, 2. renal failure, 3. deep sternal wound infection, 4. prolonged ventilation/intubation, and 5. cerebrovascular accident/permanent stroke. All measures are based on audited clinical	The STS Mitral Valve Repair/Replacement (MVRR) Composite Score measures surgical performance for isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD). To assess overall quality, the STS MVRR Composite Score comprises two domains consisting of six measures: Domain 1 – Absence of Operative Mortality Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation. Domain 2 – Absence of Major Morbidity Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score
	Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons. All measures are based on audited clinical data collected in the STS Adult Cardiac Surgery Database. Individual surgeons with at least 100 eligible cases during the 3-year measurement window will receive a score for each domain and an overall composite score. In addition to calculating composite score point estimates with credible intervals, surgeons will be assigned rating categories designated by the following: 1 star – lower-than-expected performance 2 stars – as-expected performance 3 stars – higher-than-expected performance	data collected in a prospective registry and are risk-adjusted. Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). Star ratings are publicly reported on the STS website.	Prolonged ventilation, Deep sternal wound infection, Permanent stroke, Renal failure, and Reoperations for bleeding, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons. Outcome data are collected on all patients and from all participants. For optimal measure reliability, participants meeting a volume threshold of at least 36 cases over 3 years (i.e., approximately one mitral case per month) receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following: 1 star – lower-than-expected performance 2 stars – as-expected performance 3 stars – higher-than-expected performance
Type	Composite	Composite	Composite
Data Source	Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.81 went live on July 1, 2014; STS Adult Cardiac Surgery Database – Version 2.9 went live on July 1st, 2017 and STS Adult Cardiac Surgery Database version 4.20 went live on June 30, 2020. The URL provided under S.1 is for the latest data collection form that is currently in use. Available at measure-specific web page URL identified in S.1 No data dictionary	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 Attachment	Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.81 went live on July 1, 2014; STS Adult Cardiac Surgery Database – Version 2.9 went live on July 1st, 2017 and STS Adult Cardiac Surgery Database version 4.20 went live on June 30, 2020. The URL provided under S.1 is for the latest data collection form that is currently in use. Available at measure-specific web page URL identified in S.1 No data dictionary

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score
Level	Clinician : Individual	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice
Setting	Inpatient/Hospital	Inpatient/Hospital	Inpatient/Hospital
Numerator Statement	Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes in detail this multiprocedural, multidimensional composite measure. The STS Individual Surgeon Composite Measure for Adult Cardiac Surgery includes five major procedures, i.e., isolated coronary artery bypass grafting (CABG), isolated aortic valve replacement (AVR), AVR+CABG, isolated mitral valve repair or replacement (MVRR), and MVRR+CABG, and comprises the following two domains: Domain 1 – Risk-Adjusted Operative Mortality Operative mortality is defined as death before hospital discharge or within 30 days of the operation. Domain 2 – Risk-Adjusted Major Morbidity Major morbidity is defined as the occurrence of any one or more of the following major complications: Pro*longed ventilation* *Deep sternal wound infection* *Permanent stroke* *Renal failure and* *Reoperations for bleeding, coronary graft occlusion, prosthetic or nat*ive valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons	Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score. The STS AVR+CABG Composite Score comprises two domains consisting of six individual measures: 1. Absence of Operative Mortality NQF # 0123 Risk-Adjusted Operative Mortality for AVR+CABG Surgery 2. Absence of Major Morbidity, scored any-or-none. The measures used are the same morbidity outcomes included in NQF #0696 STS CABG Composite Score. Risk-Adjusted Postoperative Stroke/Cerebrovascular Accident Risk-Adjusted Postoperative Surgical Re-exploration Risk-Adjusted Postoperative Deep Sternal Wound Infection Rate Risk-Adjusted Postoperative Renal Failure Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by “rolling up” the domain scores into a single number. In addition to receiving a	Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score. The STS Mitral Valve Repair/Replacement (MVRR) Composite Score comprises two domains consisting of six measures: Domain 1 – Absence of Operative Mortality Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation. Domain 2 – Absence of Major Morbidity Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications: *Prolonged ventilation* *Deep sternal wound infection* *Permanent stroke* *Renal failure and* *Reoperations for bleeding, prosthetic or native valve dysfunction, and other car*diac reasons, but not for other non-cardiac reasons. Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by “rolling up” the domain scores into a single number. In addition to receiving a numeric score, participants are

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score
	Individual surgeons with at least 100 eligible cases during the 3-year measurement window will receive a score for each domain and an overall composite score. In addition to calculating composite score point estimates with credible intervals, surgeons will be assigned rating categories designated by the following: 1 star – lower-than-expected performance 2 stars – as-expected performance 3 stars – higher-than-expected performance Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated CABG, isolated AVR, AVR+CABG, isolated MVRR, and MVRR+CABG. Time Window: 3 years By including composite performance scores for a portfolio of five procedures that account for nearly 80% of a typical STS Adult Cardiac Surgery Database participant surgeon's clinical activity, this metric provides a more balanced and comprehensive perspective than focusing on just one procedure or one end point. Recognizing that surgeons' practices vary, each surgeon's composite performance is implicitly "weighted" by the proportion of each type of procedure he or she performs. For instance, the results of surgeons who primarily perform mitral procedures are affected most by their mitral surgery results. This approach is especially relevant for surgeons with highly specialized practices who may do relatively few isolated CABG procedures and whose performance would thus be difficult to assess using a CABG measure only. Finally,	numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). Patient Population: The analysis population consists of adult patients aged 18 years or older who undergo AVR+CABG surgery Time Period: 3 years Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 10 AVR+CABG procedures in the patient population. Technical Details The unit of measurement for the STS AVR+CABG Composite Score can be either a participant (most often a cardiac surgical practice but occasionally an individual surgeon) or a hospital. For the Absence of Operative Mortality domain, the NUMERATOR is: Number of patients undergoing AVR+CABG who survived until after discharge and >30 days post-surgery For the Absence of Major Morbidity domain, the NUMERATOR is: Number of patients undergoing AVR+CABG who did not experience any of the five specified major morbidity endpoints* *Morbidity endpoints consist of postoperative stroke/cerebrovascular accident, surgical re-exploration, deep sternal wound infection, renal failure, prolonged intubation (ventilation). Patients with	assigned to rating categories designated by the following: 1 star – lower-than-expected performance 2 stars – as-expected performance 3 stars – higher-than-expected performance Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD). Time Window: 3 years Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 36 isolated MVRR procedures in the patient population. Estimation of Composite Scores and Star Ratings: The statistical methodology used to estimate the STS MVRR composite score and star rating for each participant site was similar to that used for the STS isolated CABG, isolated AVR, and AVR+CABG measures. As with previous composite scores, we first translated risk-standardized event rates into risk-standardized absence of event rates so that a higher score indicated better performance. We then rescaled the morbidity and mortality domains by dividing by their respective standard deviations and then added the two domains together.

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score
	performance on each of these procedures is estimated using risk models specific to those procedures, in most cases the exact or slightly modified versions of previously published models (references provided below). Final Composite Score: The overall composite score was calculated as a weighted sum of (1 minus risk-adjusted mortality rate) and (1 minus risk-adjusted major morbidity rate). Mortality and morbidity rates were weighted inversely by their respective standard deviations across surgeons. This procedure is equivalent to first rescaling mortality and morbidity rates by their respective standard deviations across surgeons and then assigning equal weighting to the rescaled mortality rate and rescaled morbidity rate. Standard deviations derived from the data were used to define the final composite measure as 0.81 x (1 minus risk-standardized mortality rate) + 0.19 x (1 minus risk-standardized complication rate). Details regarding the current STS adult cardiac surgery risk models can be found in the following manuscripts: • Shahian DM, O'Brien SM, Filardo G, Ferraris VA, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 1--coronary artery bypass grafting surgery. Ann Thorac Surg. 2009 Jul;88(1 Suppl):S2-22. • O'Brien SM, Shahian DM, Filardo G, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part	documented history of renal failure (i.e., dialysis or baseline serum creatinine of 4.0 or higher) are excluded when counting renal failure outcomes. STS AVR+CABG risk models are used to estimate expected rates of mortality and any-or-none morbidity (Reference: Shahian DM, O'Brien SM, Filardo G, Ferraris VA, etal. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 3--valve plus coronary artery bypass grafting surgery. Ann Thorac Surg 2009 Jul;88(1 Suppl):S43-62.) To enhance interpretation, mortality rates are converted to survival rates (risk-standardized survival rate = 100 – risk-standardized mortality rate), and morbidity rates are converted to "absence of morbidity" rates (risk-standardized absence of morbidity rate =100 – risk-standardized morbidity rate). Defining scores in this manner ensures that increasingly positive values reflect better performance, which is easier for consumers to interpret. (Please see the appendix for the formula used to calculate the overall composite score.) The method is equivalent to calculating a weighted average, with weights proportional to the inverse of the SD. In the most recent production of the STS AVR+CABG Composite Score based on data from July 2010 – June 2013, wtmort=0.77 and wtmorb = 0.23. Star Rating: Star ratings are derived by testing whether the participant's composite or domain score is significantly different from	

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score
	2—isolated valve surgery. Ann Thorac Surg 2009;88(1 Suppl):S23–42. • Shahian DM, O'Brien SM, Filardo G, Ferraris VA, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 3--valve plus coronary artery bypass grafting surgery. Ann Thorac Surg 2009 Jul;88(1 Suppl):S43-62. Additional details regarding the Individual Surgeon Composite Measure for Adult Cardiac Surgery are provided in the attached manuscript: Shahian DM, He X, Jacobs JP, Kurlansky PA, Badhwar V, Cleveland JC Jr, Fazzalari FL, Filardo G, Normand SL, Furnary AP, Magee MJ, Rankin JS, Welke KF, Han J, O'Brien SM. The Society of Thoracic Surgeons Composite Measure of Individual Surgeon Performance for Adult Cardiac Surgery: A Report of The Society of Thoracic Surgeons Quality Measurement Task Force. Ann Thorac Surg. 2015;100:1315-25.	the overall STS average. For instance, if for each of the 2 composite score domains, a participant's estimated score is lower than the overall STS average, but the difference between the participant and STS is not statistically significant, the ratings would each be 2 stars. If however, for the overall composite, the point estimate is lower than the STS average, AND this difference is statistically significant, the overall participant star rating is 1 star. The fact that statistical significance was achieved for the composite score but not the individual domains reflects the greater precision of the composite score compared to individual endpoints. This precision is achieved by aggregating information across multiple endpoints instead of a single endpoint. Additional details regarding the AVR+CABG Composite Score are provided in the manuscript: Shahian DM, He X, Jacobs JP, et al. The STS AVR + CABG Composite Score: A Report of the STS Quality Measurement Task Force. Ann Thorac Surg 2014;97(5),1604-9.	
Numerator Details	See response in S.4. Numerator Statement	Please see S.4 above	See response in S.4. Numerator Statement
Denominator Statement	See response in S.4. Numerator Statement Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated CABG, isolated AVR, AVR+CABG, isolated MVRR, and MVRR+CABG.	Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.	See response in S.4. Numerator Statement for complete description of measure specifications. Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score
		The STS AVR+CABG Composite Score comprises two domains consisting of six individual measures: 1. Absence of Operative Mortality NQF # 0123 Risk-Adjusted Operative Mortality for AVR+CABG Surgery 2. Absence of Major Morbidity, scored any-or-none. The measures used are the same morbidity outcomes included in NQF #0696 STS CABG Composite Score. Risk-Adjusted Postoperative Stroke/Cerebrovascular Accident Risk-Adjusted Postoperative Surgical Re-exploration Risk-Adjusted Postoperative Deep Sternal Wound Infection Rate Risk-Adjusted Postoperative Renal Failure Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). Patient Population: The analysis population consists of adult patients aged 18 years or older who undergo AVR+CABG surgery Time Period: 3 years	atrial fibrillation (AF), or repair of atrial septal defect (ASD).

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score
		Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 10 AVR+CABG procedures in the patient population. Technical Details The unit of measurement for the STS AVR+CABG Composite Score can be either a participant (most often a cardiac surgical practice but occasionally an individual surgeon) or a hospital. For the Absence of Operative Mortality domain AND the Absence of Major Morbidity domain, the DENOMINATOR is: Number of patients undergoing isolated AVR+CABG during the measurement period STS AVR+CABG risk models are used to estimate expected rates of mortality and any-or-none morbidity (Reference: Shahian DM, O'Brien SM, Filardo G, Ferraris VA, etal. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 3--valve plus coronary artery bypass grafting surgery. Ann Thorac Surg 2009 Jul;88(1 Suppl):S43-62.) To enhance interpretation, mortality rates are converted to survival rates (risk-standardized survival rate = 100– risk-standardized mortality rate), and morbidity rates are converted to "absence of morbidity" rates (risk-standardized absence of morbidity rate =100 – risk-standardized morbidity rate). Defining scores in this manner ensures that increasingly positive values reflect better performance, which is easier for consumers to interpret.	

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score
		(Please see the appendix for the formula used to calculate the overall composite score.) The method is equivalent to calculating a weighted average, with weights proportional to the inverse of the SD. In the most recent production of the STS AVR+CABG Composite Score based on data from July 2010 – June 2013, wtmort=0.77 and wtmorb = 0.23. Star Rating: Star ratings are derived by testing whether the participant's composite or domain score is significantly different from the overall STS average. For instance, if for each of the 2 composite score domains, a participant's estimated score is lower than the overall STS average, but the difference between the participant and STS is not statistically significant, the ratings would each be 2 stars. If however, for the overall composite, the point estimate is lower than the STS average, AND this difference is statistically significant, the overall participant star rating is 1 star. The fact that statistical significance was achieved for the composite score but not the individual domains reflects the greater precision of the composite score compared to individual endpoints. This precision is achieved by aggregating information across multiple endpoints instead of a single endpoint. Additional details regarding the AVR+CABG Composite Score are provided in the manuscript:	

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score
		Shahian DM, He X, Jacobs JP, et al. The STS AVR + CABG Composite Score: A Report of the STS Quality Measurement Task Force. Ann Thorac Surg 2014;97(5),1604-9.	
Denominator Details	See response in S.6. Denominator Statement	Please see S.6 above	See response in S.6 Denominator Statement
Exclusions	Measure exclusions: Individual surgeons who do not meet the minimum case requirement (i.e., at least 100 eligible cases during the 3-year measurement window) will not receive a score for each domain and an overall composite score.	Please see S.6 above	Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 36 isolated MVRR procedures in the patient population.
Exclusion Details	See response in S.8. Denominator Exclusions	Please see S.6 above	See response in S.8. Denominator Exclusions
Risk Adjustment	Statistical risk model 111855| 114638| 152617| 150289 111855| 114638| 152617| 150289	Statistical risk model 111855| 137290| 114638| 141015 111855| 137290| 114638| 141015	Statistical risk model 111855| 114638| 152617 111855| 114638| 152617
Stratification	N/A	N/A	N/A
Type Score	Rate/proportion better quality = higher score	Rate/proportion better quality = higher score	Rate/proportion better quality = higher score
Algorithm	Please see discussion under section S.4 and attached manuscripts. 111855| 114638| 152617| 150289	Please see S.4 and S.6 above 111855| 137290| 114638| 141015	Please see discussion under section S.4 and attached manuscripts. 111855| 114638| 152617
Submission items	5.1 Identified measures: 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: 0123 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) + CABG Surgery 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0115 : Risk-Adjusted Surgical Re-exploration 0130 : Risk-Adjusted Deep Sternal Wound Infection	5.1 Identified measures: 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score
		0114 : Risk-Adjusted Postoperative Renal Failure 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A	

Comparison of NQF #3030 and NQF #3032

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score
Steward	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons
Description	The STS Individual Surgeon Composite Measure for Adult Cardiac Surgery includes five major procedures (isolated CABG, isolated AVR, AVR+CABG, MVRR, MVRR+CABG) and comprises the following two domains: Domain 1 – Risk-Adjusted Operative Mortality Operative mortality is defined as death before hospital discharge or within 30 days of the operation. Domain 2 – Risk-Adjusted Major Morbidity Major morbidity is defined as the occurrence of any one or more of the following major complications: *Prolonged ventilation,* *Deep sternal wound infection,* *Permanent stroke,*	The STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score measures surgical performance for MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF). To assess overall quality, the STS MVRR +CABG Composite Score comprises two domains consisting of six measures: Domain 1 – Absence of Operative Mortality Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation. Domain 2 – Absence of Major Morbidity

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score
	1. Renal failure, and 2. Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons. All measures are based on audited clinical data collected in the STS Adult Cardiac Surgery Database. Individual surgeons with at least 100 eligible cases during the 3-year measurement window will receive a score for each domain and an overall composite score. In addition to calculating composite score point estimates with credible intervals, surgeons will be assigned rating categories designated by the following: 1 star – lower-than-expected performance 2 stars – as-expected performance 3 stars – higher-than-expected performance	Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications: *Prolonged ventilation,* *Deep sternal wound infection,* *Permanent stroke,* *Renal failure, and* *Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.* Outcome data are collected on all patients and from all participants. For optimal measure reliability, participants meeting a volume threshold of at least 25 cases over 3 years receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following: 1 star – lower-than-expected performance 2 stars – as-expected performance 3 stars – higher-than-expected performance
Type	Composite	Composite
Data Source	Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.81 went live on July 1, 2014; STS Adult Cardiac Surgery Database – Version 2.9 went live on July 1st, 2017 and STS Adult Cardiac Surgery Database version 4.20 went live on June 30, 2020. The URL provided under S.1 is for the latest data collection form that is currently in use. Available at measure-specific web page URL identified in S.1 No data dictionary	Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.81 went live on July 1, 2014; STS Adult Cardiac Surgery Database – Version 2.9 went live on July 1st, 2017 and STS Adult Cardiac Surgery Database version 4.20 went live on June 30, 2020. The URL provided under S.1 is for the latest data collection form that is currently in use. Available at measure-specific web page URL identified in S.1 No data dictionary
Level	Clinician : Individual	Facility, Clinician : Group/Practice
Setting	Inpatient/Hospital	Inpatient/Hospital

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score
Numerator Statement	Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes in detail this multiprocedural, multidimensional composite measure. The STS Individual Surgeon Composite Measure for Adult Cardiac Surgery includes five major procedures, i.e., isolated coronary artery bypass grafting (CABG), isolated aortic valve replacement (AVR), AVR+CABG, isolated mitral valve repair or replacement (MVRR), and MVRR+CABG, and comprises the following two domains: Domain 1 – Risk-Adjusted Operative Mortality Operative mortality is defined as death before hospital discharge or within 30 days of the operation. Domain 2 – Risk-Adjusted Major Morbidity Major morbidity is defined as the occurrence of any one or more of the following major complications: *Prolonged ventilation* *Deep sternal wound infection* *Permanent stroke* *Renal failure and* *Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac rea*sons Individual surgeons with at least 100 eligible cases during the 3-year measurement window will receive a score for each domain and an overall composite score. In addition to calculating composite score point estimates with credible intervals, surgeons will be assigned rating categories designated by the following: 1 star – lower-than-expected performance 2 stars – as-expected performance 3 stars – higher-than-expected performance	Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score. The STS Mitral Valve Repair/Replacement (MVRR) Composite Score comprises two domains consisting of six measures: Domain 1 – Absence of Operative Mortality Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation. Domain 2 – Absence of Major Morbidity Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications: *Prolonged ventilation,* *Deep sternal wound infection,* *Permanent stroke,* *Renal failure, and* *Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac* reasons. Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following: 1 star – lower-than-expected performance 2 stars – as-expected performance 3 stars – higher-than-expected performance Patient Population: The analysis population consists of patients aged 18 years or older who MVRR + CABG with or without

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score
	Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated CABG, isolated AVR, AVR+CABG, isolated MVRR, and MVRR+CABG. Time Window: 3 years By including composite performance scores for a portfolio of five procedures that account for nearly 80% of a typical STS Adult Cardiac Surgery Database participant surgeon's clinical activity, this metric provides a more balanced and comprehensive perspective than focusing on just one procedure or one end point. Recognizing that surgeons' practices vary, each surgeon's composite performance is implicitly "weighted" by the proportion of each type of procedure he or she performs. For instance, the results of surgeons who primarily perform mitral procedures are affected most by their mitral surgery results. This approach is especially relevant for surgeons with highly specialized practices who may do relatively few isolated CABG procedures and whose performance would thus be difficult to assess using a CABG measure only. Finally, performance on each of these procedures is estimated using risk models specific to those procedures, in most cases the exact or slightly modified versions of previously published models (references provided below). Final Composite Score: The overall composite score was calculated as a weighted sum of (1 minus risk-adjusted mortality rate) and (1 minus risk-adjusted major morbidity rate). Mortality and morbidity rates were weighted inversely by their respective standard deviations across surgeons. This procedure is equivalent to first rescaling mortality and morbidity rates by their respective standard deviations across surgeons and then assigning equal weighting to the rescaled mortality rate and rescaled morbidity rate. Standard deviations derived from the data were used to define the final composite measure as 0.81 x (1 minus risk-standardized mortality rate) + 0.19 x (1 minus risk-standardized complication rate).	concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF). Time Window: 3 years Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 25 MVRR + CABG procedures in the patient population. Estimation of Composite Scores and Star Ratings: To be consistent with the conventions of previous composite measures, risk-adjusted event rates were first converted into risk-adjusted absence-of-event rates. To calculate the composite, participant-specific absence of mortality rates and absence of morbidity rates were weighted inversely by their respective standard deviations across participants. This procedure was equivalent to first rescaling the absence of mortality rates and absence of morbidity rates by their respective standard deviations across participants, and then assigning equal weighting to the rescaled rates. Finally, in order to draw statistical inferences about participant performance, a Bayesian credible interval surrounding each participant's composite score was calculated. Unlike frequentist confidence intervals, Bayesian credible intervals have an intuitively direct interpretation as an interval containing the true value of the composite score with a specified probability (e.g., 95%). To determine star ratings for each participant, the credible interval of its composite score was compared with the STS average. Participants whose intervals were entirely above the STS average were classified as 3-star (higher than expected performance), and participants whose intervals were entirely below the STS average were classified as 1-star (lower than expected performance). Credible intervals based on different probability levels (90%, 95%, 98%) were explored, and the resulting percentages of 1, 2, and 3-star programs were calculated.

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score
	Details regarding the current STS adult cardiac surgery risk models can be found in the following manuscripts: Shahian DM, O'Brien SM, Filardo G, Ferraris VA, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 1--coronary artery bypass grafting surgery. Ann Thorac Surg. 2009 Jul;88(1 Suppl):S2-22. O'Brien SM, Shahian DM, Filardo G, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 2—isolated valve surgery. Ann Thorac Surg 2009;88(1 Suppl):S23–42. Shahian DM, O'Brien SM, Filardo G, Ferraris VA, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 3--valve plus coronary artery bypass grafting surgery. Ann Thorac Surg 2009 Jul;88(1 Suppl):S43-62. Additional details regarding the Individual Surgeon Composite Measure for Adult Cardiac Surgery are provided in the attached manuscript: Shahian DM, He X, Jacobs JP, Kurlansky PA, Badhwar V, Cleveland JC Jr, Fazzalari FL, Filardo G, Normand SL, Furnary AP, Magee MJ, Rankin JS, Welke KF, Han J, O'Brien SM. The Society of Thoracic Surgeons Composite Measure of Individual Surgeon Performance for Adult Cardiac Surgery: A Report of The Society of Thoracic Surgeons Quality Measurement Task Force. Ann Thorac Surg. 2015;100:1315-25.	
Numerator Details	See response in S.4. Numerator Statement	See response in S.4. Numerator Statement
Denominator Statement	See response in S.4. Numerator Statement Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated CABG, isolated AVR, AVR+CABG, isolated MVRR, and MVRR+CABG.	See response in S.4. Numerator Statement for complete description of measure specifications. Patient Population: The analysis population consists of patients aged 18 years or older who MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF).

Measure	3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score
Denominator Details	See response in S.6. Denominator Statement	See response in S.7. Denominator Statement
Exclusions	Measure exclusions: Individual surgeons who do not meet the minimum case requirement (i.e., at least 100 eligible cases during the 3-year measurement window) will not receive a score for each domain and an overall composite score.	Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 25 MVRR + CABG procedures in the patient population.
Exclusion Details	See response in S.8. Denominator Exclusions	See response in S.8. Denominator Exclusions
Risk Adjustment	Statistical risk model 111855| 114638| 152617| 150289 111855| 114638| 152617| 150289	Statistical risk model 111855| 114638| 152617 111855| 114638| 152617
Stratification	N/A	N/A
Type Score	Rate/proportion better quality = higher score	Rate/proportion better quality = higher score
Algorithm	Please see discussion under section S.4 and attached manuscripts. 111855| 114638| 152617| 150289	Please see discussion under section S.4 and attached manuscripts. 111855| 114638| 152617
Submission items	5.1 Identified measures: 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #3031, NQF #0696, and NQF #2561

Measure	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
Steward	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons

Measure	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
Description	The STS Mitral Valve Repair/Replacement (MVRR) Composite Score measures surgical performance for isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD). To assess overall quality, the STS MVRR Composite Score comprises two domains consisting of six measures: Domain 1 – Absence of Operative Mortality Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation. Domain 2 – Absence of Major Morbidity Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications: 1. Prolonged ventilation, 2. Deep sternal wound infection, 3. Permanent stroke, 4. Renal failure, and 5. Reoperations for bleeding, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons. Outcome data are collected on all patients and from all participants. For optimal measure reliability, participants meeting a volume threshold of at least 36 cases over 3 years (i.e., approximately one mitral case per month) receive a score for each of the two domains, plus an overall composite score. The overall	The STS CABG Composite Score comprises four domains consisting of 11 individually NQF-endorsed cardiac surgery measures: Domain 1) Absence of Operative Mortality – Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death during the same hospitalization as surgery or after discharge but within 30 days of the procedure; Domain 2) Absence of Major Morbidity – Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as having at least one of the following adverse outcomes: 1. reoperations for any cardiac reason, 2. renal failure, 3. deep sternal wound infection, 4. prolonged ventilation/intubation, 5. cerebrovascular accident/permanent stroke; Domain 3) Use of Internal Mammary Artery (IMA) – Proportion of first-time CABG patients who receive at least one IMA graft; Domain 4) Use of All Evidence-based Perioperative Medications – Proportion of patients who receive all required perioperative medications for which they are eligible. The required perioperative medications are: 1. preoperative beta blockade therapy, 2. discharge anti-platelet medication, 3. discharge beta blockade therapy, and 4. discharge anti-lipid medication. All measures are based on audited clinical data collected in a prospective registry. Participants receive a score for each of the domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to	STS AVR Composite Score comprises two domains consisting of six measures: Domain 1) Absence of Operative Mortality – Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death during the same hospitalization as surgery or after discharge but within 30 days of the procedure; and Domain 2) Absence of Major Morbidity – Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as having at least one of the following adverse outcomes: 1. reoperations for any cardiac reason, 2. renal failure, 3. deep sternal wound infection, 4. prolonged ventilation/intubation, and 5. cerebrovascular accident/permanent stroke. All measures are based on audited clinical data collected in a prospective registry and are risk-adjusted. Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). Star ratings are publicly reported on the STS website and are also currently reported on the Consumer Reports website.

Measure	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
	composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following: 1 star – lower-than-expected performance 2 stars – as-expected performance 3 stars – higher-than-expected performance	receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). For consenting participants, scores and star ratings are publicly reported on the STS website.	
Type	Composite	Composite	Composite
Data Source	Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.81 went live on July 1, 2014; STS Adult Cardiac Surgery Database – Version 2.9 went live on July 1st, 2017 and STS Adult Cardiac Surgery Database version 4.20 went live on June 30, 2020. The URL provided under S.1 is for the latest data collection form that is currently in use. Available at measure-specific web page URL identified in S.1 No data dictionary	Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.8 went live on July 1, 2014; STS Adult Cardiac Surgery Database Version 2.9 went live on July 1, 2017. Available at measure-specific web page URL identified in S.1 Attachment	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 Attachment
Level	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice
Setting	Inpatient/Hospital	Inpatient/Hospital	Inpatient/Hospital
Numerator Statement	Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score. The STS Mitral Valve Repair/Replacement (MVRR) Composite Score comprises two domains consisting of six measures: Domain 1 – Absence of Operative Mortality	Please see Appendix	Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score. The STS AVR Composite Score comprises two domains consisting of six individual measures: 1. Absence of Operative Mortality NQF # 0120 Risk-Adjusted Operative Mortality for AVR

Measure	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
	Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation. Domain 2 – Absence of Major Morbidity Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications: 1. Prolonged ventilation 2. Deep sternal wound infection 3. Permanent stroke 4. Renal failure and 5. Reoperations for bleeding, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons. Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following: 1 star – lower-than-expected performance 2 stars – as-expected performance 3 stars – higher-than-expected performance Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical		2. Absence of Major Morbidity, scored any-or-none. The measures used are the same morbidity outcomes included in NQF #0696 STS CABG Composite Score. Risk-Adjusted Postoperative Stroke/Cerebrovascular Accident Risk-Adjusted Postoperative Surgical Re-exploration Risk-Adjusted Postoperative Deep Sternal Wound Infection Rate Risk-Adjusted Postoperative Renal Failure Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). Patient Population: The analysis population consists of adult patients aged 18 years or older who undergo isolated AVR surgery Time Period: 3 years Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 10 isolated AVR procedures in the patient population. Technical Details The unit of measurement for the STS AVR Composite Score can be either a participant (most often a cardiac surgical practice but occasionally an individual surgeon) or a hospital.

Measure	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
	ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD). Time Window: 3 years Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 36 isolated MVRR procedures in the patient population. Estimation of Composite Scores and Star Ratings: The statistical methodology used to estimate the STS MVRR composite score and star rating for each participant site was similar to that used for the STS isolated CABG, isolated AVR, and AVR+CABG measures. As with previous composite scores, we first translated risk-standardized event rates into risk-standardized absence of event rates so that a higher score indicated better performance. We then rescaled the morbidity and mortality domains by dividing by their respective standard deviations and then added the two domains together.		For the Absence of Operative Mortality domain, the NUMERATOR is: Number of patients undergoing isolated AVR who survived until after discharge and >30 days post-surgery For the Absence of Major Morbidity domain, the NUMERATOR is: Number of patients undergoing isolated AVR who did not experience any of the five specified major morbidity endpoints* *Morbidity endpoints consist of postoperative stroke/cerebrovascular accident, surgical re-exploration, deep sternal wound infection, renal failure, prolonged intubation (ventilation). Patients with documented history of renal failure (i.e., dialysis or baseline serum creatinine of 4.0 or higher) are excluded when counting renal failure outcomes. STS AVR risk models are used to estimate expected rates of mortality and any-or-none morbidity (Reference: O'Brien SM, Shahian DM, Filardo G, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 2—isolated valve surgery. Ann Thorac Surg 2009;88(1 Suppl):S23–42). To enhance interpretation, mortality rates are converted to survival rates (risk-standardized survival rate = 100 – risk-standardized mortality rate), and morbidity rates are converted to "absence of morbidity" rates (risk-standardized absence of morbidity rate =100 – risk-standardized morbidity rate). Defining scores in this manner ensures that increasingly positive values reflect better performance, which is easier for consumers to interpret.

Measure	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
			(Please see the appendix for the formula used to calculate the overall composite score.) The method is equivalent to calculating a weighted average, with weights proportional to the inverse of the SD. In the most recent production of the STS AVR Composite Score based on data from July 2010 – June 2013, wtmort=0.79 and wtmorb = 0.21. Star Rating: Star ratings are derived by testing whether the participant's composite or domain score is significantly different from the overall STS average. For instance, if for each of the 2 composite score domains, a participant's estimated score is lower than the overall STS average, but the difference between the participant and STS is not statistically significant, the ratings would each be 2 stars. If however, for the overall composite, the point estimate is lower than the STS average, AND this difference is statistically significant, the overall participant star rating is 1 star. The fact that statistical significance was achieved for the composite score but not the individual domains reflects the greater precision of the composite score compared to individual endpoints. This precision is achieved by aggregating information across multiple endpoints instead of a single endpoint. Additional details regarding the AVR Composite Score are provided in the attached manuscript: Shahian DM, He X, Jacobs JP, et al. The Society of Thoracic Surgeons Isolated Aortic Valve Replacement (AVR) Composite Score: a report of the STS Quality Measurement Task Force. Ann Thorac Surg 2012;94:2166-71.
Numerator Details	See response in S.4. Numerator Statement	Please see Appendix	Please see S.4 above

Measure	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
Denominator Statement	See response in S.4. Numerator Statement for complete description of measure specifications. Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD).	Please see Appendix	Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score. The STS AVR Composite Score comprises two domains consisting of six individual measures: 1. Absence of Operative Mortality NQF # 0120 Risk-Adjusted Operative Mortality for AVR 2. Absence of Major Morbidity, scored any-or-none. The measures used are the same morbidity outcomes included in NQF #0696 STS CABG Composite Score. Risk-Adjusted Postoperative Stroke/Cerebrovascular Accident Risk-Adjusted Postoperative Surgical Re-exploration Risk-Adjusted Postoperative Deep Sternal Wound Infection Rate Risk-Adjusted Postoperative Renal Failure Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance).

Measure	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
			Patient Population: The analysis population consists of adult patients aged 18 years or older who undergo isolated AVR surgery Time Period: 3 years Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 10 isolated AVR procedures in the patient population. Technical Details The unit of measurement for the STS AVR Composite Score can be either a participant (most often a cardiac surgical practice but occasionally an individual surgeon) or a hospital. For the Absence of Operative Mortality domain AND the Absence of Major Morbidity domain, the DENOMINATOR is: Number of patients undergoing isolated AVR during the measurement period STS AVR risk models are used to estimate expected rates of mortality and any-or-none morbidity (Reference: O'Brien SM, Shahian DM, Filardo G, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 2—isolated valve surgery. Ann Thorac Surg 2009;88(1 Suppl):S23–42). To enhance interpretation, mortality rates are converted to survival rates (risk-standardized survival rate = 100 – risk-standardized mortality rate), and morbidity rates are converted to "absence of morbidity" rates (risk-standardized absence of morbidity rate =100 – risk-standardized morbidity rate). Defining scores in this manner ensures that increasingly positive values reflect better performance, which is easier for consumers to interpret.

Measure	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
			(Please see the appendix for the formula used to calculate the overall composite score.) The method is equivalent to calculating a weighted average, with weights proportional to the inverse of the SD. In the most recent production of the STS AVR Composite Score based on data from July 2010 – June 2013, wtmort=0.79 and wtmorb = 0.21. Star Rating: Star ratings are derived by testing whether the participant's composite or domain score is significantly different from the overall STS average. For instance, if for each of the 2 composite score domains, a participant's estimated score is lower than the overall STS average, but the difference between the participant and STS is not statistically significant, the ratings would each be 2 stars. If however, for the overall composite, the point estimate is lower than the STS average, AND this difference is statistically significant, the overall participant star rating is 1 star. The fact that statistical significance was achieved for the composite score but not the individual domains reflects the greater precision of the composite score compared to individual endpoints. This precision is achieved by aggregating information across multiple endpoints instead of a single endpoint. Additional details regarding the AVR Composite Score are provided in the attached manuscript: Shahian DM, He X, Jacobs JP, et al. The Society of Thoracic Surgeons Isolated Aortic Valve Replacement (AVR) Composite Score: a report of the STS Quality Measurement Task Force. Ann Thorac Surg 2012;94:2166-71.
Denominator Details	See response in S.6 Denominator Statement	Please see Appendix	Please see S.6 above

Measure	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
Exclusions	Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 36 isolated MVRR procedures in the patient population.	Please see Appendix	Please see S.6 above
Exclusion Details	See response in S.8. Denominator Exclusions	Please see Appendix	Please see S.6 above
Risk Adjustment	Statistical risk model 111855| 114638 | 152617 111855| 114638 | 152617	Statistical risk model 111855| 137290 | 114638| 135810 111855| 137290 | 114638| 135810	Statistical risk model 111855| 137290 | 114638| 141015 111855| 137290 | 114638| 141015
Stratification	N/A	N/A	N/A
Type Score	Rate/proportion better quality = higher score	Rate/proportion better quality = higher score	Rate/proportion better quality = higher score
Algorithm	Please see discussion under section S.4 and attached manuscripts. 111855| 114638 | 152617	Please see discussion under section S.4 (Appendix) and attached articles. 111855 | 137290| 114638 | 135810	Please see S.4 and S.6 above 111855 | 137290| 114638| 141015
Submission items	5.1 Identified measures: 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 0123 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) + CABG Surgery 0122 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Replacement + CABG Surgery 0121 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Replacement 0120 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) 0119 : Risk-Adjusted Operative Mortality for CABG 0118 : Anti-Lipid Treatment Discharge 0117 : Beta Blockade at Discharge 0116 : Anti-Platelet Medication at Discharge 0115 : Risk-Adjusted Surgical Re-exploration 0114 : Risk-Adjusted Postoperative Renal Failure	5.1 Identified measures: 0120 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0115 : Risk-Adjusted Surgical Re-exploration 0130 : Risk-Adjusted Deep Sternal Wound Infection 0114 : Risk-Adjusted Postoperative Renal Failure 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A

Measure	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
		0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0130 : Risk-Adjusted Deep Sternal Wound Infection 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0127 : Preoperative Beta Blockade 1501 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Repair 1502 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Repair + CABG Surgery 2514 : Risk-Adjusted Coronary Artery Bypass Graft (CABG) Readmission Rate 2683 : Risk-Adjusted Operative Mortality for Pediatric and Congenital Heart Surgery 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A	

Comparison of NQF #3031, NQF #2563, and NQF #3032

Measure	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score
Steward	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons
Description	The STS Mitral Valve Repair/Replacement (MVRR) Composite Score measures surgical performance for isolated MVRR with or without	The STS AVR+CABG Composite Score comprises two domains consisting of six measures: Domain 1) Absence of Operative Mortality – Proportion	The STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score measures surgical performance for MVRR +

Measure	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score
	concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD). To assess overall quality, the STS MVRR Composite Score comprises two domains consisting of six measures: Domain 1 – Absence of Operative Mortality Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation. Domain 2 – Absence of Major Morbidity Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications: *Prolonged ventilation,* *Deep sternal wound infection,* *Permanent stroke,* *Renal failure, and* *Reoperations for bleeding, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.* Outcome data are collected on all patients and from all participants. For optimal measure reliability, participants meeting a volume threshold of at least 36 cases over 3 years (i.e., approximately one mitral case per month) receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are	of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death during the same hospitalization as surgery or after discharge but within 30 days of the procedure; and Domain 2) Absence of Major Morbidity – Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as having at least one of the following adverse outcomes: 1. reoperations for any cardiac reason, 2. renal failure, 3. deep sternal wound infection, 4. prolonged ventilation/intubation, and 5. cerebrovascular accident/permanent stroke. All measures are based on audited clinical data collected in a prospective registry and are risk-adjusted. Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). Star ratings are publicly reported on the STS website.	CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF). To assess overall quality, the STS MVRR +CABG Composite Score comprises two domains consisting of six measures: Domain 1 – Absence of Operative Mortality Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation. Domain 2 – Absence of Major Morbidity Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications: *Prolonged ventilation,* *Deep sternal wound infection,* *Permanent stroke,* *Renal failure, and* *Reoperations for bleeding, coronary graft* occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons. Outcome data are collected on all patients and from all participants. For optimal measure reliability, participants meeting a volume threshold of at least 25 cases over 3 years receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a

Measure	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score
	assigned to rating categories designated by the following: 1 star – lower-than-expected performance 2 stars – as-expected performance 3 stars – higher-than-expected performance		numeric score, participants are assigned to rating categories designated by the following: 1 star – lower-than-expected performance 2 stars – as-expected performance 3 stars – higher-than-expected performance
Type	Composite	Composite	Composite
Data Source	Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.81 went live on July 1, 2014; STS Adult Cardiac Surgery Database – Version 2.9 went live on July 1st, 2017 and STS Adult Cardiac Surgery Database version 4.20 went live on June 30, 2020. The URL provided under S.1 is for the latest data collection form that is currently in use. Available at measure-specific web page URL identified in S.1 No data dictionary	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 Attachment	Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.81 went live on July 1, 2014; STS Adult Cardiac Surgery Database – Version 2.9 went live on July 1st, 2017 and STS Adult Cardiac Surgery Database version 4.20 went live on June 30, 2020. The URL provided under S.1 is for the latest data collection form that is currently in use. Available at measure-specific web page URL identified in S.1 No data dictionary
Level	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice
Setting	Inpatient/Hospital	Inpatient/Hospital	Inpatient/Hospital
Numerator Statement	Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score. The STS Mitral Valve Repair/Replacement (MVRR) Composite Score comprises two domains consisting of six measures: Domain 1 – Absence of Operative Mortality Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative	Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score. The STS AVR+CABG Composite Score comprises two domains consisting of six individual measures: 1. Absence of Operative Mortality NQF # 0123 Risk-Adjusted Operative Mortality for AVR+CABG Surgery	Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score. The STS Mitral Valve Repair/Replacement (MVRR) Composite Score comprises two domains consisting of six measures: Domain 1 – Absence of Operative Mortality Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative

Measure	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score
	mortality is defined as death before hospital discharge or within 30 days of the operation. Domain 2 – Absence of Major Morbidity Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications: *Prolonged ventilation* *Deep sternal wound infection* *Permanent stroke* *Renal failure and* *Reoperations for bleeding, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.* Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following: 1 star – lower-than-expected performance 2 stars – as-expected performance 3 stars – higher-than-expected performance Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD). Time Window: 3 years	2. Absence of Major Morbidity, scored any-or-none. The measures used are the same morbidity outcomes included in NQF #0696 STS CABG Composite Score. Risk-Adjusted Postoperative Stroke/Cerebrovascular Accident Risk-Adjusted Postoperative Surgical Re-exploration Risk-Adjusted Postoperative Deep Sternal Wound Infection Rate Risk-Adjusted Postoperative Renal Failure Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). Patient Population: The analysis population consists of adult patients aged 18 years or older who undergo AVR+CABG surgery Time Period: 3 years Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 10 AVR+CABG procedures in the patient population. Technical Details The unit of measurement for the STS AVR+CABG Composite Score can be either a participant	mortality is defined as death before hospital discharge or within 30 days of the operation. Domain 2 – Absence of Major Morbidity Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications: *Prolonged ventilation,* *Deep sternal wound infection,* *Permanent stroke,* *Renal failure, and* *Reoperations for bleeding, coronary graft occlusion, prosthet*ic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons. Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following: 1 star – lower-than-expected performance 2 stars – as-expected performance 3 stars – higher-than-expected performance Patient Population: The analysis population consists of patients aged 18 years or older who MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF). Time Window: 3 years

Measure	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score
	Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 36 isolated MVRR procedures in the patient population. Estimation of Composite Scores and Star Ratings: The statistical methodology used to estimate the STS MVRR composite score and star rating for each participant site was similar to that used for the STS isolated CABG, isolated AVR, and AVR+CABG measures. As with previous composite scores, we first translated risk-standardized event rates into risk-standardized absence of event rates so that a higher score indicated better performance. We then rescaled the morbidity and mortality domains by dividing by their respective standard deviations and then added the two domains together.	(most often a cardiac surgical practice but occasionally an individual surgeon) or a hospital. For the Absence of Operative Mortality domain, the NUMERATOR is: Number of patients undergoing AVR+CABG who survived until after discharge and >30 days post-surgery For the Absence of Major Morbidity domain, the NUMERATOR is: Number of patients undergoing AVR+CABG who did not experience any of the five specified major morbidity endpoints* *Morbidity endpoints consist of postoperative stroke/cerebrovascular accident, surgical re-exploration, deep sternal wound infection, renal failure, prolonged intubation (ventilation). Patients with documented history of renal failure (i.e., dialysis or baseline serum creatinine of 4.0 or higher) are excluded when counting renal failure outcomes. STS AVR+CABG risk models are used to estimate expected rates of mortality and any-or-none morbidity (Reference: Shahian DM, O'Brien SM, Filardo G, Ferraris VA, etal. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 3--valve plus coronary artery bypass grafting surgery. Ann Thorac Surg 2009 Jul;88(1 Suppl):S43-62.) To enhance interpretation, mortality rates are converted to survival rates (risk-standardized survival rate = 100 – risk-standardized mortality rate), and morbidity rates are converted to “absence of morbidity” rates (risk-standardized absence of morbidity rate =100 – risk-standardized morbidity rate). Defining scores in this manner	Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 25 MVRR + CABG procedures in the patient population. Estimation of Composite Scores and Star Ratings: To be consistent with the conventions of previous composite measures, risk-adjusted event rates were first converted into risk-adjusted absence-of-event rates. To calculate the composite, participant-specific absence of mortality rates and absence of morbidity rates were weighted inversely by their respective standard deviations across participants. This procedure was equivalent to first rescaling the absence of mortality rates and absence of morbidity rates by their respective standard deviations across participants, and then assigning equal weighting to the rescaled rates. Finally, in order to draw statistical inferences about participant performance, a Bayesian credible interval surrounding each participant’s composite score was calculated. Unlike frequentist confidence intervals, Bayesian credible intervals have an intuitively direct interpretation as an interval containing the true value of the composite score with a specified probability (e.g., 95%). To determine star ratings for each participant, the credible interval of its composite score was compared with the STS average. Participants whose intervals were entirely above the STS average were classified as 3-star (higher than expected performance), and participants whose intervals were entirely below the STS average were classified as1-star (lower than expected performance). Credible intervals based on

Measure	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score
		ensures that increasingly positive values reflect better performance, which is easier for consumers to interpret. (Please see the appendix for the formula used to calculate the overall composite score.) The method is equivalent to calculating a weighted average, with weights proportional to the inverse of the SD. In the most recent production of the STS AVR+CABG Composite Score based on data from July 2010 – June 2013, wtmort=0.77 and wtmorb = 0.23. Star Rating: Star ratings are derived by testing whether the participant's composite or domain score is significantly different from the overall STS average. For instance, if for each of the 2 composite score domains, a participant's estimated score is lower than the overall STS average, but the difference between the participant and STS is not statistically significant, the ratings would each be 2 stars. If however, for the overall composite, the point estimate is lower than the STS average, AND this difference is statistically significant, the overall participant star rating is 1 star. The fact that statistical significance was achieved for the composite score but not the individual domains reflects the greater precision of the composite score compared to individual endpoints. This precision is achieved by aggregating information across multiple endpoints instead of a single endpoint. Additional details regarding the AVR+CABG Composite Score are provided in the manuscript: Shahian DM, He X, Jacobs JP, et al. The STS AVR + CABG Composite Score: A Report of the STS	different probability levels (90%, 95%, 98%) were explored, and the resulting percentages of 1, 2, and 3-star programs were calculated.

Measure	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score
		Quality Measurement Task Force. Ann Thorac Surg 2014;97(5),1604-9.	
Numerator Details	See response in S.4. Numerator Statement	Please see S.4 above	See response in S.4. Numerator Statement
Denominator Statement	See response in S.4. Numerator Statement for complete description of measure specifications. Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD).	Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score. The STS AVR+CABG Composite Score comprises two domains consisting of six individual measures: 1. Absence of Operative Mortality NQF # 0123 Risk-Adjusted Operative Mortality for AVR+CABG Surgery 2. Absence of Major Morbidity, scored any-or-none. The measures used are the same morbidity outcomes included in NQF #0696 STS CABG Composite Score. Risk-Adjusted Postoperative Stroke/Cerebrovascular Accident Risk-Adjusted Postoperative Surgical Re-exploration Risk-Adjusted Postoperative Deep Sternal Wound Infection Rate Risk-Adjusted Postoperative Renal Failure Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In	See response in S.4. Numerator Statement for complete description of measure specifications. Patient Population: The analysis population consists of patients aged 18 years or older who MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF).

Measure	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score
		addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). Patient Population: The analysis population consists of adult patients aged 18 years or older who undergo AVR+CABG surgery Time Period: 3 years Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 10 AVR+CABG procedures in the patient population. Technical Details The unit of measurement for the STS AVR+CABG Composite Score can be either a participant (most often a cardiac surgical practice but occasionally an individual surgeon) or a hospital. For the Absence of Operative Mortality domain AND the Absence of Major Morbidity domain, the DENOMINATOR is: Number of patients undergoing isolated AVR+CABG during the measurement period STS AVR+CABG risk models are used to estimate expected rates of mortality and any-or-none morbidity (Reference: Shahian DM, O'Brien SM, Filardo G, Ferraris VA, etal. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 3--valve plus coronary artery bypass grafting surgery. Ann Thorac Surg 2009 Jul;88(1 Suppl):S43-62.) To enhance interpretation, mortality rates are converted to survival rates (risk-standardized survival rate = 100 – risk-standardized mortality rate), and	

Measure	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score
		morbidity rates are converted to "absence of morbidity" rates (risk-standardized absence of morbidity rate =100– risk-standardized morbidity rate). Defining scores in this manner ensures that increasingly positive values reflect better performance, which is easier for consumers to interpret. (Please see the appendix for the formula used to calculate the overall composite score.) The method is equivalent to calculating a weighted average, with weights proportional to the inverse of the SD. In the most recent production of the STS AVR+CABG Composite Score based on data from July 2010– June 2013, wtmort=0.77 and wtmorb = 0.23. Star Rating: Star ratings are derived by testing whether the participant's composite or domain score is significantly different from the overall STS average. For instance, if for each of the 2 composite score domains, a participant's estimated score is lower than the overall STS average, but the difference between the participant and STS is not statistically significant, the ratings would each be 2 stars. If however, for the overall composite, the point estimate is lower than the STS average, AND this difference is statistically significant, the overall participant star rating is 1 star. The fact that statistical significance was achieved for the composite score but not the individual domains reflects the greater precision of the composite score compared to individual endpoints. This precision is achieved by aggregating information across multiple endpoints instead of a single endpoint.	

Measure	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score
		Additional details regarding the AVR+CABG Composite Score are provided in the manuscript: Shahian DM, He X, Jacobs JP, et al. The STS AVR + CABG Composite Score: A Report of the STS Quality Measurement Task Force. Ann Thorac Surg 2014;97(5),1604-9.	
Denominator Details	See response in S.6 Denominator Statement	Please see S.6 above	See response in S.7. Denominator Statement
Exclusions	Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 36 isolated MVRR procedures in the patient population.	Please see S.6 above	Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 25 MVRR + CABG procedures in the patient population.
Exclusion Details	See response in S.8. Denominator Exclusions	Please see S.6 above	See response in S.8. Denominator Exclusions
Risk Adjustment	Statistical risk model 111855| 114638| 152617 111855| 114638| 152617	Statistical risk model 111855| 137290| 114638| 141015 111855| 137290| 114638| 141015	Statistical risk model 111855| 114638| 152617 111855| 114638| 152617
Stratification	N/A	N/A	N/A
Type Score	Rate/proportion better quality = higher score	Rate/proportion better quality = higher score	Rate/proportion better quality = higher score
Algorithm	Please see discussion under section S.4 and attached manuscripts. 111855| 114638| 152617	Please see S.4 and S.6 above 111855| 137290| 114638| 141015	Please see discussion under section S.4 and attached manuscripts. 111855| 114638| 152617
Submission items	5.1 Identified measures: 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: 0123 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) + CABG Surgery 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0115 : Risk-Adjusted Surgical Re-exploration 0130 : Risk-Adjusted Deep Sternal Wound Infection 0114 : Risk-Adjusted Postoperative Renal Failure 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)	5.1 Identified measures: 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A

Measure	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score
		5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A	

Comparison of NQF #3032, NQF #0696, and NQF #2561

Measure	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
Steward	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons
Description	The STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score measures surgical performance for MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF). To assess overall quality, the STS MVRR +CABG Composite Score comprises two domains consisting of six measures: Domain 1 – Absence of Operative Mortality Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation. Domain 2 – Absence of Major Morbidity	The STS CABG Composite Score comprises four domains consisting of 11 individually NQF-endorsed cardiac surgery measures: Domain 1) Absence of Operative Mortality – Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death during the same hospitalization as surgery or after discharge but within 30 days of the procedure; Domain 2) Absence of Major Morbidity – Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as having at least one of the following adverse outcomes: 1. reoperations for any cardiac reason, 2. renal failure, 3. deep sternal wound infection, 4. prolonged ventilation/intubation, 5. cerebrovascular accident/permanent stroke;	STS AVR Composite Score comprises two domains consisting of six measures: Domain 1) Absence of Operative Mortality – Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death during the same hospitalization as surgery or after discharge but within 30 days of the procedure; and Domain 2) Absence of Major Morbidity – Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as having at least one of the following adverse outcomes: 1. reoperations for any cardiac reason, 2. renal failure, 3. deep sternal wound infection, 4. prolonged ventilation/intubation, and 5. cerebrovascular accident/permanent stroke. All measures are based on audited clinical data collected in a prospective registry and are risk-adjusted.

Measure	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
	Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications: *Prolonged ventilation,* *Deep sternal wound infection,* *Permanent stroke,* *Renal failure, and* *Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.* Outcome data are collected on all patients and from all participants. For optimal measure reliability, participants meeting a volume threshold of at least 25 cases over 3 years receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following: 1 star – lower-than-expected performance 2 stars – as-expected performance 3 stars – higher-than-expected performance	Domain 3) Use of Internal Mammary Artery (IMA) – Proportion of first-time CABG patients who receive at least one IMA graft; Domain 4) Use of All Evidence-based Perioperative Medications – Proportion of patients who receive all required perioperative medications for which they are eligible. The required perioperative medications are: 1. preoperative beta blockade therapy, 2. discharge anti-platelet medication, 3. discharge beta blockade therapy, and 4. discharge anti-lipid medication. All measures are based on audited clinical data collected in a prospective registry. Participants receive a score for each of the domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). For consenting participants, scores and star ratings are publicly reported on the STS website.	Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). Star ratings are publicly reported on the STS website and are also currently reported on the Consumer Reports website.
Type	Composite	Composite	Composite
Data Source	Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.81 went live on July 1, 2014; STS Adult Cardiac Surgery Database – Version 2.9 went live on July 1st, 2017 and STS	Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.8 went live on July 1, 2014; STS Adult Cardiac Surgery Database Version 2.9 went live on July 1, 2017.	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 Attachment

Measure	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
	Adult Cardiac Surgery Database version 4.20 went live on June 30, 2020. The URL provided under S.1 is for the latest data collection form that is currently in use. Available at measure-specific web page URL identified in S.1 No data dictionary	Available at measure-specific web page URL identified in S.1 Attachment	
Level	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice
Setting	Inpatient/Hospital	Inpatient/Hospital	Inpatient/Hospital
Numerator Statement	Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score. The STS Mitral Valve Repair/Replacement (MVRR) Composite Score comprises two domains consisting of six measures: Domain 1 – Absence of Operative Mortality Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation. Domain 2 – Absence of Major Morbidity Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications: 1. Prolonged ventilation, 2. Deep sternal wound infection, 3. Permanent stroke, 4. Renal failure, and	Please see Appendix	Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score. The STS AVR Composite Score comprises two domains consisting of six individual measures: 1. Absence of Operative Mortality NQF # 0120 Risk-Adjusted Operative Mortality for AVR 2. Absence of Major Morbidity, scored any-or-none. The measures used are the same morbidity outcomes included in NQF #0696 STS CABG Composite Score. Risk-Adjusted Postoperative Stroke/Cerebrovascular Accident Risk-Adjusted Postoperative Surgical Re-exploration Risk-Adjusted Postoperative Deep Sternal Wound Infection Rate Risk-Adjusted Postoperative Renal Failure Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Measure	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
	5. Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons. Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following: 1 star – lower-than-expected performance 2 stars – as-expected performance 3 stars – higher-than-expected performance Patient Population: The analysis population consists of patients aged 18 years or older who MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF). Time Window: 3 years Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 25 MVRR + CABG procedures in the patient population. Estimation of Composite Scores and Star Ratings: To be consistent with the conventions of previous composite measures, risk-adjusted event rates were first converted into risk-adjusted absence-of-event rates. To calculate the composite, participant-specific absence of mortality rates and absence of morbidity rates were weighted inversely by their respective		Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). Patient Population: The analysis population consists of adult patients aged 18 years or older who undergo isolated AVR surgery Time Period: 3 years Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 10 isolated AVR procedures in the patient population. Technical Details The unit of measurement for the STS AVR Composite Score can be either a participant (most often a cardiac surgical practice but occasionally an individual surgeon) or a hospital. For the Absence of Operative Mortality domain, the NUMERATOR is: Number of patients undergoing isolated AVR who survived until after discharge and >30 days post-surgery For the Absence of Major Morbidity domain, the NUMERATOR is: Number of patients undergoing isolated AVR who did not experience any of the five specified major morbidity endpoints* *Morbidity endpoints consist of postoperative stroke/cerebrovascular accident, surgical re-

Measure	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
	standard deviations across participants. This procedure was equivalent to first rescaling the absence of mortality rates and absence of morbidity rates by their respective standard deviations across participants, and then assigning equal weighting to the rescaled rates. Finally, in order to draw statistical inferences about participant performance, a Bayesian credible interval surrounding each participant's composite score was calculated. Unlike frequentist confidence intervals, Bayesian credible intervals have an intuitively direct interpretation as an interval containing the true value of the composite score with a specified probability (e.g., 95%). To determine star ratings for each participant, the credible interval of its composite score was compared with the STS average. Participants whose intervals were entirely above the STS average were classified as 3-star (higher than expected performance), and participants whose intervals were entirely below the STS average were classified as1-star (lower than expected performance). Credible intervals based on different probability levels (90%, 95%, 98%) were explored, and the resulting percentages of 1, 2, and 3-star programs were calculated.		exploration, deep sternal wound infection, renal failure, prolonged intubation (ventilation). Patients with documented history of renal failure (i.e., dialysis or baseline serum creatinine of 4.0 or higher) are excluded when counting renal failure outcomes. STS AVR risk models are used to estimate expected rates of mortality and any-or-none morbidity (Reference: O'Brien SM, Shahian DM, Filardo G, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 2—isolated valve surgery. Ann Thorac Surg 2009;88(1 Suppl):S23–42). To enhance interpretation, mortality rates are converted to survival rates (risk-standardized survival rate = 100 – risk-standardized mortality rate), and morbidity rates are converted to "absence of morbidity" rates (risk-standardized absence of morbidity rate =100 – risk-standardized morbidity rate). Defining scores in this manner ensures that increasingly positive values reflect better performance, which is easier for consumers to interpret. (Please see the appendix for the formula used to calculate the overall composite score.) The method is equivalent to calculating a weighted average, with weights proportional to the inverse of the SD. In the most recent production of the STS AVR Composite Score based on data from July 2010 – June 2013, wtmort=0.79 and wtmorb = 0.21. Star Rating: Star ratings are derived by testing whether the participant's composite or domain score is significantly different from the overall STS average. For instance, if for each of the 2 composite score domains, a participant's

Measure	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
			estimated score is lower than the overall STS average, but the difference between the participant and STS is not statistically significant, the ratings would each be 2 stars. If however, for the overall composite, the point estimate is lower than the STS average, AND this difference is statistically significant, the overall participant star rating is 1 star. The fact that statistical significance was achieved for the composite score but not the individual domains reflects the greater precision of the composite score compared to individual endpoints. This precision is achieved by aggregating information across multiple endpoints instead of a single endpoint. Additional details regarding the AVR Composite Score are provided in the attached manuscript: Shahian DM, He X, Jacobs JP, et al. The Society of Thoracic Surgeons Isolated Aortic Valve Replacement (AVR) Composite Score: a report of the STS Quality Measurement Task Force. Ann Thorac Surg 2012;94:2166-71.
Numerator Details	See response in S.4. Numerator Statement	Please see Appendix	Please see S.4 above
Denominator Statement	See response in S.4. Numerator Statement for complete description of measure specifications. Patient Population: The analysis population consists of patients aged 18 years or older who MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF).	Please see Appendix	Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score. The STS AVR Composite Score comprises two domains consisting of six individual measures: Absence of Operative Mortality

Measure	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
			NQF # 0120 Risk-Adjusted Operative Mortality for AVR Absence of Major Morbidity, scored any-or-none. The measures used are the same morbidity outcomes included in NQF #0696 STS CABG Composite Score. Risk-Adjusted Postoperative Stroke/Cerebrovascular Accident Risk-Adjusted Postoperative Surgical Re-exploration Risk-Adjusted Postoperative Deep Sternal Wound Infection Rate Risk-Adjusted Postoperative Renal Failure Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). Patient Population: The analysis population consists of adult patients aged 18 years or older who undergo isolated AVR surgery Time Period: 3 years Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 10 isolated AVR procedures in the patient population. Technical Details

Measure	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
			The unit of measurement for the STS AVR Composite Score can be either a participant (most often a cardiac surgical practice but occasionally an individual surgeon) or a hospital. For the Absence of Operative Mortality domain AND the Absence of Major Morbidity domain, the DENOMINATOR is: Number of patients undergoing isolated AVR during the measurement period STS AVR risk models are used to estimate expected rates of mortality and any-or-none morbidity (Reference: O'Brien SM, Shahian DM, Filardo G, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 2—isolated valve surgery. Ann Thorac Surg 2009;88(1 Suppl):S23–42). To enhance interpretation, mortality rates are converted to survival rates (risk-standardized survival rate = 100 – risk-standardized mortality rate), and morbidity rates are converted to "absence of morbidity" rates (risk-standardized absence of morbidity rate = 100 – risk-standardized morbidity rate). Defining scores in this manner ensures that increasingly positive values reflect better performance, which is easier for consumers to interpret. (Please see the appendix for the formula used to calculate the overall composite score.) The method is equivalent to calculating a weighted average, with weights proportional to the inverse of the SD. In the most recent production of the STS AVR Composite Score based on data from July 2010 – June 2013, wtmort=0.79 and wtmorb = 0.21. Star Rating: Star ratings are derived by testing whether the participant's composite or domain

Measure	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
			score is significantly different from the overall STS average. For instance, if for each of the 2 composite score domains, a participant's estimated score is lower than the overall STS average, but the difference between the participant and STS is not statistically significant, the ratings would each be 2 stars. If however, for the overall composite, the point estimate is lower than the STS average, AND this difference is statistically significant, the overall participant star rating is 1 star. The fact that statistical significance was achieved for the composite score but not the individual domains reflects the greater precision of the composite score compared to individual endpoints. This precision is achieved by aggregating information across multiple endpoints instead of a single endpoint. Additional details regarding the AVR Composite Score are provided in the attached manuscript: Shahian DM, He X, Jacobs JP, et al. The Society of Thoracic Surgeons Isolated Aortic Valve Replacement (AVR) Composite Score: a report of the STS Quality Measurement Task Force. Ann Thorac Surg 2012;94:2166-71.
Denominator Details	See response in S.7. Denominator Statement	Please see Appendix	Please see S.6 above
Exclusions	Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 25 MVRR + CABG procedures in the patient population.	Please see Appendix	Please see S.6 above
Exclusion Details	See response in S.8. Denominator Exclusions	Please see Appendix	Please see S.6 above
Risk Adjustment	Statistical risk model 111855| 114638| 152617	Statistical risk model 111855| 137290| 114638| 135810	Statistical risk model 111855| 137290| 114638| 141015

Measure	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
	111855| 114638| 152617	111855| 137290| 114638| 135810	111855| 137290| 114638| 141015
Stratification	N/A	N/A	N/A
Type Score	Rate/proportion better quality = higher score	Rate/proportion better quality = higher score	Rate/proportion better quality = higher score
Algorithm	Please see discussion under section S.4 and attached manuscripts. 111855| 114638| 152617	Please see discussion under section S.4 (Appendix) and attached articles. 111855| 137290| 114638| 135810	Please see S.4 and S.6 above 111855| 137290| 114638| 141015
Submission items	5.1 Identified measures: 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG) 0123 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) + CABG Surgery 0122 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Replacement + CABG Surgery 0121 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Replacement 0120 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) 0119 : Risk-Adjusted Operative Mortality for CABG 0118 : Anti-Lipid Treatment Discharge 0117 : Beta Blockade at Discharge 0116 : Anti-Platelet Medication at Discharge 0115 : Risk-Adjusted Surgical Re-exploration 0114 : Risk-Adjusted Postoperative Renal Failure 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0130 : Risk-Adjusted Deep Sternal Wound Infection 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 0127 : Preoperative Beta Blockade	5.1 Identified measures: 0120 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0115 : Risk-Adjusted Surgical Re-exploration 0130 : Risk-Adjusted Deep Sternal Wound Infection 0114 : Risk-Adjusted Postoperative Renal Failure 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A

Measure	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score	0696 STS CABG Composite Score	2561 STS Aortic Valve Replacement (AVR) Composite Score
		1501 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Repair 1502 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Repair + CABG Surgery 2514 : Risk-Adjusted Coronary Artery Bypass Graft (CABG) Readmission Rate 2683 : Risk-Adjusted Operative Mortality for Pediatric and Congenital Heart Surgery 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A	

Comparison of NQF #3032, NQF #2563, and NQF #3031

Measure	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score
Steward	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons	The Society of Thoracic Surgeons
Description	The STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score measures surgical performance for MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF). To assess overall quality, the STS MVRR +CABG Composite Score comprises two domains consisting of six measures:	The STS AVR+CABG Composite Score comprises two domains consisting of six measures: Domain 1) Absence of Operative Mortality – Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death during the same hospitalization as surgery or after discharge but within 30 days of the procedure; and Domain 2) Absence of Major Morbidity – Proportion of patients (risk-adjusted) who do not experience	The STS Mitral Valve Repair/Replacement (MVRR) Composite Score measures surgical performance for isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD). To assess overall quality, the STS MVRR Composite Score comprises two domains consisting of six measures: Domain 1 – Absence of Operative Mortality

Measure	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score
	Domain 1 – Absence of Operative Mortality Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation. Domain 2 – Absence of Major Morbidity Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications: *Prolonged ventilation,* *Deep sternal wound infection,* *Permanent stroke,* *Renal failure, and* *Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and o*ther cardiac reasons, but not for other non-cardiac reasons. Outcome data are collected on all patients and from all participants. For optimal measure reliability, participants meeting a volume threshold of at least 25 cases over 3 years receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following: 1 star – lower-than-expected performance 2 stars – as-expected performance 3 stars – higher-than-expected performance	any major morbidity. Major morbidity is defined as having at least one of the following adverse outcomes: 1. reoperations for any cardiac reason, 2. renal failure, 3. deep sternal wound infection, 4. prolonged ventilation/intubation, and 5. cerebrovascular accident/permanent stroke. All measures are based on audited clinical data collected in a prospective registry and are risk-adjusted. Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). Star ratings are publicly reported on the STS website.	Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation. Domain 2 – Absence of Major Morbidity Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications: Prolo*nged ventilation,* *Deep sternal wound infection,* *Permanent stroke,* *Renal failure, and* *Reoperations for bleeding, prosthetic or native valve dysfunction, and other* cardiac reasons, but not for other non-cardiac reasons. Outcome data are collected on all patients and from all participants. For optimal measure reliability, participants meeting a volume threshold of at least 36 cases over 3 years (i.e., approximately one mitral case per month) receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following: 1 star – lower-than-expected performance 2 stars – as-expected performance 3 stars – higher-than-expected performance

Measure	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score
Type	Composite	Composite	Composite
Data Source	Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.81 went live on July 1, 2014; STS Adult Cardiac Surgery Database – Version 2.9 went live on July 1st, 2017 and STS Adult Cardiac Surgery Database version 4.20 went live on June 30, 2020. The URL provided under S.1 is for the latest data collection form that is currently in use. Available at measure-specific web page URL identified in S.1 No data dictionary	Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017) Available at measure-specific web page URL identified in S.1 Attachment	Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.81 went live on July 1, 2014; STS Adult Cardiac Surgery Database – Version 2.9 went live on July 1st, 2017 and STS Adult Cardiac Surgery Database version 4.20 went live on June 30, 2020. The URL provided under S.1 is for the latest data collection form that is currently in use. Available at measure-specific web page URL identified in S.1 No data dictionary
Level	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice	Facility, Clinician : Group/Practice
Setting	Inpatient/Hospital	Inpatient/Hospital	Inpatient/Hospital
Numerator Statement	Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score. The STS Mitral Valve Repair/Replacement (MVRR) Composite Score comprises two domains consisting of six measures: Domain 1 – Absence of Operative Mortality Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation. Domain 2 – Absence of Major Morbidity Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any	Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score. The STS AVR+CABG Composite Score comprises two domains consisting of six individual measures: 1. Absence of Operative Mortality NQF # 0123 Risk-Adjusted Operative Mortality for AVR+CABG Surgery 2. Absence of Major Morbidity, scored any-or-none. The measures used are the same morbidity outcomes included in NQF #0696 STS CABG Composite Score. Risk-Adjusted Postoperative Stroke/Cerebrovascular Accident	Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score. The STS Mitral Valve Repair/Replacement (MVRR) Composite Score comprises two domains consisting of six measures: Domain 1 – Absence of Operative Mortality Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation. Domain 2 – Absence of Major Morbidity Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity

Measure	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score
	one or more of the following major complications: *Prolonged ventilation,* *Deep sternal wound infection,* *Permanent stroke,* *Renal failure, and* *Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.* Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following: 1 star – lower-than-expected performance 2 stars – as-expected performance 3 stars – higher-than-expected performance Patient Population: The analysis population consists of patients aged 18 years or older who MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF). Time Window: 3 years Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 25 MVRR + CABG procedures in the patient population. Estimation of Composite Scores and Star Ratings:	Risk-Adjusted Postoperative Surgical Re-exploration Risk-Adjusted Postoperative Deep Sternal Wound Infection Rate Risk-Adjusted Postoperative Renal Failure Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). Patient Population: The analysis population consists of adult patients aged 18 years or older who undergo AVR+CABG surgery Time Period: 3 years Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 10 AVR+CABG procedures in the patient population. Technical Details The unit of measurement for the STS AVR+CABG Composite Score can be either a participant (most often a cardiac surgical practice but occasionally an individual surgeon) or a hospital. For the Absence of Operative Mortality domain, the NUMERATOR is: Number of patients undergoing AVR+CABG who survived until after discharge and >30 days post-surgery	is defined as the occurrence of any one or more of the following major complications: *Prolonged ventilation* *Deep sternal wound infection* *Permanent stroke* *Renal failure and* *Reoperations for bleeding, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons*. Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following: 1 star – lower-than-expected performance 2 stars – as-expected performance 3 stars – higher-than-expected performance Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD). Time Window: 3 years Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 36 isolated MVRR procedures in the patient population.

Measure	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score
	To be consistent with the conventions of previous composite measures, risk-adjusted event rates were first converted into risk-adjusted absence-of-event rates. To calculate the composite, participant-specific absence of mortality rates and absence of morbidity rates were weighted inversely by their respective standard deviations across participants. This procedure was equivalent to first rescaling the absence of mortality rates and absence of morbidity rates by their respective standard deviations across participants, and then assigning equal weighting to the rescaled rates. Finally, in order to draw statistical inferences about participant performance, a Bayesian credible interval surrounding each participant's composite score was calculated. Unlike frequentist confidence intervals, Bayesian credible intervals have an intuitively direct interpretation as an interval containing the true value of the composite score with a specified probability (e.g., 95%). To determine star ratings for each participant, the credible interval of its composite score was compared with the STS average. Participants whose intervals were entirely above the STS average were classified as 3-star (higher than expected performance), and participants whose intervals were entirely below the STS average were classified as1-star (lower than expected performance). Credible intervals based on different probability levels (90%, 95%, 98%) were explored, and the resulting percentages of 1, 2, and 3-star programs were calculated.	For the Absence of Major Morbidity domain, the NUMERATOR is: Number of patients undergoing AVR+CABG who did not experience any of the five specified major morbidity endpoints* *Morbidity endpoints consist of postoperative stroke/cerebrovascular accident, surgical re-exploration, deep sternal wound infection, renal failure, prolonged intubation (ventilation). Patients with documented history of renal failure (i.e., dialysis or baseline serum creatinine of 4.0 or higher) are excluded when counting renal failure outcomes. STS AVR+CABG risk models are used to estimate expected rates of mortality and any-or-none morbidity (Reference: Shahian DM, O'Brien SM, Filardo G, Ferraris VA, etal. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 3--valve plus coronary artery bypass grafting surgery. Ann Thorac Surg 2009 Jul;88(1 Suppl):S43-62.) To enhance interpretation, mortality rates are converted to survival rates (risk-standardized survival rate = 100 – risk-standardized mortality rate), and morbidity rates are converted to "absence of morbidity" rates (risk-standardized absence of morbidity rate =100– risk-standardized morbidity rate). Defining scores in this manner ensures that increasingly positive values reflect better performance, which is easier for consumers to interpret. (Please see the appendix for the formula used to calculate the overall composite score.) The method is equivalent to calculating a weighted average, with weights proportional to	Estimation of Composite Scores and Star Ratings: The statistical methodology used to estimate the STS MVRR composite score and star rating for each participant site was similar to that used for the STS isolated CABG, isolated AVR, and AVR+CABG measures. As with previous composite scores, we first translated risk-standardized event rates into risk-standardized absence of event rates so that a higher score indicated better performance. We then rescaled the morbidity and mortality domains by dividing by their respective standard deviations and then added the two domains together.

Measure	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score
		the inverse of the SD. In the most recent production of the STS AVR+CABG Composite Score based on data from July 2010 – June 2013, wtmort=0.77 and wtmorb = 0.23. Star Rating: Star ratings are derived by testing whether the participant's composite or domain score is significantly different from the overall STS average. For instance, if for each of the 2 composite score domains, a participant's estimated score is lower than the overall STS average, but the difference between the participant and STS is not statistically significant, the ratings would each be 2 stars. If however, for the overall composite, the point estimate is lower than the STS average, AND this difference is statistically significant, the overall participant star rating is 1 star. The fact that statistical significance was achieved for the composite score but not the individual domains reflects the greater precision of the composite score compared to individual endpoints. This precision is achieved by aggregating information across multiple endpoints instead of a single endpoint. Additional details regarding the AVR+CABG Composite Score are provided in the manuscript: Shahian DM, He X, Jacobs JP, et al. The STS AVR + CABG Composite Score: A Report of the STS Quality Measurement Task Force. Ann Thorac Surg 2014;97(5),1604-9.	
Numerator Details	See response in S.4. Numerator Statement	Please see S.4 above	See response in S.4. Numerator Statement
Denominator Statement	See response in S.4. Numerator Statement for complete description of measure specifications.	Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator	See response in S.4. Numerator Statement for complete description of measure specifications.

Measure	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score
	Patient Population: The analysis population consists of patients aged 18 years or older who MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF).	and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score. The STS AVR+CABG Composite Score comprises two domains consisting of six individual measures: 1. Absence of Operative Mortality NQF # 0123 Risk-Adjusted Operative Mortality for AVR+CABG Surgery 2. Absence of Major Morbidity, scored any-or-none. The measures used are the same morbidity outcomes included in NQF #0696 STS CABG Composite Score. Risk-Adjusted Postoperative Stroke/Cerebrovascular Accident Risk-Adjusted Postoperative Surgical Re-exploration Risk-Adjusted Postoperative Deep Sternal Wound Infection Rate Risk-Adjusted Postoperative Renal Failure Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance).	Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD).

Measure	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score
		Patient Population: The analysis population consists of adult patients aged 18 years or older who undergo AVR+CABG surgery Time Period: 3 years Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 10 AVR+CABG procedures in the patient population. Technical Details The unit of measurement for the STS AVR+CABG Composite Score can be either a participant (most often a cardiac surgical practice but occasionally an individual surgeon) or a hospital. For the Absence of Operative Mortality domain AND the Absence of Major Morbidity domain, the DENOMINATOR is: Number of patients undergoing isolated AVR+CABG during the measurement period STS AVR+CABG risk models are used to estimate expected rates of mortality and any-or-none morbidity (Reference: Shahian DM, O'Brien SM, Filardo G, Ferraris VA, etal. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 3--valve plus coronary artery bypass grafting surgery. Ann Thorac Surg 2009 Jul;88(1 Suppl):S43-62.) To enhance interpretation, mortality rates are converted to survival rates (risk-standardized survival rate = 100 – risk-standardized mortality rate), and morbidity rates are converted to “absence of morbidity” rates (risk-standardized absence of morbidity rate =100– risk-standardized morbidity rate). Defining scores in this manner ensures that increasingly positive values reflect	

Measure	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score
		better performance, which is easier for consumers to interpret. (Please see the appendix for the formula used to calculate the overall composite score.) The method is equivalent to calculating a weighted average, with weights proportional to the inverse of the SD. In the most recent production of the STS AVR+CABG Composite Score based on data from July 2010 – June 2013, wtmort=0.77 and wtmorb = 0.23. Star Rating: Star ratings are derived by testing whether the participant's composite or domain score is significantly different from the overall STS average. For instance, if for each of the 2 composite score domains, a participant's estimated score is lower than the overall STS average, but the difference between the participant and STS is not statistically significant, the ratings would each be 2 stars. If however, for the overall composite, the point estimate is lower than the STS average, AND this difference is statistically significant, the overall participant star rating is 1 star. The fact that statistical significance was achieved for the composite score but not the individual domains reflects the greater precision of the composite score compared to individual endpoints. This precision is achieved by aggregating information across multiple endpoints instead of a single endpoint. Additional details regarding the AVR+CABG Composite Score are provided in the manuscript: Shahian DM, He X, Jacobs JP, et al. The STS AVR + CABG Composite Score: A Report of the STS	

Measure	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score
		Quality Measurement Task Force. Ann Thorac Surg 2014;97(5),1604-9.	
Denominator Details	See response in S.7. Denominator Statement	Please see S.6 above	See response in S.6 Denominator Statement
Exclusions	Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 25 MVRR + CABG procedures in the patient population.	Please see S.6 above	Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 36 isolated MVRR procedures in the patient population.
Exclusion Details	See response in S.8. Denominator Exclusions	Please see S.6 above	See response in S.8. Denominator Exclusions
Risk Adjustment	Statistical risk model 111855| 114638| 152617 111855| 114638| 152617	Statistical risk model 111855| 137290| 114638| 141015 111855| 137290| 114638| 141015	Statistical risk model 111855| 114638| 152617 111855| 114638| 152617
Stratification	N/A	N/A	N/A
Type Score	Rate/proportion better quality = higher score	Rate/proportion better quality = higher score	Rate/proportion better quality = higher score
Algorithm	Please see discussion under section S.4 and attached manuscripts. 111855| 114638| 152617	Please see S.4 and S.6 above 111855| 137290| 114638| 141015	Please see discussion under section S.4 and attached manuscripts. 111855| 114638| 152617
Submission items	5.1 Identified measures: 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A	5.1 Identified measures: 0123 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) + CABG Surgery 0131 : Risk-Adjusted Stroke/Cerebrovascular Accident 0115 : Risk-Adjusted Surgical Re-exploration 0130 : Risk-Adjusted Deep Sternal Wound Infection 0114 : Risk-Adjusted Postoperative Renal Failure 0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation) 5a.1 Are specs completely harmonized? Yes	5.1 Identified measures: 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A

Measure	3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score	2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score	3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score
		5a.2 If not completely harmonized, identify difference, rationale, impact: N/A 5b.1 If competing, why superior or rationale for additive value: N/A	

Appendix E2: Related and Competing Measures (narrative)

Comparison of NQF #0117, NQF #0114, and NQF #0115

0117 Beta Blockade at Discharge
0114 Risk-Adjusted Postoperative Renal Failure
0115 Risk-Adjusted Surgical Re-exploration

Steward

0117 Beta Blockade at Discharge
The Society of Thoracic Surgeons

0114 Risk-Adjusted Postoperative Renal Failure
The Society of Thoracic Surgeons

0115 Risk-Adjusted Surgical Re-exploration
The Society of Thoracic Surgeons

Description

0117 Beta Blockade at Discharge
Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on beta blockers

0114 Risk-Adjusted Postoperative Renal Failure
Percent of patients aged 18 years and older undergoing isolated CABG (without pre-existing renal failure) who develop postoperative renal failure or require dialysis

0115 Risk-Adjusted Surgical Re-exploration
Percent of patients aged 18 years and older undergoing isolated CABG who require a re-intervention during the current hospitalization for mediastinal bleeding with or without tamponade, graft occlusion, valve dysfunction, or other cardiac reason

Type

0117 Beta Blockade at Discharge
Process

0114 Risk-Adjusted Postoperative Renal Failure
Outcome

0115 Risk-Adjusted Surgical Re-exploration
Outcome

Data Source

0117 Beta Blockade at Discharge
Registry Data STS Adult Cardiac Surgery Database Version 4.20
Available at measure-specific web page URL identified in S.1 No data dictionary

0114 Risk-Adjusted Postoperative Renal Failure

Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 Attachment

0115 Risk-Adjusted Surgical Re-exploration

Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 Attachment

Level

0117 Beta Blockade at Discharge

Facility, Clinician : Group/Practice

0114 Risk-Adjusted Postoperative Renal Failure

Facility, Clinician : Group/Practice

0115 Risk-Adjusted Surgical Re-exploration

Facility, Clinician : Group/Practice

Setting

0117 Beta Blockade at Discharge

Inpatient/Hospital

0114 Risk-Adjusted Postoperative Renal Failure

Inpatient/Hospital

0115 Risk-Adjusted Surgical Re-exploration

Inpatient/Hospital

Numerator Statement

0117 Beta Blockade at Discharge

Number of patients undergoing isolated CABG who were discharged on beta blockers

0114 Risk-Adjusted Postoperative Renal Failure

Number of patients undergoing isolated CABG who develop postoperative renal failure or require dialysis

0115 Risk-Adjusted Surgical Re-exploration

Number of patients undergoing isolated CABG who require a re-intervention during the current hospitalization for mediastinal bleeding with or without tamponade, graft occlusion, valve dysfunction, or other cardiac reason

Numerator Details

0117 Beta Blockade at Discharge

Number of isolated CABG procedures in which discharge beta blockers [DCBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"

114 k-Adjusted Postoperative Renal Failure

Definition of renal failure/dialysis requirement – Patients with acute renal failure or worsening renal function resulting in one or both of the following:

- Increase of serum creatinine to 4.0 or higher, or 3x the most recent preoperative creatinine level
- New requirement for dialysis postoperatively

Number of isolated CABG procedures in which postoperative renal failure [CRenFail (STS Adult Cardiac Surgery Database Version 2.9)] is marked as "yes"

0115 Risk-Adjusted Surgical Re-exploration

Number of isolated CABG procedures in which any of the following are marked "yes" –

ReOp for Bleeding [COpReBld (STS Adult Cardiac Surgery Database Version 2.73)], Reintervention for Graft Occlusion (COpReGft), ReOp for Valve Dysfunction (COpReVlv), ReOp for Other Cardiac Reason (COpReOth)

Denominator Statement

0117 Beta Blockade at Discharge

Patients aged 18 years and older undergoing isolated CABG

0114 Risk-Adjusted Postoperative Renal Failure

All patients undergoing isolated CABG

0115 Risk-Adjusted Surgical Re-exploration

All patients undergoing isolated CABG

Denominator Details

0117 Beta Blockade at Discharge

Number of isolated CABG procedures excluding cases with an in-hospital mortality or cases for which discharge beta blocker use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

0114 Risk-Adjusted Postoperative Renal Failure

Number of isolated CABG procedures including re-operations; the SQL code used to create the function to identify cardiac procedures is provided in the appendix.

0115 Risk-Adjusted Surgical Re-exploration

Number of isolated CABG procedures. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

Exclusions

0117 Beta Blockade at Discharge

Cases are removed from the denominator if there was an in-hospital mortality or if discharge beta blocker was contraindicated.

0114 Risk-Adjusted Postoperative Renal Failure

Patients with documented history of renal failure, baseline serum creatinine of 4.0 or higher; prior renal transplants are not considered preoperative renal failure unless since transplantation their Cr has been or is 4.0 or higher

0115 Risk-Adjusted Surgical Re-exploration

N/A

Exclusion Details

0117 Beta Blockade at Discharge

Mortality Discharge Status (DischMortStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; discharge beta blocker (DCBeta) marked as "Contraindicated"

0114 Risk-Adjusted Postoperative Renal Failure

(Dialysis) is marked yes; Last Creatinine Level (CreatLst) is 4.0 or higher

0115 Risk-Adjusted Surgical Re-exploration

N/A

Risk Adjustment

0117 Beta Blockade at Discharge

No risk adjustment or risk stratification

111855| 137290| 141010| 114638| 150289| 152617

111855| 137290| 141010| 114638| 150289| 152617

0114 Risk-Adjusted Postoperative Renal Failure

Statistical risk model

111855| 137290| 114638| 141015

111855| 137290| 114638| 141015

0115 Risk-Adjusted Surgical Re-exploration

Statistical risk model

111855| 137290| 114638

111855| 137290| 114638

Stratification

0117 Beta Blockade at Discharge

N/A

0114 Risk-Adjusted Postoperative Renal Failure

N/A

0115 Risk-Adjusted Surgical Re-exploration

N/A

Type Score

0117 Beta Blockade at Discharge

Rate/proportion better quality = higher score

0114 Risk-Adjusted Postoperative Renal Failure

Rate/proportion better quality = lower score

0115 Risk-Adjusted Surgical Re-exploration

Rate/proportion better quality = lower score

Algorithm

0117 Beta Blockade at Discharge

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 141010| 114638| 150289| 152617

0114 Risk-Adjusted Postoperative Renal Failure

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 141015

0115 Risk-Adjusted Surgical Re-exploration

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638

Submission items

0117 Beta Blockade at Discharge

5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

0119 : Risk-Adjusted Operative Mortality for CABG

0118 : Anti-Lipid Treatment Discharge

0116 : Anti-Platelet Medication at Discharge

0115 : Risk-Adjusted Surgical Re-exploration

0114 : Risk-Adjusted Postoperative Renal Failure

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0130 : Risk-Adjusted Deep Sternal Wound Infection

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0127 : Preoperative Beta Blockade

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact:

5b.1 If competing, why superior or rationale for additive value: N/A

0114 Risk-Adjusted Postoperative Renal Failure

5.1 Identified measures: 0115 : Risk-Adjusted Surgical Re-exploration

0116 : Anti-Platelet Medication at Discharge

0117 : Beta Blockade at Discharge

0118 : Anti-Lipid Treatment Discharge

0127 : Preoperative Beta Blockade

0119 : Risk-Adjusted Operative Mortality for CABG

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0130 : Risk-Adjusted Deep Sternal Wound Infection

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

0115 Risk-Adjusted Surgical Re-exploration

5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure

0116 : Anti-Platelet Medication at Discharge

0117 : Beta Blockade at Discharge

0118 : Anti-Lipid Treatment Discharge

0119 : Risk-Adjusted Operative Mortality for CABG

0127 : Preoperative Beta Blockade

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0130 : Risk-Adjusted Deep Sternal Wound Infection

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #0117, NQF #0116, and NQF #0118

0117 Beta Blockade at Discharge
0116 Anti-Platelet Medication at Discharge
0118 Anti-Lipid Treatment Discharge

Steward

0117 Beta Blockade at Discharge

The Society of Thoracic Surgeons

0116 Anti-Platelet Medication at Discharge

DeLaine | Schmitz | dschmitz@sts.org | 312-202-5827-

0118 Anti-Lipid Treatment Discharge

The Society of Thoracic Surgeons

Description

0117 Beta Blockade at Discharge

Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on beta blockers

0116 Anti-Platelet Medication at Discharge

Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on anti-platelet medication

0118 Anti-Lipid Treatment Discharge

Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on a lipid lowering statin

Type

0117 Beta Blockade at Discharge

Process

0116 Anti-Platelet Medication at Discharge

Process

0118 Anti-Lipid Treatment Discharge

Process

Data Source

0117 Beta Blockade at Discharge

Registry Data STS Adult Cardiac Surgery Database Version 4.20

Available at measure-specific web page URL identified in S.1 No data dictionary

0116 Anti-Platelet Medication at Discharge

Facility, Clinician : Group/Practice Hospital

No data dictionary

0118 Anti-Lipid Treatment Discharge

Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 No data dictionary

Level

0117 Beta Blockade at Discharge

Facility, Clinician : Group/Practice

0116 Anti-Platelet Medication at Discharge

N/A

0118 Anti-Lipid Treatment Discharge

Facility, Clinician : Group/Practice

Setting

0117 Beta Blockade at Discharge

Inpatient/Hospital

115 Anti-Platelet Medication at Discharge

Attachment at measure URL

0118 Anti-Lipid Treatment Discharge

Inpatient/Hospital

Numerator Statement

0117 Beta Blockade at Discharge

Number of patients undergoing isolated CABG who were discharged on beta blockers

0116 Anti-Platelet Medication at Discharge

Number of isolated CABG procedures excluding cases with in-hospital mortality or cases for which discharge aspirin use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

0118 Anti-Lipid Treatment Discharge

Number of patients undergoing isolated CABG who were discharged on a lipid lowering statin

Numerator Details

0117 Beta Blockade at Discharge

Number of isolated CABG procedures in which discharge beta blockers [DCBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"

0116 Anti-Platelet Medication at Discharge

Cases are removed from the denominator if there was an in-hospital mortality or if discharge aspirin was contraindicated.

0118 Anti-Lipid Treatment Discharge

Number of isolated CABG procedures in which discharge lipid lowering medication [DCLipid (STS Adult Cardiac Surgery Database Version 2.73)] is marked "yes" and lipid lowering discharge medication type [DCLipMT (STS Adult Cardiac Surgery Database Version 2.73)] is marked "statin"

Denominator Statement

0117 Beta Blockade at Discharge

Patients aged 18 years and older undergoing isolated CABG

0116 Anti-Platelet Medication at Discharge

Mortality Discharge Status (MtDCStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; discharge aspirin (DCASA) is marked as “Contraindicated”

0118 Anti-Lipid Treatment Discharge

All patients undergoing isolated CABG

Denominator Details

0117 Beta Blockade at Discharge

Number of isolated CABG procedures excluding cases with an in-hospital mortality or cases for which discharge beta blocker use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

0116 Anti-Platelet Medication at Discharge

N/A

0118 Anti-Lipid Treatment Discharge

Number of isolated CABG procedures excluding cases with an in-hospital mortality or cases for which discharge anti-lipid treatment use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

Exclusions

0117 Beta Blockade at Discharge

Cases are removed from the denominator if there was an in-hospital mortality or if discharge beta blocker was contraindicated.

0116 Anti-Platelet Medication at Discharge

No risk adjustment or risk stratification

0118 Anti-Lipid Treatment Discharge

Cases are removed from the denominator if there was an in-hospital mortality or if discharge anti-lipid treatment was contraindicated.

Exclusion Details

0117 Beta Blockade at Discharge

Mortality Discharge Status (DischMortStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; discharge beta blocker (DCBeta) marked as “Contraindicated”

0116 Anti-Platelet Medication at Discharge

0118 Anti-Lipid Treatment Discharge

Mortality Discharge Status (MtDCStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; DCLipid is marked as "Contraindicated"

Risk Adjustment

0117 Beta Blockade at Discharge

No risk adjustment or risk stratification

111855| 137290| 141010| 114638| 150289| 152617

111855| 137290| 141010| 114638| 150289| 152617

0116 Anti-Platelet Medication at Discharge

better quality = higher score

111855| 137290| 114638

111855| 137290| 114638

0118 Anti-Lipid Treatment Discharge

No risk adjustment or risk stratification

111855| 137290| 114638

111855| 137290| 114638

Stratification

0117 Beta Blockade at Discharge

N/A

0116 Anti-Platelet Medication at Discharge

Rate/proportion

0118 Anti-Lipid Treatment Discharge

N/A

Type Score

0117 Beta Blockade at Discharge

Rate/proportion better quality = higher score

0116 Anti-Platelet Medication at Discharge

Please refer to numerator and denominator sections for detailed information. N/A N/A

0118 Anti-Lipid Treatment Discharge

Rate/proportion better quality = higher score

Algorithm

0117 Beta Blockade at Discharge

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 141010| 114638| 150289| 152617

0116 Anti-Platelet Medication at Discharge

Registry 111855| 137290| 114638

0118 Anti-Lipid Treatment Discharge

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638

Submission items

0117 Beta Blockade at Discharge

5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

0119 : Risk-Adjusted Operative Mortality for CABG

0118 : Anti-Lipid Treatment Discharge

0116 : Anti-Platelet Medication at Discharge

0115 : Risk-Adjusted Surgical Re-exploration

0114 : Risk-Adjusted Postoperative Renal Failure

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0130 : Risk-Adjusted Deep Sternal Wound Infection

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0127 : Preoperative Beta Blockade

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact:

5b.1 If competing, why superior or rationale for additive value: N/A

0116 Anti-Platelet Medication at Discharge

5.1 Identified measures: N/A

5a.1 Are specs completely harmonized? Attachment

5a.2 If not completely harmonized, identify difference, rationale, impact: Attachment at measure URL

5b.1 If competing, why superior or rationale for additive value: The Society of Thoracic Surgeons

0118 Anti-Lipid Treatment Discharge

5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure

0115 : Risk-Adjusted Surgical Re-exploration

0116 : Anti-Platelet Medication at Discharge

0117 : Beta Blockade at Discharge

0119 : Risk-Adjusted Operative Mortality for CABG

0127 : Preoperative Beta Blockade

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0130 : Risk-Adjusted Deep Sternal Wound Infection

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #0117, NQF #0119, and NQF #0127

0117 Beta Blockade at Discharge
0119 Risk-Adjusted Operative Mortality for CABG
0127 Preoperative Beta Blockade

Steward

0117 Beta Blockade at Discharge

The Society of Thoracic Surgeons

0119 Risk-Adjusted Operative Mortality for CABG

The Society of Thoracic Surgeons

0127 Preoperative Beta Blockade

The Society of Thoracic Surgeons

Description

0117 Beta Blockade at Discharge

Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on beta blockers

0119 Risk-Adjusted Operative Mortality for CABG

Percent of patients aged 18 years and older undergoing isolated CABG who die, including both 1) all deaths occurring during the hospitalization in which the CABG was performed, even if after 30

days, and 2) those deaths occurring after discharge from the hospital, but within 30 days of the procedure

0127 Preoperative Beta Blockade

Percent of patients aged 18 years and older undergoing isolated CABG who received beta blockers within 24 hours preceding surgery.

Type

0117 Beta Blockade at Discharge

Process

0119 Risk-Adjusted Operative Mortality for CABG

Outcome

0127 Preoperative Beta Blockade

Process

Data Source

0117 Beta Blockade at Discharge

Registry Data STS Adult Cardiac Surgery Database Version 4.20

Available at measure-specific web page URL identified in S.1 No data dictionary

0119 Risk-Adjusted Operative Mortality for CABG

Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 Attachment

0127 Preoperative Beta Blockade

Registry Data STS Adult Cardiac Surgery Database Version 4.20

Available at measure-specific web page URL identified in S.1 No data dictionary

Level

0117 Beta Blockade at Discharge

Facility, Clinician : Group/Practice

0119 Risk-Adjusted Operative Mortality for CABG

Facility, Clinician : Group/Practice

0127 Preoperative Beta Blockade

Facility, Clinician : Group/Practice

Setting

0117 Beta Blockade at Discharge

Inpatient/Hospital

0119 Risk-Adjusted Operative Mortality for CABG

Inpatient/Hospital

0127 Preoperative Beta Blockade

Inpatient/Hospital

Numerator Statement

0117 Beta Blockade at Discharge

Number of patients undergoing isolated CABG who were discharged on beta blockers

0119 Risk-Adjusted Operative Mortality for CABG

Number of patients undergoing isolated CABG who die, including both 1) all deaths occurring during the hospitalization in which the operation was performed, even if after 30 days, and 2) those deaths occurring after discharge from the hospital, but within 30 days of the procedure

0127 Preoperative Beta Blockade

Number of patients undergoing isolated CABG who received beta blockers within 24 hours preceding surgery

Numerator Details

0117 Beta Blockade at Discharge

Number of isolated CABG procedures in which discharge beta blockers [DCBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"

0119 Risk-Adjusted Operative Mortality for CABG

Number of isolated CABG procedures with an operative mortality;

Number of isolated CABG procedures in which Mortality [Mortalty (STS Adult Cardiac Surgery Database Version 2.9)] and Mortality Operative Death (MtOpD) are marked “yes.” Operative mortality is further verified by the following variables: Mortality Status at 30 days (Mt30Stat), Mortality Date (MtDate), Mortality Discharge Status (MtDCStat)

0127 Preoperative Beta Blockade

Number of isolated CABG procedures in which preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"

Denominator Statement

0117 Beta Blockade at Discharge

Patients aged 18 years and older undergoing isolated CABG

0119 Risk-Adjusted Operative Mortality for CABG

All patients undergoing isolated CABG

0127 Preoperative Beta Blockade

Patients aged 18 years and older undergoing isolated CABG

Denominator Details

0117 Beta Blockade at Discharge

Number of isolated CABG procedures excluding cases with an in-hospital mortality or cases for which discharge beta blocker use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

0119 Risk-Adjusted Operative Mortality for CABG

Number of isolated CABG procedures. The SQL code used to create the function to identify cardiac procedures is provided in the appendix.

0127 Preoperative Beta Blockade

Number of isolated CABG procedures excluding cases for which preoperative beta blockers were contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

Exclusions

0117 Beta Blockade at Discharge

Cases are removed from the denominator if there was an in-hospital mortality or if discharge beta blocker was contraindicated.

0119 Risk-Adjusted Operative Mortality for CABG

N/A

0127 Preoperative Beta Blockade

Cases are removed from the denominator if preoperative beta blocker was contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room.

Exclusion Details

0117 Beta Blockade at Discharge

Mortality Discharge Status (DischMortStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; discharge beta blocker (DCBeta) marked as “Contraindicated”

0119 Risk-Adjusted Operative Mortality for CABG

N/A

0127 Preoperative Beta Blockade

Procedures with preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] marked as "Contraindicated" or procedures with Status [Status(STS Adult Cardiac Surgery Database Version 2.81)] marked "Emergent" or "Emergent Salvage"

Risk Adjustment

0117 Beta Blockade at Discharge

No risk adjustment or risk stratification

111855| 137290| 141010| 114638| 150289| 152617

111855| 137290| 141010| 114638| 150289| 152617

0119 Risk-Adjusted Operative Mortality for CABG

Statistical risk model

111855| 137290| 114638| 141015

111855| 137290| 114638| 141015

0127 Preoperative Beta Blockade

No risk adjustment or risk stratification

111855| 137290| 114638| 152617

111855| 137290| 114638| 152617

Stratification

0117 Beta Blockade at Discharge

N/A

0119 Risk-Adjusted Operative Mortality for CABG

N/A

0127 Preoperative Beta Blockade

N/A

Type Score

0117 Beta Blockade at Discharge

Rate/proportion better quality = higher score

0119 Risk-Adjusted Operative Mortality for CABG

Rate/proportion better quality = lower score

0127 Preoperative Beta Blockade

Rate/proportion better quality = higher score

Algorithm

0117 Beta Blockade at Discharge

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 141010| 114638| 150289| 152617

0119 Risk-Adjusted Operative Mortality for CABG

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 141015

0127 Preoperative Beta Blockade

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 152617

Submission items

0117 Beta Blockade at Discharge

5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

0119 : Risk-Adjusted Operative Mortality for CABG

0118 : Anti-Lipid Treatment Discharge

0116 : Anti-Platelet Medication at Discharge

0115 : Risk-Adjusted Surgical Re-exploration

0114 : Risk-Adjusted Postoperative Renal Failure

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0130 : Risk-Adjusted Deep Sternal Wound Infection

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0127 : Preoperative Beta Blockade

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact:

5b.1 If competing, why superior or rationale for additive value: N/A

0119 Risk-Adjusted Operative Mortality for CABG

5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure

0115 : Risk-Adjusted Surgical Re-exploration

0116 : Anti-Platelet Medication at Discharge

0117 : Beta Blockade at Discharge

0118 : Anti-Lipid Treatment Discharge

0120 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR)

0127 : Preoperative Beta Blockade

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0130 : Risk-Adjusted Deep Sternal Wound Infection

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

0123 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) + CABG Surgery

0121 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Replacement

0122 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Replacement + CABG Surgery

1501 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Repair

1502 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Repair + CABG Surgery

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact:

5b.1 If competing, why superior or rationale for additive value: N/A

0127 Preoperative Beta Blockade

5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

0119 : Risk-Adjusted Operative Mortality for CABG

0118 : Anti-Lipid Treatment Discharge

0117 : Beta Blockade at Discharge

0116 : Anti-Platelet Medication at Discharge

0115 : Risk-Adjusted Surgical Re-exploration

0114 : Risk-Adjusted Postoperative Renal Failure

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0130 : Risk-Adjusted Deep Sternal Wound Infection

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact:

5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #0117, NQF #0129, and NQF #0130

0117 Beta Blockade at Discharge
0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)
0130 Risk-Adjusted Deep Sternal Wound Infection

Steward

0117 Beta Blockade at Discharge

The Society of Thoracic Surgeons

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

The Society of Thoracic Surgeons

0130 Risk-Adjusted Deep Sternal Wound Infection

The Society of Thoracic Surgeons

Description

0117 Beta Blockade at Discharge

Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on beta blockers

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Percent of patients aged 18 years and older undergoing isolated CABG who require intubation for more than 24 hours postoperatively

0130 Risk-Adjusted Deep Sternal Wound Infection

Percent of patients aged 18 years and older undergoing isolated CABG for whom mediastinitis or deep sternal wound infection is diagnosed within 30 days postoperatively or at any time during the hospitalization for surgery

Type

0117 Beta Blockade at Discharge

Process

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Outcome

0130 Risk-Adjusted Deep Sternal Wound Infection

Outcome

Data Source

0117 Beta Blockade at Discharge

Registry Data STS Adult Cardiac Surgery Database Version 4.20

Available at measure-specific web page URL identified in S.1 No data dictionary

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 Attachment

0130 Risk-Adjusted Deep Sternal Wound Infection

Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 Attachment

Level

0117 Beta Blockade at Discharge

Facility, Clinician : Group/Practice

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Facility, Clinician : Group/Practice

0130 Risk-Adjusted Deep Sternal Wound Infection

Facility, Clinician : Group/Practice

Setting

0117 Beta Blockade at Discharge

Inpatient/Hospital

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Inpatient/Hospital

0130 Risk-Adjusted Deep Sternal Wound Infection

Inpatient/Hospital

Numerator Statement

0117 Beta Blockade at Discharge

Number of patients undergoing isolated CABG who were discharged on beta blockers

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Number of patients undergoing isolated CABG who require intubation > 24 hours following exit from the operating room

0130 Risk-Adjusted Deep Sternal Wound Infection

Number of patients aged 18 years and older undergoing isolated CABG for whom mediastinitis or deep sternal wound infection is diagnosed within 30 days postoperatively or at any time during the hospitalization for surgery

Numerator Details

0117 Beta Blockade at Discharge

Number of isolated CABG procedures in which discharge beta blockers [DCBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Number of isolated CABG procedures in which Prolonged Ventilation (CPVntLng) is marked "yes" (STS Adult Cardiac Surgery Database Version 2.9)

The hours of postoperative ventilation time include OR exit until extubation, plus any additional hours following reintubation.

0130 Risk-Adjusted Deep Sternal Wound Infection

Numerator time period:

Within 30 days postoperatively or at any time during the hospitalization for surgery

Number of isolated CABG procedures in which deep sternal infection/mediastinitis [DeepSternInf (STS Adult Cardiac Surgery Database Version 2.9)] is marked "yes"

DeepSternInf

Deep incisional SSI: Must meet the following criteria

- Infection occurs within 30 days after the operative procedure, and involves deep soft tissues of the incision (e.g., fascial and muscle layers) and patient has at least one of the following:
- Purulent drainage from the deep incision.
- A deep incision that spontaneously dehisces or is deliberately opened by a surgeon, attending physician or other designee and is culture-positive or not cultured, and patient has at least one of the following signs or symptoms:

  Fever (>38°C)

  Localized pain or tenderness

  An abscess or other evidence of infection involving the deep incision that is detected on direct examination, during invasive procedure, or by histopathologic examination or imaging test.

  A culture with negative findings does not meet this criterion.

- There are two specific types of deep incisional SSIs:

  Deep Incisional Primary (DIP) – a deep incisional SSI that is identified in a primary incision in a patient that has had an operation with one or more incisions (e.g., chest incision for CABG)

  Deep Incisional Secondary (DIS) – a deep incisional SSI that is identified in the secondary incision in a patient that has had an operation with more than one incision (e.g., donor site incision for CABG)

MED-Mediastinitis: Must meet the following criteria

Mediastinitis must meet at least 1 of the following criteria:

Patient has organisms cultured from mediastinal tissue or fluid obtained during an invasive procedure.

Patient has evidence of mediastinitis seen during an invasive procedure or histopathologic examination.

- Patient has at least 1 of the following signs or symptoms:

  Fever (>38°C)

  Chest pain (with no other recognized cause)

  Sternal instability (with no other recognized cause) and at least 1 of the following:

Purulent discharge from mediastinal area

Organisms cultured from blood or discharge from mediastinal area

Mediastinal widening on imaging test.

Denominator Statement

0117 Beta Blockade at Discharge

Patients aged 18 years and older undergoing isolated CABG

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

All patients undergoing isolated CABG

0130 Risk-Adjusted Deep Sternal Wound Infection

All patients undergoing isolated CABG

Denominator Details

0117 Beta Blockade at Discharge

Number of isolated CABG procedures excluding cases with an in-hospital mortality or cases for which discharge beta blocker use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Number of isolated CABG procedures. The SQL code used to create the function to identify cardiac procedures is provided in the appendix.

0130 Risk-Adjusted Deep Sternal Wound Infection

Number of isolated CABG procedures. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

Exclusions

0117 Beta Blockade at Discharge

Cases are removed from the denominator if there was an in-hospital mortality or if discharge beta blocker was contraindicated.

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

N/A

0130 Risk-Adjusted Deep Sternal Wound Infection

N/A

Exclusion Details

0117 Beta Blockade at Discharge

Mortality Discharge Status (DischMortStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; discharge beta blocker (DCBeta) marked as “Contraindicated”

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

N/A

0130 Risk-Adjusted Deep Sternal Wound Infection

N/A

Risk Adjustment

0117 Beta Blockade at Discharge

No risk adjustment or risk stratification

111855| 137290| 141010| 114638| 150289| 152617

111855| 137290| 141010| 114638| 150289| 152617

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Statistical risk model

111855| 137290| 114638| 141015

111855| 137290| 114638| 141015

0130 Risk-Adjusted Deep Sternal Wound Infection

Statistical risk model

111855| 137290| 114638

111855| 137290| 114638

Stratification

0117 Beta Blockade at Discharge

N/A

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

N/A

0130 Risk-Adjusted Deep Sternal Wound Infection

N/A

Type Score

0117 Beta Blockade at Discharge

Rate/proportion better quality = higher score

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Rate/proportion better quality = lower score

0130 Risk-Adjusted Deep Sternal Wound Infection

Rate/proportion better quality = lower score

Algorithm

0117 Beta Blockade at Discharge

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 141010| 114638| 150289| 152617

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 141015

0130 Risk-Adjusted Deep Sternal Wound Infection

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638

Submission items

0117 Beta Blockade at Discharge

5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

0119 : Risk-Adjusted Operative Mortality for CABG

0118 : Anti-Lipid Treatment Discharge

0116 : Anti-Platelet Medication at Discharge

0115 : Risk-Adjusted Surgical Re-exploration

0114 : Risk-Adjusted Postoperative Renal Failure

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0130 : Risk-Adjusted Deep Sternal Wound Infection

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0127 : Preoperative Beta Blockade

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact:

5b.1 If competing, why superior or rationale for additive value: N/A

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure

0115 : Risk-Adjusted Surgical Re-exploration

0116 : Anti-Platelet Medication at Discharge

0117 : Beta Blockade at Discharge

0118 : Anti-Lipid Treatment Discharge

0119 : Risk-Adjusted Operative Mortality for CABG

0127 : Preoperative Beta Blockade

0130 : Risk-Adjusted Deep Sternal Wound Infection

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

0130 Risk-Adjusted Deep Sternal Wound Infection

5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure

0115 : Risk-Adjusted Surgical Re-exploration

0116 : Anti-Platelet Medication at Discharge

0117 : Beta Blockade at Discharge

0118 : Anti-Lipid Treatment Discharge

0119 : Risk-Adjusted Operative Mortality for CABG

0127 : Preoperative Beta Blockade

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #0117, NQF #0131, and NQF #0134

0117 Beta Blockade at Discharge
0131 Risk-Adjusted Stroke/Cerebrovascular Accident
0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Steward

0117 Beta Blockade at Discharge

The Society of Thoracic Surgeons

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

The Society of Thoracic Surgeons

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

The Society of Thoracic Surgeons

Description

0117 Beta Blockade at Discharge

Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on beta blockers

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Percent of patients aged 18 years and older undergoing isolated CABG who have a postoperative stroke (i.e., any confirmed neurological deficit of abrupt onset caused by a disturbance in blood supply to the brain) that did not resolve within 24 hours

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Percentage of patients aged 18 years and older undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft

Type

0117 Beta Blockade at Discharge

Process

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Outcome

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Process

Data Source

0117 Beta Blockade at Discharge

Registry Data STS Adult Cardiac Surgery Database Version 4.20

Available at measure-specific web page URL identified in S.1 No data dictionary

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 Attachment

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Registry Data STS Adult Cardiac Surgery Database Version 4.20

Available at measure-specific web page URL identified in S.1 No data dictionary

Level

0117 Beta Blockade at Discharge

Facility, Clinician : Group/Practice

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Facility, Clinician : Group/Practice

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Facility, Clinician : Group/Practice

Setting

0117 Beta Blockade at Discharge

Inpatient/Hospital

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Inpatient/Hospital

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Inpatient/Hospital

Numerator Statement

0117 Beta Blockade at Discharge

Number of patients undergoing isolated CABG who were discharged on beta blockers

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Number of patients undergoing isolated CABG who have a postoperative stroke (i.e., any confirmed neurological deficit of abrupt onset caused by a disturbance in blood supply to the brain) that did not resolve within 24 hours

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Number of patients undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft

Numerator Details

0117 Beta Blockade at Discharge

Number of isolated CABG procedures in which discharge beta blockers [DCBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Number of isolated CABG procedures in which postoperative stroke [CNStrokP (STS Adult Cardiac Surgery Database Version 2.9)] is marked "yes"

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Number of isolated CABG procedures in which IMA Artery Used [IMAUsed(STS Adult Cardiac Surgery Database Version 4.20] is marked "Left IMA" and/or "Right IMA"

Denominator Statement

0117 Beta Blockade at Discharge

Patients aged 18 years and older undergoing isolated CABG

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

All patients undergoing isolated CABG

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Patients aged 18 years and older undergoing isolated CABG

Denominator Details

0117 Beta Blockade at Discharge

Number of isolated CABG procedures excluding cases with an in-hospital mortality or cases for which discharge beta blocker use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Number of isolated CABG procedures. The SQL code used to create the function to identify cardiac procedures is provided in the appendix.

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Number of isolated CABG procedures excluding cases that were a previous CABG prior to the current admission or if IMA was not used and one of the acceptable reasons was provided. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

Exclusions

0117 Beta Blockade at Discharge

Cases are removed from the denominator if there was an in-hospital mortality or if discharge beta blocker was contraindicated.

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

N/A

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Cases are removed from the denominator if the patient had a previous CABG prior to the current admission or if IMA was not used and one of the following reasons was provided:

Subclavian stenosis

Previous cardiac or thoracic surgery

Previous mediastinal radiation

Emergent or salvage procedure

No (bypassable) LAD disease

Exclusion Details

0117 Beta Blockade at Discharge

Mortality Discharge Status (DischMortStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; discharge beta blocker (DCBeta) marked as "Contraindicated"

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

N/A

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Patients with previous CABG, identified where PrCAB is marked "yes"

or

IMA Artery Used (IMAUsed) is marked "no" and primary reason for no IMA (NoIMARsn) is marked as any of the following:

Subclavian stenosis

Previous cardiac or thoracic surgery

Previous mediastinal radiation

Emergent or salvage procedure

No (bypassable) LAD disease

Risk Adjustment

0117 Beta Blockade at Discharge

No risk adjustment or risk stratification

111855| 137290| 141010| 114638| 150289| 152617

111855| 137290| 141010| 114638| 150289| 152617

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Statistical risk model

111855| 137290| 114638| 141015

111855| 137290| 114638| 141015

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

No risk adjustment or risk stratification

111855| 137290| 114638| 152617

111855| 137290| 114638| 152617

Stratification

0117 Beta Blockade at Discharge

N/A

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

N/A

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

N/A

Type Score

0117 Beta Blockade at Discharge

Rate/proportion better quality = higher score

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Rate/proportion better quality = lower score

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Rate/proportion better quality = higher score

Algorithm

0117 Beta Blockade at Discharge

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 141010| 114638| 150289| 152617

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 141015

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 152617

Submission items

0117 Beta Blockade at Discharge

5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

0119 : Risk-Adjusted Operative Mortality for CABG

0118 : Anti-Lipid Treatment Discharge

0116 : Anti-Platelet Medication at Discharge

0115 : Risk-Adjusted Surgical Re-exploration

0114 : Risk-Adjusted Postoperative Renal Failure

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0130 : Risk-Adjusted Deep Sternal Wound Infection

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0127 : Preoperative Beta Blockade

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact:

5b.1 If competing, why superior or rationale for additive value: N/A

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure

0115 : Risk-Adjusted Surgical Re-exploration

0116 : Anti-Platelet Medication at Discharge

0117 : Beta Blockade at Discharge

0118 : Anti-Lipid Treatment Discharge

0119 : Risk-Adjusted Operative Mortality for CABG

0127 : Preoperative Beta Blockade

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0130 : Risk-Adjusted Deep Sternal Wound Infection

0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

5.1 Identified measures: 0119 : Risk-Adjusted Operative Mortality for CABG

0118 : Anti-Lipid Treatment Discharge

0117 : Beta Blockade at Discharge

0116 : Anti-Platelet Medication at Discharge

0115 : Risk-Adjusted Surgical Re-exploration

0114 : Risk-Adjusted Postoperative Renal Failure

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0130 : Risk-Adjusted Deep Sternal Wound Infection

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0127 : Preoperative Beta Blockade

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact:

5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #0127, NQF #0114, and NQF #0115

0127 Preoperative Beta Blockade

0114 Risk-Adjusted Postoperative Renal Failure

0115 Risk-Adjusted Surgical Re-exploration

Steward

0127 Preoperative Beta Blockade

The Society of Thoracic Surgeons

0114 Risk-Adjusted Postoperative Renal Failure

The Society of Thoracic Surgeons

0115 Risk-Adjusted Surgical Re-exploration

The Society of Thoracic Surgeons

Description

0127 Preoperative Beta Blockade

Percent of patients aged 18 years and older undergoing isolated CABG who received beta blockers within 24 hours preceding surgery.

0114 Risk-Adjusted Postoperative Renal Failure

Percent of patients aged 18 years and older undergoing isolated CABG (without pre-existing renal failure) who develop postoperative renal failure or require dialysis

0115 Risk-Adjusted Surgical Re-exploration

Percent of patients aged 18 years and older undergoing isolated CABG who require a re-intervention during the current hospitalization for mediastinal bleeding with or without tamponade, graft occlusion, valve dysfunction, or other cardiac reason

Type

0127 Preoperative Beta Blockade

Process

0114 Risk-Adjusted Postoperative Renal Failure

Outcome

0115 Risk-Adjusted Surgical Re-exploration

Outcome

Data Source

0127 Preoperative Beta Blockade

Registry Data STS Adult Cardiac Surgery Database Version 4.20

Available at measure-specific web page URL identified in S.1 No data dictionary

0114 Risk-Adjusted Postoperative Renal Failure

Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 Attachment

0115 Risk-Adjusted Surgical Re-exploration

Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 Attachment

Level

0127 Preoperative Beta Blockade

Facility, Clinician : Group/Practice

0114 Risk-Adjusted Postoperative Renal Failure

Facility, Clinician : Group/Practice

0115 Risk-Adjusted Surgical Re-exploration

Facility, Clinician : Group/Practice

Setting

0127 Preoperative Beta Blockade

Inpatient/Hospital

0114 Risk-Adjusted Postoperative Renal Failure

Inpatient/Hospital

0115 Risk-Adjusted Surgical Re-exploration

Inpatient/Hospital

Numerator Statement

0127 Preoperative Beta Blockade

Number of patients undergoing isolated CABG who received beta blockers within 24 hours preceding surgery

0114 Risk-Adjusted Postoperative Renal Failure

Number of patients undergoing isolated CABG who develop postoperative renal failure or require dialysis

0115 Risk-Adjusted Surgical Re-exploration

Number of patients undergoing isolated CABG who require a re-intervention during the current hospitalization for mediastinal bleeding with or without tamponade, graft occlusion, valve dysfunction, or other cardiac reason

Numerator Details

0127 Preoperative Beta Blockade

Number of isolated CABG procedures in which preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"

0114 Risk-Adjusted Postoperative Renal Failure

Definition of renal failure/dialysis requirement – Patients with acute renal failure or worsening renal function resulting in one or both of the following:

Increase of serum creatinine to 4.0 or higher, or 3x the most recent preoperative creatinine level

New requirement for dialysis postoperatively

Number of isolated CABG procedures in which postoperative renal failure [CRenFail (STS Adult Cardiac Surgery Database Version 2.9)] is marked as "yes"

0115 Risk-Adjusted Surgical Re-exploration

Number of isolated CABG procedures in which any of the following are marked "yes" –

ReOp for Bleeding [COpReBld (STS Adult Cardiac Surgery Database Version 2.73)], Reintervention for Graft Occlusion (COpReGft), ReOp for Valve Dysfunction (COpReVlv), ReOp for Other Cardiac Reason (COpReOth)

Denominator Statement

0127 Preoperative Beta Blockade

Patients aged 18 years and older undergoing isolated CABG

0114 Risk-Adjusted Postoperative Renal Failure

All patients undergoing isolated CABG

0115 Risk-Adjusted Surgical Re-exploration

All patients undergoing isolated CABG

Denominator Details

0127 Preoperative Beta Blockade

Number of isolated CABG procedures excluding cases for which preoperative beta blockers were contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

0114 Risk-Adjusted Postoperative Renal Failure

Number of isolated CABG procedures including re-operations; the SQL code used to create the function to identify cardiac procedures is provided in the appendix.

0115 Risk-Adjusted Surgical Re-exploration

Number of isolated CABG procedures. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

Exclusions

0127 Preoperative Beta Blockade

Cases are removed from the denominator if preoperative beta blocker was contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room.

0114 Risk-Adjusted Postoperative Renal Failure

Patients with documented history of renal failure, baseline serum creatinine of 4.0 or higher; prior renal transplants are not considered preoperative renal failure unless since transplantation their Cr has been or is 4.0 or higher

0115 Risk-Adjusted Surgical Re-exploration

N/A

Exclusion Details

0127 Preoperative Beta Blockade

Procedures with preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] marked as "Contraindicated" or procedures with Status [Status(STS Adult Cardiac Surgery Database Version 2.81)] marked "Emergent" or "Emergent Salvage"

0114 Risk-Adjusted Postoperative Renal Failure

(Dialysis) is marked yes; Last Creatinine Level (CreatLst) is 4.0 or higher

0115 Risk-Adjusted Surgical Re-exploration

N/A

Risk Adjustment

0127 Preoperative Beta Blockade

No risk adjustment or risk stratification

111855| 137290| 114638| 152617

111855| 137290| 114638| 152617

0114 Risk-Adjusted Postoperative Renal Failure

Statistical risk model

111855| 137290| 114638| 141015

111855| 137290| 114638| 141015

0115 Risk-Adjusted Surgical Re-exploration

Statistical risk model

111855| 137290| 114638

111855| 137290| 114638

Stratification

0127 Preoperative Beta Blockade

N/A

0114 Risk-Adjusted Postoperative Renal Failure

N/A

0115 Risk-Adjusted Surgical Re-exploration

N/A

Type Score

0127 Preoperative Beta Blockade

Rate/proportion better quality = higher score

0114 Risk-Adjusted Postoperative Renal Failure

Rate/proportion better quality = lower score

0115 Risk-Adjusted Surgical Re-exploration

Rate/proportion better quality = lower score

Algorithm

0127 Preoperative Beta Blockade

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 152617

0114 Risk-Adjusted Postoperative Renal Failure

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 141015

0115 Risk-Adjusted Surgical Re-exploration

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638

Submission items

0127 Preoperative Beta Blockade

5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

0119 : Risk-Adjusted Operative Mortality for CABG
0118 : Anti-Lipid Treatment Discharge
0117 : Beta Blockade at Discharge
0116 : Anti-Platelet Medication at Discharge
0115 : Risk-Adjusted Surgical Re-exploration
0114 : Risk-Adjusted Postoperative Renal Failure
0131 : Risk-Adjusted Stroke/Cerebrovascular Accident
0130 : Risk-Adjusted Deep Sternal Wound Infection
0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)
5a.1 Are specs completely harmonized? Yes
5a.2 If not completely harmonized, identify difference, rationale, impact:
5b.1 If competing, why superior or rationale for additive value: N/A

0114 Risk-Adjusted Postoperative Renal Failure

5.1 Identified measures: 0115 : Risk-Adjusted Surgical Re-exploration
0116 : Anti-Platelet Medication at Discharge
0117 : Beta Blockade at Discharge
0118 : Anti-Lipid Treatment Discharge
0127 : Preoperative Beta Blockade
0119 : Risk-Adjusted Operative Mortality for CABG
0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)
0130 : Risk-Adjusted Deep Sternal Wound Infection
0131 : Risk-Adjusted Stroke/Cerebrovascular Accident
0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
5a.1 Are specs completely harmonized? Yes
5a.2 If not completely harmonized, identify difference, rationale, impact: N/A
5b.1 If competing, why superior or rationale for additive value: N/A

0115 Risk-Adjusted Surgical Re-exploration

5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure
0116 : Anti-Platelet Medication at Discharge
0117 : Beta Blockade at Discharge
0118 : Anti-Lipid Treatment Discharge
0119 : Risk-Adjusted Operative Mortality for CABG
0127 : Preoperative Beta Blockade
0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)
0130 : Risk-Adjusted Deep Sternal Wound Infection
0131 : Risk-Adjusted Stroke/Cerebrovascular Accident
0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
5a.1 Are specs completely harmonized? Yes
5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #0127, NQF #0116, and NQF #0117

0127 Preoperative Beta Blockade
0116 Anti-Platelet Medication at Discharge
0117 Beta Blockade at Discharge

Steward

0127 Preoperative Beta Blockade

The Society of Thoracic Surgeons

0116 Anti-Platelet Medication at Discharge

DeLaine | Schmitz | dschmitz@sts.org | 312-202-5827-

0117 Beta Blockade at Discharge

The Society of Thoracic Surgeons

Description

0127 Preoperative Beta Blockade

Percent of patients aged 18 years and older undergoing isolated CABG who received beta blockers within 24 hours preceding surgery.

0116 Anti-Platelet Medication at Discharge

Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on anti-platelet medication

0117 Beta Blockade at Discharge

Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on beta blockers

Type

0127 Preoperative Beta Blockade

Process

0116 Anti-Platelet Medication at Discharge

Process

0117 Beta Blockade at Discharge

Process

Data Source

0127 Preoperative Beta Blockade

Registry Data STS Adult Cardiac Surgery Database Version 4.20

Available at measure-specific web page URL identified in S.1 No data dictionary

0116 Anti-Platelet Medication at Discharge

Facility, Clinician : Group/Practice Hospital

No data dictionary

0117 Beta Blockade at Discharge

Registry Data STS Adult Cardiac Surgery Database Version 4.20

Available at measure-specific web page URL identified in S.1 No data dictionary

Level

0127 Preoperative Beta Blockade

Facility, Clinician : Group/Practice

0116 Anti-Platelet Medication at Discharge

N/A

0117 Beta Blockade at Discharge

Facility, Clinician : Group/Practice

Setting

0127 Preoperative Beta Blockade

Inpatient/Hospital

116 Anti-Platelet Medication at Discharge

Attachment at measure URL

0117 Beta Blockade at Discharge

Inpatient/Hospital

Numerator Statement

0127 Preoperative Beta Blockade

Number of patients undergoing isolated CABG who received beta blockers within 24 hours preceding surgery

0116 Anti-Platelet Medication at Discharge

Number of isolated CABG procedures excluding cases with in-hospital mortality or cases for which discharge aspirin use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

0117 Beta Blockade at Discharge

Number of patients undergoing isolated CABG who were discharged on beta blockers

Numerator Details

0127 Preoperative Beta Blockade

Number of isolated CABG procedures in which preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"

0116 Anti-Platelet Medication at Discharge

Cases are removed from the denominator if there was an in-hospital mortality or if discharge aspirin was contraindicated.

0117 Beta Blockade at Discharge

Number of isolated CABG procedures in which discharge beta blockers [DCBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"

Denominator Statement

0127 Preoperative Beta Blockade

Patients aged 18 years and older undergoing isolated CABG

0116 Anti-Platelet Medication at Discharge

Mortality Discharge Status (MtDCStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; discharge aspirin (DCASA) is marked as “Contraindicated”

0117 Beta Blockade at Discharge

Patients aged 18 years and older undergoing isolated CABG

Denominator Details

0127 Preoperative Beta Blockade

Number of isolated CABG procedures excluding cases for which preoperative beta blockers were contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

0116 Anti-Platelet Medication at Discharge

N/A

0117 Beta Blockade at Discharge

Number of isolated CABG procedures excluding cases with an in-hospital mortality or cases for which discharge beta blocker use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

Exclusions

0127 Preoperative Beta Blockade

Cases are removed from the denominator if preoperative beta blocker was contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room.

0116 Anti-Platelet Medication at Discharge

No risk adjustment or risk stratification

0117 Beta Blockade at Discharge

Cases are removed from the denominator if there was an in-hospital mortality or if discharge beta blocker was contraindicated.

Exclusion Details

0127 Preoperative Beta Blockade

Procedures with preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] marked as "Contraindicated" or procedures with Status [Status(STS Adult Cardiac Surgery Database Version 2.81)] marked "Emergent" or "Emergent Salvage"

0116 Anti-Platelet Medication at Discharge

0117 Beta Blockade at Discharge

Mortality Discharge Status (DischMortStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; discharge beta blocker (DCBeta) marked as "Contraindicated"

Risk Adjustment

0127 Preoperative Beta Blockade

No risk adjustment or risk stratification

111855| 137290| 114638| 152617

111855| 137290| 114638| 152617

0116 Anti-Platelet Medication at Discharge

better quality = higher score

111855| 137290| 114638

111855| 137290| 114638

0117 Beta Blockade at Discharge

No risk adjustment or risk stratification

111855| 137290| 141010| 114638| 150289| 152617

111855| 137290| 141010| 114638| 150289| 152617

Stratification

0127 Preoperative Beta Blockade

N/A

0116 Anti-Platelet Medication at Discharge

Rate/proportion

0117 Beta Blockade at Discharge

N/A

Type Score

0127 Preoperative Beta Blockade

Rate/proportion better quality = higher score

0116 Anti-Platelet Medication at Discharge

Please refer to numerator and denominator sections for detailed information. N/A N/A

0117 Beta Blockade at Discharge

Rate/proportion better quality = higher score

Algorithm

0127 Preoperative Beta Blockade

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 152617

0116 Anti-Platelet Medication at Discharge

Registry 111855| 137290| 114638

0117 Beta Blockade at Discharge

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 141010| 114638| 150289| 152617

Submission items

0127 Preoperative Beta Blockade

5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

0119 : Risk-Adjusted Operative Mortality for CABG

0118 : Anti-Lipid Treatment Discharge

0117 : Beta Blockade at Discharge

0116 : Anti-Platelet Medication at Discharge

0115 : Risk-Adjusted Surgical Re-exploration

0114 : Risk-Adjusted Postoperative Renal Failure

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0130 : Risk-Adjusted Deep Sternal Wound Infection

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact:

5b.1 If competing, why superior or rationale for additive value: N/A

0116 Anti-Platelet Medication at Discharge

5.1 Identified measures: N/A

5a.1 Are specs completely harmonized? Attachment

5a.2 If not completely harmonized, identify difference, rationale, impact: Attachment at measure URL

5b.1 If competing, why superior or rationale for additive value: The Society of Thoracic Surgeons

0117 Beta Blockade at Discharge

5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

0119 : Risk-Adjusted Operative Mortality for CABG

0118 : Anti-Lipid Treatment Discharge

0116 : Anti-Platelet Medication at Discharge

0115 : Risk-Adjusted Surgical Re-exploration

0114 : Risk-Adjusted Postoperative Renal Failure

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0130 : Risk-Adjusted Deep Sternal Wound Infection

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0127 : Preoperative Beta Blockade

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact:

5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #0127, NQF #0118, and NQF #0119

0127 Preoperative Beta Blockade
0118 Anti-Lipid Treatment Discharge
0119 Risk-Adjusted Operative Mortality for CABG

Steward

0127 Preoperative Beta Blockade

The Society of Thoracic Surgeons

0118 Anti-Lipid Treatment Discharge

The Society of Thoracic Surgeons

0119 Risk-Adjusted Operative Mortality for CABG

The Society of Thoracic Surgeons

Description

0127 Preoperative Beta Blockade

Percent of patients aged 18 years and older undergoing isolated CABG who received beta blockers within 24 hours preceding surgery.

0118 Anti-Lipid Treatment Discharge

Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on a lipid lowering statin

0119 Risk-Adjusted Operative Mortality for CABG

Percent of patients aged 18 years and older undergoing isolated CABG who die, including both 1) all deaths occurring during the hospitalization in which the CABG was performed, even if after 30 days, and 2) those deaths occurring after discharge from the hospital, but within 30 days of the procedure

Type

0127 Preoperative Beta Blockade

Process

0118 Anti-Lipid Treatment Discharge

Process

0119 Risk-Adjusted Operative Mortality for CABG

Outcome

Data Source

0127 Preoperative Beta Blockade

Registry Data STS Adult Cardiac Surgery Database Version 4.20

Available at measure-specific web page URL identified in S.1 No data dictionary

0118 Anti-Lipid Treatment Discharge

Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 No data dictionary

0119 Risk-Adjusted Operative Mortality for CABG

Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 Attachment

Level

0127 Preoperative Beta Blockade

Facility, Clinician : Group/Practice

0118 Anti-Lipid Treatment Discharge

Facility, Clinician : Group/Practice

0119 Risk-Adjusted Operative Mortality for CABG

Facility, Clinician : Group/Practice

Setting

0127 Preoperative Beta Blockade

Inpatient/Hospital

0118 Anti-Lipid Treatment Discharge

Inpatient/Hospital

0119 Risk-Adjusted Operative Mortality for CABG

Inpatient/Hospital

Numerator Statement

0127 Preoperative Beta Blockade

Number of patients undergoing isolated CABG who received beta blockers within 24 hours preceding surgery

0118 Anti-Lipid Treatment Discharge

Number of patients undergoing isolated CABG who were discharged on a lipid lowering statin

0119 Risk-Adjusted Operative Mortality for CABG

Number of patients undergoing isolated CABG who die, including both 1) all deaths occurring during the hospitalization in which the operation was performed, even if after 30 days, and 2) those deaths occurring after discharge from the hospital, but within 30 days of the procedure

Numerator Details

0127 Preoperative Beta Blockade

Number of isolated CABG procedures in which preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"

0118 Anti-Lipid Treatment Discharge

Number of isolated CABG procedures in which discharge lipid lowering medication [DCLipid (STS Adult Cardiac Surgery Database Version 2.73)] is marked "yes" and lipid lowering discharge medication type [DCLipMT (STS Adult Cardiac Surgery Database Version 2.73)] is marked "statin"

0119 Risk-Adjusted Operative Mortality for CABG

Number of isolated CABG procedures with an operative mortality;

Number of isolated CABG procedures in which Mortality [Mortalty (STS Adult Cardiac Surgery Database Version 2.9)] and Mortality Operative Death (MtOpD) are marked "yes." Operative mortality is further verified by the following variables: Mortality Status at 30 days (Mt30Stat), Mortality Date (MtDate), Mortality Discharge Status (MtDCStat)

Denominator Statement

0127 Preoperative Beta Blockade

Patients aged 18 years and older undergoing isolated CABG

0118 Anti-Lipid Treatment Discharge

All patients undergoing isolated CABG

0119 Risk-Adjusted Operative Mortality for CABG

All patients undergoing isolated CABG

Denominator Details

0127 Preoperative Beta Blockade

Number of isolated CABG procedures excluding cases for which preoperative beta blockers were contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

0118 Anti-Lipid Treatment Discharge

Number of isolated CABG procedures excluding cases with an in-hospital mortality or cases for which discharge anti-lipid treatment use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

0119 Risk-Adjusted Operative Mortality for CABG

Number of isolated CABG procedures. The SQL code used to create the function to identify cardiac procedures is provided in the appendix.

Exclusions

0127 Preoperative Beta Blockade

Cases are removed from the denominator if preoperative beta blocker was contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room.

0118 Anti-Lipid Treatment Discharge

Cases are removed from the denominator if there was an in-hospital mortality or if discharge anti-lipid treatment was contraindicated.

0119 Risk-Adjusted Operative Mortality for CABG

N/A

Exclusion Details

0127 Preoperative Beta Blockade

Procedures with preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] marked as "Contraindicated" or procedures with Status [Status(STS Adult Cardiac Surgery Database Version 2.81)] marked "Emergent" or "Emergent Salvage"

0118 Anti-Lipid Treatment Discharge

Mortality Discharge Status (MtDCStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; DCLipid is marked as "Contraindicated"

0119 Risk-Adjusted Operative Mortality for CABG

N/A

Risk Adjustment

0127 Preoperative Beta Blockade

No risk adjustment or risk stratification

111855| 137290| 114638| 152617

111855| 137290| 114638| 152617

0118 Anti-Lipid Treatment Discharge

No risk adjustment or risk stratification

111855| 137290| 114638

111855| 137290| 114638

0119 Risk-Adjusted Operative Mortality for CABG

Statistical risk model

111855| 137290| 114638| 141015

111855| 137290| 114638| 141015

Stratification

0127 Preoperative Beta Blockade

N/A

0118 Anti-Lipid Treatment Discharge

N/A

0119 Risk-Adjusted Operative Mortality for CABG

N/A

Type Score

0127 Preoperative Beta Blockade

Rate/proportion better quality = higher score

0118 Anti-Lipid Treatment Discharge

Rate/proportion better quality = higher score

0119 Risk-Adjusted Operative Mortality for CABG

Rate/proportion better quality = lower score

Algorithm

0127 Preoperative Beta Blockade

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 152617

0118 Anti-Lipid Treatment Discharge

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638

0119 Risk-Adjusted Operative Mortality for CABG

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 141015

Submission items

0127 Preoperative Beta Blockade

5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

0119 : Risk-Adjusted Operative Mortality for CABG

0118 : Anti-Lipid Treatment Discharge

0117 : Beta Blockade at Discharge

0116 : Anti-Platelet Medication at Discharge

0115 : Risk-Adjusted Surgical Re-exploration

0114 : Risk-Adjusted Postoperative Renal Failure

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0130 : Risk-Adjusted Deep Sternal Wound Infection

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact:

5b.1 If competing, why superior or rationale for additive value: N/A

0118 Anti-Lipid Treatment Discharge

5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure

0115 : Risk-Adjusted Surgical Re-exploration

0116 : Anti-Platelet Medication at Discharge

0117 : Beta Blockade at Discharge

0119 : Risk-Adjusted Operative Mortality for CABG

0127 : Preoperative Beta Blockade

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0130 : Risk-Adjusted Deep Sternal Wound Infection

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

0119 Risk-Adjusted Operative Mortality for CABG

5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure

0115 : Risk-Adjusted Surgical Re-exploration

0116 : Anti-Platelet Medication at Discharge

0117 : Beta Blockade at Discharge

0118 : Anti-Lipid Treatment Discharge

0120 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR)

0127 : Preoperative Beta Blockade

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0130 : Risk-Adjusted Deep Sternal Wound Infection

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

0123 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) + CABG Surgery

0121 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Replacement

0122 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Replacement + CABG Surgery

1501 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Repair

1502 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Repair + CABG Surgery

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact:

5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #0127, NQF #0129, and NQF #0130

0127 Preoperative Beta Blockade

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0130 Risk-Adjusted Deep Sternal Wound Infection

Steward

0127 Preoperative Beta Blockade

The Society of Thoracic Surgeons

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

The Society of Thoracic Surgeons

0130 Risk-Adjusted Deep Sternal Wound Infection

The Society of Thoracic Surgeons

Description

0127 Preoperative Beta Blockade

Percent of patients aged 18 years and older undergoing isolated CABG who received beta blockers within 24 hours preceding surgery.

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Percent of patients aged 18 years and older undergoing isolated CABG who require intubation for more than 24 hours postoperatively

0130 Risk-Adjusted Deep Sternal Wound Infection

Percent of patients aged 18 years and older undergoing isolated CABG for whom mediastinitis or deep sternal wound infection is diagnosed within 30 days postoperatively or at any time during the hospitalization for surgery

Type

0127 Preoperative Beta Blockade

Process

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Outcome

0130 Risk-Adjusted Deep Sternal Wound Infection

Outcome

Data Source

0127 Preoperative Beta Blockade

Registry Data STS Adult Cardiac Surgery Database Version 4.20

Available at measure-specific web page URL identified in S.1 No data dictionary

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 Attachment

0130 Risk-Adjusted Deep Sternal Wound Infection

Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 Attachment

Level

0127 Preoperative Beta Blockade

Facility, Clinician : Group/Practice

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Facility, Clinician : Group/Practice

0130 Risk-Adjusted Deep Sternal Wound Infection

Facility, Clinician : Group/Practice

Setting

0127 Preoperative Beta Blockade

Inpatient/Hospital

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Inpatient/Hospital

0130 Risk-Adjusted Deep Sternal Wound Infection

Inpatient/Hospital

Numerator Statement

0127 Preoperative Beta Blockade

Number of patients undergoing isolated CABG who received beta blockers within 24 hours preceding surgery

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Number of patients undergoing isolated CABG who require intubation > 24 hours following exit from the operating room

0130 Risk-Adjusted Deep Sternal Wound Infection

Number of patients aged 18 years and older undergoing isolated CABG for whom mediastinitis or deep sternal wound infection is diagnosed within 30 days postoperatively or at any time during the hospitalization for surgery

Numerator Details

0127 Preoperative Beta Blockade

Number of isolated CABG procedures in which preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Number of isolated CABG procedures in which Prolonged Ventilation (CPVntLng) is marked "yes" (STS Adult Cardiac Surgery Database Version 2.9)

The hours of postoperative ventilation time include OR exit until extubation, plus any additional hours following reintubation.

0130 Risk-Adjusted Deep Sternal Wound Infection

Numerator time period:

Within 30 days postoperatively or at any time during the hospitalization for surgery

Number of isolated CABG procedures in which deep sternal infection/mediastinitis [DeepSternInf (STS Adult Cardiac Surgery Database Version 2.9)] is marked "yes"

DeepSternInf

Deep incisional SSI: Must meet the following criteria

Infection occurs within 30 days after the operative procedure, and involves deep soft tissues of the incision (e.g., fascial and muscle layers) and patient has at least one of the following:

Purulent drainage from the deep incision.

- A deep incision that spontaneously dehisces or is deliberately opened by a surgeon, attending physician or other designee and is culture-positive or not cultured, and patient has at least one of the following signs or symptoms:

  Fever (>38°C)

  Localized pain or tenderness

  An abscess or other evidence of infection involving the deep incision that is detected on direct examination, during invasive procedure, or by histopathologic examination or imaging test.

  A culture with negative findings does not meet this criterion.

- There are two specific types of deep incisional SSIs:

  Deep Incisional Primary (DIP) – a deep incisional SSI that is identified in a primary incision in a patient that has had an operation with one or more incisions (e.g., chest incision for CABG)

  Deep Incisional Secondary (DIS) – a deep incisional SSI that is identified in the secondary incision in a patient that has had an operation with more than one incision (e.g., donor site incision for CABG)

MED-Mediastinitis: Must meet the following criteria

Mediastinitis must meet at least 1 of the following criteria:

Patient has organisms cultured from mediastinal tissue or fluid obtained during an invasive procedure.

Patient has evidence of mediastinitis seen during an invasive procedure or histopathologic examination.

Patient has at least 1 of the following signs or symptoms:

- Fever (>38°C)
- Chest pain (with no other recognized cause)
- Sternal instability (with no other recognized cause) and at least 1 of the following:
- Purulent discharge from mediastinal area
- Organisms cultured from blood or discharge from mediastinal area
- Mediastinal widening on imaging test.

Denominator Statement

0127 Preoperative Beta Blockade

Patients aged 18 years and older undergoing isolated CABG

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

All patients undergoing isolated CABG

0130 Risk-Adjusted Deep Sternal Wound Infection

All patients undergoing isolated CABG

Denominator Details

0127 Preoperative Beta Blockade

Number of isolated CABG procedures excluding cases for which preoperative beta blockers were contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Number of isolated CABG procedures. The SQL code used to create the function to identify cardiac procedures is provided in the appendix.

0130 Risk-Adjusted Deep Sternal Wound Infection

Number of isolated CABG procedures. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

Exclusions

0127 Preoperative Beta Blockade

Cases are removed from the denominator if preoperative beta blocker was contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room.

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

N/A

0130 Risk-Adjusted Deep Sternal Wound Infection

N/A

Exclusion Details

0127 Preoperative Beta Blockade

Procedures with preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] marked as "Contraindicated" or procedures with Status [Status(STS Adult Cardiac Surgery Database Version 2.81)] marked "Emergent" or "Emergent Salvage"

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

N/A

0130 Risk-Adjusted Deep Sternal Wound Infection

N/A

Risk Adjustment

0127 Preoperative Beta Blockade

No risk adjustment or risk stratification

111855| 137290| 114638| 152617

111855| 137290| 114638| 152617

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Statistical risk model

111855| 137290| 114638| 141015

111855| 137290| 114638| 141015

0130 Risk-Adjusted Deep Sternal Wound Infection

Statistical risk model

111855| 137290| 114638

111855| 137290| 114638

Stratification

0127 Preoperative Beta Blockade

N/A

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

N/A

0130 Risk-Adjusted Deep Sternal Wound Infection

N/A

Type Score

0127 Preoperative Beta Blockade

Rate/proportion better quality = higher score

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Rate/proportion better quality = lower score

0130 Risk-Adjusted Deep Sternal Wound Infection

Rate/proportion better quality = lower score

Algorithm

0127 Preoperative Beta Blockade

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 152617

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 141015

0130 Risk-Adjusted Deep Sternal Wound Infection

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638

Submission items

0127 Preoperative Beta Blockade

5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

0119 : Risk-Adjusted Operative Mortality for CABG

0118 : Anti-Lipid Treatment Discharge

0117 : Beta Blockade at Discharge

0116 : Anti-Platelet Medication at Discharge

0115 : Risk-Adjusted Surgical Re-exploration
0114 : Risk-Adjusted Postoperative Renal Failure
0131 : Risk-Adjusted Stroke/Cerebrovascular Accident
0130 : Risk-Adjusted Deep Sternal Wound Infection
0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)
5a.1 Are specs completely harmonized? Yes
5a.2 If not completely harmonized, identify difference, rationale, impact:
5b.1 If competing, why superior or rationale for additive value: N/A

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure
0115 : Risk-Adjusted Surgical Re-exploration
0116 : Anti-Platelet Medication at Discharge
0117 : Beta Blockade at Discharge
0118 : Anti-Lipid Treatment Discharge
0119 : Risk-Adjusted Operative Mortality for CABG
0127 : Preoperative Beta Blockade
0130 : Risk-Adjusted Deep Sternal Wound Infection
0131 : Risk-Adjusted Stroke/Cerebrovascular Accident
0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
5a.1 Are specs completely harmonized? Yes
5a.2 If not completely harmonized, identify difference, rationale, impact: N/A
5b.1 If competing, why superior or rationale for additive value: N/A

0130 Risk-Adjusted Deep Sternal Wound Infection

5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure
0115 : Risk-Adjusted Surgical Re-exploration
0116 : Anti-Platelet Medication at Discharge
0117 : Beta Blockade at Discharge
0118 : Anti-Lipid Treatment Discharge
0119 : Risk-Adjusted Operative Mortality for CABG
0127 : Preoperative Beta Blockade
0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)
0131 : Risk-Adjusted Stroke/Cerebrovascular Accident
0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
5a.1 Are specs completely harmonized? Yes
5a.2 If not completely harmonized, identify difference, rationale, impact: N/A
5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #0134, NQF #0116, and NQF #0117

0127 Preoperative Beta Blockade

0131 Risk-Adjusted Stroke/Cerebrovascular Accident
0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Steward

0127 Preoperative Beta Blockade

The Society of Thoracic Surgeons

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

The Society of Thoracic Surgeons

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

The Society of Thoracic Surgeons

Description

0127 Preoperative Beta Blockade

Percent of patients aged 18 years and older undergoing isolated CABG who received beta blockers within 24 hours preceding surgery.

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Percent of patients aged 18 years and older undergoing isolated CABG who have a postoperative stroke (i.e., any confirmed neurological deficit of abrupt onset caused by a disturbance in blood supply to the brain) that did not resolve within 24 hours

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Percentage of patients aged 18 years and older undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft

Type

0127 Preoperative Beta Blockade

Process

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Outcome

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Process

Data Source

0127 Preoperative Beta Blockade

Registry Data STS Adult Cardiac Surgery Database Version 4.20

Available at measure-specific web page URL identified in S.1 No data dictionary

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 Attachment

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Registry Data STS Adult Cardiac Surgery Database Version 4.20

Available at measure-specific web page URL identified in S.1 No data dictionary

Level

0127 Preoperative Beta Blockade
Facility, Clinician : Group/Practice

0131 Risk-Adjusted Stroke/Cerebrovascular Accident
Facility, Clinician : Group/Practice

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
Facility, Clinician : Group/Practice

Setting

0127 Preoperative Beta Blockade
Inpatient/Hospital

0131 Risk-Adjusted Stroke/Cerebrovascular Accident
Inpatient/Hospital

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
Inpatient/Hospital

Numerator Statement

0127 Preoperative Beta Blockade
Number of patients undergoing isolated CABG who received beta blockers within 24 hours preceding surgery

0131 Risk-Adjusted Stroke/Cerebrovascular Accident
Number of patients undergoing isolated CABG who have a postoperative stroke (i.e., any confirmed neurological deficit of abrupt onset caused by a disturbance in blood supply to the brain) that did not resolve within 24 hours

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
Number of patients undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft

Numerator Details

0127 Preoperative Beta Blockade
Number of isolated CABG procedures in which preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"

0131 Risk-Adjusted Stroke/Cerebrovascular Accident
Number of isolated CABG procedures in which postoperative stroke [CNStrokP (STS Adult Cardiac Surgery Database Version 2.9)] is marked "yes"

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
Number of isolated CABG procedures in which IMA Artery Used [IMAUsed(STS Adult Cardiac Surgery Database Version 4.20] is marked "Left IMA" and/or "Right IMA"

Denominator Statement

0127 Preoperative Beta Blockade

Patients aged 18 years and older undergoing isolated CABG

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

All patients undergoing isolated CABG

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Patients aged 18 years and older undergoing isolated CABG

Denominator Details

0127 Preoperative Beta Blockade

Number of isolated CABG procedures excluding cases for which preoperative beta blockers were contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Number of isolated CABG procedures. The SQL code used to create the function to identify cardiac procedures is provided in the appendix.

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Number of isolated CABG procedures excluding cases that were a previous CABG prior to the current admission or if IMA was not used and one of the acceptable reasons was provided. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

Exclusions

0127 Preoperative Beta Blockade

Cases are removed from the denominator if preoperative beta blocker was contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room.

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

N/A

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Cases are removed from the denominator if the patient had a previous CABG prior to the current admission or if IMA was not used and one of the following reasons was provided:

- Subclavian stenosis
- Previous cardiac or thoracic surgery
- Previous mediastinal radiation
- Emergent or salvage procedure
- No (bypassable) LAD disease

Exclusion Details

0127 Preoperative Beta Blockade

Procedures with preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] marked as "Contraindicated" or procedures with Status [Status(STS Adult Cardiac Surgery Database Version 2.81)] marked "Emergent" or "Emergent Salvage"

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

N/A

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Patients with previous CABG, identified where PrCAB is marked "yes"

or

IMA Artery Used (IMAUsed) is marked “no” and primary reason for no IMA (NoIMARsn) is marked as any of the following:

- Subclavian stenosis
- Previous cardiac or thoracic surgery
- Previous mediastinal radiation
- Emergent or salvage procedure
- No (bypassable) LAD disease

Risk Adjustment

0127 Preoperative Beta Blockade

No risk adjustment or risk stratification

111855| 137290| 114638| 152617

111855| 137290| 114638| 152617

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Statistical risk model

111855| 137290| 114638| 141015

111855| 137290| 114638| 141015

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

No risk adjustment or risk stratification

111855| 137290| 114638| 152617

111855| 137290| 114638| 152617

Stratification

0127 Preoperative Beta Blockade

N/A

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

N/A

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

N/A

Type Score

0127 Preoperative Beta Blockade

Rate/proportion better quality = higher score

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Rate/proportion better quality = lower score

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Rate/proportion better quality = higher score

Algorithm

0127 Preoperative Beta Blockade

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 152617

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 141015

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 152617

Submission items

0127 Preoperative Beta Blockade

5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

0119 : Risk-Adjusted Operative Mortality for CABG

0118 : Anti-Lipid Treatment Discharge

0117 : Beta Blockade at Discharge

0116 : Anti-Platelet Medication at Discharge

0115 : Risk-Adjusted Surgical Re-exploration

0114 : Risk-Adjusted Postoperative Renal Failure

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0130 : Risk-Adjusted Deep Sternal Wound Infection

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact:

5b.1 If competing, why superior or rationale for additive value: N/A

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure

0115 : Risk-Adjusted Surgical Re-exploration

0116 : Anti-Platelet Medication at Discharge

0117 : Beta Blockade at Discharge

0118 : Anti-Lipid Treatment Discharge

0119 : Risk-Adjusted Operative Mortality for CABG

0127 : Preoperative Beta Blockade

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0130 : Risk-Adjusted Deep Sternal Wound Infection

0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

5.1 Identified measures: 0119 : Risk-Adjusted Operative Mortality for CABG

0118 : Anti-Lipid Treatment Discharge

0117 : Beta Blockade at Discharge

0116 : Anti-Platelet Medication at Discharge

0115 : Risk-Adjusted Surgical Re-exploration

0114 : Risk-Adjusted Postoperative Renal Failure

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0130 : Risk-Adjusted Deep Sternal Wound Infection

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0127 : Preoperative Beta Blockade

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact:

5b.1 If competing, why superior or rationale for additive value: N/A

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
0114 Risk-Adjusted Postoperative Renal Failure
0115 Risk-Adjusted Surgical Re-exploration

Steward

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

The Society of Thoracic Surgeons

0114 Risk-Adjusted Postoperative Renal Failure

The Society of Thoracic Surgeons

0115 Risk-Adjusted Surgical Re-exploration

The Society of Thoracic Surgeons

Description

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Percentage of patients aged 18 years and older undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft

0114 Risk-Adjusted Postoperative Renal Failure

Percent of patients aged 18 years and older undergoing isolated CABG (without pre-existing renal failure) who develop postoperative renal failure or require dialysis

0115 Risk-Adjusted Surgical Re-exploration

Percent of patients aged 18 years and older undergoing isolated CABG who require a re-intervention during the current hospitalization for mediastinal bleeding with or without tamponade, graft occlusion, valve dysfunction, or other cardiac reason

Type

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Process

0114 Risk-Adjusted Postoperative Renal Failure

Outcome

0115 Risk-Adjusted Surgical Re-exploration

Outcome

Data Source

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Registry Data STS Adult Cardiac Surgery Database Version 4.20

Available at measure-specific web page URL identified in S.1 No data dictionary

0114 Risk-Adjusted Postoperative Renal Failure

Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 Attachment

0115 Risk-Adjusted Surgical Re-exploration

Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 Attachment

Level

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Facility, Clinician : Group/Practice

0114 Risk-Adjusted Postoperative Renal Failure

Facility, Clinician : Group/Practice

0115 Risk-Adjusted Surgical Re-exploration

Facility, Clinician : Group/Practice

Setting

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Inpatient/Hospital

0114 Risk-Adjusted Postoperative Renal Failure

Inpatient/Hospital

0115 Risk-Adjusted Surgical Re-exploration

Inpatient/Hospital

Numerator Statement

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Number of patients undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft

0114 Risk-Adjusted Postoperative Renal Failure

Number of patients undergoing isolated CABG who develop postoperative renal failure or require dialysis

0115 Risk-Adjusted Surgical Re-exploration

Number of patients undergoing isolated CABG who require a re-intervention during the current hospitalization for mediastinal bleeding with or without tamponade, graft occlusion, valve dysfunction, or other cardiac reason

Numerator Details

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Number of isolated CABG procedures in which IMA Artery Used [IMAUsed(STS Adult Cardiac Surgery Database Version 4.20] is marked "Left IMA" and/or "Right IMA"

0114 Risk-Adjusted Postoperative Renal Failure

Definition of renal failure/dialysis requirement – Patients with acute renal failure or worsening renal function resulting in one or both of the following:

- Increase of serum creatinine to 4.0 or higher, or 3x the most recent preoperative creatinine level
- New requirement for dialysis postoperatively

Number of isolated CABG procedures in which postoperative renal failure [CRenFail (STS Adult Cardiac Surgery Database Version 2.9)] is marked as "yes"

0115 Risk-Adjusted Surgical Re-exploration

Number of isolated CABG procedures in which any of the following are marked "yes" –

ReOp for Bleeding [COpReBld (STS Adult Cardiac Surgery Database Version 2.73)], Reintervention for Graft Occlusion (COpReGft), ReOp for Valve Dysfunction (COpReVlv), ReOp for Other Cardiac Reason (COpReOth)

Denominator Statement

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Patients aged 18 years and older undergoing isolated CABG

0114 Risk-Adjusted Postoperative Renal Failure

All patients undergoing isolated CABG

0115 Risk-Adjusted Surgical Re-exploration

All patients undergoing isolated CABG

Denominator Details

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Number of isolated CABG procedures excluding cases that were a previous CABG prior to the current admission or if IMA was not used and one of the acceptable reasons was provided. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

0114 Risk-Adjusted Postoperative Renal Failure

Number of isolated CABG procedures including re-operations; the SQL code used to create the function to identify cardiac procedures is provided in the appendix.

0115 Risk-Adjusted Surgical Re-exploration

Number of isolated CABG procedures. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

Exclusions

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Cases are removed from the denominator if the patient had a previous CABG prior to the current admission or if IMA was not used and one of the following reasons was provided:

Subclavian stenosis

Previous cardiac or thoracic surgery

Previous mediastinal radiation

Emergent or salvage procedure

No (bypassable) LAD disease

0114 Risk-Adjusted Postoperative Renal Failure

Patients with documented history of renal failure, baseline serum creatinine of 4.0 or higher; prior renal transplants are not considered preoperative renal failure unless since transplantation their Cr has been or is 4.0 or higher

0115 Risk-Adjusted Surgical Re-exploration

N/A

Exclusion Details

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Patients with previous CABG, identified where PrCAB is marked "yes"

or

IMA Artery Used (IMAUsed) is marked “no” and primary reason for no IMA (NoIMARsn) is marked as any of the following:

Subclavian stenosis

Previous cardiac or thoracic surgery

Previous mediastinal radiation

Emergent or salvage procedure

No (bypassable) LAD disease

0114 Risk-Adjusted Postoperative Renal Failure

(Dialysis) is marked yes; Last Creatinine Level (CreatLst) is 4.0 or higher

0115 Risk-Adjusted Surgical Re-exploration

N/A

Risk Adjustment

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

No risk adjustment or risk stratification

111855| 137290| 114638| 152617

111855| 137290| 114638| 152617

0114 Risk-Adjusted Postoperative Renal Failure

Statistical risk model

111855| 137290| 114638| 141015

111855| 137290| 114638| 141015

0115 Risk-Adjusted Surgical Re-exploration

Statistical risk model

111855| 137290| 114638

111855| 137290| 114638

Stratification

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

N/A

0114 Risk-Adjusted Postoperative Renal Failure

N/A

0115 Risk-Adjusted Surgical Re-exploration

N/A

Type Score

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Rate/proportion better quality = higher score

0114 Risk-Adjusted Postoperative Renal Failure

Rate/proportion better quality = lower score

0115 Risk-Adjusted Surgical Re-exploration

Rate/proportion better quality = lower score

Algorithm

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 152617

0114 Risk-Adjusted Postoperative Renal Failure

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 141015

0115 Risk-Adjusted Surgical Re-exploration

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638

Submission items

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

5.1 Identified measures: 0119 : Risk-Adjusted Operative Mortality for CABG

0118 : Anti-Lipid Treatment Discharge

0117 : Beta Blockade at Discharge

0116 : Anti-Platelet Medication at Discharge

0115 : Risk-Adjusted Surgical Re-exploration

0114 : Risk-Adjusted Postoperative Renal Failure

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0130 : Risk-Adjusted Deep Sternal Wound Infection

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0127 : Preoperative Beta Blockade

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact:

5b.1 If competing, why superior or rationale for additive value: N/A

0114 Risk-Adjusted Postoperative Renal Failure

5.1 Identified measures: 0115 : Risk-Adjusted Surgical Re-exploration

0116 : Anti-Platelet Medication at Discharge

0117 : Beta Blockade at Discharge

0118 : Anti-Lipid Treatment Discharge

0127 : Preoperative Beta Blockade

0119 : Risk-Adjusted Operative Mortality for CABG

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0130 : Risk-Adjusted Deep Sternal Wound Infection

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

0115 Risk-Adjusted Surgical Re-exploration

5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure

0116 : Anti-Platelet Medication at Discharge

0117 : Beta Blockade at Discharge

0118 : Anti-Lipid Treatment Discharge

0119 : Risk-Adjusted Operative Mortality for CABG

0127 : Preoperative Beta Blockade

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0130 : Risk-Adjusted Deep Sternal Wound Infection

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
0116 Anti-Platelet Medication at Discharge
0117 Beta Blockade at Discharge

Steward

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

The Society of Thoracic Surgeons

0116 Anti-Platelet Medication at Discharge

DeLaine | Schmitz | dschmitz@sts.org | 312-202-5827-

0117 Beta Blockade at Discharge

The Society of Thoracic Surgeons

Description

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Percentage of patients aged 18 years and older undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft

0116 Anti-Platelet Medication at Discharge

Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on anti-platelet medication

0117 Beta Blockade at Discharge

Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on beta blockers

Type

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Process

0116 Anti-Platelet Medication at Discharge

Process

0117 Beta Blockade at Discharge

Process

Data Source

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Registry Data STS Adult Cardiac Surgery Database Version 4.20

Available at measure-specific web page URL identified in S.1 No data dictionary

0116 Anti-Platelet Medication at Discharge

Facility, Clinician : Group/Practice Hospital

No data dictionary

0117 Beta Blockade at Discharge

Registry Data STS Adult Cardiac Surgery Database Version 4.20

Available at measure-specific web page URL identified in S.1 No data dictionary

Level

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Facility, Clinician : Group/Practice

0116 Anti-Platelet Medication at Discharge

N/A

0117 Beta Blockade at Discharge

Facility, Clinician : Group/Practice

Setting

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Inpatient/Hospital

0116 Anti-Platelet Medication at Discharge

Attachment at measure URL

0117 Beta Blockade at Discharge

Inpatient/Hospital

Numerator Statement

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Number of patients undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft

0116 Anti-Platelet Medication at Discharge

Number of isolated CABG procedures excluding cases with in-hospital mortality or cases for which discharge aspirin use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

0117 Beta Blockade at Discharge

Number of patients undergoing isolated CABG who were discharged on beta blockers

Numerator Details

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Number of isolated CABG procedures in which IMA Artery Used [IMAUsed(STS Adult Cardiac Surgery Database Version 4.20] is marked "Left IMA" and/or "Right IMA"

0116 Anti-Platelet Medication at Discharge

Cases are removed from the denominator if there was an in-hospital mortality or if discharge aspirin was contraindicated.

0117 Beta Blockade at Discharge

Number of isolated CABG procedures in which discharge beta blockers [DCBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"

Denominator Statement

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Patients aged 18 years and older undergoing isolated CABG

0116 Anti-Platelet Medication at Discharge

Mortality Discharge Status (MtDCStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; discharge aspirin (DCASA) is marked as “Contraindicated”

0117 Beta Blockade at Discharge

Patients aged 18 years and older undergoing isolated CABG

Denominator Details

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Number of isolated CABG procedures excluding cases that were a previous CABG prior to the current admission or if IMA was not used and one of the acceptable reasons was provided. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

0116 Anti-Platelet Medication at Discharge

N/A

0117 Beta Blockade at Discharge

Number of isolated CABG procedures excluding cases with an in-hospital mortality or cases for which discharge beta blocker use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

Exclusions

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Cases are removed from the denominator if the patient had a previous CABG prior to the current admission or if IMA was not used and one of the following reasons was provided:

Subclavian stenosis

Previous cardiac or thoracic surgery

Previous mediastinal radiation

Emergent or salvage procedure

No (bypassable) LAD disease

0116 Anti-Platelet Medication at Discharge

No risk adjustment or risk stratification

0117 Beta Blockade at Discharge

Cases are removed from the denominator if there was an in-hospital mortality or if discharge beta blocker was contraindicated.

Exclusion Details

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Patients with previous CABG, identified where PrCAB is marked "yes"

or

IMA Artery Used (IMAUsed) is marked "no" and primary reason for no IMA (NoIMARsn) is marked as any of the following:

Subclavian stenosis

Previous cardiac or thoracic surgery

Previous mediastinal radiation

Emergent or salvage procedure

No (bypassable) LAD disease

0116 Anti-Platelet Medication at Discharge

0117 Beta Blockade at Discharge

Mortality Discharge Status (DischMortStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; discharge beta blocker (DCBeta) marked as "Contraindicated"

Risk Adjustment

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

No risk adjustment or risk stratification

111855| 137290| 114638| 152617

111855| 137290| 114638| 152617

0116 Anti-Platelet Medication at Discharge

better quality = higher score

111855| 137290| 114638

111855| 137290| 114638

0117 Beta Blockade at Discharge

No risk adjustment or risk stratification

111855| 137290| 141010| 114638| 150289| 152617

111855| 137290| 141010| 114638| 150289| 152617

Stratification

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

N/A

0116 Anti-Platelet Medication at Discharge

Rate/proportion

0117 Beta Blockade at Discharge

N/A

Type Score

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Rate/proportion better quality = higher score

0116 Anti-Platelet Medication at Discharge

Please refer to numerator and denominator sections for detailed information. N/A N/A

0117 Beta Blockade at Discharge

Rate/proportion better quality = higher score

Algorithm

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 152617

0116 Anti-Platelet Medication at Discharge

Registry 111855| 137290| 114638

0117 Beta Blockade at Discharge

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 141010| 114638| 150289| 152617

Submission items

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

5.1 Identified measures: 0119 : Risk-Adjusted Operative Mortality for CABG

0118 : Anti-Lipid Treatment Discharge

0117 : Beta Blockade at Discharge

0116 : Anti-Platelet Medication at Discharge

0115 : Risk-Adjusted Surgical Re-exploration

0114 : Risk-Adjusted Postoperative Renal Failure

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0130 : Risk-Adjusted Deep Sternal Wound Infection

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0127 : Preoperative Beta Blockade

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact:

5b.1 If competing, why superior or rationale for additive value: N/A

0116 Anti-Platelet Medication at Discharge

5.1 Identified measures: N/A

5a.1 Are specs completely harmonized? Attachment

5a.2 If not completely harmonized, identify difference, rationale, impact: Attachment at measure URL

5b.1 If competing, why superior or rationale for additive value: The Society of Thoracic Surgeons

0117 Beta Blockade at Discharge

5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

0119 : Risk-Adjusted Operative Mortality for CABG

0118 : Anti-Lipid Treatment Discharge

0116 : Anti-Platelet Medication at Discharge

0115 : Risk-Adjusted Surgical Re-exploration

0114 : Risk-Adjusted Postoperative Renal Failure

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0130 : Risk-Adjusted Deep Sternal Wound Infection

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0127 : Preoperative Beta Blockade

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact:

5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #0134, NQF #0118, and NQF #0119

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
0118 Anti-Lipid Treatment Discharge
0119 Risk-Adjusted Operative Mortality for CABG

Steward

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

The Society of Thoracic Surgeons

0118 Anti-Lipid Treatment Discharge

The Society of Thoracic Surgeons

0119 Risk-Adjusted Operative Mortality for CABG

The Society of Thoracic Surgeons

Description

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Percentage of patients aged 18 years and older undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft

0118 Anti-Lipid Treatment Discharge

Percent of patients aged 18 years and older undergoing isolated CABG who were discharged on a lipid lowering statin

0119 Risk-Adjusted Operative Mortality for CABG

Percent of patients aged 18 years and older undergoing isolated CABG who die, including both 1) all deaths occurring during the hospitalization in which the CABG was performed, even if after 30 days, and 2) those deaths occurring after discharge from the hospital, but within 30 days of the procedure

Type

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Process

0118 Anti-Lipid Treatment Discharge

Process

0119 Risk-Adjusted Operative Mortality for CABG

Outcome

Data Source

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Registry Data STS Adult Cardiac Surgery Database Version 4.20

Available at measure-specific web page URL identified in S.1 No data dictionary

0118 Anti-Lipid Treatment Discharge

Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 No data dictionary

0119 Risk-Adjusted Operative Mortality for CABG

Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 Attachment

Level

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Facility, Clinician : Group/Practice

0118 Anti-Lipid Treatment Discharge

Facility, Clinician : Group/Practice

0119 Risk-Adjusted Operative Mortality for CABG

Facility, Clinician : Group/Practice

Setting

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Inpatient/Hospital

0118 Anti-Lipid Treatment Discharge

Inpatient/Hospital

0119 Risk-Adjusted Operative Mortality for CABG

Inpatient/Hospital

Numerator Statement

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Number of patients undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft

0118 Anti-Lipid Treatment Discharge

Number of patients undergoing isolated CABG who were discharged on a lipid lowering statin

0119 Risk-Adjusted Operative Mortality for CABG

Number of patients undergoing isolated CABG who die, including both 1) all deaths occurring during the hospitalization in which the operation was performed, even if after 30 days, and 2) those deaths occurring after discharge from the hospital, but within 30 days of the procedure

Numerator Details

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Number of isolated CABG procedures in which IMA Artery Used [IMAUsed(STS Adult Cardiac Surgery Database Version 4.20] is marked "Left IMA" and/or "Right IMA"

0118 Anti-Lipid Treatment Discharge

Number of isolated CABG procedures in which discharge lipid lowering medication [DCLipid (STS Adult Cardiac Surgery Database Version 2.73)] is marked "yes" and lipid lowering discharge medication type [DCLipMT (STS Adult Cardiac Surgery Database Version 2.73)] is marked "statin"

0119 Risk-Adjusted Operative Mortality for CABG

Number of isolated CABG procedures with an operative mortality;

Number of isolated CABG procedures in which Mortality [Mortalty (STS Adult Cardiac Surgery Database Version 2.9)] and Mortality Operative Death (MtOpD) are marked “yes.” Operative mortality is further verified by the following variables: Mortality Status at 30 days (Mt30Stat), Mortality Date (MtDate), Mortality Discharge Status (MtDCStat)

Denominator Statement

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Patients aged 18 years and older undergoing isolated CABG

0118 Anti-Lipid Treatment Discharge

All patients undergoing isolated CABG

0119 Risk-Adjusted Operative Mortality for CABG

All patients undergoing isolated CABG

Denominator Details

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Number of isolated CABG procedures excluding cases that were a previous CABG prior to the current admission or if IMA was not used and one of the acceptable reasons was provided. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

0118 Anti-Lipid Treatment Discharge

Number of isolated CABG procedures excluding cases with an in-hospital mortality or cases for which discharge anti-lipid treatment use was contraindicated. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

0119 Risk-Adjusted Operative Mortality for CABG

Number of isolated CABG procedures. The SQL code used to create the function to identify cardiac procedures is provided in the appendix.

Exclusions

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Cases are removed from the denominator if the patient had a previous CABG prior to the current admission or if IMA was not used and one of the following reasons was provided:

Subclavian stenosis

Previous cardiac or thoracic surgery

Previous mediastinal radiation

Emergent or salvage procedure

No (bypassable) LAD disease

0118 Anti-Lipid Treatment Discharge

Cases are removed from the denominator if there was an in-hospital mortality or if discharge anti-lipid treatment was contraindicated.

0119 Risk-Adjusted Operative Mortality for CABG

N/A

Exclusion Details

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Patients with previous CABG, identified where PrCAB is marked "yes"

or

IMA Artery Used (IMAUsed) is marked “no” and primary reason for no IMA (NoIMARsn) is marked as any of the following:

Subclavian stenosis

Previous cardiac or thoracic surgery

Previous mediastinal radiation

Emergent or salvage procedure

No (bypassable) LAD disease

0118 Anti-Lipid Treatment Discharge

Mortality Discharge Status (MtDCStat), Mortality Date (MtDate), and Discharge Date (DischDt) indicate an in-hospital mortality; DCLipid is marked as "Contraindicated"

0119 Risk-Adjusted Operative Mortality for CABG

N/A

Risk Adjustment

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

No risk adjustment or risk stratification

111855| 137290| 114638| 152617

111855| 137290| 114638| 152617

0118 Anti-Lipid Treatment Discharge

No risk adjustment or risk stratification

111855| 137290| 114638

111855| 137290| 114638

0119 Risk-Adjusted Operative Mortality for CABG

Statistical risk model

111855| 137290| 114638| 141015

111855| 137290| 114638| 141015

Stratification

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

N/A

0118 Anti-Lipid Treatment Discharge

N/A

0119 Risk-Adjusted Operative Mortality for CABG

N/A

Type Score

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Rate/proportion better quality = higher score

0118 Anti-Lipid Treatment Discharge

Rate/proportion better quality = higher score

0119 Risk-Adjusted Operative Mortality for CABG

Rate/proportion better quality = lower score

Algorithm

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 152617

0118 Anti-Lipid Treatment Discharge

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638

0119 Risk-Adjusted Operative Mortality for CABG

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 141015

Submission items

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

5.1 Identified measures: 0119 : Risk-Adjusted Operative Mortality for CABG
0118 : Anti-Lipid Treatment Discharge
0117 : Beta Blockade at Discharge
0116 : Anti-Platelet Medication at Discharge
0115 : Risk-Adjusted Surgical Re-exploration
0114 : Risk-Adjusted Postoperative Renal Failure
0131 : Risk-Adjusted Stroke/Cerebrovascular Accident
0130 : Risk-Adjusted Deep Sternal Wound Infection
0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)
0127 : Preoperative Beta Blockade
5a.1 Are specs completely harmonized? Yes
5a.2 If not completely harmonized, identify difference, rationale, impact:
5b.1 If competing, why superior or rationale for additive value: N/A

0118 Anti-Lipid Treatment Discharge

5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure
0115 : Risk-Adjusted Surgical Re-exploration
0116 : Anti-Platelet Medication at Discharge
0117 : Beta Blockade at Discharge
0119 : Risk-Adjusted Operative Mortality for CABG
0127 : Preoperative Beta Blockade
0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)
0130 : Risk-Adjusted Deep Sternal Wound Infection
0131 : Risk-Adjusted Stroke/Cerebrovascular Accident
0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
5a.1 Are specs completely harmonized? Yes
5a.2 If not completely harmonized, identify difference, rationale, impact: N/A
5b.1 If competing, why superior or rationale for additive value: N/A

0119 Risk-Adjusted Operative Mortality for CABG

5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure
0115 : Risk-Adjusted Surgical Re-exploration
0116 : Anti-Platelet Medication at Discharge
0117 : Beta Blockade at Discharge
0118 : Anti-Lipid Treatment Discharge
0120 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR)
0127 : Preoperative Beta Blockade
0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0130 : Risk-Adjusted Deep Sternal Wound Infection

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

0123 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) + CABG Surgery

0121 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Replacement

0122 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Replacement + CABG Surgery

1501 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Repair

1502 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Repair + CABG Surgery

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact:

5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #0134, NQF #0127, and NQF #0129

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
0127 Preoperative Beta Blockade
0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Steward

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

The Society of Thoracic Surgeons

0127 Preoperative Beta Blockade

The Society of Thoracic Surgeons

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

The Society of Thoracic Surgeons

Description

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Percentage of patients aged 18 years and older undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft

0127 Preoperative Beta Blockade

Percent of patients aged 18 years and older undergoing isolated CABG who received beta blockers within 24 hours preceding surgery.

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Percent of patients aged 18 years and older undergoing isolated CABG who require intubation for more than 24 hours postoperatively

Type

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Process

0127 Preoperative Beta Blockade

Process

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Outcome

Data Source

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Registry Data STS Adult Cardiac Surgery Database Version 4.20

Available at measure-specific web page URL identified in S.1 No data dictionary

0127 Preoperative Beta Blockade

Registry Data STS Adult Cardiac Surgery Database Version 4.20

Available at measure-specific web page URL identified in S.1 No data dictionary

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 Attachment

Level

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Facility, Clinician : Group/Practice

0127 Preoperative Beta Blockade

Facility, Clinician : Group/Practice

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Facility, Clinician : Group/Practice

Setting

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Inpatient/Hospital

0127 Preoperative Beta Blockade

Inpatient/Hospital

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Inpatient/Hospital

Numerator Statement

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Number of patients undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft

0127 Preoperative Beta Blockade

Number of patients undergoing isolated CABG who received beta blockers within 24 hours preceding surgery

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Number of patients undergoing isolated CABG who require intubation > 24 hours following exit from the operating room

Numerator Details

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Number of isolated CABG procedures in which IMA Artery Used [IMAUsed(STS Adult Cardiac Surgery Database Version 4.20] is marked "Left IMA" and/or "Right IMA"

0127 Preoperative Beta Blockade

Number of isolated CABG procedures in which preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] is marked "yes"

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Number of isolated CABG procedures in which Prolonged Ventilation (CPVntLng) is marked "yes" (STS Adult Cardiac Surgery Database Version 2.9)

The hours of postoperative ventilation time include OR exit until extubation, plus any additional hours following reintubation.

Denominator Statement

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Patients aged 18 years and older undergoing isolated CABG

0127 Preoperative Beta Blockade

Patients aged 18 years and older undergoing isolated CABG

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

All patients undergoing isolated CABG

Denominator Details

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Number of isolated CABG procedures excluding cases that were a previous CABG prior to the current admission or if IMA was not used and one of the acceptable reasons was provided. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

0127 Preoperative Beta Blockade

Number of isolated CABG procedures excluding cases for which preoperative beta blockers were contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Number of isolated CABG procedures. The SQL code used to create the function to identify cardiac procedures is provided in the appendix.

Exclusions

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Cases are removed from the denominator if the patient had a previous CABG prior to the current admission or if IMA was not used and one of the following reasons was provided:

Subclavian stenosis

Previous cardiac or thoracic surgery

Previous mediastinal radiation

Emergent or salvage procedure

No (bypassable) LAD disease

0127 Preoperative Beta Blockade

Cases are removed from the denominator if preoperative beta blocker was contraindicated or if the clinical status of the patient was emergent or emergent salvage prior to entering the operating room.

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

N/A

Exclusion Details

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Patients with previous CABG, identified where PrCAB is marked "yes"

or

IMA Artery Used (IMAUsed) is marked “no” and primary reason for no IMA (NoIMARsn) is marked as any of the following:

Subclavian stenosis

Previous cardiac or thoracic surgery

Previous mediastinal radiation

Emergent or salvage procedure

No (bypassable) LAD disease

0127 Preoperative Beta Blockade

Procedures with preoperative beta blockers [MedBeta (STS Adult Cardiac Surgery Database Version 4.20)] marked as "Contraindicated" or procedures with Status [Status(STS Adult Cardiac Surgery Database Version 2.81)] marked "Emergent" or "Emergent Salvage"

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

N/A

Risk Adjustment

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

No risk adjustment or risk stratification

111855| 137290| 114638| 152617

111855| 137290| 114638| 152617

0127 Preoperative Beta Blockade

No risk adjustment or risk stratification

111855| 137290| 114638| 152617

111855| 137290| 114638| 152617

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Statistical risk model

111855| 137290| 114638| 141015

111855| 137290| 114638| 141015

Stratification

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

N/A

0127 Preoperative Beta Blockade

N/A

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

N/A

Type Score

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Rate/proportion better quality = higher score

0127 Preoperative Beta Blockade

Rate/proportion better quality = higher score

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Rate/proportion better quality = lower score

Algorithm

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 152617

0127 Preoperative Beta Blockade

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 152617

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 141015

Submission items

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

5.1 Identified measures: 0119 : Risk-Adjusted Operative Mortality for CABG

0118 : Anti-Lipid Treatment Discharge

0117 : Beta Blockade at Discharge

0116 : Anti-Platelet Medication at Discharge

0115 : Risk-Adjusted Surgical Re-exploration

0114 : Risk-Adjusted Postoperative Renal Failure

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0130 : Risk-Adjusted Deep Sternal Wound Infection

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0127 : Preoperative Beta Blockade

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact:

5b.1 If competing, why superior or rationale for additive value: N/A

0127 Preoperative Beta Blockade

5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

0119 : Risk-Adjusted Operative Mortality for CABG

0118 : Anti-Lipid Treatment Discharge

0117 : Beta Blockade at Discharge

0116 : Anti-Platelet Medication at Discharge

0115 : Risk-Adjusted Surgical Re-exploration

0114 : Risk-Adjusted Postoperative Renal Failure

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0130 : Risk-Adjusted Deep Sternal Wound Infection

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact:

5b.1 If competing, why superior or rationale for additive value: N/A

0129 Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure

0115 : Risk-Adjusted Surgical Re-exploration

0116 : Anti-Platelet Medication at Discharge

0117 : Beta Blockade at Discharge

0118 : Anti-Lipid Treatment Discharge

0119 : Risk-Adjusted Operative Mortality for CABG

0127 : Preoperative Beta Blockade

0130 : Risk-Adjusted Deep Sternal Wound Infection

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #0134, NQF #0130, and NQF #0131

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
0130 Risk-Adjusted Deep Sternal Wound Infection
0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Steward

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
The Society of Thoracic Surgeons

0130 Risk-Adjusted Deep Sternal Wound Infection
The Society of Thoracic Surgeons

0131 Risk-Adjusted Stroke/Cerebrovascular Accident
The Society of Thoracic Surgeons

Description

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
Percentage of patients aged 18 years and older undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft

0130 Risk-Adjusted Deep Sternal Wound Infection
Percent of patients aged 18 years and older undergoing isolated CABG for whom mediastinitis or deep sternal wound infection is diagnosed within 30 days postoperatively or at any time during the hospitalization for surgery

0131 Risk-Adjusted Stroke/Cerebrovascular Accident
Percent of patients aged 18 years and older undergoing isolated CABG who have a postoperative stroke (i.e., any confirmed neurological deficit of abrupt onset caused by a disturbance in blood supply to the brain) that did not resolve within 24 hours

Type

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
Process

0130 Risk-Adjusted Deep Sternal Wound Infection
Outcome

0131 Risk-Adjusted Stroke/Cerebrovascular Accident
Outcome

Data Source

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)
Registry Data STS Adult Cardiac Surgery Database Version 4.20

Available at measure-specific web page URL identified in S.1 No data dictionary

0130 Risk-Adjusted Deep Sternal Wound Infection
Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 Attachment

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 Attachment

Level

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Facility, Clinician : Group/Practice

0130 Risk-Adjusted Deep Sternal Wound Infection

Facility, Clinician : Group/Practice

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Facility, Clinician : Group/Practice

Setting

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Inpatient/Hospital

0130 Risk-Adjusted Deep Sternal Wound Infection

Inpatient/Hospital

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Inpatient/Hospital

Numerator Statement

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Number of patients undergoing isolated coronary artery bypass graft (CABG) who received an internal mammary artery (IMA) graft

0130 Risk-Adjusted Deep Sternal Wound Infection

Number of patients aged 18 years and older undergoing isolated CABG for whom mediastinitis or deep sternal wound infection is diagnosed within 30 days postoperatively or at any time during the hospitalization for surgery

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Number of patients undergoing isolated CABG who have a postoperative stroke (i.e., any confirmed neurological deficit of abrupt onset caused by a disturbance in blood supply to the brain) that did not resolve within 24 hours

Numerator Details

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Number of isolated CABG procedures in which IMA Artery Used [IMAUsed(STS Adult Cardiac Surgery Database Version 4.20] is marked "Left IMA" and/or "Right IMA"

0130 Risk-Adjusted Deep Sternal Wound Infection

Numerator time period:

Within 30 days postoperatively or at any time during the hospitalization for surgery

Number of isolated CABG procedures in which deep sternal infection/mediastinitis [DeepSternInf (STS Adult Cardiac Surgery Database Version 2.9)] is marked "yes"

DeepSternInf

Deep incisional SSI: Must meet the following criteria

- Infection occurs within 30 days after the operative procedure, and involves deep soft tissues of the incision (e.g., fascial and muscle layers) and patient has at least one of the following:
- Purulent drainage from the deep incision.
- A deep incision that spontaneously dehisces or is deliberately opened by a surgeon, attending physician or other designee and is culture-positive or not cultured, and patient has at least one of the following signs or symptoms:

  Fever (>38°C)

  Localized pain or tenderness

  An abscess or other evidence of infection involving the deep incision that is detected on direct examination, during invasive procedure, or by histopathologic examination or imaging test.

  A culture with negative findings does not meet this criterion.
- There are two specific types of deep incisional SSIs:

  Deep Incisional Primary (DIP) – a deep incisional SSI that is identified in a primary incision in a patient that has had an operation with one or more incisions (e.g., chest incision for CABG)

  Deep Incisional Secondary (DIS) – a deep incisional SSI that is identified in the secondary incision in a patient that has had an operation with more than one incision (e.g., donor site incision for CABG)

MED-Mediastinitis: Must meet the following criteria

- Mediastinitis must meet at least 1 of the following criteria:
- Patient has organisms cultured from mediastinal tissue or fluid obtained during an invasive procedure.
- Patient has evidence of mediastinitis seen during an invasive procedure or histopathologic examination.
- Patient has at least 1 of the following signs or symptoms:

  Fever (>38°C)

  Chest pain (with no other recognized cause)

  Sternal instability (with no other recognized cause) and at least 1 of the following:

  Purulent discharge from mediastinal area

  Organisms cultured from blood or discharge from mediastinal area

  Mediastinal widening on imaging test.

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Number of isolated CABG procedures in which postoperative stroke [CNStrokP (STS Adult Cardiac Surgery Database Version 2.9)] is marked "yes"

Denominator Statement

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Patients aged 18 years and older undergoing isolated CABG

0130 Risk-Adjusted Deep Sternal Wound Infection

All patients undergoing isolated CABG

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

All patients undergoing isolated CABG

Denominator Details

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Number of isolated CABG procedures excluding cases that were a previous CABG prior to the current admission or if IMA was not used and one of the acceptable reasons was provided. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

0130 Risk-Adjusted Deep Sternal Wound Infection

Number of isolated CABG procedures. The SQL code used to create the function used to identify cardiac procedures is provided in the Appendix.

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Number of isolated CABG procedures. The SQL code used to create the function to identify cardiac procedures is provided in the appendix.

Exclusions

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Cases are removed from the denominator if the patient had a previous CABG prior to the current admission or if IMA was not used and one of the following reasons was provided:

Subclavian stenosis

Previous cardiac or thoracic surgery

Previous mediastinal radiation

Emergent or salvage procedure

No (bypassable) LAD disease

0130 Risk-Adjusted Deep Sternal Wound Infection

N/A

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

N/A

Exclusion Details

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Patients with previous CABG, identified where PrCAB is marked "yes"

or

IMA Artery Used (IMAUsed) is marked “no” and primary reason for no IMA (NoIMARsn) is marked as any of the following:

Subclavian stenosis

Previous cardiac or thoracic surgery

Previous mediastinal radiation

Emergent or salvage procedure

No (bypassable) LAD disease

0130 Risk-Adjusted Deep Sternal Wound Infection

N/A

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

N/A

Risk Adjustment

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

No risk adjustment or risk stratification

111855| 137290| 114638| 152617

111855| 137290| 114638| 152617

0130 Risk-Adjusted Deep Sternal Wound Infection

Statistical risk model

111855| 137290| 114638

111855| 137290| 114638

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Statistical risk model

111855| 137290| 114638| 141015

111855| 137290| 114638| 141015

Stratification

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

N/A

0130 Risk-Adjusted Deep Sternal Wound Infection

N/A

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

N/A

Type Score

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Rate/proportion better quality = higher score

0130 Risk-Adjusted Deep Sternal Wound Infection

Rate/proportion better quality = lower score

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Rate/proportion better quality = lower score

Algorithm

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 152617

0130 Risk-Adjusted Deep Sternal Wound Infection

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

Please refer to numerator and denominator sections for detailed information. 111855| 137290| 114638| 141015

Submission items

0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

5.1 Identified measures: 0119 : Risk-Adjusted Operative Mortality for CABG

0118 : Anti-Lipid Treatment Discharge

0117 : Beta Blockade at Discharge

0116 : Anti-Platelet Medication at Discharge

0115 : Risk-Adjusted Surgical Re-exploration

0114 : Risk-Adjusted Postoperative Renal Failure

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0130 : Risk-Adjusted Deep Sternal Wound Infection

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0127 : Preoperative Beta Blockade

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact:

5b.1 If competing, why superior or rationale for additive value: N/A

0130 Risk-Adjusted Deep Sternal Wound Infection

5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure

0115 : Risk-Adjusted Surgical Re-exploration

0116 : Anti-Platelet Medication at Discharge

0117 : Beta Blockade at Discharge

0118 : Anti-Lipid Treatment Discharge

0119 : Risk-Adjusted Operative Mortality for CABG

0127 : Preoperative Beta Blockade

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

0131 Risk-Adjusted Stroke/Cerebrovascular Accident

5.1 Identified measures: 0114 : Risk-Adjusted Postoperative Renal Failure

0115 : Risk-Adjusted Surgical Re-exploration

0116 : Anti-Platelet Medication at Discharge

0117 : Beta Blockade at Discharge

0118 : Anti-Lipid Treatment Discharge

0119 : Risk-Adjusted Operative Mortality for CABG

0127 : Preoperative Beta Blockade

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0130 : Risk-Adjusted Deep Sternal Wound Infection

0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #1550, NQF #1551, and NQF #3493

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)
1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)
3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

Steward

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Centers for Medicare & Medicaid Services

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Centers for Medicare & Medicaid Services

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

Centers for Medicare & Medicaid Services

Description

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The measure estimates a hospital-level risk-standardized complication rate (RSCR) associated with elective primary THA and TKA in Medicare Fee-For-Service beneficiaries who are age 65 and older.

The outcome (complication) is defined as any one of the specified complications occurring from the date of index admission to 90 days post date of the index admission (the admission included in the measure cohort).

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The measure estimates a hospital-level risk-standardized readmission rate (RSRR) following elective primary THA and/or TKA in Medicare Fee-For-Service (FFS) beneficiaries who are 65 years and older. The outcome (readmission) is defined as unplanned readmission for any cause within 30 days of the discharge date for the index admission (the admission included in the measure cohort). A specified set of planned readmissions do not count in the readmission outcome.

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

This measure is a re-specified version of the measure, "Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)" (NQF 1550), which was developed for patients 65 years and older using Medicare claims data. This re-specified measure attributes outcomes to MIPS participating Eligible Clinicians and/or Eligible Clinician Groups ("providers"), rather than to hospitals, and assesses each provider's complication rate, defined as any one of the specified complications occurring from the date of index admission to 90 days post date of the index admission (the admission included in the measure cohort).

Type

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Outcome

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Outcome

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

Outcome

Data Source

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Claims, Enrollment Data Data sources for the Medicare FFS measure:

Medicare Part A Inpatient and Part B Outpatient Claims: This data source contains claims data for FFS inpatient and outpatient services including Medicare inpatient hospital care, outpatient hospital services, as well as inpatient and outpatient physician claims for the 12 months prior to an index admission.

Medicare Enrollment Database (EDB): This database contains Medicare beneficiary demographic, benefit/coverage, and vital status information. This data source was used to obtain information on

several inclusion/exclusion indicators such as Medicare status on admission as well as vital status. These data have previously been shown to accurately reflect patient vital status (Fleming et al., 1992). The Master Beneficiary Summary File (MBSF) is an annually created file derived the EDB that contains enrollment information for all Medicare beneficiaries including dual eligible status. Years 2016-2019 were used.

The American Community Survey (2013-2017): We used the American Community Survey (2013-2017) to derive an updated Agency for Healthcare Research and Quality (AHRQ) Socioeconomic (SES) index score at the patient nine-digit zip code level for use in studying the association between our measure and social risk factors (SRFs).

References:

Fleming C., Fisher ES, Chang CH, Bubolz D, Malenda J. Studying outcomes and hospital utilization in the elderly: The advantages of a merged data base for Medicare and Veterans Affairs Hospitals. Medical Care. 1992; 30(5): 377-91.

No data collection instrument provided Attachment

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Claims, Enrollment Data Data sources for the Medicare FFS measure:

Medicare Part A Inpatient and Part B Outpatient Claims: This data source contains claims data for FFS inpatient and outpatient services including Medicare inpatient hospital care, outpatient hospital services, as well as inpatient and outpatient physician claims for the 12 months prior to an index admission.

Medicare Enrollment Database (EDB): This database contains Medicare beneficiary demographic, benefit/coverage, and vital status information. This data source was used to obtain information on several inclusion/exclusion indicators such as Medicare status on admission as well as vital status. These data have previously been shown to accurately reflect patient vital status (Fleming et al., 1992). The Master Beneficiary Summary File (MBSF) is an annually created file derived from the EDB that contains enrollment information for all Medicare beneficiaries including dual eligible status. Years 2016-2019 were used.

The American Community Survey (2013-2017): We used the American Community Survey (2013-2017) to derive an updated Agency for Healthcare Research and Quality(AHRQ) Socioeconomic Status (SES) index score at the patient nine-digit zip code level for use in studying the association between our measure and social risk factors (SRFs).

Reference:

Fleming C., Fisher ES, Chang CH, Bubolz D, Malenda J. Studying outcomes and hospital utilization in the elderly: The advantages of a merged data base for Medicare and Veterans Affairs Hospitals. Medical Care. 1992; 30(5): 377-91.

No data collection instrument provided Attachment

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

Claims, Enrollment Data Medicare administrative claims and enrollment data

No data collection instrument provided Attachment

Level

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Facility

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Facility

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

Clinician : Group/Practice, Clinician : Individual

Setting

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Inpatient/Hospital

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Inpatient/Hospital

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

Inpatient/Hospital, Outpatient Services

Numerator Statement

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The outcome for this measure is any complication occurring during the index admission (not coded present on arrival) to 90 days post-date of the index admission. Complications are counted in the measure only if they occur during the index hospital admission or during a readmission. The complication outcome is a dichotomous (yes/no) outcome. If a patient experiences one or more of these complications in the applicable time period, the complication outcome for that patient is counted in the measure as a "yes".

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The outcome for this measure is 30-day readmissions. We define readmissions as inpatient admissions for any cause, with the exception of certain planned readmissions, within 30 days from the date of discharge of the index hospitalization. If a patient has more than one unplanned admission (for any reason) within 30 days after discharge from the index admission, only one is counted as a readmission. The measure looks for a dichotomous yes or no outcome of whether each admitted patient has an unplanned readmission within 30 days. However, if the first readmission after discharge is considered planned, any subsequent unplanned readmission is not counted as an outcome for that index admission, because the unplanned readmission could be

related to care provided during the intervening planned readmission rather than during the index admission.

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

The outcome for this measure is any complication occurring during the index admission (not coded present on arrival) to 90 days post-date of the index admission. Complications other than mortality are counted in the measure only if they occur during the index hospital admission or during a readmission. This outcome is identical to that of the original hospital measure. Additional details are provided in S.5 Numerator Details.

Numerator Details

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The composite complication is a dichotomous outcome (yes for any complication(s); no for no complications). Therefore, if a patient experiences one or more complications, the outcome variable will get coded as a "yes". Complications are counted in the measure only if they occur during the index hospital admission (and are not present on admission) or during a readmission.

The complications captured in the numerator are identified during the index admission OR associated with a readmission up to 90 days post-date of index admission, depending on the complication. The follow-up period for complications from date of index admission is as follows:

The follow-up period for AMI, pneumonia, and sepsis/septicemia/shock is seven days from the date of index admission because these conditions are more likely to be attributable to the procedure if they occur within the first week after the procedure. Additionally, analyses indicated a sharp decrease in the rate of these complications after seven days.

Death, surgical site bleeding, and pulmonary embolism are followed for 30 days following admission because clinical experts agree these complications are still likely attributable to the hospital performing the procedure during this period and rates for these complications remained elevated until roughly 30 days post admission.

The measure follow-up period is 90 days after admission for mechanical complications and periprosthetic joint infection/wound infection. Experts agree that mechanical complications and periprosthetic joint infection/wound infections due to the index THA/TKA occur up to 90 days following THA/TKA.

The measure counts all complications occurring during the index admission regardless of when they occur. For example, if a patient experiences an AMI on day 10 of the index admission, the measure will count the AMI as a complication, although the specified follow-up period for AMI is seven days. Clinical experts agree with this approach, as such complications likely represent the quality of care provided during the index admission.

As of 2014 reporting, the measure does not count complications in the complications outcome that are coded as present on admission (POA) during the index admission; this prevents identifying a condition as a complication of care if it was present on admission for the THA/TKA procedure.

For full list of codes defining complications, see the Data Dictionary attached in field S.2b.

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The measure counts readmissions to any acute care hospital for any cause within 30 days of the date of discharge of the index THA and/or TKA hospitalization, excluding planned readmissions as defined below.

Planned Readmission Algorithm (Version 4.0)

The Planned Readmission Algorithm is a set of criteria for classifying readmissions as planned among the general Medicare population using Medicare administrative claims data. The algorithm identifies admissions that are typically planned and may occur within 30 days of discharge from the hospital.

The Planned Readmission Algorithm has three fundamental principles:

A few specific, limited types of care are always considered planned (transplant surgery, maintenance chemotherapy/immunotherapy, and rehabilitation);

Otherwise, a planned readmission is defined as a non-acute readmission for a scheduled procedure; and

Admissions for acute illness or for complications of care are never planned.

The algorithm was developed in 2011 as part of the Hospital-Wide Readmission measure. In 2013, CMS applied the algorithm to its other readmission measures. In applying the algorithm to condition- and procedure-specific measures, teams of clinical experts reviewed the algorithm in the context of each measure-specific patient cohort and, where clinically indicated, adapted the content of the algorithm to better reflect the likely clinical experience of each measure's patient cohort. The planned readmission algorithm is applied to the THA/TKA readmission measure with small modifications.

The Planned Readmission Algorithm and associated code tables are attached in data field S.2b (Data Dictionary or Code Table).

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

Outcome Definition

The composite complication is a dichotomous outcome (yes for any complication(s); no for no complications) occurring within 90 days post-date of the index admission. Therefore, if a patient experiences one or more complications, the outcome variable will get coded as a "yes." The measure includes the following surgical complications: surgical site bleeding, mechanical complications, periprosthetic joint infection/wound infection; and also includes death as a complication. The measure also includes the following medical complications, as they are important in measuring overall quality: acute myocardial infarction (AMI), pneumonia, pulmonary embolism, and sepsis/septicemia/shock. Complications are counted in the measure only if they occur during the index hospital admission (and are not present on admission) or during a readmission. This outcome definition is identical to the Hospital-level RSCR following elective primary THA and/or TKA" (NQF 1550).

The measure assesses a dichotomous yes or no outcome of whether each admitted patient experiences one or more of the complications defined below. Complications other than mortality are counted in the measure only if they occur during the index admission or require a readmission. The measure does not count complications that occur in the outpatient setting and do not require a readmission. The outcome is aligned with CMS's hospital-level THA/TKA complication measure.

The measure defines a "complication" as:

Acute myocardial infarction (AMI), pneumonia, or sepsis/septicemia/shock during the index admission or a subsequent inpatient admission that occurs within 7 days from the start of the index admission;

Surgical site bleeding or pulmonary embolism during the index admission or a subsequent inpatient admission within 30 days from the start of the index admission;

Death during the index admission or within 30 days from the start of the index admission;

Mechanical complication or periprosthetic joint infection/wound infection during the index admission or a subsequent inpatient admission that occurs within 90 days from the start of the index admission. (See attached Data Dictionary for list of ICD-9 and 10 codes used to define complications).

The measure counts all complications occurring during the index admission regardless of when they occur. For example, if a patient experiences an AMI on day 10 of the index admission, the measure will count the AMI as a complication, although the specified follow-up period for AMI is seven days. Clinical experts agree with this approach, as such complications likely represent the quality of care provided during the index admission.

For the full list of ICD-9 and ICD-10 codes defining complications, see the Data Dictionary attached in field S.2b., sheets HK Complications I10-Outcome" and "Complication Codes ICD9."

Denominator Statement

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The target population for the publicly reported measure includes admissions for Medicare FFS beneficiaries who are at least 65 years of age undergoing elective primary THA and/or TKA procedures.

Additional details are provided in S.7 Denominator Details.

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The target population for the publicly reported measure includes admissions for Medicare FFS beneficiaries who are at least 65 years of age undergoing elective primary THA and/or TKA procedures.

Additional details are provided in S.9 Denominator Details.

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

The target population for the measure includes admissions for Medicare FFS beneficiaries who are at least 65 years of age who have undergone elective primary THA and/or TKA procedures.

Attribution of Index Admissions to Eligible Clinicians

Each patient index admission (the admission during which the patient has the eligible THA/TKA procedure), and therefore their outcome (complication or no complication) is attributed to the Eligible Clinician who bills for the procedure (Billing Surgeon). Conceptually, the Billing Surgeon is the Clinician with the primary responsibility for the procedure and procedure related care.

In practice, patients may have different claims for the same procedure, and so the billing surgeon is assigned through an algorithm that resolves ambiguities in billing. The algorithm uses billing claims

to identify the clinician(s) who bills for a THA (CPT® code 27130) or TKA (CPT®® code 27447 or CPT® code 27446) (steps 1-3 below). These CPT® codes are representative of the THA and/or TKA procedures included in the measure cohort.

1. If only one clinician bills for a THA (CPT® code 27130) or TKA (CPT® code 27446 or 27447) for a patient, the algorithm identifies and assigns this individual as the Billing Surgeon.
2. If two or more clinicians bill for THA/TKA procedures (CPT® 27130, 27447, or 27446), the algorithm seeks to identify a 'key' physician among them. The algorithm identifies and excludes assignment to clinicians who were assistants-at-surgery (assistant surgeon with CPT® modifier 80 or 82, minimum assistant surgeon with CPT® modifier 81). In this step, the algorithm assigns the Billing Surgeon as the clinician who billed for a THA or TKA procedure and is not an assistant-at-surgery.
3. If a single clinician who is not an assistant-at-surgery could not be identified for assignment, then the algorithm identifies whether there is a single clinician who was an orthopedic surgeon (Medicare Specialty Code 20) and assigns this as the Billing Surgeon.
4. If the algorithm cannot identify a Billing Surgeon, it identifies whether an Operator is listed on the institutional claim. The algorithm then defaults assignment to the Operator listed on the institutional claim.

Finally, if a Billing Surgeon or Operator cannot be identified with the steps above, the patient is not assigned to a clinician or group and is excluded from the measure.

Attribution of Index Admissions to an Eligible Clinician Group

CMS needs the flexibility to assign each eligible patient index admission to at least one Eligible Clinician and at least one Eligible Clinician group. This allows them the ability to report at either the Eligible Clinician or the Eligible Clinician Group level. Conceptually, these assignments should represent a consistent group of clinicians. That is, it would be confusing to assign a patient to Eligible Clinician A and also to Eligible Clinician Group B if Eligible Clinician A is not in that Group. The attribution methodology addresses this by using both individual and group identifiers.

Every Medicare Eligible Clinician has a unique National Provider Identifier (NPI). Similarly, every Medicare Eligible Clinician Group has one or more Tax Identification Numbers (TINs), reflecting their practice setting(s). Each Eligible Clinician claim should include both their NPI and a TIN which identifies their "group" (which may consist only of that clinician if they are solo providers). Therefore, we identify clinicians for each patient index admission through the unique National Provider ID (NPI) and Tax ID (TIN) combination listed on a patient's claim. For a Billing Surgeon, the NPI and TIN are those on the procedure claim used to attribute the patient index admission. To identify the unique TIN/NPI combination for the Operator, the Operator's NPI is matched to the TIN with the most Part B allowed charges during the index admission or during the measurement year if the Operator did not bill during the index admission. Most NPIs are associated with only one TIN. A Clinician Group is set of Clinicians (NPI-TIN combinations) assigned to the same TIN.

Additional details are provided in S.7 Denominator Details.

Denominator Details

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

To be included in the measure cohort used in public reporting, patients must meet the following additional inclusion criteria:

1. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of admission; and enrolled in Part A during the index admission;
2. Aged 65 or older
3. Having a qualifying elective primary THA/TKA procedure; elective primary THA/TKA procedures are defined as those procedures without any of the following:
   - Fracture of the pelvis or lower limbs coded in the principal or secondary discharge diagnosis fields on the index admission claim (Note: Periprosthetic fractures must be additionally coded as present on admission [POA] in order to disqualify a THA/TKA from cohort inclusion, unless exempt from POA reporting.);
   - A concurrent partial hip or knee arthroplasty procedure;
   - A concurrent revision, resurfacing, or implanted device/prosthesis removal procedure;
   - Mechanical complication coded in the principal discharge diagnosis field on the index admission claim;
   - Malignant neoplasm of the pelvis, sacrum, coccyx, lower limbs, or bone/bone marrow or a disseminated malignant neoplasm coded in the principal discharge diagnosis field on the index admission claim; or,
   - Transfer from another acute care facility for the THA/TKA.

Patients are eligible for inclusion in the denominator if they had an elective primary THA and/or a TKA AND had continuous enrollment in Part A and Part B Medicare fee-for-service (FFS) 12 months prior to the date of index admission.

This measure can also be used for an all-payer population aged 18 years and older. We have explicitly tested the measure in both patients aged 18+ years and those aged 65+ years (see Testing Attachment for details).

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

To be included in the measure cohort used in public reporting, patients must meet the following additional inclusion criteria:

Enrolled in Medicare FFS Part A and Part B Medicare for the 12 months prior to the date of admission; and enrolled in Part A during the index admission;

Aged 65 or over;

Discharged alive from a non-federal acute care hospital; and

Have a qualifying elective primary THA/TKA procedure; elective primary THA/TKA procedures defined as those procedures without any of the following:

- Femur, hip, or pelvic fractures coded in principal or secondary discharge diagnosis fields of the index admission;
- Partial hip arthroplasty (PHA) procedures with a concurrent THA/TKA;
- Revision procedures with a concurrent THA/TKA;
- Resurfacing procedures with a concurrent THA/TKA;
- Mechanical complication coded in the principal discharge diagnosis field;
- Malignant neoplasm of the pelvis, sacrum, coccyx, lower limbs, or bone/bone marrow or a disseminated malignant neoplasm coded in the principal discharge diagnosis field;
- Removal of implanted devices/prostheses; or

- Transfer from another acute care facility for the THA/TKA

This measure can also be used for an all-payer population aged 18 years and older. We have explicitly tested the measure in both patients aged 18 years and older and those aged 65 years or older (see Testing Attachment for details, 2b4.11).

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

To be included in the measure cohort used, patients must meet the following additional inclusion criteria:

Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of admission; and enrolled in Part A during the index admission and for 90 days after discharge;

Aged 65 or older; and

Having a qualifying elective primary THA/TKA procedure.

Elective primary THA/TKA procedures are defined as those procedures without any of the following:

Femur, hip, or pelvic fractures coded in the principal or secondary discharge diagnosis field of the index admission

Partial hip arthroplasty (PHA) procedures (with a concurrent THA/TKA); partial knee arthroplasty procedures are not distinguished by ICD9 codes and are currently captured by the THA/TKA measure

Revision procedures with a concurrent THA/TKA

Resurfacing procedures with a concurrent THA/TKA

Mechanical complication coded in the principal discharge

Malignant neoplasm of the pelvis, sacrum, coccyx, lower limbs, or bone/bone marrow or a disseminated malignant neoplasm coded in the principal discharge diagnosis field

Removal of implanted devises/prostheses

Transfer status from another acute care facility for the THA/TKA

Patients are eligible for inclusion in the denominator if they had an elective primary THA and/or a TKA AND had continuous enrollment in Part A and Part B Medicare fee-for-service (FFS) 12 months prior to the date of index admission.

Elective primary THA/TKA procedures are defined as those procedures without any of the 8 associated conditions or finding noted above.

For a full list of ICD-9 and ICD-10 codes defining the following see attached Data Dictionary, sheets "I-10 Cohort Codes" and "I9 Cohort Codes."

Additional details are provided in S.9 Denominator Details.

Exclusions

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

This measure excludes index admissions for patients:

Without at least 90 days post-discharge enrollment in FFS Medicare;

Who were discharged against medical advice (AMA); or,

Who had more than two THA/TKA procedure codes during the index hospitalization.

After applying these exclusion criteria, we randomly select one index admission for patients with multiple index admissions in a calendar year. We therefore exclude the other eligible index admissions in that year.

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The THA/TKA readmission measure excludes admissions for patients:

Without at least 30 days post-discharge enrollment in FFS Medicare;

Who were discharged against medical advice (AMA);

Admitted for the index procedure and subsequently transferred to another acute care facility;

Who had more than two THA/TKA procedure codes during the index hospitalization; or

Who had THA/TKA admissions within 30 days of a prior THA/TKA index admission.

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

This measure excludes index admissions for patients:

1. *Who survived the index admission but without 90-day Medicare part A enrollment post discharge;*
2. *Who were transferred in to the index hospital;*
3. *Who leave the hospital against medical advice (AMA);*
4. *With more than two THA/TKA procedures codes during the index hospitalization; or*
5. *Who cannot be attributed to a billing surgeon or operator using claims data*

After applying the exclusion criteria above, we randomly select one index admission for patients with multiple index admissions in a calendar year. We therefore exclude the other eligible index admissions in that year.

Exclusion Details

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

This measure excludes index admissions for patients:

1. Without at least 90 days post-discharge enrollment in FFS Medicare

Rationale: The 90-day complication outcome cannot be assessed in this group since claims data are used to determine whether a complication of care occurred.

2. Who were discharged against medical advice (AMA); or,

Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.

3. Who had more than two THA/TKA procedure codes during the index hospitalization

Rationale: Although clinically possible, it is highly unlikely that patients would receive more than two elective THA/TKA procedures in one hospitalization, which may reflect a coding erzror.

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

This measure excludes index admissions for patients:

1. Without at least 30 days of post-discharge enrollment in FFS Medicare as determined by examining the Medicare Enrollment Database (EDB).

Rationale: The 30-day readmission outcome cannot be assessed in this group since claims data are used to determine whether a patient was readmitted.

2. Discharges against medical advice (AMA) are identified using the discharge disposition indicator in claims data.

Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.

3. Admitted for the index procedure and subsequently transferred to another acute care facility, which are defined as when a patient with an inpatient hospital admission (with at least one qualifying THA/TKA procedure) is discharged from an acute care hospital and admitted to another acute care hospital on the same or next day.

Rationale: Patients admitted for the index procedure and subsequently transferred to another acute care facility are excluded, as determining which hospital the readmission outcome should be attributed to is difficult.

4. Who had more than two THA/TKA procedure codes during the index hospitalization, which is identified by examining procedure codes in the claims data.

Rationale: Although clinically possible, it is highly unlikely that patients would receive more than two elective THA/TKA procedures in one hospitalization, which may reflect a coding error.

5. Who had THA/TKA admissions within 30 days prior to THA/TKA index admission.

Rationale: Additional THA/TKA admissions within 30 days are excluded as index admissions because they are part of the outcome. A single admission does not count as both an index admission and a readmission for another index admission.

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

The measure excludes admissions for patients:

1. Who survived the index admission but without 90-day Medicare part A enrollment post discharge

Rationale: Only patients with adequate claims data for attribution should be included in risk-adjustment model and the measure.

2. Who were transferred in to the index hospital

Rationale: If the patient is transferred from another acute care facility to the hospital where the index procedure occurs, it is likely that the procedure is not elective, or that the admission is associated with an acute condition.

3. Who leave the hospital against medical advice (AMA)

Rationale: Clinicians have limited opportunity to implement high quality care.

4. With more than two THA/TKA procedures codes during the index hospitalization

Rationale: Although clinically possible, it is highly unlikely that patients would receive more than two elective THA/TKA procedures in one hospitalization, and this may reflect a coding error.

5. Who cannot be attributed to a billing surgeon or operator using claims data

Rationale: Only patients with adequate clinician claims for attribution should be included in risk-adjustment model and the measure.

Risk Adjustment

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Statistical risk model

112469| 118210| 137301| 146637| 141015

112469| 118210| 137301| 146637| 141015

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Statistical risk model

112469| 109921| 118210| 135810| 117446| 146637| 141015

112469| 109921| 118210| 135810| 117446| 146637| 141015

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

Statistical risk model

146637| 110639| 146313

146637| 110639| 146313

Stratification

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

N/A

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

N/A

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

N/a

Type Score

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Rate/proportion better quality = lower score

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Rate/proportion better quality = lower score

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

Rate/proportion better quality = lower score

Algorithm

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The measure estimates hospital-level RSCRs following elective primary THA/TKA using hierarchical logistic regression models. In brief, the approach simultaneously models data at the patient and hospital levels to account for variance in patient outcomes within and between hospitals (Normand and Shahian, 2007). At the patient level, it models the log-odds of a complication occurring within 90 days of the index admission using age, sex, selected clinical covariates, and a hospital-specific intercept. At the hospital level, it models the hospital-specific intercepts as arising from a normal distribution. The hospital intercept represents the underlying risk of a complication at the hospital, after accounting for patient risk. The hospital-specific intercepts are given a distribution to account for the clustering (non-independence) of patients within the same hospital. If there were no differences among hospitals, then after adjusting for patient risk, the hospital intercepts should be identical across all hospitals.

The RSCR is calculated as the ratio of the number of "predicted" to the number of "expected" admissions with a complication at a given hospital, multiplied by the national observed complication rate. For each hospital, the numerator of the ratio is the number of complications within 90 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of complications expected based on the nation's performance with that hospital's case mix. This approach is analogous to a ratio of "observed" to "expected" used in other types of statistical analyses. It conceptually allows for a comparison of a particular hospital's performance given its case mix to an average hospital's performance with the same case mix. Thus, a lower ratio indicates lower-than-expected complication rates or better quality, and a higher ratio indicates higher-than-expected complication rates or worse quality.

The "predicted" number of admissions with a complication (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of having an admission with a complication. The estimated hospital-specific intercept is added to the sum of the estimated regression coefficients multiplied by the patient characteristics. The results are log transformed and summed over all patients attributed to a hospital to get a predicted value. The "expected" number of admissions with a complication (the denominator) is obtained in the same manner, but a common intercept using all hospitals in our sample is added in place of the hospital-specific effect. The results are log transformed and summed over all patients in the hospital to get an expected value. To assess hospital performance for each reporting period, we re-estimate the model coefficients using the years of data in that period.

This calculation transforms the ratio of predicted over expected into a rate that is compared to the national observed complication rate. The hierarchical logistic regression models are described fully in the original methodology report posted on QualityNet:.

References:

Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 112469| 118210| 137301| 146637| 141015

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The measure estimates hospital-level 30-day all-cause RSRRs following elective primary THA/TKA using hierarchical logistic regression models. In brief, the approach simultaneously models data at the patient and hospital levels to account for variance in patient outcomes within and between hospitals (Normand and Shahian, 2007). At the patient level, it models the log-odds of readmission within 30 days of discharge using age, sex, selected clinical covariates, and a hospital-specific intercept. At the hospital level, it models the hospital-specific intercepts as arising from a normal distribution. The hospital intercept represents the underlying risk of a readmission at the hospital, after accounting for patient risk. The hospital-specific intercepts are given a distribution to account for the clustering (non-independence) of patients within the same hospital. If there were no differences among hospitals after adjusting for patient risk, the hospital intercepts should be identical across all hospitals.

The RSRR is calculated as the ratio of the number of "predicted" to the number of "expected" readmission at a given hospital, multiplied by the national observed readmission rate. For each hospital, the numerator of the ratio is the number of readmissions within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of readmissions expected based on the nation's performance with that hospital's case mix. This approach is analogous to a ratio of "observed" to "expected" used in other types of statistical analyses. It conceptually allows for a comparison of a particular hospital's performance given its case mix to an average hospital's performance with the same case mix. Thus, a lower ratio indicates lower-than-expected readmission rates or better quality, and a higher ratio indicates higher-than-expected readmission rates or worse quality.

The "predicted" number of readmissions (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of readmission. The estimated hospital-specific intercept is added to the sum of the estimated regression coefficients multiplied by the patient characteristics. The results are transformed and summed over all patients attributed to a hospital to get a predicted value. The "expected" number of readmissions (the denominator) is obtained in the same manner, but a common intercept using all hospitals in our sample is added in place of the hospital-specific intercept. The results are transformed and summed over all patients in the hospital to get an expected value. To assess hospital performance for each reporting period, we re-estimate the model coefficients using the years of data in that period.

This calculation transforms the ratio of predicted over expected into a rate that is compared to the national observed readmission rate. The hierarchical logistic regression models are described fully in the original methodology report (Grosso et al., 2012), which is also posted on QualityNet

References:

Grosso L, Curtis J, Geary L, et al. Hospital-level 30-Day All-Cause Risk-Standardized Readmission Rate Following Elective Primary Total Hip Arthroplasty (THA) And/Or Total Knee Arthroplasty (TKA) Measure Methodology Report. 2012.

Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 112469| 109921| 118210| 135810| 117446| 146637| 141015

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

In Dataset April 2013 to March 2016 (prior to exclusions being applied): We started with the hospital HKC measure cohort, with an initial index cohort size of 982,436 index admissions with an elective primary THA/TKA procedure. After applying exclusion criteria 1 through 4 listed in the table below, we have a cohort sample size of 935,029 index admissions. Our previous NQF filing for hospital HKC showed no bias introduced through the exclusion process for hospitals for this same cohort of 935,029 index admissions. We then further excluded 10,243 (1.0%) index admissions (criteria 5 and 6 below) which cannot be attributed to physician/physician group to create our final measure cohort.

The measure estimates eligible clinician or clinician group ("provider")-level RSCRs following elective primary THA/TKA using hierarchical logistic regression models. In brief, the approach simultaneously models data at the patient and provider levels to account for variance in patient outcomes within and between hospitals (Normand and Shahian, 2007). At the patient level, it models the log-odds of a complication occurring within 90 days of the index admission using age, sex, selected clinical covariates, and a provider-specific intercept. At the provider level, it models the provider-specific intercepts as arising from a normal distribution. The provider intercept represents the underlying risk of a complication for patients treated by the provider, after accounting for patient risk. The provider-specific intercepts are given a distribution to account for the clustering (non-independence) of patients treated by the same provider. If there were no differences among providers, then after adjusting for patient risk, the provider intercepts should be identical across all providers.

The RSCR is calculated as the ratio of the number of "predicted" to the number of "expected" admissions with a complication at a given provider, multiplied by the national observed complication rate. The "predicted" number of admissions with a complication (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the provider-specific intercept on the risk of having an admission with a complication. The estimated provider-specific intercept is added to the sum of the estimated regression coefficients multiplied by the patient characteristics. The results are log transformed and summed over all patients attributed to a provider to get a predicted value. The "expected" number of admissions with a complication (the denominator) is obtained in the same manner, but a common intercept using all providers in our sample is added in place of the provider-specific effect. The results are log transformed and summed over all patients in the provider to get an expected value. To assess provider performance for each reporting period, we re-estimate the model coefficients using the years of data in that period.

For each provider, the numerator of the ratio is the number of complications within 90 days predicted on the basis of the provider's performance with its observed case mix, and the denominator is the number of complications expected based on the nation's performance with that provider's case mix. This approach is analogous to a ratio of "observed" to "expected" used in other types of statistical analyses. It conceptually allows for a comparison of a particular provider's performance given its case mix to an average provider's performance with the same case mix. Thus, a lower ratio indicates lower-than-expected complication rates or better quality, and a higher ratio indicates higher-than-expected complication rates or worse quality.

This calculation transforms the ratio of predicted over expected into a rate that is compared to the national observed complication rate. The hierarchical logistic regression models are described fully in the original methodology report (Grosso et al., 2012).

References:

Grosso L, Curtis J, Geary L, et al. Hospital-level Risk-Standardized Complication Rate Following Elective Primary Total Hip Arthroplasty (THA) And/Or Total Knee Arthroplasty (TKA) Measure Methodology Report. 2012.

Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226 146637| 110639| 146313

Submission items

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

5.1 Identified measures: 1551 : Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

3493 : Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: We did not include in our list of related measures any non-outcome measures (for example, process measures) with the same target population as our measure. Because this is an outcome measure, clinical coherence of the cohort takes precedence over alignment with related non-outcome measures. Furthermore, non-outcome measures are limited due to broader patient exclusions. This is because they typically only include a specific subset of patients who are eligible for that measure (for example, patients who receive a specific medication or undergo a specific procedure).

5b.1 If competing, why superior or rationale for additive value: N/A

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

5.1 Identified measures: 0505 : Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

0506 : Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

1550 : Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

1789 : Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

3493 : Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: We did not include in our list of related measures any non-outcome measures (for example, process measures) with the same target population as our measure. Because this is an outcome measure, clinical coherence of the cohort takes precedence over alignment with related non-outcome measures. Furthermore, non-outcome measures are limited due to broader patient exclusions. This is because they typically only include a specific subset of patients who are eligible for that measure (for example, patients who receive a specific medication or undergo a specific procedure).

5b.1 If competing, why superior or rationale for additive value: N/A

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

5.1 Identified measures:

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: The measure is fully harmonized with NQF #1550 regarding cohort definition, outcome, and risk adjustment approach. The only discrepancy is the attribution approach, which assigns each index admission to a clinician rather than a hospital, and the exclusion of patients for which no billing surgeon or operator can be identified.

5b.1 If competing, why superior or rationale for additive value: Clinicians, particularly the surgeon performing the procedure, can influence the outcome of surgery for better or worse, both through their technical skill and through their influence on the care team and hospital safety culture. Therefore, many of the strategies and best practices used by hospitals to reduce the risk of complications can also be adopted by individual clinicians and groups of clinicians to improve patient outcomes. Further evidence of surgeons' influence are data indicating that increasing surgeon volume is associated with reductions in adverse surgical outcomes (Battaglia TC et al., 2006; Shervin et al., 2007).

The THA/TKA risk-standardized complication rate (RSCR) measure for clinicians is thus intended to inform quality-of-care improvement efforts, as individual process-based performance measures cannot encompass all the complex and critical aspects of care that contribute to patient outcomes. It also complements the hospital measure as a proportion of surgeons have very different performance quality than the institutions in which they perform surgery; this measure provides a transparent reflection of these discordances to further support quality improvement.

References:

Battaglia TC, Mulhall KJ, Brown TE, Saleh KJ. Increased surgical volume is associated with lower THA dislocation rates. Clin Orthop Relat Res. 2006 Jun;447:28-33.

Shervin N, Rubash HE, Katz JN. Orthopaedic procedure volume and patient outcomes: a systematic literature review. Clin Orthop Relat Res. 2007 Apr;457:35-41.

Comparison of NQF #1551, NQF #0505, and NQF #0506

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)
0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.
0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

Steward

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Centers for Medicare & Medicaid Services

0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

Centers for Medicare & Medicaid Services

0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

Centers for Medicare & Medicaid Services

Description

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The measure estimates a hospital-level risk-standardized readmission rate (RSRR) following elective primary THA and/or TKA in Medicare Fee-For-Service (FFS) beneficiaries who are 65 years and older. The outcome (readmission) is defined as unplanned readmission for any cause within 30 days of the discharge date for the index admission (the admission included in the measure cohort). A specified set of planned readmissions do not count in the readmission outcome.

0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

The measure estimates a hospital-level 30-day, all-cause, risk-standardized readmission rate (RSRR) for patients age 65 and older discharged from the hospital with a principal diagnosis of acute myocardial infarction (AMI). Readmission is defined as unplanned readmission for any cause within 30 days of the discharge date for the index admission. Readmissions are classified as planned and unplanned by applying the planned readmission algorithm. CMS annually reports the measure for patients who are 65 years or older and enrolled in fee-for-service (FFS) Medicare and hospitalized in non-federal hospitals or are patients hospitalized in Veterans Health Administration (VA) facilities.

0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

The measure estimates a hospital-level 30-day, all-cause, risk-standardized readmission rate (RSRR) for patients age 65 and older discharged from the hospital with either a principal discharge diagnosis of pneumonia (including aspiration pneumonia) or a principal discharge diagnosis of sepsis (not severe sepsis) with a secondary diagnosis of pneumonia (including aspiration pneumonia) coded as present on admission (POA). Readmission is defined as an unplanned readmission for any cause within 30 days of the discharge date for the index admission. Readmissions are classified as planned and unplanned by applying the planned readmission algorithm. CMS annually reports the measure for patients who are 65 years or older and enrolled in fee-for-service (FFS) Medicare and hospitalized in non-federal hospitals or are patients hospitalized in Veterans Health Administration (VA) facilities.

Type

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Outcome

0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

Outcome

0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

Outcome

Data Source

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Claims, Enrollment Data Data sources for the Medicare FFS measure:

Medicare Part A Inpatient and Part B Outpatient Claims: This data source contains claims data for FFS inpatient and outpatient services including Medicare inpatient hospital care, outpatient hospital services, as well as inpatient and outpatient physician claims for the 12 months prior to an index admission.

Medicare Enrollment Database (EDB): This database contains Medicare beneficiary demographic, benefit/coverage, and vital status information. This data source was used to obtain information on several inclusion/exclusion indicators such as Medicare status on admission as well as vital status. These data have previously been shown to accurately reflect patient vital status (Fleming et al., 1992). The Master Beneficiary Summary File (MBSF) is an annually created file derived from the EDB that contains enrollment information for all Medicare beneficiaries including dual eligible status. Years 2016-2019 were used.

The American Community Survey (2013-2017): We used the American Community Survey (2013-2017) to derive an updated Agency for Healthcare Research and Quality(AHRQ) Socioeconomic Status (SES) index score at the patient nine-digit zip code level for use in studying the association between our measure and social risk factors (SRFs).

Reference:

Fleming C., Fisher ES, Chang CH, Bubolz D, Malenda J. Studying outcomes and hospital utilization in the elderly: The advantages of a merged data base for Medicare and Veterans Affairs Hospitals. Medical Care. 1992; 30(5): 377-91.

No data collection instrument provided Attachment

0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

Claims, Enrollment Data, Other Data sources for the Medicare FFS measure:

Medicare Part A Inpatient and Part B Outpatient claims: This data source contains claims data for FFS inpatient and outpatient services including Medicare inpatient hospital care, outpatient hospital services, as well as inpatient and outpatient physician claims for the 12 months prior to an index admission.

Medicare Enrollment Database (EDB): This database contains Medicare beneficiary demographic, benefit/coverage, and vital status information. This data source was used to obtain information on several inclusion/exclusion indicators such as Medicare status on admission as well as vital status. These data have previously been shown to accurately reflect patient vital status (Fleming et al., 1992). The Master Beneficiary Summary File (MBSF) is an annually created file derived the EDB that

contains enrollment information for all Medicare beneficiaries including dual eligible status. Years 2016-2019 were used.

Veterans Health Administration (VA) Data: This data source contains administrative data for VA inpatient and outpatient services including: inpatient hospital care, outpatient hospital services, skilled nursing facility care, some home health agency services, as well as inpatient and outpatient physician data for the 12 months prior to and including each index admission. Unlike Medicare FFS patients, VA patients are not required to have been enrolled in Part A and Part B Medicare for the 12 months prior to the date of admission.

The American Community Survey (2013-2017): We used the American Community Survey (2013-2017) to derive an updated AHRQ SES index score at the patient nine-digit zip code level for use in studying the association between our measure and SRFs.

References

Fleming C., Fisher ES, Chang CH, Bubolz D, Malenda J. Studying outcomes and hospital utilization in the elderly: The advantages of a merged data base for Medicare and Veterans Affairs Hospitals. Medical Care. 1992; 30(5): 377-91.

No data collection instrument provided Attachment

0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

Claims, Enrollment Data, Other Data sources for the Medicare FFS measure:

Medicare Part A Inpatient and Part B Outpatient Claims: This data source contains claims data for FFS inpatient and outpatient services including Medicare inpatient hospital care, outpatient hospital services, as well as inpatient and outpatient physician claims for the 12 months prior to an index admission.

Medicare Enrollment Database (EDB): This database contains Medicare beneficiary demographic, benefit/coverage, and vital status information. This data source was used to obtain information on several inclusion/exclusion indicators such as Medicare status on admission as well as vital status. These data have previously been shown to accurately reflect patient vital status (Fleming et al., 1992). The Master Beneficiary Summary File (MBSF) is an annually created file derived from the EDB that contains enrollment information for all Medicare beneficiaries including dual eligible status. Years 2016-2019 were used.

Veterans Health Administration (VA) Data: This data source contains data for VA inpatient and outpatient services including: inpatient hospital care, outpatient hospital services, skilled nursing facility care, some home health agency services, as well as inpatient and outpatient physician data for the 12 months prior to and including each index admission. Unlike Medicare FFS patients, VA patients are not required to have been enrolled in Part A and Part B Medicare for the 12 months prior to the date of admission.

The American Community Survey (2013-2017): We used the American Community Survey (2013-2017) to derive an updated Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) index score at the patient nine-digit zip code level for use in studying the association between our measure and social risk factors (SRFs).

References

Fleming C., Fisher ES, Chang CH, Bubolz D, Malenda J. Studying outcomes and hospital utilization in the elderly: The advantages of a merged data base for Medicare and Veterans Affairs Hospitals. Medical Care. 1992; 30(5): 377-91.

No data collection instrument provided Attachment

Level

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Facility

0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

Facility

0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

Facility

Setting

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Inpatient/Hospital

0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

Inpatient/Hospital

0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

Inpatient/Hospital

Numerator Statement

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The outcome for this measure is 30-day readmissions. We define readmissions as inpatient admissions for any cause, with the exception of certain planned readmissions, within 30 days from the date of discharge of the index hospitalization. If a patient has more than one unplanned admission (for any reason) within 30 days after discharge from the index admission, only one is counted as a readmission. The measure looks for a dichotomous yes or no outcome of whether each admitted patient has an unplanned readmission within 30 days. However, if the first readmission after discharge is considered planned, any subsequent unplanned readmission is not counted as an outcome for that index admission, because the unplanned readmission could be related to care provided during the intervening planned readmission rather than during the index admission.

0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

The outcome for this measure is 30-day all-cause readmissions. We define readmission as an inpatient acute care admission for any cause, with the exception of certain planned readmissions, within 30 days from the date of discharge from the index for patients 65 and older discharged from the hospital with a principal discharge diagnosis of AMI. If a patient has more than one unplanned admission (for any reason) within 30 days after discharge from the index admission, only the first

one is counted as a readmission. The measure looks for a dichotomous yes or no outcome of whether each admitted patient has an unplanned readmission within 30 days. However, if the first readmission after discharge is considered planned, any subsequent unplanned readmission is not counted as an outcome for that index admission because the unplanned readmission could be related to care provided during the intervening planned readmission rather than during the index admission.

Additional details are provided in S.5 Numerator Details.

0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

The outcome for this measure is 30-day readmissions. We define readmission as an inpatient acute care admission for any cause, with the exception of certain planned readmissions, within 30 days from the date of discharge from the index admission for patients 65 and older discharged from the hospital with a principal diagnosis of pneumonia, including aspiration pneumonia or a principal diagnosis of sepsis (not severe sepsis) with a secondary diagnosis of pneumonia (including aspiration pneumonia) coded as POA and no secondary diagnosis of severe sepsis. If a patient has more than one unplanned admission (for any reason) within 30 days after discharge from the index admission, only the first one is counted as a readmission. The measure looks for a dichotomous yes or no outcome of whether each admitted patient has an unplanned readmission within 30 days. However, if the first readmission after discharge is considered planned, any subsequent unplanned readmission is not counted as an outcome for that index admission because the unplanned readmission could be related to care provided during the intervening planned readmission rather than during the index admission.

Numerator Details

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The measure counts readmissions to any acute care hospital for any cause within 30 days of the date of discharge of the index THA and/or TKA hospitalization, excluding planned readmissions as defined below.

Planned Readmission Algorithm (Version 4.0)

The Planned Readmission Algorithm is a set of criteria for classifying readmissions as planned among the general Medicare population using Medicare administrative claims data. The algorithm identifies admissions that are typically planned and may occur within 30 days of discharge from the hospital.

The Planned Readmission Algorithm has three fundamental principles:

1. A few specific, limited types of care are always considered planned (transplant surgery, maintenance chemotherapy/immunotherapy, and rehabilitation);
2. Otherwise, a planned readmission is defined as a non-acute readmission for a scheduled procedure; and
3. Admissions for acute illness or for complications of care are never planned.

The algorithm was developed in 2011 as part of the Hospital-Wide Readmission measure. In 2013, CMS applied the algorithm to its other readmission measures. In applying the algorithm to condition- and procedure-specific measures, teams of clinical experts reviewed the algorithm in the context of each measure-specific patient cohort and, where clinically indicated, adapted the content of the algorithm to better reflect the likely clinical experience of each measure's patient

cohort. The planned readmission algorithm is applied to the THA/TKA readmission measure with small modifications.

The Planned Readmission Algorithm and associated code tables are attached in data field S.2b (Data Dictionary or Code Table).

0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

The measure counts readmissions to any acute care hospital for any cause within 30 days of the date of discharge of the index AMI admission, excluding planned readmissions as defined below.

Planned Readmission Algorithm (Version 4.0)

The planned readmission algorithm is a set of criteria for classifying readmissions as planned using Medicare and VA administrative claims data. The algorithm identifies admissions that are typically planned and may occur within 30 days of discharge from the hospital.

The planned readmission algorithm has three fundamental principles:

A few specific, limited types of care are always considered planned (transplant surgery, maintenance chemotherapy/immunotherapy, rehabilitation);

Otherwise, a planned readmission is defined as a non-acute readmission for a scheduled procedure; and,

Admissions for acute illness or for complications of care are never planned.

The algorithm was developed in 2011 as part of the Hospital-Wide Readmission measure. In 2013, CMS applied the algorithm to its other readmission measures.

In applying the algorithm to condition- and procedure-specific measures, teams of clinical experts reviewed the algorithm in the context of each measure-specific patient cohort and, where clinically indicated, adapted the content of the algorithm to better reflect the likely clinical experience of each measure's patient cohort. The planned readmission algorithm is applied to the AMI measure without modifications.

The planned readmission algorithm and associated code tables are attached in data field S.2b (Data Dictionary or Code Table).

0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

The measure counts readmissions to any acute care hospital for any cause within 30 days of the date of discharge of the index pneumonia admission, excluding planned readmissions as defined below.

Planned Readmission Algorithm (Version 4.0)

The planned readmission algorithm is a set of criteria for classifying readmissions as planned using Medicare claims and VA administrative data. The algorithm identifies admissions that are typically planned and may occur within 30 days of discharge from the hospital.

The planned readmission algorithm has three fundamental principles:

A few specific, limited types of care are always considered planned (transplant surgery, maintenance chemotherapy/immunotherapy, rehabilitation);

Otherwise, a planned readmission is defined as a non-acute readmission for a scheduled procedure; and,

Admissions for acute illness or for complications of care are never planned.

The algorithm was developed in 2011 as part of the Hospital-Wide Readmission measure. In 2013, CMS applied the algorithm to its other readmission measures.

In applying the algorithm to condition- and procedure-specific measures, teams of clinical experts reviewed the algorithm in the context of each measure-specific patient cohort and, where clinically indicated, adapted the content of the algorithm to better reflect the likely clinical experience of each measure's patient cohort. The planned readmission algorithm is applied to the pneumonia measure without modifications.

The planned readmission algorithm and associated code tables are attached in data field S.2b (Data Dictionary or Code Table).

Denominator Statement

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The target population for the publicly reported measure includes admissions for Medicare FFS beneficiaries who are at least 65 years of age undergoing elective primary THA and/or TKA procedures.

Additional details are provided in S.9 Denominator Details.

0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal diagnosis of AMI; and with a complete claims history for the 12 months prior to admission.

Additional details are provided in S.7 Denominator Details.

0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of pneumonia, including aspiration pneumonia or a principal discharge diagnosis of sepsis (not severe sepsis) with a secondary discharge diagnosis of pneumonia (including aspiration pneumonia) coded as POA and no secondary discharge diagnosis of severe sepsis; and with a complete claims history for the 12 months prior to admission. The measure is publicly reported by CMS for those patients 65 years and older who are Medicare FFS or VA beneficiaries admitted to non-federal or VA hospitals, respectively.

Additional details are provided in S.7 Denominator Details.

Denominator Details

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

To be included in the measure cohort used in public reporting, patients must meet the following additional inclusion criteria:

Enrolled in Medicare FFS Part A and Part B Medicare for the 12 months prior to the date of admission; and enrolled in Part A during the index admission;

Aged 65 or over;

Discharged alive from a non-federal acute care hospital; and

Have a qualifying elective primary THA/TKA procedure; elective primary THA/TKA procedures defined as those procedures without any of the following:

- Femur, hip, or pelvic fractures coded in principal or secondary discharge diagnosis fields of the index admission;
- Partial hip arthroplasty (PHA) procedures with a concurrent THA/TKA;
- Revision procedures with a concurrent THA/TKA;
- Resurfacing procedures with a concurrent THA/TKA;
- Mechanical complication coded in the principal discharge diagnosis field;
- Malignant neoplasm of the pelvis, sacrum, coccyx, lower limbs, or bone/bone marrow or a disseminated malignant neoplasm coded in the principal discharge diagnosis field;
- Removal of implanted devices/prostheses; or
- Transfer from another acute care facility for the THA/TKA

This measure can also be used for an all-payer population aged 18 years and older. We have explicitly tested the measure in both patients aged 18 years and older and those aged 65 years or older (see Testing Attachment for details, 2b4.11).

0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria:

Principal discharge diagnosis of AMI;

Enrolled in Medicare fee-for-service (FFS) Part A and B for the 12 months prior to the date of admission, and enrolled in Part A during the index admission, or those who are VA beneficiaries;

Aged 65 or over;

Discharged alive from a non-federal short-term acute care hospital or VA hospital; and,

Not transferred to another acute care facility.

0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria:

Principal discharge diagnosis of pneumonia, including aspiration pneumonia; or principal discharge diagnosis of sepsis (not including severe sepsis), with a secondary discharge diagnosis of pneumonia (including aspiration pneumonia) coded as POA but no secondary discharge diagnosis of severe sepsis;

Enrolled in Medicare fee-for-service (FFS) in Part A and Part B for the 12 months prior to the date of admission, and enrolled in Part A during the index admission, or those who are VA beneficiaries;

Aged 65 or over;

Discharged alive from a non-federal short-term acute care hospital or VA hospital; and,

Not transferred from another acute care facility.

Exclusions

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The THA/TKA readmission measure excludes admissions for patients:

Without at least 30 days post-discharge enrollment in FFS Medicare;

Who were discharged against medical advice (AMA);

Admitted for the index procedure and subsequently transferred to another acute care facility;

Who had more than two THA/TKA procedure codes during the index hospitalization; or

Who had THA/TKA admissions within 30 days of a prior THA/TKA index admission.

0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

The 30-day AMI readmission measure excludes index admissions for patients:

Without at least 30 days of post-discharge enrollment in Medicare FFS (in the case of patients who are not VA beneficiaries);

Discharged against medical advice (AMA);

Same-day discharges; or

Admitted within 30 days of a prior index admission for AMI.

0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

The 30-day pneumonia (PN) readmission measure excludes index admissions for patients:

Discharged against medical advice (AMA);

Without at least 30 days post-discharge enrollment in FFS Medicare (in the case of patients who are not VA beneficiaries);

Admitted within 30 days of a prior index admission for pneumonia.

Exclusion Details

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

This measure excludes index admissions for patients:

1. Without at least 30 days of post-discharge enrollment in FFS Medicare as determined by examining the Medicare Enrollment Database (EDB).

Rationale: The 30-day readmission outcome cannot be assessed in this group since claims data are used to determine whether a patient was readmitted.

2. Discharges against medical advice (AMA) are identified using the discharge disposition indicator in claims data.

Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.

3. Admitted for the index procedure and subsequently transferred to another acute care facility, which are defined as when a patient with an inpatient hospital admission (with at least one qualifying THA/TKA procedure) is discharged from an acute care hospital and admitted to another acute care hospital on the same or next day.

Rationale: Patients admitted for the index procedure and subsequently transferred to another acute care facility are excluded, as determining which hospital the readmission outcome should be attributed to is difficult.

4. Who had more than two THA/TKA procedure codes during the index hospitalization, which is identified by examining procedure codes in the claims data.

Rationale: Although clinically possible, it is highly unlikely that patients would receive more than two elective THA/TKA procedures in one hospitalization, which may reflect a coding error.

5. Who had THA/TKA admissions within 30 days prior to THA/TKA index admission.

Rationale: Additional THA/TKA admissions within 30 days are excluded as index admissions because they are part of the outcome. A single admission does not count as both an index admission and a readmission for another index admission.

0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

The AMI readmission measure excludes index admissions for patients:

1. Without at least 30 days of post-discharge enrollment in Medicare FFS (in the case of patients who are not VA beneficiaries), which is identified with enrollment data from the Medicare Enrollment Database.

Rationale: The 30-day readmission outcome cannot be assessed in this group since claims data are used to determine whether a patient was readmitted.

2. Discharged against medical advice (AMA) are identified using the discharge disposition indicator in claims data.

Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.

3. Same-day discharges. This information is identified in claims data.

Rationale: Patients admitted and then discharged on the same day are not included as an index admission because it is unlikely that these patients had clinically significant AMIs.

4. AMI admissions within 30 days of discharge from a qualifying AMI index admission are identified by comparing the discharge date from the index admission with subsequent admission dates.

Rationale: Additional AMI admissions within 30 days are excluded as index admissions because they are part of the outcome. A single admission does not count as both an index admission and a readmission for another index admission.

0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

The pneumonia readmission measure excludes index admissions for patients:

1. Discharges against medical advice (AMA) are identified using the discharge disposition indicator in claims data.

Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.

2. Without at least 30 days of post-discharge enrollment in Medicare FFS (in the case of patients who are not VA beneficiaries), which is identified with enrollment data from the Medicare Enrollment Database.

Rationale: The 30-day readmission outcome cannot be assessed in this group since claims data are used to determine whether a patient was readmitted.

3. Pneumonia admissions within 30 days of discharge from a qualifying pneumonia index admission are identified by comparing the discharge date from the index admission with subsequent admission dates.

Rationale: Additional pneumonia admissions within 30 days are excluded as index admissions because they are part of the outcome. A single admission does not count as both an index admission and a readmission for another index admission.

Risk Adjustment

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Statistical risk model

112469| 109921| 118210| 135810| 117446| 146637| 141015

112469| 109921| 118210| 135810| 117446| 146637| 141015

0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

Statistical risk model

118210| 112469| 146637

118210| 112469| 146637

0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

Statistical risk model

141973| 112469| 146637

141973| 112469| 146637

Stratification

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

N/A

0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

N/A

0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

N/A

Type Score

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Rate/proportion better quality = lower score

0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

Rate/proportion better quality = lower score

0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

Rate/proportion better quality = lower score

Algorithm

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The measure estimates hospital-level 30-day all-cause RSRRs following elective primary THA/TKA using hierarchical logistic regression models. In brief, the approach simultaneously models data at the patient and hospital levels to account for variance in patient outcomes within and between hospitals (Normand and Shahian, 2007). At the patient level, it models the log-odds of readmission within 30 days of discharge using age, sex, selected clinical covariates, and a hospital-specific intercept. At the hospital level, it models the hospital-specific intercepts as arising from a normal distribution. The hospital intercept represents the underlying risk of a readmission at the hospital, after accounting for patient risk. The hospital-specific intercepts are given a distribution to account for the clustering (non-independence) of patients within the same hospital. If there were no differences among hospitals after adjusting for patient risk, the hospital intercepts should be identical across all hospitals.

The RSRR is calculated as the ratio of the number of "predicted" to the number of "expected" readmission at a given hospital, multiplied by the national observed readmission rate. For each hospital, the numerator of the ratio is the number of readmissions within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of readmissions expected based on the nation's performance with that hospital's case mix. This approach is analogous to a ratio of "observed" to "expected" used in other types of statistical analyses. It conceptually allows for a comparison of a particular hospital's performance given its case mix to an average hospital's performance with the same case mix. Thus, a lower ratio indicates lower-than-expected readmission rates or better quality, and a higher ratio indicates higher-than-expected readmission rates or worse quality.

The "predicted" number of readmissions (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of readmission. The estimated hospital-specific intercept is added to the sum of the estimated regression coefficients multiplied by the patient characteristics. The results are transformed and summed over all patients attributed to a hospital to get a predicted value. The "expected" number of readmissions (the denominator) is obtained in the same manner, but a common intercept using all hospitals in our sample is added in place of the hospital-specific intercept. The results are transformed and summed over all patients in the hospital to get an expected value. To assess hospital performance for each reporting period, we re-estimate the model coefficients using the years of data in that period.

This calculation transforms the ratio of predicted over expected into a rate that is compared to the national observed readmission rate. The hierarchical logistic regression models are described fully in the original methodology report (Grosso et al., 2012), which is also posted on QualityNet.

References:

Grosso L, Curtis J, Geary L, et al. Hospital-level 30-Day All-Cause Risk-Standardized Readmission Rate Following Elective Primary Total Hip Arthroplasty (THA) And/Or Total Knee Arthroplasty (TKA) Measure Methodology Report. 2012.

Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 112469| 109921| 118210| 135810| 117446| 146637| 141015

0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

The measure estimates hospital-level 30-day, all-cause, RSRRs following hospitalization for AMI using hierarchical logistic regression models. In brief, the approach simultaneously models data at the patient and hospital levels to account for variance in patient outcomes within and between hospitals (Normand and Shahian, 2007). At the patient level, it models the log-odds of readmission within 30 days of index admission using age, sex, selected clinical covariates, and a hospital-specific intercept. At the hospital level, it models the hospital-specific intercepts as arising from a normal distribution. The hospital intercept represents the underlying risk of a readmission at the hospital, after accounting for patient risk. The hospital-specific intercepts are given a distribution to account for the clustering (non-independence) of patients within the same hospital. If there were no differences among hospitals, then after adjusting for patient risk, the hospital intercepts should be identical across all hospitals.

The RSRR is calculated as the ratio of the number of "predicted" to the number of "expected" readmissions at a given hospital, multiplied by the national observed readmission rate. For each hospital, the numerator of the ratio is the number of readmissions within 30 days predicted on the basis of the hospital's performance with its observed case mix; and the denominator is the number of readmissions expected based on the nation's performance with that hospital's case mix. This approach is analogous to a ratio of "observed" to "expected" used in other types of statistical analyses. It conceptually allows for a comparison of a particular hospital's performance given its case mix to an average hospital's performance with the same case mix. Thus, a lower ratio indicates lower-than-expected readmission rates or better quality, and a higher ratio indicates higher-than-expected readmission rates or worse quality.

The "predicted" number of readmissions (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of readmission. The estimated hospital-specific intercept is added to the sum of the estimated regression coefficients multiplied by the patient characteristics. The results are transformed and summed over all patients attributed to a hospital to get a predicted value. The "expected" number of readmissions (the denominator) is obtained in the same manner, but a common intercept using all hospitals in our sample is added in place of the hospital-specific intercept. The results are transformed and summed over all patients in the hospital to get an expected value. To assess hospital performance for each reporting period, we re-estimate the model coefficients using the years of data in that period.

This calculation transforms the ratio of predicted over expected into a rate that is compared to the national observed readmission rate. The hierarchical logistic regression models are described fully and in the original methodology reports posted on QualityNet

References

Normand S-LT, Shahian D, M,. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Statistical Science. 2007;22(2):206-226 118210| 112469| 146637

0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

The measure estimates hospital-level 30-day, all-cause, RSRRs following hospitalization for pneumonia using hierarchical logistic regression models. In brief, the approach simultaneously models data at the patient and hospital levels to account for variance in patient outcomes within and between hospitals (Normand and Shahian, 2007). At the patient level, it models the log-odds of readmission within 30 days of index admission using age, sex, selected clinical covariates, and a hospital-specific intercept. At the hospital level, it models the hospital-specific intercepts as arising from a normal distribution. The hospital intercept represents the underlying risk of a readmission at the hospital, after accounting for patient risk. The hospital-specific intercepts are given a distribution to account for the clustering (non-independence) of patients within the same hospital. If there were no differences among hospitals, then after adjusting for patient risk, the hospital intercepts should be identical across all hospitals.

The RSRR is calculated as the ratio of the number of "predicted" to the number of "expected" readmissions at a given hospital, multiplied by the national observed readmission rate. For each hospital, the numerator of the ratio is the number of readmissions within 30 days predicted on the basis of the hospital's performance with its observed case mix; and the denominator is the number of readmissions expected based on the nation's performance with that hospital's case mix. This approach is analogous to a ratio of "observed" to "expected" used in other types of statistical analyses. It conceptually allows for a comparison of a particular hospital's performance given its case mix to an average hospital's performance with the same case mix. Thus, a lower ratio indicates lower-than-expected readmission rates or better quality, and a higher ratio indicates higher-than-expected readmission rates or worse quality.

The "predicted" number of readmissions (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of readmission. The estimated hospital-specific intercept is added to the sum of the estimated regression coefficients multiplied by the patient characteristics. The results are transformed and summed over all patients attributed to a hospital to get a predicted value. The "expected" number of readmissions (the denominator) is obtained in the same manner, but a common intercept using all hospitals in our sample is added in place of the hospital-specific intercept. The results are transformed and summed over all patients in the hospital to get an expected value. To assess hospital performance for each reporting period, we re-estimate the model coefficients using the years of data in that period.

This calculation transforms the ratio of predicted over expected into a rate that is compared to the national observed readmission rate. The hierarchical logistic regression models are described fully in the original methodology report posted on QualityNet

References:

Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 141973| 112469| 146637

Submission items

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

5.1 Identified measures: 0505 : Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

0506 : Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

1550 : Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

1789 : Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

3493 : Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: We did not include in our list of related measures any non-outcome measures (for example, process measures) with the same target population as our measure. Because this is an outcome measure, clinical coherence of the cohort takes precedence over alignment with related non-outcome measures. Furthermore, non-outcome measures are limited due to broader patient exclusions. This is because they typically only include a specific subset of patients who are eligible for that measure (for example, patients who receive a specific medication or undergo a specific procedure).

5b.1 If competing, why superior or rationale for additive value: N/A

0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

5.1 Identified measures: 0730 : Acute Myocardial Infarction (AMI) Mortality Rate

0330 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

0230 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

1789 : Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

2431 : Hospital-level, risk-standardized payment associated with a 30-day episode-of-care for Acute Myocardial Infarction (AMI)

2473 : Hybrid hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI)

2879 : Hybrid Hospital-Wide Readmission (HWR) Measure with Claims and Electronic Health Record Data

2881 : Excess days in acute care (EDAC) after hospitalization for acute myocardial infarction (AMI)

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: We did not include in our list of related measures any non-outcome (e.g., process) measures with the same target population as our measure. Because this is an outcome measure, clinical coherence of the cohort takes precedence over alignment with related non-outcome measures. Furthermore, non-outcome measures are limited due to broader patient exclusions. This is because they typically only include a specific subset of patients who are eligible for that measure (for example, patients who receive a specific medication or undergo a specific procedure).

5b.1 If competing, why superior or rationale for additive value: N/A

0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

5.1 Identified measures: 0231 : Pneumonia Mortality Rate (IQI #20)

0279 : Community Acquired Pneumonia Admission Rate (PQI 11)

1789 : Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

2579 : Hospital-level, risk-standardized payment associated with a 30-day episode of care for pneumonia (PN)

2882 : Excess days in acute care (EDAC) after hospitalization for pneumonia

5a.1 Are specs completely harmonized? No

5a.2 If not completely harmonized, identify difference, rationale, impact: We did not include in our list of related measures any non-outcome (e.g., process) measures with the same target population as our measure. Because this is an outcome measure, clinical coherence of the cohort takes precedence over alignment with related non-outcome measures. Furthermore, non-outcome measures are limited due to broader patient exclusions. This is because they typically only include a specific subset of patients who are eligible for that measure (for example, patients who receive a specific medication or undergo a specific procedure).

5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #1551, NQF #1550, and NQF #1789

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)
1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)
1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

Steward

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Centers for Medicare & Medicaid Services

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Centers for Medicare & Medicaid Services

1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

Centers for Medicare & Medicaid Services

Description

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The measure estimates a hospital-level risk-standardized readmission rate (RSRR) following elective primary THA and/or TKA in Medicare Fee-For-Service (FFS) beneficiaries who are 65 years and older. The outcome (readmission) is defined as unplanned readmission for any cause within 30 days of the discharge date for the index admission (the admission included in the measure cohort). A specified set of planned readmissions do not count in the readmission outcome.

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The measure estimates a hospital-level risk-standardized complication rate (RSCR) associated with elective primary THA and TKA in Medicare Fee-For-Service beneficiaries who are age 65 and older. The outcome (complication) is defined as any one of the specified complications occurring from the date of index admission to 90 days post date of the index admission (the admission included in the measure cohort).

1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

This measure estimates a hospital-level, risk-standardized readmission rate (RSRR) of unplanned, all-cause readmission within 30 days of discharge from an index admission with an eligible condition or procedure. The measure reports a single summary RSRR, derived from the volume-weighted results of five different models, one for each of the following specialty cohorts based on groups of discharge condition categories or procedure categories: surgery/gynecology, general medicine, cardiorespiratory, cardiovascular, and neurology. The measure also indicates the hospital-level standardized readmission ratios (SRR) for each of these five specialty cohorts. The outcome is defined as unplanned readmission for any cause within 30 days of the discharge date from the index admission (the admission included in the measure cohort). A specified set of readmissions are planned and do not count in the readmission outcome. CMS annually reports the measure for Medicare fee-for-service (FFS) patients who are 65 years or older and are hospitalized in non-federal short-term acute care hospitals.

For the All-Cause Readmission (ACR) measure version used in the Shared Savings Program (SSP) beginning in 2017, the measure estimates an Accountable Care Organization (ACO) facility-level RSRR of unplanned, all-cause readmission after admission for any eligible condition or procedure within 30 days of hospital discharge. The ACR measure is calculated using the same five specialty cohorts and estimates an ACO-level standardized risk ratio for each. CMS annually reports the measure for patients who are 65 years or older, are enrolled in Medicare FFS, and are ACO assigned beneficiaries.

The updates in this form reflect changes both to the original HWR measure and the ACS measure version. For instances where the two versions differ, we provide additional clarifications below the original description.

Type

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Outcome

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Outcome

1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

Outcome

Data Source

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Claims, Enrollment Data Data sources for the Medicare FFS measure:

Medicare Part A Inpatient and Part B Outpatient Claims: This data source contains claims data for FFS inpatient and outpatient services including Medicare inpatient hospital care, outpatient hospital services, as well as inpatient and outpatient physician claims for the 12 months prior to an index admission.

Medicare Enrollment Database (EDB): This database contains Medicare beneficiary demographic, benefit/coverage, and vital status information. This data source was used to obtain information on several inclusion/exclusion indicators such as Medicare status on admission as well as vital status. These data have previously been shown to accurately reflect patient vital status (Fleming et al., 1992). The Master Beneficiary Summary File (MBSF) is an annually created file derived from the EDB that contains enrollment information for all Medicare beneficiaries including dual eligible status. Years 2016-2019 were used.

The American Community Survey (2013-2017): We used the American Community Survey (2013-2017) to derive an updated Agency for Healthcare Research and Quality(AHRQ) Socioeconomic Status (SES) index score at the patient nine-digit zip code level for use in studying the association between our measure and social risk factors (SRFs).

Reference:

Fleming C., Fisher ES, Chang CH, Bubolz D, Malenda J. Studying outcomes and hospital utilization in the elderly: The advantages of a merged data base for Medicare and Veterans Affairs Hospitals. Medical Care. 1992; 30(5): 377-91.

No data collection instrument provided Attachment

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Claims, Enrollment Data Data sources for the Medicare FFS measure:

Medicare Part A Inpatient and Part B Outpatient Claims: This data source contains claims data for FFS inpatient and outpatient services including Medicare inpatient hospital care, outpatient hospital services, as well as inpatient and outpatient physician claims for the 12 months prior to an index admission.

Medicare Enrollment Database (EDB): This database contains Medicare beneficiary demographic, benefit/coverage, and vital status information. This data source was used to obtain information on several inclusion/exclusion indicators such as Medicare status on admission as well as vital status. These data have previously been shown to accurately reflect patient vital status (Fleming et al., 1992). The Master Beneficiary Summary File (MBSF) is an annually created file derived the EDB that contains enrollment information for all Medicare beneficiaries including dual eligible status. Years 2016-2019 were used.

The American Community Survey (2013-2017): We used the American Community Survey (2013-2017) to derive an updated Agency for Healthcare Research and Quality (AHRQ) Socioeconomic (SES) index score at the patient nine-digit zip code level for use in studying the association between our measure and social risk factors (SRFs).

References:

Fleming C., Fisher ES, Chang CH, Bubolz D, Malenda J. Studying outcomes and hospital utilization in the elderly: The advantages of a merged data base for Medicare and Veterans Affairs Hospitals. Medical Care. 1992; 30(5): 377-91.

No data collection instrument provided Attachment

1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

Claims Data sources for the Medicare FFS measure:

HWR

1. Medicare Part A claims data for calendar years 2007 and 2008 were combined and then randomly split into two equal subsets (development sample and validation sample). Risk variable selection was done using the development sample, the risk models for each of the five specialty cohorts in the measure were applied to the validation sample and the models' performance was compared. In addition we re-tested the models in Medicare Part A claims data from calendar year 2009 to look for temporal stability in the models' performance. The number of measured entities and index admissions are listed below by specialty cohort.

2. Medicare Enrollment Database (EDB): This database contains Medicare beneficiary demographic, benefit/coverage, and vital status information. This data source was used to obtain information on several inclusion/exclusion indicators such as Medicare status on admission and following discharge from index admission

ACR

1. Medicare Part A claims data for calendar years 2013, 2014, and 2015.
2. Medicare Enrollment Database (EDB).

Reference:

Fleming C., Fisher ES, Chang CH, Bubolz D, Malenda J. Studying outcomes and hospital utilization in the elderly: The advantages of a merged data base for Medicare and Veterans Affairs Hospitals. Medical Care. 1992; 30(5): 377-91.

Available in attached appendix at A.1 Attachment

Level

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Facility

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Facility

1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

Facility

Setting

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Inpatient/Hospital

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Inpatient/Hospital

1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

Inpatient/Hospital, Outpatient Services

Numerator Statement

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The outcome for this measure is 30-day readmissions. We define readmissions as inpatient admissions for any cause, with the exception of certain planned readmissions, within 30 days from the date of discharge of the index hospitalization. If a patient has more than one unplanned admission (for any reason) within 30 days after discharge from the index admission, only one is counted as a readmission. The measure looks for a dichotomous yes or no outcome of whether each admitted patient has an unplanned readmission within 30 days. However, if the first readmission after discharge is considered planned, any subsequent unplanned readmission is not counted as an outcome for that index admission, because the unplanned readmission could be related to care provided during the intervening planned readmission rather than during the index admission.

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The outcome for this measure is any complication occurring during the index admission (not coded present on arrival) to 90 days post-date of the index admission. Complications are counted in the measure only if they occur during the index hospital admission or during a readmission. The complication outcome is a dichotomous (yes/no) outcome. If a patient experiences one or more of these complications in the applicable time period, the complication outcome for that patient is counted in the measure as a "yes".

1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

The outcome for both the original HWR and ACR measures is 30-day readmission. We define readmission as an inpatient admission for any cause, except for certain planned readmissions, within 30 days from the date of discharge from an eligible index admission. If a patient has more than one unplanned admission (for any reason) within 30 days after discharge from the index admission, only one is counted as a readmission. The measure looks for a dichotomous yes or no outcome of whether each admitted patient has an unplanned readmission within 30 days. However, if the first readmission after discharge is considered planned, any subsequent unplanned readmission is not counted as an outcome for that index admission because the unplanned readmission could be related to care provided during the intervening planned readmission rather than during the index admission.

Numerator Details

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The measure counts readmissions to any acute care hospital for any cause within 30 days of the date of discharge of the index THA and/or TKA hospitalization, excluding planned readmissions as defined below.

Planned Readmission Algorithm (Version 4.0)

The Planned Readmission Algorithm is a set of criteria for classifying readmissions as planned among the general Medicare population using Medicare administrative claims data. The algorithm identifies admissions that are typically planned and may occur within 30 days of discharge from the hospital.

The Planned Readmission Algorithm has three fundamental principles:

1. A few specific, limited types of care are always considered planned (transplant surgery, maintenance chemotherapy/immunotherapy, and rehabilitation);
2. Otherwise, a planned readmission is defined as a non-acute readmission for a scheduled procedure; and
3. Admissions for acute illness or for complications of care are never planned.

The algorithm was developed in 2011 as part of the Hospital-Wide Readmission measure. In 2013, CMS applied the algorithm to its other readmission measures. In applying the algorithm to condition- and procedure-specific measures, teams of clinical experts reviewed the algorithm in the context of each measure-specific patient cohort and, where clinically indicated, adapted the content of the algorithm to better reflect the likely clinical experience of each measure's patient cohort. The planned readmission algorithm is applied to the THA/TKA readmission measure with small modifications.

The Planned Readmission Algorithm and associated code tables are attached in data field S.2b (Data Dictionary or Code Table).

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The composite complication is a dichotomous outcome (yes for any complication(s); no for no complications). Therefore, if a patient experiences one or more complications, the outcome variable will get coded as a "yes". Complications are counted in the measure only if they occur during the index hospital admission (and are not present on admission) or during a readmission.

The complications captured in the numerator are identified during the index admission OR associated with a readmission up to 90 days post-date of index admission, depending on the complication. The follow-up period for complications from date of index admission is as follows:

The follow-up period for AMI, pneumonia, and sepsis/septicemia/shock is seven days from the date of index admission because these conditions are more likely to be attributable to the procedure if they occur within the first week after the procedure. Additionally, analyses indicated a sharp decrease in the rate of these complications after seven days.

Death, surgical site bleeding, and pulmonary embolism are followed for 30 days following admission because clinical experts agree these complications are still likely attributable to the hospital performing the procedure during this period and rates for these complications remained elevated until roughly 30 days post admission.

The measure follow-up period is 90 days after admission for mechanical complications and periprosthetic joint infection/wound infection. Experts agree that mechanical complications and periprosthetic joint infection/wound infections due to the index THA/TKA occur up to 90 days following THA/TKA.

The measure counts all complications occurring during the index admission regardless of when they occur. For example, if a patient experiences an AMI on day 10 of the index admission, the measure will count the AMI as a complication, although the specified follow-up period for AMI is seven days. Clinical experts agree with this approach, as such complications likely represent the quality of care provided during the index admission.

As of 2014 reporting, the measure does not count complications in the complications outcome that are coded as present on admission (POA) during the index admission; this prevents identifying a condition as a complication of care if it was present on admission for the THA/TKA procedure.

For full list of codes defining complications, see the Data Dictionary attached in field S.2b.

1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

Outcome definition

The measure counts readmissions to any short-term acute care hospital for any cause within 30 days of the date of discharge from an eligible index admission, excluding planned readmissions as defined below.

Rationale

From a patient perspective, an unplanned readmission from any cause is an adverse event. Outcomes occurring within 30 days of discharge can be influenced by hospital care and the early transition to the non-acute care setting. The 30-day time frame is a clinically meaningful period for hospitals to collaborate with their communities to reduce readmissions. However, planned readmissions are generally not a signal of quality of care. Including planned readmissions in a readmission measure could create a disincentive to provide appropriate care to patients who are scheduled for elective or necessary procedures within 30 days of discharge.

It is important to note that for the HWR measure, a readmission is included as an index admission if it meets all other eligibility criteria. This differs from the publicly reported condition-specific and procedure-specific readmission measures, which do not consider a readmission as a new index admission within the same measure.

Planned Readmission Algorithm (Version 4.0)

The Planned Readmission Algorithm is a set of criteria for classifying readmissions as planned among the general Medicare population using Medicare administrative claims data. The algorithm identifies admissions that are typically planned and may occur within 30 days of discharge from the hospital.

The Planned Readmission Algorithm has three fundamental principles:

A few specific, limited types of care are always considered planned (obstetric delivery, transplant surgery, maintenance chemotherapy/radiotherapy/immunotherapy, rehabilitation);

Otherwise, a planned readmission is defined as a non-acute readmission for a scheduled procedure; and

Admissions for acute illness or for complications of care are never planned.

The algorithm was developed in 2011 as part of the HWR measure. In 2013, CMS applied the algorithm to its other readmission measures.

For more details on the Planned Readmission Algorithm, please see Appendix E of the report titled "2019 All-Cause Hospital-Wide Measure Updates and Specifications Report: Hospital-Wide Readmission"

Wallace Lori, Grady J, Djordjevic Darinka, et al. 2019 All-Cause Hospital Wide Measure Updates and Specifications Report.

Denominator Statement

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The target population for the publicly reported measure includes admissions for Medicare FFS beneficiaries who are at least 65 years of age undergoing elective primary THA and/or TKA procedures.

Additional details are provided in S.9 Denominator Details.

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The target population for the publicly reported measure includes admissions for Medicare FFS beneficiaries who are at least 65 years of age undergoing elective primary THA and/or TKA procedures.

Additional details are provided in S.7 Denominator Details.

1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

The measure includes admissions for Medicare beneficiaries who are 65 years and older and are discharged from all non-federal, acute care inpatient US hospitals (including territories) with a complete claims history for the 12 months prior to admission.

ACR-Specific: The measure at the ACO level includes all relevant admissions for ACO assigned beneficiaries who are 65 and older, and are discharged from all non-Federal short-stay acute care hospitals, including critical access hospitals.

Additional details are provided in S.7 Denominator Details.

Denominator Details

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

To be included in the measure cohort used in public reporting, patients must meet the following additional inclusion criteria:

Enrolled in Medicare FFS Part A and Part B Medicare for the 12 months prior to the date of admission; and enrolled in Part A during the index admission;

Aged 65 or over;

Discharged alive from a non-federal acute care hospital; and

Have a qualifying elective primary THA/TKA procedure; elective primary THA/TKA procedures defined as those procedures without any of the following:

- Femur, hip, or pelvic fractures coded in principal or secondary discharge diagnosis fields of the index admission;
- Partial hip arthroplasty (PHA) procedures with a concurrent THA/TKA;
- Revision procedures with a concurrent THA/TKA;
- Resurfacing procedures with a concurrent THA/TKA;
- Mechanical complication coded in the principal discharge diagnosis field;
- Malignant neoplasm of the pelvis, sacrum, coccyx, lower limbs, or bone/bone marrow or a disseminated malignant neoplasm coded in the principal discharge diagnosis field;
- Removal of implanted devices/prostheses; or
- Transfer from another acute care facility for the THA/TKA

This measure can also be used for an all-payer population aged 18 years and older. We have explicitly tested the measure in both patients aged 18 years and older and those aged 65 years or older (see Testing Attachment for details, 2b4.11).

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

To be included in the measure cohort used in public reporting, patients must meet the following additional inclusion criteria:

Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of admission; and enrolled in Part A during the index admission;

Aged 65 or older

Having a qualifying elective primary THA/TKA procedure; elective primary THA/TKA procedures are defined as those procedures without any of the following:

Fracture of the pelvis or lower limbs coded in the principal or secondary discharge diagnosis fields on the index admission claim (Note: Periprosthetic fractures must be additionally coded as present on admission [POA] in order to disqualify a THA/TKA from cohort inclusion, unless exempt from POA reporting.);

A concurrent partial hip or knee arthroplasty procedure;

A concurrent revision, resurfacing, or implanted device/prosthesis removal procedure;

Mechanical complication coded in the principal discharge diagnosis field on the index admission claim;

Malignant neoplasm of the pelvis, sacrum, coccyx, lower limbs, or bone/bone marrow or a disseminated malignant neoplasm coded in the principal discharge diagnosis field on the index admission claim; or,

Transfer from another acute care facility for the THA/TKA.

Patients are eligible for inclusion in the denominator if they had an elective primary THA and/or a TKA AND had continuous enrollment in Part A and Part B Medicare fee-for-service (FFS) 12 months prior to the date of index admission.

This measure can also be used for an all-payer population aged 18 years and older. We have explicitly tested the measure in both patients aged 18+ years and those aged 65+ years (see Testing Attachment for details).

1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

To be included in the measure cohort, patients must meet the following inclusion criteria:

Enrolled in Medicare FFS Part A for the 12 months prior to the date of admission and during the index admission;

Aged 65 or older;

Discharged alive from a non-federal short-term acute care hospital; and

Not transferred to another acute care facility.

ACR-Specific: An additional criterion for the ACO version of this measure is that only hospitalizations for ACO-assigned beneficiaries that meet all of the other criteria listed above are included. The cohort definition is otherwise identical to that of the HWR described below.

The measure first assigns admissions with qualifying Agency for Healthcare Research and Quality (AHRQ) Clinical Classifications Software (CCS) procedure categories to the Surgery/Gynecology Cohort. This cohort includes admissions likely cared for by surgical or gynecological teams.

The measure then sorts admissions into one of the four remaining specialty cohorts based on the AHRQ CCS diagnosis category of the principal discharge diagnosis:

The Cardiorespiratory Cohort includes several condition categories with very high readmission rates such as pneumonia, chronic obstructive pulmonary disease, and heart failure. These admissions are combined into a single cohort because they are often clinically indistinguishable, and patients are often simultaneously treated for several of these diagnoses.

The Cardiovascular Cohort includes condition categories such as acute myocardial infarction that in large hospitals might be cared for by a separate cardiac or cardiovascular team.

The Neurology Cohort includes neurologic condition categories such as stroke that in large hospitals might be cared for by a separate neurology team.

The Medicine Cohort includes all non-surgical patients who were not assigned to any of the other cohorts.

The full list of the specific diagnosis and procedure AHRQ CCS categories used to define the specialty cohorts can be found in the attached data dictionary.

Exclusions

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The THA/TKA readmission measure excludes admissions for patients:

Without at least 30 days post-discharge enrollment in FFS Medicare;

Who were discharged against medical advice (AMA);

Admitted for the index procedure and subsequently transferred to another acute care facility;

Who had more than two THA/TKA procedure codes during the index hospitalization; or

Who had THA/TKA admissions within 30 days of a prior THA/TKA index admission.

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

This measure excludes index admissions for patients:

Without at least 90 days post-discharge enrollment in FFS Medicare;

Who were discharged against medical advice (AMA); or,

Who had more than two THA/TKA procedure codes during the index hospitalization.

After applying these exclusion criteria, we randomly select one index admission for patients with multiple index admissions in a calendar year. We therefore exclude the other eligible index admissions in that year.

1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

Both the original HWR and ACR versions of the measure exclude index admissions for patients:

Admitted to Prospective Payment System (PPS)-exempt cancer hospitals;

Without at least 30 days post-discharge enrollment in Medicare FFS;

Discharged against medical advice;

Admitted for primary psychiatric diagnoses;

Admitted for rehabilitation; or

Admitted for medical treatment of cancer.

Exclusion Details

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

This measure excludes index admissions for patients:

1. Without at least 30 days of post-discharge enrollment in FFS Medicare as determined by examining the Medicare Enrollment Database (EDB).

Rationale: The 30-day readmission outcome cannot be assessed in this group since claims data are used to determine whether a patient was readmitted.

2. Discharges against medical advice (AMA) are identified using the discharge disposition indicator in claims data.

Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.

3. Admitted for the index procedure and subsequently transferred to another acute care facility, which are defined as when a patient with an inpatient hospital admission (with at least one qualifying THA/TKA procedure) is discharged from an acute care hospital and admitted to another acute care hospital on the same or next day.

Rationale: Patients admitted for the index procedure and subsequently transferred to another acute care facility are excluded, as determining which hospital the readmission outcome should be attributed to is difficult.

4. Who had more than two THA/TKA procedure codes during the index hospitalization, which is identified by examining procedure codes in the claims data.

Rationale: Although clinically possible, it is highly unlikely that patients would receive more than two elective THA/TKA procedures in one hospitalization, which may reflect a coding error.

5. Who had THA/TKA admissions within 30 days prior to THA/TKA index admission.

Rationale: Additional THA/TKA admissions within 30 days are excluded as index admissions because they are part of the outcome. A single admission does not count as both an index admission and a readmission for another index admission.

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

This measure excludes index admissions for patients:

1. Without at least 90 days post-discharge enrollment in FFS Medicare

Rationale: The 90-day complication outcome cannot be assessed in this group since claims data are used to determine whether a complication of care occurred.

2. Who were discharged against medical advice (AMA); or,

Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.

3. Who had more than two THA/TKA procedure codes during the index hospitalization

Rationale: Although clinically possible, it is highly unlikely that patients would receive more than two elective THA/TKA procedures in one hospitalization, which may reflect a coding error.

1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

Both the original HWR and ACR versions of the measure exclude index admissions for patients:

1. Admitted to PPS-exempt cancer hospitals; identified by the Medicare provider ID

Rationale: These hospitals care for a unique population of patients that cannot reasonably be compared to patients admitted to other hospitals.

2. Without at least 30 days of post-discharge enrollment in Medicare FFS; determined using data captured in the Medicare Enrollment Database (EDB)

Rationale: The 30-day readmission outcome cannot be assessed in this group since claims data are used to determine whether a patient was readmitted.

3. Discharged against medical advice; identified using the discharge disposition indicator in claims data.

Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.

4. Admitted for primary psychiatric diagnoses

Rationale: Patients admitted for psychiatric treatment are typically cared for in separate psychiatric or rehabilitation centers that are not comparable to short-term acute care hospitals.

5. Admitted for rehabilitation

Rationale: These admissions are not typically to a short-term acute care hospital and are not for acute care.

6. Admitted for medical treatment of cancer

Rationale: These admissions have a different mortality and readmission profile than the rest of the Medicare population, and outcomes for these admissions do not correlate well with outcomes for other admissions. Patients with cancer admitted for other diagnoses or for surgical treatment of their cancer remain in the measure.

Risk Adjustment

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Statistical risk model

112469| 109921| 118210| 135810| 117446| 146637| 141015

112469| 109921| 118210| 135810| 117446| 146637| 141015

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Statistical risk model

112469| 118210| 137301| 146637| 141015

112469| 118210| 137301| 146637| 141015

1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

Statistical risk model

112469| 118210| 135810| 141973| 146637| 146313

112469| 118210| 135810| 141973| 146637| 146313

Stratification

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

N/A

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

N/A

1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

N/A

Type Score

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Rate/proportion better quality = lower score

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Rate/proportion better quality = lower score

1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

Rate/proportion better quality = lower score

Algorithm

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The measure estimates hospital-level 30-day all-cause RSRRs following elective primary THA/TKA using hierarchical logistic regression models. In brief, the approach simultaneously models data at the patient and hospital levels to account for variance in patient outcomes within and between hospitals (Normand and Shahian, 2007). At the patient level, it models the log-odds of readmission within 30 days of discharge using age, sex, selected clinical covariates, and a hospital-specific intercept. At the hospital level, it models the hospital-specific intercepts as arising from a normal distribution. The hospital intercept represents the underlying risk of a readmission at the hospital, after accounting for patient risk. The hospital-specific intercepts are given a distribution to account for the clustering (non-independence) of patients within the same hospital. If there were no differences among hospitals after adjusting for patient risk, the hospital intercepts should be identical across all hospitals.

The RSRR is calculated as the ratio of the number of "predicted" to the number of "expected" readmission at a given hospital, multiplied by the national observed readmission rate. For each hospital, the numerator of the ratio is the number of readmissions within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of readmissions expected based on the nation's performance with that hospital's case mix. This approach is analogous to a ratio of "observed" to "expected" used in other types of statistical analyses. It conceptually allows for a comparison of a particular hospital's performance given its case mix to an average hospital's performance with the same case mix. Thus, a lower ratio indicates lower-than-expected readmission rates or better quality, and a higher ratio indicates higher-than-expected readmission rates or worse quality.

The "predicted" number of readmissions (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of readmission. The estimated hospital-specific intercept is added to the sum of the estimated regression coefficients multiplied by the patient characteristics. The results are transformed and summed over all patients attributed to a hospital to get a predicted value. The "expected" number

of readmissions (the denominator) is obtained in the same manner, but a common intercept using all hospitals in our sample is added in place of the hospital-specific intercept. The results are transformed and summed over all patients in the hospital to get an expected value. To assess hospital performance for each reporting period, we re-estimate the model coefficients using the years of data in that period.

This calculation transforms the ratio of predicted over expected into a rate that is compared to the national observed readmission rate. The hierarchical logistic regression models are described fully in the original methodology report (Grosso et al., 2012), which is also posted on QualityNet.

References:

Grosso L, Curtis J, Geary L, et al. Hospital-level 30-Day All-Cause Risk-Standardized Readmission Rate Following Elective Primary Total Hip Arthroplasty (THA) And/Or Total Knee Arthroplasty (TKA) Measure Methodology Report. 2012.

Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 112469| 109921| 118210| 135810| 117446| 146637| 141015

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The measure estimates hospital-level RSCRs following elective primary THA/TKA using hierarchical logistic regression models. In brief, the approach simultaneously models data at the patient and hospital levels to account for variance in patient outcomes within and between hospitals (Normand and Shahian, 2007). At the patient level, it models the log-odds of a complication occurring within 90 days of the index admission using age, sex, selected clinical covariates, and a hospital-specific intercept. At the hospital level, it models the hospital-specific intercepts as arising from a normal distribution. The hospital intercept represents the underlying risk of a complication at the hospital, after accounting for patient risk. The hospital-specific intercepts are given a distribution to account for the clustering (non-independence) of patients within the same hospital. If there were no differences among hospitals, then after adjusting for patient risk, the hospital intercepts should be identical across all hospitals.

The RSCR is calculated as the ratio of the number of "predicted" to the number of "expected" admissions with a complication at a given hospital, multiplied by the national observed complication rate. For each hospital, the numerator of the ratio is the number of complications within 90 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of complications expected based on the nation's performance with that hospital's case mix. This approach is analogous to a ratio of "observed" to "expected" used in other types of statistical analyses. It conceptually allows for a comparison of a particular hospital's performance given its case mix to an average hospital's performance with the same case mix. Thus, a lower ratio indicates lower-than-expected complication rates or better quality, and a higher ratio indicates higher-than-expected complication rates or worse quality.

The "predicted" number of admissions with a complication (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of having an admission with a complication. The estimated hospital-specific intercept is added to the sum of the estimated regression coefficients multiplied by the patient characteristics. The results are log transformed and summed over all patients attributed to a hospital to get a predicted value. The "expected" number of admissions with a complication (the denominator) is obtained in the same manner, but a common intercept using all hospitals in our sample is added in place of the hospital-specific effect. The results are log transformed and summed over all patients

in the hospital to get an expected value. To assess hospital performance for each reporting period, we re-estimate the model coefficients using the years of data in that period.

This calculation transforms the ratio of predicted over expected into a rate that is compared to the national observed complication rate. The hierarchical logistic regression models are described fully in the original methodology report posted on QualityNet.

References:

Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 112469| 118210| 137301| 146637| 141015

1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

The measure estimates hospital-level 30-day all-cause RSRRs using hierarchical logistic regression models. In brief, the approach simultaneously models data at the patient and hospital levels to account for variance in patient outcomes within and between hospitals (Normand et al., 2007). At the patient level, it models the log-odds of hospital readmission within 30 days of discharge using age, selected clinical covariates, and a hospital-specific effect. At the hospital level, the approach models the hospital-specific effects as arising from a normal distribution. The hospital effect represents the underlying risk of a readmission at the hospital, after accounting for patient risk. The hospital-specific effects are given a distribution to account for the clustering (non-independence) of patients within the same hospital (Normand et al., 2007). If there were no differences among hospitals, then after adjusting for patient risk, the hospital effects should be identical across all hospitals.

Admissions are assigned to one of five mutually exclusive specialty cohort groups consisting of related conditions or procedures. For each specialty cohort group, the SRR is calculated as the ratio of the number of "predicted" readmissions to the number of "expected" readmissions at a given hospital. For each hospital, the numerator of the ratio is the number of readmissions within 30 days, predicted based on the hospital's performance with its observed case mix and service mix, and the denominator is the number of readmissions expected based on the nation's performance with that hospital's case mix and service mix. This approach is analogous to a ratio of "observed" to "expected" used in other types of statistical analyses. It conceptually allows a particular hospital's performance, given its case mix and service mix, to be compared to an average hospital's performance with the same case mix and service mix. Thus, a lower ratio indicates lower-than-expected readmission rates or better quality, while a higher ratio indicates higher-than-expected readmission rates or worse quality.

For each specialty cohort, the "predicted" number of readmissions (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific effect on the risk of readmission. The estimated hospital-specific effect for each cohort is added to the sum of the estimated regression coefficients multiplied by patient characteristics. The results are log-transformed and summed over all patients attributed to a hospital to calculate a predicted value. The "expected" number of readmissions (the denominator) is obtained in the same manner, but a common effect using all hospitals in our sample is added in place of the hospital-specific effect. The results are log-transformed and summed over all patients attributed to a hospital to calculate an expected value. To assess hospital performance for each reporting period, we re-estimate the model coefficients using the data in that period.

The specialty cohort SRRs are then pooled for each hospital using a volume-weighted geometric mean to create a hospital-wide combined SRR. The combined SRR is multiplied by the national observed readmission rate to produce the RSRR. The statistical modeling approach is described fully in the original methodology report (Horwitz et al., 2012).

ACR-specific: The ACR quality measure was adapted from the HWR quality measure. The unit of analysis was changed from the hospital to the ACO. This was possible because both the HWR and ACR measures assess readmission performance for a population that clusters patients together (either in hospitals or in ACOs). The goal is to isolate the effects of beneficiary characteristics on the probability that a patient will be readmitted from the effects of being in a specific hospital or ACO. In addition, planned readmissions are excluded for the ACR quality measure in the same way that they are excluded for the HWR measure. The ACR measure is calculated identically to what is described above for the HWR measure.

References:

Horwitz L, Partovian C, Lin Z, et al. Hospital-Wide All-Cause Unplanned Readmission Measure: Final Technical Report. 2012;

Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 112469| 118210| 135810| 141973| 146637| 146313

Submission items

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

5.1 Identified measures: 0505 : Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

0506 : Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

1550 : Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

1789 : Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

3493 : Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: We did not include in our list of related measures any non-outcome measures (for example, process measures) with the same target population as our measure. Because this is an outcome measure, clinical coherence of the cohort takes precedence over alignment with related non-outcome measures. Furthermore, non-outcome measures are limited due to broader patient exclusions. This is because they typically only include a specific subset of patients who are eligible for that measure (for example, patients who receive a specific medication or undergo a specific procedure).

5b.1 If competing, why superior or rationale for additive value: N/A

1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

5.1 Identified measures: 1551 : Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

3493 : Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: We did not include in our list of related measures any non-outcome measures (for example, process measures) with the same target population as our measure. Because this is an outcome measure, clinical coherence of the cohort takes precedence over alignment with related non-outcome measures. Furthermore, non-outcome measures are limited due to broader patient exclusions. This is because they typically only include a specific subset of patients who are eligible for that measure (for example, patients who receive a specific medication or undergo a specific procedure).

5b.1 If competing, why superior or rationale for additive value: N/A

1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

5.1 Identified measures: 0695 : Hospital 30-Day Risk-Standardized Readmission Rates following Percutaneous Coronary Intervention (PCI)

0329 : Risk-Adjusted 30-Day All-Cause Readmission Rate

0330 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

0505 : Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

0506 : Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

1551 : Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

1768 : Plan All-Cause Readmissions (PCR)

1891 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following chronic obstructive pulmonary disease (COPD) hospitalization

5a.1 Are specs completely harmonized? No

5a.2 If not completely harmonized, identify difference, rationale, impact: This measure and the National Committee for Quality Assurance (NCQA) Plan All-Cause Readmissions (PCR) Measure #1768 are related measures, but are not competing because they don't have the same measure focus and same target population. In addition, both have been previously harmonized to the extent possible under the guidance of the National Quality Forum Steering Committee in 2011. Each of these measures has different specifications. NCQA's Measure #1768 counts the number of inpatient stays for patients aged 18 and older during a measurement year that were followed by an acute readmission for any diagnosis to any hospital within 30 days. It contrasts this count with a calculation of the predicted probability of an acute readmission. NCQA's measure is intended for quality monitoring and accountability at the health plan level. This measure estimates the risk-standardized rate of unplanned, all-cause readmissions to a hospital or ACO for any eligible condition within 30 days of hospital discharge for patients aged 18 and older. The measure will result in a single summary risk-adjusted readmission rate for conditions or procedures that fall under five specialties: surgery/gynecology, general medicine, cardiorespiratory, cardiovascular, and neurology. This measure is specified for evaluating hospital or ACO performance. However, despite these differences in cohort specifications, both measures under NQF guidance have been harmonized to the extent possible through modifications such as exclusion of planned readmissions. We did not include in our list of related measures any non-outcome (e.g., process) measures with the same target population as our measure. Because this is an outcome measure, clinical coherence of the cohort takes precedence over alignment with related non-outcome measures. Furthermore, non-outcome measures are limited due to broader patient exclusions.

This is because they typically only include a specific subset of patients who are eligible for that measure (for example, patients who receive a specific medication or undergo a specific procedure).

5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #1551 and NQF #3493

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)
3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

Steward

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Centers for Medicare & Medicaid Services

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

Centers for Medicare & Medicaid Services

Description

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The measure estimates a hospital-level risk-standardized readmission rate (RSRR) following elective primary THA and/or TKA in Medicare Fee-For-Service (FFS) beneficiaries who are 65 years and older. The outcome (readmission) is defined as unplanned readmission for any cause within 30 days of the discharge date for the index admission (the admission included in the measure cohort). A specified set of planned readmissions do not count in the readmission outcome.

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

This measure is a re-specified version of the measure, "Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)" (NQF 1550), which was developed for patients 65 years and older using Medicare claims data. This re-specified measure attributes outcomes to MIPS participating Eligible Clinicians and/or Eligible Clinician Groups ("providers"), rather than to hospitals, and assesses each provider's complication rate, defined as any one of the specified complications occurring from the date of index admission to 90 days post date of the index admission (the admission included in the measure cohort).

Type

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Outcome

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

Outcome

Data Source

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Claims, Enrollment Data Data sources for the Medicare FFS measure:

Medicare Part A Inpatient and Part B Outpatient Claims: This data source contains claims data for FFS inpatient and outpatient services including Medicare inpatient hospital care, outpatient hospital services, as well as inpatient and outpatient physician claims for the 12 months prior to an index admission.

Medicare Enrollment Database (EDB): This database contains Medicare beneficiary demographic, benefit/coverage, and vital status information. This data source was used to obtain information on several inclusion/exclusion indicators such as Medicare status on admission as well as vital status. These data have previously been shown to accurately reflect patient vital status (Fleming et al., 1992). The Master Beneficiary Summary File (MBSF) is an annually created file derived from the EDB that contains enrollment information for all Medicare beneficiaries including dual eligible status. Years 2016-2019 were used.

The American Community Survey (2013-2017): We used the American Community Survey (2013-2017) to derive an updated Agency for Healthcare Research and Quality(AHRQ) Socioeconomic Status (SES) index score at the patient nine-digit zip code level for use in studying the association between our measure and social risk factors (SRFs).

Reference:

Fleming C., Fisher ES, Chang CH, Bubolz D, Malenda J. Studying outcomes and hospital utilization in the elderly: The advantages of a merged data base for Medicare and Veterans Affairs Hospitals. Medical Care. 1992; 30(5): 377-91.

No data collection instrument provided Attachment

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

Claims, Enrollment Data Medicare administrative claims and enrollment data

No data collection instrument provided Attachment

Level

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Facility

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

Clinician : Group/Practice, Clinician : Individual

Setting

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Inpatient/Hospital

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

Inpatient/Hospital, Outpatient Services

Numerator Statement

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The outcome for this measure is 30-day readmissions. We define readmissions as inpatient admissions for any cause, with the exception of certain planned readmissions, within 30 days from the date of discharge of the index hospitalization. If a patient has more than one unplanned admission (for any reason) within 30 days after discharge from the index admission, only one is counted as a readmission. The measure looks for a dichotomous yes or no outcome of whether each admitted patient has an unplanned readmission within 30 days. However, if the first readmission after discharge is considered planned, any subsequent unplanned readmission is not counted as an outcome for that index admission, because the unplanned readmission could be related to care provided during the intervening planned readmission rather than during the index admission.

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

The outcome for this measure is any complication occurring during the index admission (not coded present on arrival) to 90 days post-date of the index admission. Complications other than mortality are counted in the measure only if they occur during the index hospital admission or during a readmission. This outcome is identical to that of the original hospital measure. Additional details are provided in S.5 Numerator Details.

Numerator Details

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The measure counts readmissions to any acute care hospital for any cause within 30 days of the date of discharge of the index THA and/or TKA hospitalization, excluding planned readmissions as defined below.

Planned Readmission Algorithm (Version 4.0)

The Planned Readmission Algorithm is a set of criteria for classifying readmissions as planned among the general Medicare population using Medicare administrative claims data. The algorithm identifies admissions that are typically planned and may occur within 30 days of discharge from the hospital.

The Planned Readmission Algorithm has three fundamental principles:

A few specific, limited types of care are always considered planned (transplant surgery, maintenance chemotherapy/immunotherapy, and rehabilitation);

Otherwise, a planned readmission is defined as a non-acute readmission for a scheduled procedure; and

Admissions for acute illness or for complications of care are never planned.

The algorithm was developed in 2011 as part of the Hospital-Wide Readmission measure. In 2013, CMS applied the algorithm to its other readmission measures. In applying the algorithm to condition- and procedure-specific measures, teams of clinical experts reviewed the algorithm in the context of each measure-specific patient cohort and, where clinically indicated, adapted the content of the algorithm to better reflect the likely clinical experience of each measure's patient cohort. The planned readmission algorithm is applied to the THA/TKA readmission measure with small modifications.

The Planned Readmission Algorithm and associated code tables are attached in data field S.2b (Data Dictionary or Code Table).

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

Outcome Definition

The composite complication is a dichotomous outcome (yes for any complication(s); no for no complications) occurring within 90 days post-date of the index admission. Therefore, if a patient experiences one or more complications, the outcome variable will get coded as a "yes." The measure includes the following surgical complications: surgical site bleeding, mechanical complications, periprosthetic joint infection/wound infection; and also includes death as a complication. The measure also includes the following medical complications, as they are important in measuring overall quality: acute myocardial infarction (AMI), pneumonia, pulmonary embolism, and sepsis/septicemia/shock. Complications are counted in the measure only if they occur during the index hospital admission (and are not present on admission) or during a readmission. This outcome definition is identical to the Hospital-level RSCR following elective primary THA and/or TKA" (NQF 1550).

The measure assesses a dichotomous yes or no outcome of whether each admitted patient experiences one or more of the complications defined below. Complications other than mortality are counted in the measure only if they occur during the index admission or require a readmission. The measure does not count complications that occur in the outpatient setting and do not require a readmission. The outcome is aligned with CMS's hospital-level THA/TKA complication measure.

The measure defines a "complication" as:

Acute myocardial infarction (AMI), pneumonia, or sepsis/septicemia/shock during the index admission or a subsequent inpatient admission that occurs within 7 days from the start of the index admission;

Surgical site bleeding or pulmonary embolism during the index admission or a subsequent inpatient admission within 30 days from the start of the index admission;

Death during the index admission or within 30 days from the start of the index admission;

Mechanical complication or periprosthetic joint infection/wound infection during the index admission or a subsequent inpatient admission that occurs within 90 days from the start of the index admission. (See attached Data Dictionary for list of ICD-9 and 10 codes used to define complications).

The measure counts all complications occurring during the index admission regardless of when they occur. For example, if a patient experiences an AMI on day 10 of the index admission, the measure will count the AMI as a complication, although the specified follow-up period for AMI is seven days. Clinical experts agree with this approach, as such complications likely represent the quality of care provided during the index admission.

For the full list of ICD-9 and ICD-10 codes defining complications, see the Data Dictionary attached in field S.2b., sheets HK Complications I10-Outcome" and "Complication Codes ICD9."

Denominator Statement

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The target population for the publicly reported measure includes admissions for Medicare FFS beneficiaries who are at least 65 years of age undergoing elective primary THA and/or TKA procedures.

Additional details are provided in S.9 Denominator Details.

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

The target population for the measure includes admissions for Medicare FFS beneficiaries who are at least 65 years of age who have undergone elective primary THA and/or TKA procedures.

Attribution of Index Admissions to Eligible Clinicians

Each patient index admission (the admission during which the patient has the eligible THA/TKA procedure), and therefore their outcome (complication or no complication) is attributed to the Eligible Clinician who bills for the procedure (Billing Surgeon). Conceptually, the Billing Surgeon is the Clinician with the primary responsibility for the procedure and procedure related care.

In practice, patients may have different claims for the same procedure, and so the billing surgeon is assigned through an algorithm that resolves ambiguities in billing. The algorithm uses billing claims to identify the clinician(s) who bills for a THA (CPT® code 27130) or TKA (CPT®® code 27447 or CPT® code 27446) (steps 1-3 below). These CPT® codes are representative of the THA and/or TKA procedures included in the measure cohort.

If only one clinician bills for a THA (CPT® code 27130) or TKA (CPT® code 27446 or 27447) for a patient, the algorithm identifies and assigns this individual as the Billing Surgeon.

If two or more clinicians bill for THA/TKA procedures (CPT® 27130, 27447, or 27446), the algorithm seeks to identify a 'key' physician among them. The algorithm identifies and excludes assignment to clinicians who were assistants-at-surgery (assistant surgeon with CPT® modifier 80 or 82, minimum assistant surgeon with CPT® modifier 81). In this step, the algorithm assigns the Billing Surgeon as the clinician who billed for a THA or TKA procedure and is not an assistant-at-surgery.

If a single clinician who is not an assistant-at-surgery could not be identified for assignment, then the algorithm identifies whether there is a single clinician who was an orthopedic surgeon (Medicare Specialty Code 20) and assigns this as the Billing Surgeon.

If the algorithm cannot identify a Billing Surgeon, it identifies whether an Operator is listed on the institutional claim. The algorithm then defaults assignment to the Operator listed on the institutional claim.

Finally, if a Billing Surgeon or Operator cannot be identified with the steps above, the patient is not assigned to a clinician or group and is excluded from the measure.

Attribution of Index Admissions to an Eligible Clinician Group

CMS needs the flexibility to assign each eligible patient index admission to at least one Eligible Clinician and at least one Eligible Clinician group. This allows them the ability to report at either the Eligible Clinician or the Eligible Clinician Group level. Conceptually, these assignments should represent a consistent group of clinicians. That is, it would be confusing to assign a patient to Eligible Clinician A and also to Eligible Clinician Group B if Eligible Clinician A is not in that Group. The attribution methodology addresses this by using both individual and group identifiers.

Every Medicare Eligible Clinician has a unique National Provider Identifier (NPI). Similarly, every Medicare Eligible Clinician Group has one or more Tax Identification Numbers (TINs), reflecting their practice setting(s). Each Eligible Clinician claim should include both their NPI and a TIN which identifies their "group" (which may consist only of that clinician if they are solo providers). Therefore, we identify clinicians for each patient index admission through the unique National Provider ID (NPI) and Tax ID (TIN) combination listed on a patient's claim. For a Billing Surgeon, the NPI and TIN are those on the procedure claim used to attribute the patient index admission. To identify the unique TIN/NPI combination for the Operator, the Operator's NPI is matched to the TIN with the most Part B allowed charges during the index admission or during the measurement year if the Operator did not bill during the index admission. Most NPIs are associated with only one TIN. A Clinician Group is set of Clinicians (NPI-TIN combinations) assigned to the same TIN.

Additional details are provided in S.7 Denominator Details.

Denominator Details

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

To be included in the measure cohort used in public reporting, patients must meet the following additional inclusion criteria:

1. Enrolled in Medicare FFS Part A and Part B Medicare for the 12 months prior to the date of admission; and enrolled in Part A during the index admission;

2. Aged 65 or over;

3. Discharged alive from a non-federal acute care hospital; and

4. Have a qualifying elective primary THA/TKA procedure; elective primary THA/TKA procedures defined as those procedures without any of the following:

- Femur, hip, or pelvic fractures coded in principal or secondary discharge diagnosis fields of the index admission;
- Partial hip arthroplasty (PHA) procedures with a concurrent THA/TKA;
- Revision procedures with a concurrent THA/TKA;
- Resurfacing procedures with a concurrent THA/TKA;
- Mechanical complication coded in the principal discharge diagnosis field;
- Malignant neoplasm of the pelvis, sacrum, coccyx, lower limbs, or bone/bone marrow or a disseminated malignant neoplasm coded in the principal discharge diagnosis field;
- Removal of implanted devices/prostheses; or
- Transfer from another acute care facility for the THA/TKA

This measure can also be used for an all-payer population aged 18 years and older. We have explicitly tested the measure in both patients aged 18 years and older and those aged 65 years or older (see Testing Attachment for details, 2b4.11).

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

To be included in the measure cohort used, patients must meet the following additional inclusion criteria:

Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of admission; and enrolled in Part A during the index admission and for 90 days after discharge;

Aged 65 or older; and

Having a qualifying elective primary THA/TKA procedure.

Elective primary THA/TKA procedures are defined as those procedures without any of the following:

- Femur, hip, or pelvic fractures coded in the principal or secondary discharge diagnosis field of the index admission
- Partial hip arthroplasty (PHA) procedures (with a concurrent THA/TKA); partial knee arthroplasty procedures are not distinguished by ICD9 codes and are currently captured by the THA/TKA measure
- Revision procedures with a concurrent THA/TKA
- Resurfacing procedures with a concurrent THA/TKA
- Mechanical complication coded in the principal discharge
- Malignant neoplasm of the pelvis, sacrum, coccyx, lower limbs, or bone/bone marrow or a disseminated malignant neoplasm coded in the principal discharge diagnosis field
- Removal of implanted devises/prostheses
- Transfer status from another acute care facility for the THA/TKA

Patients are eligible for inclusion in the denominator if they had an elective primary THA and/or a TKA AND had continuous enrollment in Part A and Part B Medicare fee-for-service (FFS) 12 months prior to the date of index admission.

Elective primary THA/TKA procedures are defined as those procedures without any of the 8 associated conditions or finding noted above.

For a full list of ICD-9 and ICD-10 codes defining the following see attached Data Dictionary, sheets "I-10 Cohort Codes" and "I9 Cohort Codes."

Additional details are provided in S.9 Denominator Details.

Exclusions

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The THA/TKA readmission measure excludes admissions for patients:

1. Without at least 30 days post-discharge enrollment in FFS Medicare;
2. Who were discharged against medical advice (AMA);
3. Admitted for the index procedure and subsequently transferred to another acute care facility;
4. Who had more than two THA/TKA procedure codes during the index hospitalization; or
5. Who had THA/TKA admissions within 30 days of a prior THA/TKA index admission.

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

This measure excludes index admissions for patients:

1. Who survived the index admission but without 90-day Medicare part A enrollment post discharge;
2. Who were transferred in to the index hospital;
3. Who leave the hospital against medical advice (AMA);
4. With more than two THA/TKA procedures codes during the index hospitalization; or
5. Who cannot be attributed to a billing surgeon or operator using claims data

After applying the exclusion criteria above, we randomly select one index admission for patients with multiple index admissions in a calendar year. We therefore exclude the other eligible index admissions in that year.

Exclusion Details

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

This measure excludes index admissions for patients:

1. Without at least 30 days of post-discharge enrollment in FFS Medicare as determined by examining the Medicare Enrollment Database (EDB).

Rationale: The 30-day readmission outcome cannot be assessed in this group since claims data are used to determine whether a patient was readmitted.

2. Discharges against medical advice (AMA) are identified using the discharge disposition indicator in claims data.

Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.

3. Admitted for the index procedure and subsequently transferred to another acute care facility, which are defined as when a patient with an inpatient hospital admission (with at least one qualifying THA/TKA procedure) is discharged from an acute care hospital and admitted to another acute care hospital on the same or next day.

Rationale: Patients admitted for the index procedure and subsequently transferred to another acute care facility are excluded, as determining which hospital the readmission outcome should be attributed to is difficult.

4. Who had more than two THA/TKA procedure codes during the index hospitalization, which is identified by examining procedure codes in the claims data.

Rationale: Although clinically possible, it is highly unlikely that patients would receive more than two elective THA/TKA procedures in one hospitalization, which may reflect a coding error.

5. Who had THA/TKA admissions within 30 days prior to THA/TKA index admission.

Rationale: Additional THA/TKA admissions within 30 days are excluded as index admissions because they are part of the outcome. A single admission does not count as both an index admission and a readmission for another index admission.

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

The measure excludes admissions for patients:

1. Who survived the index admission but without 90-day Medicare part A enrollment post discharge

Rationale: Only patients with adequate claims data for attribution should be included in risk-adjustment model and the measure.

2. Who were transferred in to the index hospital

Rationale: If the patient is transferred from another acute care facility to the hospital where the index procedure occurs, it is likely that the procedure is not elective, or that the admission is associated with an acute condition.

3. Who leave the hospital against medical advice (AMA)

Rationale: Clinicians have limited opportunity to implement high quality care.

4. With more than two THA/TKA procedures codes during the index hospitalization

Rationale: Although clinically possible, it is highly unlikely that patients would receive more than two elective THA/TKA procedures in one hospitalization, and this may reflect a coding error.

5. Who cannot be attributed to a billing surgeon or operator using claims data

Rationale: Only patients with adequate clinician claims for attribution should be included in risk-adjustment model and the measure.

Risk Adjustment

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Statistical risk model

112469| 109921| 118210| 135810| 117446| 146637| 141015

112469| 109921| 118210| 135810| 117446| 146637| 141015

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

Statistical risk model

146637| 110639| 146313

146637| 110639| 146313

Stratification

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

N/A

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

N/a

Type Score

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

Rate/proportion better quality = lower score

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

Rate/proportion better quality = lower score

Algorithm

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

The measure estimates hospital-level 30-day all-cause RSRRs following elective primary THA/TKA using hierarchical logistic regression models. In brief, the approach simultaneously models data at the patient and hospital levels to account for variance in patient outcomes within and between hospitals (Normand and Shahian, 2007). At the patient level, it models the log-odds of readmission within 30 days of discharge using age, sex, selected clinical covariates, and a hospital-specific intercept. At the hospital level, it models the hospital-specific intercepts as arising from a normal distribution. The hospital intercept represents the underlying risk of a readmission at the hospital, after accounting for patient risk. The hospital-specific intercepts are given a distribution to account for the clustering (non-independence) of patients within the same hospital. If there were no differences among hospitals after adjusting for patient risk, the hospital intercepts should be identical across all hospitals.

The RSRR is calculated as the ratio of the number of "predicted" to the number of "expected" readmission at a given hospital, multiplied by the national observed readmission rate. For each hospital, the numerator of the ratio is the number of readmissions within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of readmissions expected based on the nation's performance with that hospital's case mix. This approach is analogous to a ratio of "observed" to "expected" used in other types of statistical analyses. It conceptually allows for a comparison of a particular hospital's performance given its case mix to an average hospital's performance with the same case mix. Thus, a lower ratio indicates lower-than-expected readmission rates or better quality, and a higher ratio indicates higher-than-expected readmission rates or worse quality.

The "predicted" number of readmissions (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of readmission. The estimated hospital-specific intercept is added to the sum of the estimated regression coefficients multiplied by the patient characteristics. The results are transformed and summed over all patients attributed to a hospital to get a predicted value. The "expected" number of readmissions (the denominator) is obtained in the same manner, but a common intercept using all hospitals in our sample is added in place of the hospital-specific intercept. The results are transformed and summed over all patients in the hospital to get an expected value. To assess hospital performance for each reporting period, we re-estimate the model coefficients using the years of data in that period.

This calculation transforms the ratio of predicted over expected into a rate that is compared to the national observed readmission rate. The hierarchical logistic regression models are described fully in the original methodology report (Grosso et al., 2012), which is also posted on QualityNet.

References:

Grosso L, Curtis J, Geary L, et al. Hospital-level 30-Day All-Cause Risk-Standardized Readmission Rate Following Elective Primary Total Hip Arthroplasty (THA) And/Or Total Knee Arthroplasty (TKA) Measure Methodology Report. 2012.

Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 112469| 109921| 118210| 135810| 117446| 146637| 141015

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

In Dataset April 2013 to March 2016 (prior to exclusions being applied): We started with the hospital HKC measure cohort, with an initial index cohort size of 982,436 index admissions with an elective primary THA/TKA procedure. After applying exclusion criteria 1 through 4 listed in the table below, we have a cohort sample size of 935,029 index admissions. Our previous NQF filing for hospital HKC showed no bias introduced through the exclusion process for hospitals for this same cohort of 935,029 index admissions. We then further excluded 10,243 (1.0%) index admissions (criteria 5 and 6 below) which cannot be attributed to physician/physician group to create our final measure cohort.

The measure estimates eligible clinician or clinician group ("provider")-level RSCRs following elective primary THA/TKA using hierarchical logistic regression models. In brief, the approach simultaneously models data at the patient and provider levels to account for variance in patient outcomes within and between hospitals (Normand and Shahian, 2007). At the patient level, it models the log-odds of a complication occurring within 90 days of the index admission using age, sex, selected clinical covariates, and a provider-specific intercept. At the provider level, it models the provider-specific intercepts as arising from a normal distribution. The provider intercept represents the underlying risk of a complication for patients treated by the provider, after accounting for patient risk. The provider-specific intercepts are given a distribution to account for the clustering (non-independence) of patients treated by the same provider. If there were no differences among providers, then after adjusting for patient risk, the provider intercepts should be identical across all providers.

The RSCR is calculated as the ratio of the number of "predicted" to the number of "expected" admissions with a complication at a given provider, multiplied by the national observed complication rate. The "predicted" number of admissions with a complication (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the provider-specific intercept on the risk of having an admission with a complication. The estimated provider-specific intercept is added to the sum of the estimated regression coefficients multiplied by the patient characteristics. The results are log transformed and summed over all patients attributed to a provider to get a predicted value. The "expected" number of admissions with a complication (the denominator) is obtained in the same manner, but a common intercept using all providers in our sample is added in place of the provider-specific effect. The results are log transformed and summed over all patients in the provider to get an expected value. To assess provider performance for each reporting period, we re-estimate the model coefficients using the years of data in that period.

For each provider, the numerator of the ratio is the number of complications within 90 days predicted on the basis of the provider's performance with its observed case mix, and the denominator is the number of complications expected based on the nation's performance with that provider's case mix. This approach is analogous to a ratio of "observed" to "expected" used in other types of statistical analyses. It conceptually allows for a comparison of a particular provider's performance given its case mix to an average provider's performance with the same case mix. Thus, a lower ratio indicates lower-than-expected complication rates or better quality, and a higher ratio indicates higher-than-expected complication rates or worse quality.

This calculation transforms the ratio of predicted over expected into a rate that is compared to the national observed complication rate. The hierarchical logistic regression models are described fully in the original methodology report (Grosso et al., 2012).

References:

Grosso L, Curtis J, Geary L, et al. Hospital-level Risk-Standardized Complication Rate Following Elective Primary Total Hip Arthroplasty (THA) And/Or Total Knee Arthroplasty (TKA) Measure Methodology Report. 2012.

Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226 146637| 110639| 146313

Submission items

1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

5.1 Identified measures: 0505 : Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

0506 : Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

1550 : Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)

1789 : Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

3493 : Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: We did not include in our list of related measures any non-outcome measures (for example, process measures) with the same target population as our measure. Because this is an outcome measure, clinical coherence of the cohort takes precedence over alignment with related non-outcome measures. Furthermore, non-outcome measures are limited due to broader patient exclusions. This is because they typically only include a specific subset of patients who are eligible for that measure (for example, patients who receive a specific medication or undergo a specific procedure).

5b.1 If competing, why superior or rationale for additive value: N/A

3493 Risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA) for Merit-based Incentive Payment System (MIPS) Eligible Clinicians and Eligible Clinician Groups

5.1 Identified measures:

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: The measure is fully harmonized with NQF #1550 regarding cohort definition, outcome, and risk adjustment approach. The only discrepancy is the attribution approach, which assigns each index admission to a clinician rather than a hospital, and the exclusion of patients for which no billing surgeon or operator can be identified.

5b.1 If competing, why superior or rationale for additive value: Clinicians, particularly the surgeon performing the procedure, can influence the outcome of surgery for better or worse, both through their technical skill and through their influence on the care team and hospital safety culture. Therefore, many of the strategies and best practices used by hospitals to reduce the risk of complications can also be adopted by individual clinicians and groups of clinicians to improve patient outcomes. Further evidence of surgeons' influence are data indicating that increasing surgeon volume is associated with reductions in adverse surgical outcomes (Battaglia TC et al., 2006; Shervin et al., 2007).

The THA/TKA risk-standardized complication rate (RSCR) measure for clinicians is thus intended to inform quality-of-care improvement efforts, as individual process-based performance measures cannot encompass all the complex and critical aspects of care that contribute to patient outcomes. It also complements the hospital measure as a proportion of surgeons have very different performance quality than the institutions in which they perform surgery; this measure provides a transparent reflection of these discordances to further support quality improvement.

References:

Battaglia TC, Mulhall KJ, Brown TE, Saleh KJ. Increased surgical volume is associated with lower THA dislocation rates. Clin Orthop Relat Res. 2006 Jun;447:28-33.

Shervin N, Rubash HE, Katz JN. Orthopaedic procedure volume and patient outcomes: a systematic literature review. Clin Orthop Relat Res. 2007 Apr;457:35-41.

Comparison of NQF #3030, NQF #0696, and NQF #2561

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

0696 STS CABG Composite Score

2561 STS Aortic Valve Replacement (AVR) Composite Score

Steward

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

The Society of Thoracic Surgeons

0696 STS CABG Composite Score

The Society of Thoracic Surgeons

2561 STS Aortic Valve Replacement (AVR) Composite Score

The Society of Thoracic Surgeons

Description

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

The STS Individual Surgeon Composite Measure for Adult Cardiac Surgery includes five major procedures (isolated CABG, isolated AVR, AVR+CABG, MVRR, MVRR+CABG) and comprises the following two domains:

Domain 1 – Risk-Adjusted Operative Mortality

Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Risk-Adjusted Major Morbidity

Major morbidity is defined as the occurrence of any one or more of the following major complications:

Prolonged ventilation,

Deep sternal wound infection,

Permanent stroke,

Renal failure, and

Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

All measures are based on audited clinical data collected in the STS Adult Cardiac Surgery Database. Individual surgeons with at least 100 eligible cases during the 3-year measurement window will receive a score for each domain and an overall composite score. In addition to calculating composite score point estimates with credible intervals, surgeons will be assigned rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

0696 STS CABG Composite Score

The STS CABG Composite Score comprises four domains consisting of 11 individually NQF-endorsed cardiac surgery measures:

Domain 1) Absence of Operative Mortality – Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death during the same hospitalization as surgery or after discharge but within 30 days of the procedure;

Domain 2) Absence of Major Morbidity – Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as having at least one of the following adverse outcomes: 1. reoperations for any cardiac reason, 2. renal failure, 3. deep sternal wound infection, 4. prolonged ventilation/intubation, 5. cerebrovascular accident/permanent stroke;

Domain 3) Use of Internal Mammary Artery (IMA) – Proportion of first-time CABG patients who receive at least one IMA graft;

Domain 4) Use of All Evidence-based Perioperative Medications – Proportion of patients who receive all required perioperative medications for which they are eligible. The required perioperative medications are: 1. preoperative beta blockade therapy, 2. discharge anti-platelet medication, 3. discharge beta blockade therapy, and 4. discharge anti-lipid medication.

All measures are based on audited clinical data collected in a prospective registry. Participants receive a score for each of the domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). For consenting participants, scores and star ratings are publicly reported on the STS website.

2561 STS Aortic Valve Replacement (AVR) Composite Score

STS AVR Composite Score comprises two domains consisting of six measures: Domain 1) Absence of Operative Mortality – Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death during the same hospitalization as surgery or after discharge but within 30 days of the procedure; and Domain 2) Absence of Major Morbidity – Proportion of patients (risk-adjusted) who do not experience any major morbidity.

Major morbidity is defined as having at least one of the following adverse outcomes: 1. reoperations for any cardiac reason, 2. renal failure, 3. deep sternal wound infection, 4. prolonged ventilation/intubation, and 5. cerebrovascular accident/permanent stroke. All measures are based on audited clinical data collected in a prospective registry and are risk-adjusted.

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). Star ratings are publicly reported on the STS website and are also currently reported on the Consumer Reports website.

Type

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Composite

0696 STS CABG Composite Score

Composite

2561 STS Aortic Valve Replacement (AVR) Composite Score

Composite

Data Source

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.81 went live on July 1, 2014; STS Adult Cardiac Surgery Database – Version 2.9 went live on July 1st, 2017 and STS Adult Cardiac Surgery Database version 4.20 went live on June 30, 2020.

The URL provided under S.1 is for the latest data collection form that is currently in use.

Available at measure-specific web page URL identified in S.1 No data dictionary

0696 STS CABG Composite Score

Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.8 went live on July 1, 2014; STS Adult Cardiac Surgery Database Version 2.9 went live on July 1, 2017.

Available at measure-specific web page URL identified in S.1 Attachment

2561 STS Aortic Valve Replacement (AVR) Composite Score

Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 Attachment

Level

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Clinician : Individual

0696 STS CABG Composite Score

Facility, Clinician : Group/Practice

2561 STS Aortic Valve Replacement (AVR) Composite Score

Facility, Clinician : Group/Practice

Setting

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Inpatient/Hospital

0696 STS CABG Composite Score

Inpatient/Hospital

2561 STS Aortic Valve Replacement (AVR) Composite Score

Inpatient/Hospital

Numerator Statement

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes in detail this multiprocedural, multidimensional composite measure.

The STS Individual Surgeon Composite Measure for Adult Cardiac Surgery includes five major procedures, i.e., isolated coronary artery bypass grafting (CABG), isolated aortic valve replacement (AVR), AVR+CABG, isolated mitral valve repair or replacement (MVRR), and MVRR+CABG, and comprises the following two domains:

Domain 1 – Risk-Adjusted Operative Mortality

Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Risk-Adjusted Major Morbidity

Major morbidity is defined as the occurrence of any one or more of the following major complications:

Prolonged ventilation

Deep sternal wound infection

Permanent stroke

Renal failure and

Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons

Individual surgeons with at least 100 eligible cases during the 3-year measurement window will receive a score for each domain and an overall composite score. In addition to calculating composite score point estimates with credible intervals, surgeons will be assigned rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated CABG, isolated AVR, AVR+CABG, isolated MVRR, and MVRR+CABG.

Time Window: 3 years

By including composite performance scores for a portfolio of five procedures that account for nearly 80% of a typical STS Adult Cardiac Surgery Database participant surgeon's clinical activity, this metric provides a more balanced and comprehensive perspective than focusing on just one procedure or one end point. Recognizing that surgeons' practices vary, each surgeon's composite performance is implicitly "weighted" by the proportion of each type of procedure he or she performs. For instance, the results of surgeons who primarily perform mitral procedures are affected most by their mitral surgery results. This approach is especially relevant for surgeons with highly specialized practices who may do relatively few isolated CABG procedures and whose performance would thus be difficult to assess using a CABG measure only. Finally, performance on each of these procedures is estimated using risk models specific to those procedures, in most cases the exact or slightly modified versions of previously published models (references provided below).

Final Composite Score:

The overall composite score was calculated as a weighted sum of (1 minus risk-adjusted mortality rate) and (1 minus risk-adjusted major morbidity rate). Mortality and morbidity rates were weighted inversely by their respective standard deviations across surgeons. This procedure is equivalent to first rescaling mortality and morbidity rates by their respective standard deviations across surgeons and then assigning equal weighting to the rescaled mortality rate and rescaled morbidity rate. Standard deviations derived from the data were used to define the final composite measure as 0.81 x (1 minus risk-standardized mortality rate) + 0.19 x (1 minus risk-standardized complication rate).

Details regarding the current STS adult cardiac surgery risk models can be found in the following manuscripts:

Shahian DM, O'Brien SM, Filardo G, Ferraris VA, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 1--coronary artery bypass grafting surgery. Ann Thorac Surg. 2009 Jul;88(1 Suppl):S2-22.

O'Brien SM, Shahian DM, Filardo G, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 2—isolated valve surgery. Ann Thorac Surg 2009;88(1 Suppl):S23–42.

Shahian DM, O'Brien SM, Filardo G, Ferraris VA, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 3--valve plus coronary artery bypass grafting surgery. Ann Thorac Surg 2009 Jul;88(1 Suppl):S43-62.

Additional details regarding the Individual Surgeon Composite Measure for Adult Cardiac Surgery are provided in the attached manuscript:

Shahian DM, He X, Jacobs JP, Kurlansky PA, Badhwar V, Cleveland JC Jr, Fazzalari FL, Filardo G, Normand SL, Furnary AP, Magee MJ, Rankin JS, Welke KF, Han J, O'Brien SM. The Society of Thoracic Surgeons Composite Measure of Individual Surgeon Performance for Adult Cardiac Surgery: A Report of The Society of Thoracic Surgeons Quality Measurement Task Force. Ann Thorac Surg. 2015;100:1315-25.

0696 STS CABG Composite Score

Please see Appendix

2561 STS Aortic Valve Replacement (AVR) Composite Score

Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.

The STS AVR Composite Score comprises two domains consisting of six individual measures:

1. Absence of Operative Mortality

NQF # 0120 Risk-Adjusted Operative Mortality for AVR

2. Absence of Major Morbidity, scored any-or-none. The measures used are the same morbidity outcomes included in NQF #0696 STS CABG Composite Score.

Risk-Adjusted Postoperative Stroke/Cerebrovascular Accident

Risk-Adjusted Postoperative Surgical Re-exploration

Risk-Adjusted Postoperative Deep Sternal Wound Infection Rate

Risk-Adjusted Postoperative Renal Failure

Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance).

Patient Population: The analysis population consists of adult patients aged 18 years or older who undergo isolated AVR surgery

Time Period: 3 years

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 10 isolated AVR procedures in the patient population.

Technical Details

The unit of measurement for the STS AVR Composite Score can be either a participant (most often a cardiac surgical practice but occasionally an individual surgeon) or a hospital.

For the Absence of Operative Mortality domain, the NUMERATOR is:

Number of patients undergoing isolated AVR who survived until after discharge and >30 days post-surgery

For the Absence of Major Morbidity domain, the NUMERATOR is:

Number of patients undergoing isolated AVR who did not experience any of the

five specified major morbidity endpoints*

*Morbidity endpoints consist of postoperative stroke/cerebrovascular accident, surgical re-exploration, deep sternal wound infection, renal failure, prolonged intubation (ventilation). Patients with documented history of renal failure (i.e., dialysis or baseline serum creatinine of 4.0 or higher) are excluded when counting renal failure outcomes.

STS AVR risk models are used to estimate expected rates of mortality and any-or-none morbidity (Reference: O'Brien SM, Shahian DM, Filardo G, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 2—isolated valve surgery. Ann Thorac Surg 2009;88(1 Suppl):S23–

42). To enhance interpretation, mortality rates are converted to survival rates (risk-standardized survival rate = 100 – risk-standardized mortality rate), and morbidity rates are converted to "absence of morbidity" rates (risk-standardized absence of morbidity rate =100 – risk-standardized morbidity rate). Defining scores in this manner ensures that increasingly positive values reflect better performance, which is easier for consumers to interpret.

(Please see the appendix for the formula used to calculate the overall composite score.)

The method is equivalent to calculating a weighted average, with weights proportional to the inverse of the SD. In the most recent production of the STS AVR Composite Score based on data from July 2010 – June 2013, wtmort=0.79 and wtmorb = 0.21.

Star Rating: Star ratings are derived by testing whether the participant's composite or domain score is significantly different from the overall STS average. For instance, if for each of the 2 composite score domains, a participant's estimated score is lower than the overall STS average, but the difference between the participant and STS is not statistically significant, the ratings would each be 2 stars. If however, for the overall composite, the point estimate is lower than the STS average, AND this difference is statistically significant, the overall participant star rating is 1 star. The fact that statistical significance was achieved for the composite score but not the individual domains reflects the greater precision of the composite score compared to

individual endpoints. This precision is achieved by aggregating information across multiple endpoints instead of a single endpoint.

Additional details regarding the AVR Composite Score are provided in the attached manuscript:

Shahian DM, He X, Jacobs JP, et al. The Society of Thoracic Surgeons Isolated Aortic Valve Replacement (AVR) Composite Score: a report of the STS Quality Measurement Task Force. Ann Thorac Surg 2012;94:2166-71.

Numerator Details

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

See response in S.4. Numerator Statement

0696 STS CABG Composite Score

Please see Appendix

2561 STS Aortic Valve Replacement (AVR) Composite Score

Please see S.4 above

Denominator Statement

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

See response in S.4. Numerator Statement

Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated CABG, isolated AVR, AVR+CABG, isolated MVRR, and MVRR+CABG.

0696 STS CABG Composite Score

Please see Appendix

2561 STS Aortic Valve Replacement (AVR) Composite Score

Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.

The STS AVR Composite Score comprises two domains consisting of six individual measures:

Absence of Operative Mortality

NQF # 0120 Risk-Adjusted Operative Mortality for AVR

Absence of Major Morbidity, scored any-or-none. The measures used are the same morbidity outcomes included in NQF #0696 STS CABG Composite Score.

Risk-Adjusted Postoperative Stroke/Cerebrovascular Accident

Risk-Adjusted Postoperative Surgical Re-exploration

Risk-Adjusted Postoperative Deep Sternal Wound Infection Rate

Risk-Adjusted Postoperative Renal Failure

Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance).

Patient Population: The analysis population consists of adult patients aged 18 years or older who undergo isolated AVR surgery

Time Period: 3 years

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 10 isolated AVR procedures in the patient population.

Technical Details

The unit of measurement for the STS AVR Composite Score can be either a participant (most often a cardiac surgical practice but occasionally an individual surgeon) or a hospital.

For the Absence of Operative Mortality domain AND the Absence of Major Morbidity domain, the DENOMINATOR is:

Number of patients undergoing isolated AVR during the measurement period

STS AVR risk models are used to estimate expected rates of mortality and any-or-none morbidity (Reference: O'Brien SM, Shahian DM, Filardo G, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 2—isolated valve surgery. Ann Thorac Surg 2009;88(1 Suppl):S23–42). To enhance interpretation, mortality rates are converted to survival rates (risk-standardized survival rate = 100 – risk-standardized

mortality rate), and morbidity rates are converted to "absence of morbidity" rates (risk-standardized absence of morbidity rate =100 – risk-standardized morbidity rate). Defining scores in this manner ensures that increasingly positive values reflect better performance, which is easier for consumers to interpret.

(Please see the appendix for the formula used to calculate the overall composite score.)

The method is equivalent to calculating a weighted average, with weights proportional to the inverse of the SD. In the most recent production of the STS AVR Composite Score based on data from July 2010 – June 2013, wtmort=0.79 and wtmorb = 0.21.

Star Rating: Star ratings are derived by testing whether the participant's composite or domain score is significantly different from the overall STS average. For instance, if for each of the 2 composite score domains, a participant's estimated score is lower than the overall STS average, but the difference between the participant and STS is not statistically significant, the ratings would

each be 2 stars. If however, for the overall composite, the point estimate is lower than the STS average, AND this difference is statistically significant, the overall participant star rating is 1 star. The fact that statistical significance was achieved for the composite score but not the individual domains reflects the greater precision of the composite score compared to

individual endpoints. This precision is achieved by aggregating information across multiple endpoints instead of a single endpoint.

Additional details regarding the AVR Composite Score are provided in the attached manuscript:

Shahian DM, He X, Jacobs JP, et al. The Society of Thoracic Surgeons Isolated Aortic Valve Replacement (AVR) Composite Score: a report of the STS Quality Measurement Task Force. Ann Thorac Surg 2012;94:2166-71.

Denominator Details

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

See response in S.6. Denominator Statement

0696 STS CABG Composite Score

Please see Appendix

2561 STS Aortic Valve Replacement (AVR) Composite Score

Please see S.6 above

Exclusions

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Measure exclusions: Individual surgeons who do not meet the minimum case requirement (i.e., at least 100 eligible cases during the 3-year measurement window) will not receive a score for each domain and an overall composite score.

0696 STS CABG Composite Score

Please see Appendix

2561 STS Aortic Valve Replacement (AVR) Composite Score

Please see S.6 above

Exclusion Details

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

See response in S.8. Denominator Exclusions

0696 STS CABG Composite Score

Please see Appendix

2561 STS Aortic Valve Replacement (AVR) Composite Score

Please see S.6 above

Risk Adjustment

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Statistical risk model

111855| 114638| 152617| 150289

111855| 114638| 152617| 150289

0696 STS CABG Composite Score

Statistical risk model

111855| 137290| 114638| 135810

111855| 137290| 114638| 135810

2561 STS Aortic Valve Replacement (AVR) Composite Score

Statistical risk model

111855| 137290| 114638| 141015

111855| 137290| 114638| 141015

Stratification

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

N/A

0696 STS CABG Composite Score

N/A

2561 STS Aortic Valve Replacement (AVR) Composite Score

N/A

Type Score

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Rate/proportion better quality = higher score

0696 STS CABG Composite Score

Rate/proportion better quality = higher score

2561 STS Aortic Valve Replacement (AVR) Composite Score

Rate/proportion better quality = higher score

Algorithm

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Please see discussion under section S.4 and attached manuscripts. 111855| 114638| 152617| 150289

0696 STS CABG Composite Score

Please see discussion under section S.4 (Appendix) and attached articles. 111855| 137290| 114638| 135810

2561 STS Aortic Valve Replacement (AVR) Composite Score

Please see S.4 and S.6 above 111855| 137290| 114638| 141015

Submission items

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

5.1 Identified measures:

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

0696 STS CABG Composite Score

5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

0123 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) + CABG Surgery

0122 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Replacement + CABG Surgery

0121 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Replacement

0120 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR)

0119 : Risk-Adjusted Operative Mortality for CABG

0118 : Anti-Lipid Treatment Discharge

0117 : Beta Blockade at Discharge

0116 : Anti-Platelet Medication at Discharge

0115 : Risk-Adjusted Surgical Re-exploration

0114 : Risk-Adjusted Postoperative Renal Failure

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0130 : Risk-Adjusted Deep Sternal Wound Infection

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0127 : Preoperative Beta Blockade

1501 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Repair

1502 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Repair + CABG Surgery

2514 : Risk-Adjusted Coronary Artery Bypass Graft (CABG) Readmission Rate

2683 : Risk-Adjusted Operative Mortality for Pediatric and Congenital Heart Surgery

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

2561 STS Aortic Valve Replacement (AVR) Composite Score

5.1 Identified measures: 0120 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR)

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0115 : Risk-Adjusted Surgical Re-exploration

0130 : Risk-Adjusted Deep Sternal Wound Infection

0114 : Risk-Adjusted Postoperative Renal Failure

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #3030, NQF #2563, and NQF #3031

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery
2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Steward

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

The Society of Thoracic Surgeons

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

The Society of Thoracic Surgeons

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

The Society of Thoracic Surgeons

Description

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

The STS Individual Surgeon Composite Measure for Adult Cardiac Surgery includes five major procedures (isolated CABG, isolated AVR, AVR+CABG, MVRR, MVRR+CABG) and comprises the following two domains:

Domain 1 – Risk-Adjusted Operative Mortality

Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Risk-Adjusted Major Morbidity

Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation,
2. Deep sternal wound infection,
3. Permanent stroke,
4. Renal failure, and
5. Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

All measures are based on audited clinical data collected in the STS Adult Cardiac Surgery Database. Individual surgeons with at least 100 eligible cases during the 3-year measurement window will receive a score for each domain and an overall composite score. In addition to calculating composite score point estimates with credible intervals, surgeons will be assigned rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

The STS AVR+CABG Composite Score comprises two domains consisting of six measures: Domain 1) Absence of Operative Mortality – Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death during the same hospitalization as surgery or after discharge but within 30 days of the procedure; and Domain 2) Absence of Major Morbidity – Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as having at least one of the following adverse outcomes: 1.

reoperations for any cardiac reason, 2. renal failure, 3. deep sternal wound infection, 4. prolonged ventilation/intubation, and 5. cerebrovascular accident/permanent stroke. All measures are based on audited clinical data collected in a prospective registry and are risk-adjusted.

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). Star ratings are publicly reported on the STS website.

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

The STS Mitral Valve Repair/Replacement (MVRR) Composite Score measures surgical performance for isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD). To assess overall quality, the STS MVRR Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

Prolonged ventilation,

Deep sternal wound infection,

Permanent stroke,

Renal failure, and

Reoperations for bleeding, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Outcome data are collected on all patients and from all participants. For optimal measure reliability, participants meeting a volume threshold of at least 36 cases over 3 years (i.e., approximately one mitral case per month) receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Type

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Composite

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Composite

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Composite

Data Source

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.81 went live on July 1, 2014; STS Adult Cardiac Surgery Database – Version 2.9 went live on July 1st, 2017 and STS Adult Cardiac Surgery Database version 4.20 went live on June 30, 2020.

The URL provided under S.1 is for the latest data collection form that is currently in use.

Available at measure-specific web page URL identified in S.1 No data dictionary

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 Attachment

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.81 went live on July 1, 2014; STS Adult Cardiac Surgery Database – Version 2.9 went live on July 1st, 2017 and STS Adult Cardiac Surgery Database version 4.20 went live on June 30, 2020.

The URL provided under S.1 is for the latest data collection form that is currently in use.

Available at measure-specific web page URL identified in S.1 No data dictionary

Level

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Clinician : Individual

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Facility, Clinician : Group/Practice

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Facility, Clinician : Group/Practice

Setting

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Inpatient/Hospital

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Inpatient/Hospital

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Inpatient/Hospital

Numerator Statement

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes in detail this multiprocedural, multidimensional composite measure.

The STS Individual Surgeon Composite Measure for Adult Cardiac Surgery includes five major procedures, i.e., isolated coronary artery bypass grafting (CABG), isolated aortic valve replacement (AVR), AVR+CABG, isolated mitral valve repair or replacement (MVRR), and MVRR+CABG, and comprises the following two domains:

Domain 1 – Risk-Adjusted Operative Mortality

Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Risk-Adjusted Major Morbidity

Major morbidity is defined as the occurrence of any one or more of the following major complications:

Prolonged ventilation

Deep sternal wound infection

Permanent stroke

Renal failure and

Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons

Individual surgeons with at least 100 eligible cases during the 3-year measurement window will receive a score for each domain and an overall composite score. In addition to calculating composite score point estimates with credible intervals, surgeons will be assigned rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated CABG, isolated AVR, AVR+CABG, isolated MVRR, and MVRR+CABG.

Time Window: 3 years

By including composite performance scores for a portfolio of five procedures that account for nearly 80% of a typical STS Adult Cardiac Surgery Database participant surgeon's clinical activity, this metric provides a more balanced and comprehensive perspective than focusing on just one procedure or one end point. Recognizing that surgeons' practices vary, each surgeon's composite performance is implicitly "weighted" by the proportion of each type of procedure he or she performs. For instance, the results of surgeons who primarily perform mitral procedures are affected most by their mitral surgery results. This approach is especially relevant for surgeons with highly specialized practices who may do relatively few isolated CABG procedures and whose performance would thus be difficult to assess using a CABG measure only. Finally, performance on each of these procedures is estimated using risk models specific to those procedures, in most cases the exact or slightly modified versions of previously published models (references provided below).

Final Composite Score:

The overall composite score was calculated as a weighted sum of (1 minus risk-adjusted mortality rate) and (1 minus risk-adjusted major morbidity rate). Mortality and morbidity rates were weighted inversely by their respective standard deviations across surgeons. This procedure is equivalent to first rescaling mortality and morbidity rates by their respective standard deviations across surgeons and then assigning equal weighting to the rescaled mortality rate and rescaled morbidity rate. Standard deviations derived from the data were used to define the final composite

measure as 0.81 x (1 minus risk-standardized mortality rate) + 0.19 x (1 minus risk-standardized complication rate).

Details regarding the current STS adult cardiac surgery risk models can be found in the following manuscripts:

Shahian DM, O'Brien SM, Filardo G, Ferraris VA, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 1--coronary artery bypass grafting surgery. Ann Thorac Surg. 2009 Jul;88(1 Suppl):S2-22.

O'Brien SM, Shahian DM, Filardo G, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 2—isolated valve surgery. Ann Thorac Surg 2009;88(1 Suppl):S23–42.

Shahian DM, O'Brien SM, Filardo G, Ferraris VA, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 3--valve plus coronary artery bypass grafting surgery. Ann Thorac Surg 2009 Jul;88(1 Suppl):S43-62.

Additional details regarding the Individual Surgeon Composite Measure for Adult Cardiac Surgery are provided in the attached manuscript:

Shahian DM, He X, Jacobs JP, Kurlansky PA, Badhwar V, Cleveland JC Jr, Fazzalari FL, Filardo G, Normand SL, Furnary AP, Magee MJ, Rankin JS, Welke KF, Han J, O'Brien SM. The Society of Thoracic Surgeons Composite Measure of Individual Surgeon Performance for Adult Cardiac Surgery: A Report of The Society of Thoracic Surgeons Quality Measurement Task Force. Ann Thorac Surg. 2015;100:1315-25.

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.

The STS AVR+CABG Composite Score comprises two domains consisting of six individual measures:

1. Absence of Operative Mortality

NQF # 0123 Risk-Adjusted Operative Mortality for AVR+CABG Surgery

2. Absence of Major Morbidity, scored any-or-none. The measures used are the same morbidity outcomes included in NQF #0696 STS CABG Composite Score.

Risk-Adjusted Postoperative Stroke/Cerebrovascular Accident

Risk-Adjusted Postoperative Surgical Re-exploration

Risk-Adjusted Postoperative Deep Sternal Wound Infection Rate

Risk-Adjusted Postoperative Renal Failure

Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance).

Patient Population: The analysis population consists of adult patients aged 18 years or older who undergo AVR+CABG surgery

Time Period: 3 years

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 10 AVR+CABG procedures in the patient population.

Technical Details

The unit of measurement for the STS AVR+CABG Composite Score can be either a participant (most often a cardiac surgical practice but occasionally an individual surgeon) or a hospital.

For the Absence of Operative Mortality domain, the NUMERATOR is:

Number of patients undergoing AVR+CABG who survived until after discharge and >30 days post-surgery

For the Absence of Major Morbidity domain, the NUMERATOR is:

Number of patients undergoing AVR+CABG who did not experience any of the

five specified major morbidity endpoints*

*Morbidity endpoints consist of postoperative stroke/cerebrovascular accident, surgical re-exploration, deep sternal wound infection, renal failure, prolonged intubation (ventilation). Patients with documented history of renal failure (i.e., dialysis or baseline serum creatinine of 4.0 or higher) are excluded when counting renal failure outcomes.

STS AVR+CABG risk models are used to estimate expected rates of mortality and any-or-none morbidity (Reference: Shahian DM, O'Brien SM, Filardo G, Ferraris VA, etal. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 3--valve plus coronary artery bypass grafting surgery. Ann Thorac Surg 2009 Jul;88(1 Suppl):S43-62.) To enhance interpretation, mortality rates are converted to survival rates (risk-standardized survival rate = 100 – risk-standardized mortality rate), and morbidity rates are converted to “absence of morbidity” rates (risk-standardized absence of morbidity rate =100 – risk-standardized morbidity rate). Defining scores in this manner ensures that increasingly positive values reflect better performance, which is easier for consumers to interpret.

(Please see the appendix for the formula used to calculate the overall composite score.)

The method is equivalent to calculating a weighted average, with weights proportional to the inverse of the SD. In the most recent production of the STS AVR+CABG Composite Score based on data from July 2010 – June 2013, wtmort=0.77 and wtmorb = 0.23.

Star Rating: Star ratings are derived by testing whether the participant's composite or domain score is significantly different from the overall STS average. For instance, if for each of the 2 composite score domains, a participant’s estimated score is lower than the overall STS average, but the difference between the participant and STS is not statistically significant, the ratings would each be 2 stars. If however, for the overall composite, the point estimate is lower than the STS average, AND this difference is statistically significant, the overall participant star rating is 1 star. The fact that statistical significance was achieved for the composite score but not the individual domains reflects the greater precision of the composite score compared to

individual endpoints. This precision is achieved by aggregating information across multiple endpoints instead of a single endpoint.

Additional details regarding the AVR+CABG Composite Score are provided in the manuscript:

Shahian DM, He X, Jacobs JP, et al. The STS AVR + CABG Composite Score: A Report of the STS Quality Measurement Task Force. Ann Thorac Surg 2014;97(5),1604-9.

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.

The STS Mitral Valve Repair/Replacement (MVRR) Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

Prolonged ventilation

Deep sternal wound infection

Permanent stroke

Renal failure and

Reoperations for bleeding, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD).

Time Window: 3 years

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 36 isolated MVRR procedures in the patient population.

Estimation of Composite Scores and Star Ratings: The statistical methodology used to estimate the STS

MVRR composite score and star rating for each participant site was similar to that used for the STS isolated CABG, isolated AVR, and AVR+CABG measures. As with previous composite scores, we first translated risk-standardized event rates into risk-standardized absence of event rates so that a higher score indicated better performance. We then rescaled the morbidity and mortality domains by dividing by their respective standard deviations and then added the two domains together.

Numerator Details

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

See response in S.4. Numerator Statement

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Please see S.4 above

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

See response in S.4. Numerator Statement

Denominator Statement

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

See response in S.4. Numerator Statement

Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated CABG, isolated AVR, AVR+CABG, isolated MVRR, and MVRR+CABG.

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.

The STS AVR+CABG Composite Score comprises two domains consisting of six individual measures:

1. Absence of Operative Mortality

NQF # 0123 Risk-Adjusted Operative Mortality for AVR+CABG Surgery

2. Absence of Major Morbidity, scored any-or-none. The measures used are the same morbidity outcomes included in NQF #0696 STS CABG Composite Score.

Risk-Adjusted Postoperative Stroke/Cerebrovascular Accident

Risk-Adjusted Postoperative Surgical Re-exploration

Risk-Adjusted Postoperative Deep Sternal Wound Infection Rate

Risk-Adjusted Postoperative Renal Failure

Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance).

Patient Population: The analysis population consists of adult patients aged 18 years or older who undergo AVR+CABG surgery

Time Period: 3 years

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 10 AVR+CABG procedures in the patient population.

Technical Details

The unit of measurement for the STS AVR+CABG Composite Score can be either a participant (most often a cardiac surgical practice but occasionally an individual surgeon) or a hospital.

For the Absence of Operative Mortality domain AND the Absence of Major Morbidity domain, the DENOMINATOR is:

Number of patients undergoing isolated AVR+CABG during the measurement period

STS AVR+CABG risk models are used to estimate expected rates of mortality and any-or-none morbidity (Reference: Shahian DM, O'Brien SM, Filardo G, Ferraris VA, etal. The Society of Thoracic

Surgeons 2008 cardiac surgery risk models: part 3--valve plus coronary artery bypass grafting surgery. Ann Thorac Surg 2009 Jul;88(1 Suppl):S43-62.) To enhance interpretation, mortality rates are converted to survival rates (risk-standardized survival rate = 100 – risk-standardized mortality rate), and morbidity rates are converted to "absence of morbidity" rates (risk-standardized absence of morbidity rate =100 – risk-standardized morbidity rate). Defining scores in this manner ensures that increasingly positive values reflect better performance, which is easier for consumers to interpret.

(Please see the appendix for the formula used to calculate the overall composite score.)

The method is equivalent to calculating a weighted average, with weights proportional to the inverse of the SD. In the most recent production of the STS AVR+CABG Composite Score based on data from July 2010 – June 2013, wtmort=0.77 and wtmorb = 0.23.

Star Rating: Star ratings are derived by testing whether the participant's composite or domain score is significantly different from the overall STS average. For instance, if for each of the 2 composite score domains, a participant's estimated score is lower than the overall STS average, but the difference between the participant and STS is not statistically significant, the ratings would each be 2 stars. If however, for the overall composite, the point estimate is lower than the STS average, AND this difference is statistically significant, the overall participant star rating is 1 star. The fact that statistical significance was achieved for the composite score but not the individual domains reflects the greater precision of the composite score compared to

individual endpoints. This precision is achieved by aggregating information across multiple endpoints instead of a single endpoint.

Additional details regarding the AVR+CABG Composite Score are provided in the manuscript:

Shahian DM, He X, Jacobs JP, et al. The STS AVR + CABG Composite Score: A Report of the STS Quality Measurement Task Force. Ann Thorac Surg 2014;97(5),1604-9.

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

See response in S.4. Numerator Statement for complete description of measure specifications.

Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD).

Denominator Details

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

See response in S.6. Denominator Statement

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Please see S.6 above

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

See response in S.6 Denominator Statement

Exclusions

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Measure exclusions: Individual surgeons who do not meet the minimum case requirement (i.e., at least 100 eligible cases during the 3-year measurement window) will not receive a score for each domain and an overall composite score.

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Please see S.6 above

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 36 isolated MVRR procedures in the patient population.

Exclusion Details

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

See response in S.8. Denominator Exclusions

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Please see S.6 above

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

See response in S.8. Denominator Exclusions

Risk Adjustment

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Statistical risk model

111855| 114638| 152617| 150289

111855| 114638| 152617| 150289

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Statistical risk model

111855| 137290| 114638| 141015

111855| 137290| 114638| 141015

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Statistical risk model

111855| 114638| 152617

111855| 114638| 152617

Stratification

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

N/A

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

N/A

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

N/A

Type Score

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Rate/proportion better quality = higher score

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Rate/proportion better quality = higher score

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Rate/proportion better quality = higher score

Algorithm

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Please see discussion under section S.4 and attached manuscripts. 111855| 114638| 152617| 150289

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Please see S.4 and S.6 above 111855| 137290| 114638| 141015

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Please see discussion under section S.4 and attached manuscripts. 111855| 114638| 152617

Submission items

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

5.1 Identified measures:

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

5.1 Identified measures: 0123 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) + CABG Surgery

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0115 : Risk-Adjusted Surgical Re-exploration

0130 : Risk-Adjusted Deep Sternal Wound Infection

0114 : Risk-Adjusted Postoperative Renal Failure

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

5.1 Identified measures:

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #3030 and NQF #3032

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery
3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Steward

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

The Society of Thoracic Surgeons

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

The Society of Thoracic Surgeons

Description

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

The STS Individual Surgeon Composite Measure for Adult Cardiac Surgery includes five major procedures (isolated CABG, isolated AVR, AVR+CABG, MVRR, MVRR+CABG) and comprises the following two domains:

Domain 1 – Risk-Adjusted Operative Mortality

Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Risk-Adjusted Major Morbidity

Major morbidity is defined as the occurrence of any one or more of the following major complications:

Prolonged ventilation,

Deep sternal wound infection,

Permanent stroke,

Renal failure, and

Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

All measures are based on audited clinical data collected in the STS Adult Cardiac Surgery Database. Individual surgeons with at least 100 eligible cases during the 3-year measurement window will receive a score for each domain and an overall composite score. In addition to calculating composite score point estimates with credible intervals, surgeons will be assigned rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

The STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score measures surgical performance for MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF). To assess overall quality, the STS MVRR +CABG Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

Prolonged ventilation,

Deep sternal wound infection,

Permanent stroke,

Renal failure, and

Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Outcome data are collected on all patients and from all participants. For optimal measure reliability, participants meeting a volume threshold of at least 25 cases over 3 years receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Type

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Composite

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Composite

Data Source

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.81 went live on July 1, 2014; STS Adult Cardiac Surgery Database – Version 2.9 went live on July 1st, 2017 and STS Adult Cardiac Surgery Database version 4.20 went live on June 30, 2020.

The URL provided under S.1 is for the latest data collection form that is currently in use.

Available at measure-specific web page URL identified in S.1 No data dictionary

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.81 went live on July 1, 2014; STS Adult Cardiac Surgery Database – Version 2.9 went live on July 1st, 2017 and STS Adult Cardiac Surgery Database version 4.20 went live on June 30, 2020.

The URL provided under S.1 is for the latest data collection form that is currently in use.

Available at measure-specific web page URL identified in S.1 No data dictionary

Level

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Clinician : Individual

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Facility, Clinician : Group/Practice

Setting

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Inpatient/Hospital

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Inpatient/Hospital

Numerator Statement

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes in detail this multiprocedural, multidimensional composite measure.

The STS Individual Surgeon Composite Measure for Adult Cardiac Surgery includes five major procedures, i.e., isolated coronary artery bypass grafting (CABG), isolated aortic valve replacement (AVR), AVR+CABG, isolated mitral valve repair or replacement (MVRR), and MVRR+CABG, and comprises the following two domains:

Domain 1 – Risk-Adjusted Operative Mortality

Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Risk-Adjusted Major Morbidity

Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation
2. Deep sternal wound infection
3. Permanent stroke
4. Renal failure and
5. Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons

Individual surgeons with at least 100 eligible cases during the 3-year measurement window will receive a score for each domain and an overall composite score. In addition to calculating composite score point estimates with credible intervals, surgeons will be assigned rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated CABG, isolated AVR, AVR+CABG, isolated MVRR, and MVRR+CABG.

Time Window: 3 years

By including composite performance scores for a portfolio of five procedures that account for nearly 80% of a typical STS Adult Cardiac Surgery Database participant surgeon's clinical activity, this metric provides a more balanced and comprehensive perspective than focusing on just one procedure or one end point. Recognizing that surgeons' practices vary, each surgeon's composite performance is implicitly "weighted" by the proportion of each type of procedure he or she performs. For instance, the results of surgeons who primarily perform mitral procedures are affected most by their mitral surgery results. This approach is especially relevant for surgeons with highly specialized practices who may do relatively few isolated CABG procedures and whose performance would thus be difficult to assess using a CABG measure only. Finally, performance on each of these procedures is estimated using risk models specific to those procedures, in most cases the exact or slightly modified versions of previously published models (references provided below).

Final Composite Score:

The overall composite score was calculated as a weighted sum of (1 minus risk-adjusted mortality rate) and (1 minus risk-adjusted major morbidity rate). Mortality and morbidity rates were weighted inversely by their respective standard deviations across surgeons. This procedure is equivalent to first rescaling mortality and morbidity rates by their respective standard deviations across surgeons and then assigning equal weighting to the rescaled mortality rate and rescaled morbidity rate. Standard deviations derived from the data were used to define the final composite measure as 0.81 x (1 minus risk-standardized mortality rate) + 0.19 x (1 minus risk-standardized complication rate).

Details regarding the current STS adult cardiac surgery risk models can be found in the following manuscripts:

Shahian DM, O'Brien SM, Filardo G, Ferraris VA, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 1--coronary artery bypass grafting surgery. Ann Thorac Surg. 2009 Jul;88(1 Suppl):S2-22.

O'Brien SM, Shahian DM, Filardo G, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 2—isolated valve surgery. Ann Thorac Surg 2009;88(1 Suppl):S23–42.

Shahian DM, O'Brien SM, Filardo G, Ferraris VA, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 3--valve plus coronary artery bypass grafting surgery. Ann Thorac Surg 2009 Jul;88(1 Suppl):S43-62.

Additional details regarding the Individual Surgeon Composite Measure for Adult Cardiac Surgery are provided in the attached manuscript:

Shahian DM, He X, Jacobs JP, Kurlansky PA, Badhwar V, Cleveland JC Jr, Fazzalari FL, Filardo G, Normand SL, Furnary AP, Magee MJ, Rankin JS, Welke KF, Han J, O'Brien SM. The Society of Thoracic Surgeons Composite Measure of Individual Surgeon Performance for Adult Cardiac Surgery: A Report of The Society of Thoracic Surgeons Quality Measurement Task Force. Ann Thorac Surg. 2015;100:1315-25.

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.

The STS Mitral Valve Repair/Replacement (MVRR) Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

Prolonged ventilation,

Deep sternal wound infection,

Permanent stroke,

Renal failure, and

Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Patient Population: The analysis population consists of patients aged 18 years or older who MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF).

Time Window: 3 years

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 25 MVRR + CABG procedures in the patient population.

Estimation of Composite Scores and Star Ratings:

To be consistent with the conventions of previous composite measures, risk-adjusted event rates were first converted into risk-adjusted absence-of-event rates. To calculate the composite, participant-specific absence of mortality rates and absence of morbidity rates were weighted inversely by their respective standard deviations across participants. This procedure was equivalent to first rescaling the absence of mortality rates and absence of morbidity rates by their respective standard deviations across participants, and then assigning equal weighting to the rescaled rates. Finally, in order to draw statistical inferences about participant performance, a Bayesian credible interval surrounding each participant's composite score was calculated. Unlike frequentist confidence intervals, Bayesian credible intervals have an intuitively direct interpretation as an interval containing the true value of the composite score with a specified probability (e.g., 95%). To determine star ratings for each participant, the credible interval of its composite score was compared with the STS average. Participants whose intervals were entirely above the STS average were classified as 3-star (higher than expected performance), and participants whose intervals were entirely below the STS average were classified as1-star (lower than expected performance). Credible intervals based on different probability levels (90%, 95%, 98%) were explored, and the resulting percentages of 1, 2, and 3-star programs were calculated.

Numerator Details

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

See response in S.4. Numerator Statement

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

See response in S.4. Numerator Statement

Denominator Statement

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

See response in S.4. Numerator Statement

Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated CABG, isolated AVR, AVR+CABG, isolated MVRR, and MVRR+CABG.

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

See response in S.4. Numerator Statement for complete description of measure specifications.

Patient Population: The analysis population consists of patients aged 18 years or older who MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF).

Denominator Details

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

See response in S.6. Denominator Statement

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

See response in S.7. Denominator Statement

Exclusions

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Measure exclusions: Individual surgeons who do not meet the minimum case requirement (i.e., at least 100 eligible cases during the 3-year measurement window) will not receive a score for each domain and an overall composite score.

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 25 MVRR + CABG procedures in the patient population.

Exclusion Details

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

See response in S.8. Denominator Exclusions

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

See response in S.8. Denominator Exclusions

Risk Adjustment

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Statistical risk model

111855| 114638| 152617| 150289

111855| 114638| 152617| 150289

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Statistical risk model

111855| 114638| 152617

111855| 114638| 152617

Stratification

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

N/A

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

N/A

Type Score

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Rate/proportion better quality = higher score

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Rate/proportion better quality = higher score

Algorithm

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

Please see discussion under section S.4 and attached manuscripts. 111855| 114638| 152617| 150289

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Please see discussion under section S.4 and attached manuscripts. 111855| 114638| 152617

Submission items

3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery

5.1 Identified measures:

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

5.1 Identified measures:

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #3031, NQF #0696, and NQF #2561

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score
0696 STS CABG Composite Score
2561 STS Aortic Valve Replacement (AVR) Composite Score

Steward

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

The Society of Thoracic Surgeons

0696 STS CABG Composite Score

The Society of Thoracic Surgeons

2561 STS Aortic Valve Replacement (AVR) Composite Score

The Society of Thoracic Surgeons

Description

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

The STS Mitral Valve Repair/Replacement (MVRR) Composite Score measures surgical performance for isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD). To assess overall quality, the STS MVRR Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

Prolonged ventilation,

Deep sternal wound infection,

Permanent stroke,

Renal failure, and

Reoperations for bleeding, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Outcome data are collected on all patients and from all participants. For optimal measure reliability, participants meeting a volume threshold of at least 36 cases over 3 years (i.e., approximately one mitral case per month) receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores

into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

0696 STS CABG Composite Score

The STS CABG Composite Score comprises four domains consisting of 11 individually NQF-endorsed cardiac surgery measures:

Domain 1) Absence of Operative Mortality – Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death during the same hospitalization as surgery or after discharge but within 30 days of the procedure;

Domain 2) Absence of Major Morbidity – Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as having at least one of the following adverse outcomes: 1. reoperations for any cardiac reason, 2. renal failure, 3. deep sternal wound infection, 4. prolonged ventilation/intubation, 5. cerebrovascular accident/permanent stroke;

Domain 3) Use of Internal Mammary Artery (IMA) – Proportion of first-time CABG patients who receive at least one IMA graft;

Domain 4) Use of All Evidence-based Perioperative Medications – Proportion of patients who receive all required perioperative medications for which they are eligible. The required perioperative medications are: 1. preoperative beta blockade therapy, 2. discharge anti-platelet medication, 3. discharge beta blockade therapy, and 4. discharge anti-lipid medication.

All measures are based on audited clinical data collected in a prospective registry. Participants receive a score for each of the domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). For consenting participants, scores and star ratings are publicly reported on the STS website.

2561 STS Aortic Valve Replacement (AVR) Composite Score

STS AVR Composite Score comprises two domains consisting of six measures: Domain 1) Absence of Operative Mortality – Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death during the same hospitalization as surgery or after discharge but within 30 days of the procedure; and Domain 2) Absence of Major Morbidity – Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as having at least one of the following adverse outcomes: 1. reoperations for any cardiac reason, 2. renal failure, 3. deep sternal wound infection, 4. prolonged ventilation/intubation, and 5. cerebrovascular accident/permanent stroke. All measures are based on audited clinical data collected in a prospective registry and are risk-adjusted.

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). Star ratings are publicly reported on the STS website and are also currently reported on the Consumer Reports website.

Type

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Composite

0696 STS CABG Composite Score

Composite

2561 STS Aortic Valve Replacement (AVR) Composite Score

Composite

Data Source

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.81 went live on July 1, 2014; STS Adult Cardiac Surgery Database – Version 2.9 went live on July 1st, 2017 and STS Adult Cardiac Surgery Database version 4.20 went live on June 30, 2020.

The URL provided under S.1 is for the latest data collection form that is currently in use.

Available at measure-specific web page URL identified in S.1 No data dictionary

0696 STS CABG Composite Score

Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.8 went live on July 1, 2014; STS Adult Cardiac Surgery Database Version 2.9 went live on July 1, 2017.

Available at measure-specific web page URL identified in S.1 Attachment

2561 STS Aortic Valve Replacement (AVR) Composite Score

Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 Attachment

Level

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Facility, Clinician : Group/Practice

0696 STS CABG Composite Score

Facility, Clinician : Group/Practice

2561 STS Aortic Valve Replacement (AVR) Composite Score

Facility, Clinician : Group/Practice

Setting

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Inpatient/Hospital

0696 STS CABG Composite Score

Inpatient/Hospital

2561 STS Aortic Valve Replacement (AVR) Composite Score

Inpatient/Hospital

Numerator Statement

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.

The STS Mitral Valve Repair/Replacement (MVRR) Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation
2. Deep sternal wound infection
3. Permanent stroke
4. Renal failure and
5. Reoperations for bleeding, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD).

Time Window: 3 years

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 36 isolated MVRR procedures in the patient population.

Estimation of Composite Scores and Star Ratings: The statistical methodology used to estimate the STS

MVRR composite score and star rating for each participant site was similar to that used for the STS isolated CABG, isolated AVR, and AVR+CABG measures. As with previous composite scores, we first translated risk-standardized event rates into risk-standardized absence of event rates so that a higher score indicated better performance. We then rescaled the morbidity and mortality domains by dividing by their respective standard deviations and then added the two domains together.

0696 STS CABG Composite Score

Please see Appendix

2561 STS Aortic Valve Replacement (AVR) Composite Score

Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.

The STS AVR Composite Score comprises two domains consisting of six individual measures:

1. Absence of Operative Mortality

NQF # 0120 Risk-Adjusted Operative Mortality for AVR

2. Absence of Major Morbidity, scored any-or-none. The measures used are the same morbidity outcomes included in NQF #0696 STS CABG Composite Score.

Risk-Adjusted Postoperative Stroke/Cerebrovascular Accident

Risk-Adjusted Postoperative Surgical Re-exploration

Risk-Adjusted Postoperative Deep Sternal Wound Infection Rate

Risk-Adjusted Postoperative Renal Failure

Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance).

Patient Population: The analysis population consists of adult patients aged 18 years or older who undergo isolated AVR surgery

Time Period: 3 years

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 10 isolated AVR procedures in the patient population.

Technical Details

The unit of measurement for the STS AVR Composite Score can be either a participant (most often a cardiac surgical practice but occasionally an individual surgeon) or a hospital.

For the Absence of Operative Mortality domain, the NUMERATOR is:

Number of patients undergoing isolated AVR who survived until after discharge and >30 days post-surgery

For the Absence of Major Morbidity domain, the NUMERATOR is:

Number of patients undergoing isolated AVR who did not experience any of the

five specified major morbidity endpoints*

*Morbidity endpoints consist of postoperative stroke/cerebrovascular accident, surgical re-exploration, deep sternal wound infection, renal failure, prolonged intubation (ventilation). Patients with documented history of renal failure (i.e., dialysis or baseline serum creatinine of 4.0 or higher) are excluded when counting renal failure outcomes.

STS AVR risk models are used to estimate expected rates of mortality and any-or-none morbidity (Reference: O'Brien SM, Shahian DM, Filardo G, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 2—isolated valve surgery. Ann Thorac Surg 2009;88(1 Suppl):S23–

42). To enhance interpretation, mortality rates are converted to survival rates (risk-standardized survival rate = 100 – risk-standardized mortality rate), and morbidity rates are converted to "absence of morbidity" rates (risk-standardized absence of morbidity rate =100 – risk-standardized morbidity rate). Defining scores in this manner ensures that increasingly positive values reflect better performance, which is easier for consumers to interpret.

(Please see the appendix for the formula used to calculate the overall composite score.)

The method is equivalent to calculating a weighted average, with weights proportional to the inverse of the SD. In the most recent production of the STS AVR Composite Score based on data from July 2010 – June 2013, wtmort=0.79 and wtmorb = 0.21.

Star Rating: Star ratings are derived by testing whether the participant's composite or domain score is significantly different from the overall STS average. For instance, if for each of the 2 composite score domains, a participant's estimated score is lower than the overall STS average, but the difference between the participant and STS is not statistically significant, the ratings would each be 2 stars. If however, for the overall composite, the point estimate is lower than the STS average, AND this difference is statistically significant, the overall participant star rating is 1 star. The fact that statistical significance was achieved for the composite score but not the individual domains reflects the greater precision of the composite score compared to

individual endpoints. This precision is achieved by aggregating information across multiple endpoints instead of a single endpoint.

Additional details regarding the AVR Composite Score are provided in the attached manuscript:

Shahian DM, He X, Jacobs JP, et al. The Society of Thoracic Surgeons Isolated Aortic Valve Replacement (AVR) Composite Score: a report of the STS Quality Measurement Task Force. Ann Thorac Surg 2012;94:2166-71.

Numerator Details

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

See response in S.4. Numerator Statement

0696 STS CABG Composite Score

Please see Appendix

2561 STS Aortic Valve Replacement (AVR) Composite Score

Please see S.4 above

Denominator Statement

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

See response in S.4. Numerator Statement for complete description of measure specifications.

Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD).

0696 STS CABG Composite Score

Please see Appendix

2561 STS Aortic Valve Replacement (AVR) Composite Score

Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.

The STS AVR Composite Score comprises two domains consisting of six individual measures:

1. Absence of Operative Mortality

NQF # 0120 Risk-Adjusted Operative Mortality for AVR

2. Absence of Major Morbidity, scored any-or-none. The measures used are the same morbidity outcomes included in NQF #0696 STS CABG Composite Score.

Risk-Adjusted Postoperative Stroke/Cerebrovascular Accident

Risk-Adjusted Postoperative Surgical Re-exploration

Risk-Adjusted Postoperative Deep Sternal Wound Infection Rate

Risk-Adjusted Postoperative Renal Failure

Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance).

Patient Population: The analysis population consists of adult patients aged 18 years or older who undergo isolated AVR surgery

Time Period: 3 years

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 10 isolated AVR procedures in the patient population.

Technical Details

The unit of measurement for the STS AVR Composite Score can be either a participant (most often a cardiac surgical practice but occasionally an individual surgeon) or a hospital.

For the Absence of Operative Mortality domain AND the Absence of Major Morbidity domain, the DENOMINATOR is:

Number of patients undergoing isolated AVR during the measurement period

STS AVR risk models are used to estimate expected rates of mortality and any-or-none morbidity (Reference: O'Brien SM, Shahian DM, Filardo G, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 2—isolated valve surgery. Ann Thorac Surg 2009;88(1 Suppl):S23–42). To enhance interpretation, mortality rates are converted to survival rates (risk-standardized survival rate = 100 – risk-standardized

mortality rate), and morbidity rates are converted to "absence of morbidity" rates (risk-standardized absence of morbidity rate =100 – risk-standardized morbidity rate). Defining scores in this manner ensures that increasingly positive values reflect better performance, which is easier for consumers to interpret.

(Please see the appendix for the formula used to calculate the overall composite score.)

The method is equivalent to calculating a weighted average, with weights proportional to the inverse of the SD. In the most recent production of the STS AVR Composite Score based on data from July 2010 – June 2013, wtmort=0.79 and wtmorb = 0.21.

Star Rating: Star ratings are derived by testing whether the participant's composite or domain score is significantly different from the overall STS average. For instance, if for each of the 2 composite score domains, a participant's estimated score is lower than the overall STS average, but the difference between the participant and STS is not statistically significant, the ratings would each be 2 stars. If however, for the overall composite, the point estimate is lower than the STS average, AND this difference is statistically significant, the overall participant star rating is 1 star. The fact that statistical significance was achieved for the composite score but not the individual domains reflects the greater precision of the composite score compared to

individual endpoints. This precision is achieved by aggregating information across multiple endpoints instead of a single endpoint.

Additional details regarding the AVR Composite Score are provided in the attached manuscript:

Shahian DM, He X, Jacobs JP, et al. The Society of Thoracic Surgeons Isolated Aortic Valve Replacement (AVR) Composite Score: a report of the STS Quality Measurement Task Force. Ann Thorac Surg 2012;94:2166-71.

Denominator Details

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

See response in S.6 Denominator Statement

0696 STS CABG Composite Score

Please see Appendix

2561 STS Aortic Valve Replacement (AVR) Composite Score

Please see S.6 above

Exclusions

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 36 isolated MVRR procedures in the patient population.

0696 STS CABG Composite Score

Please see Appendix

2561 STS Aortic Valve Replacement (AVR) Composite Score

Please see S.6 above

Exclusion Details

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

See response in S.8. Denominator Exclusions

0696 STS CABG Composite Score

Please see Appendix

2561 STS Aortic Valve Replacement (AVR) Composite Score

Please see S.6 above

Risk Adjustment

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Statistical risk model

111855| 114638| 152617

111855| 114638| 152617

0696 STS CABG Composite Score

Statistical risk model

111855| 137290| 114638| 135810

111855| 137290| 114638| 135810

2561 STS Aortic Valve Replacement (AVR) Composite Score

Statistical risk model

111855| 137290| 114638| 141015

111855| 137290| 114638| 141015

Stratification

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

N/A

0696 STS CABG Composite Score

N/A

2561 STS Aortic Valve Replacement (AVR) Composite Score

N/A

Type Score

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Rate/proportion better quality = higher score

0696 STS CABG Composite Score

Rate/proportion better quality = higher score

2561 STS Aortic Valve Replacement (AVR) Composite Score

Rate/proportion better quality = higher score

Algorithm

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Please see discussion under section S.4 and attached manuscripts. 111855| 114638| 152617

0696 STS CABG Composite Score

Please see discussion under section S.4 (Appendix) and attached articles. 111855| 137290| 114638| 135810

2561 STS Aortic Valve Replacement (AVR) Composite Score

Please see S.4 and S.6 above 111855| 137290| 114638| 141015

Submission items

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

5.1 Identified measures:

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

0696 STS CABG Composite Score

5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

0123 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) + CABG Surgery

0122 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Replacement + CABG Surgery

0121 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Replacement

0120 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR)

0119 : Risk-Adjusted Operative Mortality for CABG

0118 : Anti-Lipid Treatment Discharge

0117 : Beta Blockade at Discharge

0116 : Anti-Platelet Medication at Discharge

0115 : Risk-Adjusted Surgical Re-exploration

0114 : Risk-Adjusted Postoperative Renal Failure

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0130 : Risk-Adjusted Deep Sternal Wound Infection

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0127 : Preoperative Beta Blockade

1501 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Repair

1502 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Repair + CABG Surgery

2514 : Risk-Adjusted Coronary Artery Bypass Graft (CABG) Readmission Rate

2683 : Risk-Adjusted Operative Mortality for Pediatric and Congenital Heart Surgery

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

2561 STS Aortic Valve Replacement (AVR) Composite Score

5.1 Identified measures: 0120 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR)

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0115 : Risk-Adjusted Surgical Re-exploration

0130 : Risk-Adjusted Deep Sternal Wound Infection

0114 : Risk-Adjusted Postoperative Renal Failure

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #3031, NQF #2563, and NQF #3032

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score
2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score
3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Steward

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

The Society of Thoracic Surgeons

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

The Society of Thoracic Surgeons

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

The Society of Thoracic Surgeons

Description

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

The STS Mitral Valve Repair/Replacement (MVRR) Composite Score measures surgical performance for isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD). To assess overall quality, the STS MVRR Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

Prolonged ventilation,

Deep sternal wound infection,

Permanent stroke,

Renal failure, and

Reoperations for bleeding, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Outcome data are collected on all patients and from all participants. For optimal measure reliability, participants meeting a volume threshold of at least 36 cases over 3 years (i.e., approximately one mitral case per month) receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

The STS AVR+CABG Composite Score comprises two domains consisting of six measures: Domain 1) Absence of Operative Mortality – Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death during the same hospitalization as surgery or after discharge but within 30 days of the procedure; and Domain 2) Absence of Major Morbidity – Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as having at least one of the following adverse outcomes: 1. reoperations for any cardiac reason, 2. renal failure, 3. deep sternal wound infection, 4. prolonged ventilation/intubation, and 5. cerebrovascular accident/permanent stroke. All measures are based on audited clinical data collected in a prospective registry and are risk-adjusted.

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). Star ratings are publicly reported on the STS website.

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

The STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score measures surgical performance for MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF). To assess overall quality, the STS MVRR +CABG Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

Prolonged ventilation,

Deep sternal wound infection,

Permanent stroke,

Renal failure, and

Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Outcome data are collected on all patients and from all participants. For optimal measure reliability, participants meeting a volume threshold of at least 25 cases over 3 years receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Type

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Composite

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Composite

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Composite

Data Source

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.81 went live on July 1, 2014; STS Adult Cardiac Surgery Database – Version 2.9 went live on July 1st, 2017 and STS Adult Cardiac Surgery Database version 4.20 went live on June 30, 2020.

The URL provided under S.1 is for the latest data collection form that is currently in use.

Available at measure-specific web page URL identified in S.1 No data dictionary

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 Attachment

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.81 went live on July 1, 2014; STS Adult Cardiac Surgery Database – Version 2.9 went live on July 1st, 2017 and STS Adult Cardiac Surgery Database version 4.20 went live on June 30, 2020.

The URL provided under S.1 is for the latest data collection form that is currently in use.

Available at measure-specific web page URL identified in S.1 No data dictionary

Level

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Facility, Clinician : Group/Practice

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Facility, Clinician : Group/Practice

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Facility, Clinician : Group/Practice

Setting

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Inpatient/Hospital

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Inpatient/Hospital

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Inpatient/Hospital

Numerator Statement

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.

The STS Mitral Valve Repair/Replacement (MVRR) Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

Prolonged ventilation

Deep sternal wound infection

Permanent stroke

Renal failure and

Reoperations for bleeding, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD).

Time Window: 3 years

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 36 isolated MVRR procedures in the patient population.

Estimation of Composite Scores and Star Ratings: The statistical methodology used to estimate the STS

MVRR composite score and star rating for each participant site was similar to that used for the STS isolated CABG, isolated AVR, and AVR+CABG measures. As with previous composite scores, we first translated risk-standardized event rates into risk-standardized absence of event rates so that a higher score indicated better performance. We then rescaled the morbidity and mortality domains by dividing by their respective standard deviations and then added the two domains together.

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.

The STS AVR+CABG Composite Score comprises two domains consisting of six individual measures:

1. Absence of Operative Mortality

NQF # 0123 Risk-Adjusted Operative Mortality for AVR+CABG Surgery

2. Absence of Major Morbidity, scored any-or-none. The measures used are the same morbidity outcomes included in NQF #0696 STS CABG Composite Score.

Risk-Adjusted Postoperative Stroke/Cerebrovascular Accident

Risk-Adjusted Postoperative Surgical Re-exploration

Risk-Adjusted Postoperative Deep Sternal Wound Infection Rate

Risk-Adjusted Postoperative Renal Failure

Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance).

Patient Population: The analysis population consists of adult patients aged 18 years or older who undergo AVR+CABG surgery

Time Period: 3 years

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 10 AVR+CABG procedures in the patient population.

Technical Details

The unit of measurement for the STS AVR+CABG Composite Score can be either a participant (most often a cardiac surgical practice but occasionally an individual surgeon) or a hospital.

For the Absence of Operative Mortality domain, the NUMERATOR is:

Number of patients undergoing AVR+CABG who survived until after discharge and >30 days post-surgery

For the Absence of Major Morbidity domain, the NUMERATOR is:

Number of patients undergoing AVR+CABG who did not experience any of the

five specified major morbidity endpoints*

*Morbidity endpoints consist of postoperative stroke/cerebrovascular accident, surgical re-exploration, deep sternal wound infection, renal failure, prolonged intubation (ventilation).

Patients with documented history of renal failure (i.e., dialysis or baseline serum creatinine of 4.0 or higher) are excluded when counting renal failure outcomes.

STS AVR+CABG risk models are used to estimate expected rates of mortality and any-or-none morbidity (Reference: Shahian DM, O'Brien SM, Filardo G, Ferraris VA, etal. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 3--valve plus coronary artery bypass grafting surgery. Ann Thorac Surg 2009 Jul;88(1 Suppl):S43-62.) To enhance interpretation, mortality rates are converted to survival rates (risk-standardized survival rate = 100 – risk-standardized mortality rate), and morbidity rates are converted to "absence of morbidity" rates (risk-standardized absence of morbidity rate =100 – risk-standardized morbidity rate). Defining scores in this manner ensures that increasingly positive values reflect better performance, which is easier for consumers to interpret.

(Please see the appendix for the formula used to calculate the overall composite score.)

The method is equivalent to calculating a weighted average, with weights proportional to the inverse of the SD. In the most recent production of the STS AVR+CABG Composite Score based on data from July 2010 – June 2013, wtmort=0.77 and wtmorb = 0.23.

Star Rating: Star ratings are derived by testing whether the participant's composite or domain score is significantly different from the overall STS average. For instance, if for each of the 2 composite score domains, a participant's estimated score is lower than the overall STS average, but the difference between the participant and STS is not statistically significant, the ratings would each be 2 stars. If however, for the overall composite, the point estimate is lower than the STS average, AND this difference is statistically significant, the overall participant star rating is 1 star. The fact that statistical significance was achieved for the composite score but not the individual domains reflects the greater precision of the composite score compared to

individual endpoints. This precision is achieved by aggregating information across multiple endpoints instead of a single endpoint.

Additional details regarding the AVR+CABG Composite Score are provided in the manuscript:

Shahian DM, He X, Jacobs JP, et al. The STS AVR + CABG Composite Score: A Report of the STS Quality Measurement Task Force. Ann Thorac Surg 2014;97(5),1604-9.

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.

The STS Mitral Valve Repair/Replacement (MVRR) Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation,
2. Deep sternal wound infection,
3. Permanent stroke,

4. Renal failure, and
5. Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Patient Population: The analysis population consists of patients aged 18 years or older who MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF).

Time Window: 3 years

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 25 MVRR + CABG procedures in the patient population.

Estimation of Composite Scores and Star Ratings:

To be consistent with the conventions of previous composite measures, risk-adjusted event rates were first converted into risk-adjusted absence-of-event rates. To calculate the composite, participant-specific absence of mortality rates and absence of morbidity rates were weighted inversely by their respective standard deviations across participants. This procedure was equivalent to first rescaling the absence of mortality rates and absence of morbidity rates by their respective standard deviations across participants, and then assigning equal weighting to the rescaled rates. Finally, in order to draw statistical inferences about participant performance, a Bayesian credible interval surrounding each participant's composite score was calculated. Unlike frequentist confidence intervals, Bayesian credible intervals have an intuitively direct interpretation as an interval containing the true value of the composite score with a specified probability (e.g., 95%). To determine star ratings for each participant, the credible interval of its composite score was compared with the STS average. Participants whose intervals were entirely above the STS average were classified as 3-star (higher than expected performance), and participants whose intervals were entirely below the STS average were classified as1-star (lower than expected performance). Credible intervals based on different probability levels (90%, 95%, 98%) were explored, and the resulting percentages of 1, 2, and 3-star programs were calculated.

Numerator Details

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

See response in S.4. Numerator Statement

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Please see S.4 above

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

See response in S.4. Numerator Statement

Denominator Statement

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

See response in S.4. Numerator Statement for complete description of measure specifications.

Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD).

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.

The STS AVR+CABG Composite Score comprises two domains consisting of six individual measures:

1. Absence of Operative Mortality

NQF # 0123 Risk-Adjusted Operative Mortality for AVR+CABG Surgery

2. Absence of Major Morbidity, scored any-or-none. The measures used are the same morbidity outcomes included in NQF #0696 STS CABG Composite Score.

Risk-Adjusted Postoperative Stroke/Cerebrovascular Accident

Risk-Adjusted Postoperative Surgical Re-exploration

Risk-Adjusted Postoperative Deep Sternal Wound Infection Rate

Risk-Adjusted Postoperative Renal Failure

Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance).

Patient Population: The analysis population consists of adult patients aged 18 years or older who undergo AVR+CABG surgery

Time Period: 3 years

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 10 AVR+CABG procedures in the patient population.

Technical Details

The unit of measurement for the STS AVR+CABG Composite Score can be either a participant (most often a cardiac surgical practice but occasionally an individual surgeon) or a hospital.

For the Absence of Operative Mortality domain AND the Absence of Major Morbidity domain, the DENOMINATOR is:

Number of patients undergoing isolated AVR+CABG during the measurement period

STS AVR+CABG risk models are used to estimate expected rates of mortality and any-or-none morbidity (Reference: Shahian DM, O'Brien SM, Filardo G, Ferraris VA, etal. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 3--valve plus coronary artery bypass grafting surgery. Ann Thorac Surg 2009 Jul;88(1 Suppl):S43-62.) To enhance interpretation, mortality rates are converted to survival rates (risk-standardized survival rate = 100 – risk-standardized mortality rate), and morbidity rates are converted to "absence of morbidity" rates (risk-standardized

absence of morbidity rate =100 – risk-standardized morbidity rate). Defining scores in this manner ensures that increasingly positive values reflect better performance, which is easier for consumers to interpret.

(Please see the appendix for the formula used to calculate the overall composite score.)

The method is equivalent to calculating a weighted average, with weights proportional to the inverse of the SD. In the most recent production of the STS AVR+CABG Composite Score based on data from July 2010 – June 2013, wtmort=0.77 and wtmorb = 0.23.

Star Rating: Star ratings are derived by testing whether the participant's composite or domain score is significantly different from the overall STS average. For instance, if for each of the 2 composite score domains, a participant's estimated score is lower than the overall STS average, but the difference between the participant and STS is not statistically significant, the ratings would each be 2 stars. If however, for the overall composite, the point estimate is lower than the STS average, AND this difference is statistically significant, the overall participant star rating is 1 star. The fact that statistical significance was achieved for the composite score but not the individual domains reflects the greater precision of the composite score compared to

individual endpoints. This precision is achieved by aggregating information across multiple endpoints instead of a single endpoint.

Additional details regarding the AVR+CABG Composite Score are provided in the manuscript:

Shahian DM, He X, Jacobs JP, et al. The STS AVR + CABG Composite Score: A Report of the STS Quality Measurement Task Force. Ann Thorac Surg 2014;97(5),1604-9.

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

See response in S.4. Numerator Statement for complete description of measure specifications.

Patient Population: The analysis population consists of patients aged 18 years or older who MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF).

Denominator Details

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

See response in S.6 Denominator Statement

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Please see S.6 above

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

See response in S.7. Denominator Statement

Exclusions

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 36 isolated MVRR procedures in the patient population.

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Please see S.6 above

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 25 MVRR + CABG procedures in the patient population.

Exclusion Details

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

See response in S.8. Denominator Exclusions

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Please see S.6 above

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

See response in S.8. Denominator Exclusions

Risk Adjustment

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Statistical risk model

111855| 114638| 152617

111855| 114638| 152617

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Statistical risk model

111855| 137290| 114638| 141015

111855| 137290| 114638| 141015

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Statistical risk model

111855| 114638| 152617

111855| 114638| 152617

Stratification

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

N/A

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

N/A

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

N/A

Type Score

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Rate/proportion better quality = higher score

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Rate/proportion better quality = higher score

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Rate/proportion better quality = higher score

Algorithm

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Please see discussion under section S.4 and attached manuscripts. 111855| 114638| 152617

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Please see S.4 and S.6 above 111855| 137290| 114638| 141015

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Please see discussion under section S.4 and attached manuscripts. 111855| 114638| 152617

Submission items

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

5.1 Identified measures:

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

5.1 Identified measures: 0123 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) + CABG Surgery

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0115 : Risk-Adjusted Surgical Re-exploration

0130 : Risk-Adjusted Deep Sternal Wound Infection

0114 : Risk-Adjusted Postoperative Renal Failure

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

5.1 Identified measures:

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #3032, NQF #0696, and NQF #2561

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

0696 STS CABG Composite Score
2561 STS Aortic Valve Replacement (AVR) Composite Score

Steward

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

The Society of Thoracic Surgeons

0696 STS CABG Composite Score

The Society of Thoracic Surgeons

2561 STS Aortic Valve Replacement (AVR) Composite Score

The Society of Thoracic Surgeons

Description

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

The STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score measures surgical performance for MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF). To assess overall quality, the STS MVRR +CABG Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

Prolonged ventilation,

Deep sternal wound infection,

Permanent stroke,

Renal failure, and

Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Outcome data are collected on all patients and from all participants. For optimal measure reliability, participants meeting a volume threshold of at least 25 cases over 3 years receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

0696 STS CABG Composite Score

The STS CABG Composite Score comprises four domains consisting of 11 individually NQF-endorsed cardiac surgery measures:

Domain 1) Absence of Operative Mortality – Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death during the same hospitalization as surgery or after discharge but within 30 days of the procedure;

Domain 2) Absence of Major Morbidity – Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as having at least one of the following adverse outcomes: 1. reoperations for any cardiac reason, 2. renal failure, 3. deep sternal wound infection, 4. prolonged ventilation/intubation, 5. cerebrovascular accident/permanent stroke;

Domain 3) Use of Internal Mammary Artery (IMA) – Proportion of first-time CABG patients who receive at least one IMA graft;

Domain 4) Use of All Evidence-based Perioperative Medications – Proportion of patients who receive all required perioperative medications for which they are eligible. The required perioperative medications are: 1. preoperative beta blockade therapy, 2. discharge anti-platelet medication, 3. discharge beta blockade therapy, and 4. discharge anti-lipid medication.

All measures are based on audited clinical data collected in a prospective registry. Participants receive a score for each of the domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). For consenting participants, scores and star ratings are publicly reported on the STS website.

2561 STS Aortic Valve Replacement (AVR) Composite Score

STS AVR Composite Score comprises two domains consisting of six measures: Domain 1) Absence of Operative Mortality – Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death during the same hospitalization as surgery or after discharge but within 30 days of the procedure; and Domain 2) Absence of Major Morbidity – Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as having at least one of the following adverse outcomes: 1. reoperations for any cardiac reason, 2. renal failure, 3. deep sternal wound infection, 4. prolonged ventilation/intubation, and 5. cerebrovascular accident/permanent stroke. All measures are based on audited clinical data collected in a prospective registry and are risk-adjusted.

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). Star ratings are publicly reported on the STS website and are also currently reported on the Consumer Reports website.

Type

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Composite

0696 STS CABG Composite Score

Composite

2561 STS Aortic Valve Replacement (AVR) Composite Score

Composite

Data Source

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.81 went live on July 1, 2014; STS Adult Cardiac Surgery Database – Version 2.9 went live on July 1st, 2017 and STS Adult Cardiac Surgery Database version 4.20 went live on June 30, 2020.

The URL provided under S.1 is for the latest data collection form that is currently in use.

Available at measure-specific web page URL identified in S.1 No data dictionary

0696 STS CABG Composite Score

Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.8 went live on July 1, 2014; STS Adult Cardiac Surgery Database Version 2.9 went live on July 1, 2017.

Available at measure-specific web page URL identified in S.1 Attachment

2561 STS Aortic Valve Replacement (AVR) Composite Score

Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 Attachment

Level

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Facility, Clinician : Group/Practice

0696 STS CABG Composite Score

Facility, Clinician : Group/Practice

2561 STS Aortic Valve Replacement (AVR) Composite Score

Facility, Clinician : Group/Practice

Setting

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Inpatient/Hospital

0696 STS CABG Composite Score

Inpatient/Hospital

2561 STS Aortic Valve Replacement (AVR) Composite Score

Inpatient/Hospital

Numerator Statement

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.

The STS Mitral Valve Repair/Replacement (MVRR) Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation,
2. Deep sternal wound infection,
3. Permanent stroke,
4. Renal failure, and
5. Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Patient Population: The analysis population consists of patients aged 18 years or older who MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF).

Time Window: 3 years

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 25 MVRR + CABG procedures in the patient population.

Estimation of Composite Scores and Star Ratings:

To be consistent with the conventions of previous composite measures, risk-adjusted event rates were first converted into risk-adjusted absence-of-event rates. To calculate the composite, participant-specific absence of mortality rates and absence of morbidity rates were weighted inversely by their respective standard deviations across participants. This procedure was equivalent to first rescaling the absence of mortality rates and absence of morbidity rates by their respective standard deviations across participants, and then assigning equal weighting to the rescaled rates. Finally, in order to draw statistical inferences about participant performance, a Bayesian credible interval surrounding each participant's composite score was calculated. Unlike frequentist confidence intervals, Bayesian credible intervals have an intuitively direct

interpretation as an interval containing the true value of the composite score with a specified probability (e.g., 95%). To determine star ratings for each participant, the credible interval of its composite score was compared with the STS average. Participants whose intervals were entirely above the STS average were classified as 3-star (higher than expected performance), and participants whose intervals were entirely below the STS average were classified as1-star (lower than expected performance). Credible intervals based on different probability levels (90%, 95%, 98%) were explored, and the resulting percentages of 1, 2, and 3-star programs were calculated.

0696 STS CABG Composite Score

Please see Appendix

2561 STS Aortic Valve Replacement (AVR) Composite Score

Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.

The STS AVR Composite Score comprises two domains consisting of six individual measures:

1. Absence of Operative Mortality

NQF # 0120 Risk-Adjusted Operative Mortality for AVR

2. Absence of Major Morbidity, scored any-or-none. The measures used are the same morbidity outcomes included in NQF #0696 STS CABG Composite Score.

Risk-Adjusted Postoperative Stroke/Cerebrovascular Accident

Risk-Adjusted Postoperative Surgical Re-exploration

Risk-Adjusted Postoperative Deep Sternal Wound Infection Rate

Risk-Adjusted Postoperative Renal Failure

Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance).

Patient Population: The analysis population consists of adult patients aged 18 years or older who undergo isolated AVR surgery

Time Period: 3 years

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 10 isolated AVR procedures in the patient population.

Technical Details

The unit of measurement for the STS AVR Composite Score can be either a participant (most often a cardiac surgical practice but occasionally an individual surgeon) or a hospital.

For the Absence of Operative Mortality domain, the NUMERATOR is:

Number of patients undergoing isolated AVR who survived until after discharge and >30 days post-surgery

For the Absence of Major Morbidity domain, the NUMERATOR is:

Number of patients undergoing isolated AVR who did not experience any of the

five specified major morbidity endpoints*

*Morbidity endpoints consist of postoperative stroke/cerebrovascular accident, surgical re-exploration, deep sternal wound infection, renal failure, prolonged intubation (ventilation). Patients with documented history of renal failure (i.e., dialysis or baseline serum creatinine of 4.0 or higher) are excluded when counting renal failure outcomes.

STS AVR risk models are used to estimate expected rates of mortality and any-or-none morbidity (Reference: O'Brien SM, Shahian DM, Filardo G, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 2—isolated valve surgery. Ann Thorac Surg 2009;88(1 Suppl):S23–42). To enhance interpretation, mortality rates are converted to survival rates (risk-standardized survival rate = 100 – risk-standardized mortality rate), and morbidity rates are converted to "absence of morbidity" rates (risk-standardized absence of morbidity rate =100 – risk-standardized morbidity rate). Defining scores in this manner ensures that increasingly positive values reflect better performance, which is easier for consumers to interpret.

(Please see the appendix for the formula used to calculate the overall composite score.)

The method is equivalent to calculating a weighted average, with weights proportional to the inverse of the SD. In the most recent production of the STS AVR Composite Score based on data from July 2010 – June 2013, wtmort=0.79 and wtmorb = 0.21.

Star Rating: Star ratings are derived by testing whether the participant's composite or domain score is significantly different from the overall STS average. For instance, if for each of the 2 composite score domains, a participant's estimated score is lower than the overall STS average, but the difference between the participant and STS is not statistically significant, the ratings would each be 2 stars. If however, for the overall composite, the point estimate is lower than the STS average, AND this difference is statistically significant, the overall participant star rating is 1 star. The fact that statistical significance was achieved for the composite score but not the individual domains reflects the greater precision of the composite score compared to

individual endpoints. This precision is achieved by aggregating information across multiple endpoints instead of a single endpoint.

Additional details regarding the AVR Composite Score are provided in the attached manuscript:

Shahian DM, He X, Jacobs JP, et al. The Society of Thoracic Surgeons Isolated Aortic Valve Replacement (AVR) Composite Score: a report of the STS Quality Measurement Task Force. Ann Thorac Surg 2012;94:2166-71.

Numerator Details

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

See response in S.4. Numerator Statement

0696 STS CABG Composite Score

Please see Appendix

2561 STS Aortic Valve Replacement (AVR) Composite Score

Please see S.4 above

Denominator Statement

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

See response in S.4. Numerator Statement for complete description of measure specifications.

Patient Population: The analysis population consists of patients aged 18 years or older who MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF).

0696 STS CABG Composite Score

Please see Appendix

2561 STS Aortic Valve Replacement (AVR) Composite Score

Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.

The STS AVR Composite Score comprises two domains consisting of six individual measures:

1. Absence of Operative Mortality

NQF # 0120 Risk-Adjusted Operative Mortality for AVR

2. Absence of Major Morbidity, scored any-or-none. The measures used are the same morbidity outcomes included in NQF #0696 STS CABG Composite Score.

Risk-Adjusted Postoperative Stroke/Cerebrovascular Accident

Risk-Adjusted Postoperative Surgical Re-exploration

Risk-Adjusted Postoperative Deep Sternal Wound Infection Rate

Risk-Adjusted Postoperative Renal Failure

Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance).

Patient Population: The analysis population consists of adult patients aged 18 years or older who undergo isolated AVR surgery

Time Period: 3 years

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 10 isolated AVR procedures in the patient population.

Technical Details

The unit of measurement for the STS AVR Composite Score can be either a participant (most often a cardiac surgical practice but occasionally an individual surgeon) or a hospital.

For the Absence of Operative Mortality domain AND the Absence of Major Morbidity domain, the DENOMINATOR is:

Number of patients undergoing isolated AVR during the measurement period

STS AVR risk models are used to estimate expected rates of mortality and any-or-none morbidity (Reference: O'Brien SM, Shahian DM, Filardo G, et al. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 2—isolated valve surgery. Ann Thorac Surg 2009;88(1 Suppl):S23–42). To enhance interpretation, mortality rates are converted to survival rates (risk-standardized survival rate = 100 – risk-standardized

mortality rate), and morbidity rates are converted to "absence of morbidity" rates (risk-standardized absence of morbidity rate =100 – risk-standardized morbidity rate). Defining scores in

this manner ensures that increasingly positive values reflect better performance, which is easier for consumers to interpret.

(Please see the appendix for the formula used to calculate the overall composite score.)

The method is equivalent to calculating a weighted average, with weights proportional to the inverse of the SD. In the most recent production of the STS AVR Composite Score based on data from July 2010 – June 2013, wtmort=0.79 and wtmorb = 0.21.

Star Rating: Star ratings are derived by testing whether the participant's composite or domain score is significantly different from the overall STS average. For instance, if for each of the 2 composite score domains, a participant's estimated score is lower than the overall STS average, but the difference between the participant and STS is not statistically significant, the ratings would each be 2 stars. If however, for the overall composite, the point estimate is lower than the STS average, AND this difference is statistically significant, the overall participant star rating is 1 star. The fact that statistical significance was achieved for the composite score but not the individual domains reflects the greater precision of the composite score compared to

individual endpoints. This precision is achieved by aggregating information across multiple endpoints instead of a single endpoint.

Additional details regarding the AVR Composite Score are provided in the attached manuscript:

Shahian DM, He X, Jacobs JP, et al. The Society of Thoracic Surgeons Isolated Aortic Valve Replacement (AVR) Composite Score: a report of the STS Quality Measurement Task Force. Ann Thorac Surg 2012;94:2166-71.

Denominator Details

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

See response in S.7. Denominator Statement

0696 STS CABG Composite Score

Please see Appendix

2561 STS Aortic Valve Replacement (AVR) Composite Score

Please see S.6 above

Exclusions

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 25 MVRR + CABG procedures in the patient population.

0696 STS CABG Composite Score

Please see Appendix

2561 STS Aortic Valve Replacement (AVR) Composite Score

Please see S.6 above

Exclusion Details

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

See response in S.8. Denominator Exclusions

0696 STS CABG Composite Score

Please see Appendix

2561 STS Aortic Valve Replacement (AVR) Composite Score

Please see S.6 above

Risk Adjustment

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Statistical risk model

111855| 114638| 152617

111855| 114638| 152617

0696 STS CABG Composite Score

Statistical risk model

111855| 137290| 114638| 135810

111855| 137290| 114638| 135810

2561 STS Aortic Valve Replacement (AVR) Composite Score

Statistical risk model

111855| 137290| 114638| 141015

111855| 137290| 114638| 141015

Stratification

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

N/A

0696 STS CABG Composite Score

N/A

2561 STS Aortic Valve Replacement (AVR) Composite Score

N/A

Type Score

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Rate/proportion better quality = higher score

0696 STS CABG Composite Score

Rate/proportion better quality = higher score

2561 STS Aortic Valve Replacement (AVR) Composite Score

Rate/proportion better quality = higher score

Algorithm

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Please see discussion under section S.4 and attached manuscripts. 111855| 114638| 152617

0696 STS CABG Composite Score

Please see discussion under section S.4 (Appendix) and attached articles. 111855| 137290| 114638| 135810

2561 STS Aortic Valve Replacement (AVR) Composite Score

Please see S.4 and S.6 above 111855| 137290| 114638| 141015

Submission items

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

5.1 Identified measures:

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

0696 STS CABG Composite Score

5.1 Identified measures: 0134 : Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)

0123 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) + CABG Surgery

0122 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Replacement + CABG Surgery

0121 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Replacement

0120 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR)

0119 : Risk-Adjusted Operative Mortality for CABG

0118 : Anti-Lipid Treatment Discharge

0117 : Beta Blockade at Discharge

0116 : Anti-Platelet Medication at Discharge

0115 : Risk-Adjusted Surgical Re-exploration

0114 : Risk-Adjusted Postoperative Renal Failure

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0130 : Risk-Adjusted Deep Sternal Wound Infection

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

0127 : Preoperative Beta Blockade

1501 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Repair

1502 : Risk-Adjusted Operative Mortality for Mitral Valve (MV) Repair + CABG Surgery

2514 : Risk-Adjusted Coronary Artery Bypass Graft (CABG) Readmission Rate

2683 : Risk-Adjusted Operative Mortality for Pediatric and Congenital Heart Surgery

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

2561 STS Aortic Valve Replacement (AVR) Composite Score

5.1 Identified measures: 0120 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR)

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0115 : Risk-Adjusted Surgical Re-exploration

0130 : Risk-Adjusted Deep Sternal Wound Infection

0114 : Risk-Adjusted Postoperative Renal Failure

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #3032, NQF #2563, and NQF #3031

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score
2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score
3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Steward

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

The Society of Thoracic Surgeons

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

The Society of Thoracic Surgeons

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

The Society of Thoracic Surgeons

Description

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

The STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score measures surgical performance for MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF). To assess overall quality, the STS MVRR +CABG Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation,
2. Deep sternal wound infection,
3. Permanent stroke,
4. Renal failure, and
5. Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Outcome data are collected on all patients and from all participants. For optimal measure reliability, participants meeting a volume threshold of at least 25 cases over 3 years receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

The STS AVR+CABG Composite Score comprises two domains consisting of six measures: Domain 1) Absence of Operative Mortality – Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death during the same hospitalization as surgery or after discharge but within 30 days of the procedure; and Domain 2) Absence of Major Morbidity – Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as having at least one of the following adverse outcomes: 1. reoperations for any cardiac reason, 2. renal failure, 3. deep sternal wound infection, 4. prolonged ventilation/intubation, and 5. cerebrovascular accident/permanent stroke. All measures are based on audited clinical data collected in a prospective registry and are risk-adjusted.

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance). Star ratings are publicly reported on the STS website.

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

The STS Mitral Valve Repair/Replacement (MVRR) Composite Score measures surgical performance for isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD). To assess overall quality, the STS MVRR Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

1. Prolonged ventilation,

2. Deep sternal wound infection,
3. Permanent stroke,
4. Renal failure, and
5. Reoperations for bleeding, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Outcome data are collected on all patients and from all participants. For optimal measure reliability, participants meeting a volume threshold of at least 36 cases over 3 years (i.e., approximately one mitral case per month) receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Type

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Composite

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Composite

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Composite

Data Source

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.81 went live on July 1, 2014; STS Adult Cardiac Surgery Database – Version 2.9 went live on July 1st, 2017 and STS Adult Cardiac Surgery Database version 4.20 went live on June 30, 2020.

The URL provided under S.1 is for the latest data collection form that is currently in use.

Available at measure-specific web page URL identified in S.1 No data dictionary

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Registry Data STS Adult Cardiac Surgery Database Version 2.81 (effective July 1, 2014); Version 2.9 (effective July 1, 2017)

Available at measure-specific web page URL identified in S.1 Attachment

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Registry Data STS Adult Cardiac Surgery Database – Version 2.73; STS Adult Cardiac Surgery Database Version 2.81 went live on July 1, 2014; STS Adult Cardiac Surgery Database – Version 2.9 went live on July 1st, 2017 and STS Adult Cardiac Surgery Database version 4.20 went live on June 30, 2020.

The URL provided under S.1 is for the latest data collection form that is currently in use.

Available at measure-specific web page URL identified in S.1 No data dictionary

Level

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Facility, Clinician : Group/Practice

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Facility, Clinician : Group/Practice

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Facility, Clinician : Group/Practice

Setting

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Inpatient/Hospital

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Inpatient/Hospital

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Inpatient/Hospital

Numerator Statement

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.

The STS Mitral Valve Repair/Replacement (MVRR) Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

Prolonged ventilation,

Deep sternal wound infection,

Permanent stroke,

Renal failure, and

Reoperations for bleeding, coronary graft occlusion, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Patient Population: The analysis population consists of patients aged 18 years or older who MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF).

Time Window: 3 years

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 25 MVRR + CABG procedures in the patient population.

Estimation of Composite Scores and Star Ratings:

To be consistent with the conventions of previous composite measures, risk-adjusted event rates were first converted into risk-adjusted absence-of-event rates. To calculate the composite, participant-specific absence of mortality rates and absence of morbidity rates were weighted inversely by their respective standard deviations across participants. This procedure was equivalent to first rescaling the absence of mortality rates and absence of morbidity rates by their respective standard deviations across participants, and then assigning equal weighting to the rescaled rates. Finally, in order to draw statistical inferences about participant performance, a Bayesian credible interval surrounding each participant's composite score was calculated. Unlike frequentist confidence intervals, Bayesian credible intervals have an intuitively direct interpretation as an interval containing the true value of the composite score with a specified probability (e.g., 95%). To determine star ratings for each participant, the credible interval of its composite score was compared with the STS average. Participants whose intervals were entirely above the STS average were classified as 3-star (higher than expected performance), and participants whose intervals were entirely below the STS average were classified as1-star (lower than expected performance). Credible intervals based on different probability levels (90%, 95%, 98%) were explored, and the resulting percentages of 1, 2, and 3-star programs were calculated.

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.

The STS AVR+CABG Composite Score comprises two domains consisting of six individual measures:

1. Absence of Operative Mortality

NQF # 0123 Risk-Adjusted Operative Mortality for AVR+CABG Surgery

2. Absence of Major Morbidity, scored any-or-none. The measures used are the same morbidity outcomes included in NQF #0696 STS CABG Composite Score.

Risk-Adjusted Postoperative Stroke/Cerebrovascular Accident

Risk-Adjusted Postoperative Surgical Re-exploration

Risk-Adjusted Postoperative Deep Sternal Wound Infection Rate

Risk-Adjusted Postoperative Renal Failure

Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance).

Patient Population: The analysis population consists of adult patients aged 18 years or older who undergo AVR+CABG surgery

Time Period: 3 years

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 10 AVR+CABG procedures in the patient population.

Technical Details

The unit of measurement for the STS AVR+CABG Composite Score can be either a participant (most often a cardiac surgical practice but occasionally an individual surgeon) or a hospital.

For the Absence of Operative Mortality domain, the NUMERATOR is:

Number of patients undergoing AVR+CABG who survived until after discharge and >30 days post-surgery

For the Absence of Major Morbidity domain, the NUMERATOR is:

Number of patients undergoing AVR+CABG who did not experience any of the

five specified major morbidity endpoints*

*Morbidity endpoints consist of postoperative stroke/cerebrovascular accident, surgical re-exploration, deep sternal wound infection, renal failure, prolonged intubation (ventilation). Patients with documented history of renal failure (i.e., dialysis or baseline serum creatinine of 4.0 or higher) are excluded when counting renal failure outcomes.

STS AVR+CABG risk models are used to estimate expected rates of mortality and any-or-none morbidity (Reference: Shahian DM, O'Brien SM, Filardo G, Ferraris VA, etal. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 3--valve plus coronary artery bypass grafting surgery. Ann Thorac Surg 2009 Jul;88(1 Suppl):S43-62.) To enhance interpretation, mortality rates are converted to survival rates (risk-standardized survival rate = 100 – risk-standardized mortality rate), and morbidity rates are converted to "absence of morbidity" rates (risk-standardized absence of morbidity rate =100 – risk-standardized morbidity rate). Defining scores in this manner ensures that increasingly positive values reflect better performance, which is easier for consumers to interpret.

(Please see the appendix for the formula used to calculate the overall composite score.)

The method is equivalent to calculating a weighted average, with weights proportional to the inverse of the SD. In the most recent production of the STS AVR+CABG Composite Score based on data from July 2010 – June 2013, wtmort=0.77 and wtmorb = 0.23.

Star Rating: Star ratings are derived by testing whether the participant's composite or domain score is significantly different from the overall STS average. For instance, if for each of the 2 composite score domains, a participant's estimated score is lower than the overall STS average, but the difference between the participant and STS is not statistically significant, the ratings would each be 2 stars. If however, for the overall composite, the point estimate is lower than the STS average, AND this difference is statistically significant, the overall participant star rating is 1 star.

The fact that statistical significance was achieved for the composite score but not the individual domains reflects the greater precision of the composite score compared to

individual endpoints. This precision is achieved by aggregating information across multiple endpoints instead of a single endpoint.

Additional details regarding the AVR+CABG Composite Score are provided in the manuscript:

Shahian DM, He X, Jacobs JP, et al. The STS AVR + CABG Composite Score: A Report of the STS Quality Measurement Task Force. Ann Thorac Surg 2014;97(5),1604-9.

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.

The STS Mitral Valve Repair/Replacement (MVRR) Composite Score comprises two domains consisting of six measures:

Domain 1 – Absence of Operative Mortality

Proportion of patients (risk-adjusted) who do not experience operative mortality. Operative mortality is defined as death before hospital discharge or within 30 days of the operation.

Domain 2 – Absence of Major Morbidity

Proportion of patients (risk-adjusted) who do not experience any major morbidity. Major morbidity is defined as the occurrence of any one or more of the following major complications:

Prolonged ventilation

Deep sternal wound infection

Permanent stroke

Renal failure and

Reoperations for bleeding, prosthetic or native valve dysfunction, and other cardiac reasons, but not for other non-cardiac reasons.

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score was created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by the following:

1 star – lower-than-expected performance

2 stars – as-expected performance

3 stars – higher-than-expected performance

Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD).

Time Window: 3 years

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 36 isolated MVRR procedures in the patient population.

Estimation of Composite Scores and Star Ratings: The statistical methodology used to estimate the STS

MVRR composite score and star rating for each participant site was similar to that used for the STS isolated CABG, isolated AVR, and AVR+CABG measures. As with previous composite scores, we first

translated risk-standardized event rates into risk-standardized absence of event rates so that a higher score indicated better performance. We then rescaled the morbidity and mortality domains by dividing by their respective standard deviations and then added the two domains together.

Numerator Details

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

See response in S.4. Numerator Statement

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Please see S.4 above

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

See response in S.4. Numerator Statement

Denominator Statement

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

See response in S.4. Numerator Statement for complete description of measure specifications.

Patient Population: The analysis population consists of patients aged 18 years or older who MVRR + CABG with or without concomitant Atrial Septal Defect (ASD) and Patent Foramen Ovale (PFO) closures, tricuspid valve repair (TVr), or surgical ablation for atrial fibrillation (AF).

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Due to the complex methodology used to construct the composite measure, it is impractical to separately discuss the numerator and denominator. The following discussion describes how each domain score is calculated and how these are combined into an overall composite score.

The STS AVR+CABG Composite Score comprises two domains consisting of six individual measures:

1. Absence of Operative Mortality

NQF # 0123 Risk-Adjusted Operative Mortality for AVR+CABG Surgery

2. Absence of Major Morbidity, scored any-or-none. The measures used are the same morbidity outcomes included in NQF #0696 STS CABG Composite Score.

Risk-Adjusted Postoperative Stroke/Cerebrovascular Accident

Risk-Adjusted Postoperative Surgical Re-exploration

Risk-Adjusted Postoperative Deep Sternal Wound Infection Rate

Risk-Adjusted Postoperative Renal Failure

Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

Participants receive a score for each of the two domains, plus an overall composite score. The overall composite score is created by "rolling up" the domain scores into a single number. In addition to receiving a numeric score, participants are assigned to rating categories designated by one star (below average performance), two stars (average performance), or three stars (above average performance).

Patient Population: The analysis population consists of adult patients aged 18 years or older who undergo AVR+CABG surgery

Time Period: 3 years

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 10 AVR+CABG procedures in the patient population.

Technical Details

The unit of measurement for the STS AVR+CABG Composite Score can be either a participant (most often a cardiac surgical practice but occasionally an individual surgeon) or a hospital.

For the Absence of Operative Mortality domain AND the Absence of Major Morbidity domain, the DENOMINATOR is:

Number of patients undergoing isolated AVR+CABG during the measurement period

STS AVR+CABG risk models are used to estimate expected rates of mortality and any-or-none morbidity (Reference: Shahian DM, O'Brien SM, Filardo G, Ferraris VA, etal. The Society of Thoracic Surgeons 2008 cardiac surgery risk models: part 3--valve plus coronary artery bypass grafting surgery. Ann Thorac Surg 2009 Jul;88(1 Suppl):S43-62.) To enhance interpretation, mortality rates are converted to survival rates (risk-standardized survival rate = 100 – risk-standardized mortality rate), and morbidity rates are converted to "absence of morbidity" rates (risk-standardized absence of morbidity rate =100 – risk-standardized morbidity rate). Defining scores in this manner ensures that increasingly positive values reflect better performance, which is easier for consumers to interpret.

(Please see the appendix for the formula used to calculate the overall composite score.)

The method is equivalent to calculating a weighted average, with weights proportional to the inverse of the SD. In the most recent production of the STS AVR+CABG Composite Score based on data from July 2010 – June 2013, wtmort=0.77 and wtmorb = 0.23.

Star Rating: Star ratings are derived by testing whether the participant's composite or domain score is significantly different from the overall STS average. For instance, if for each of the 2 composite score domains, a participant's estimated score is lower than the overall STS average, but the difference between the participant and STS is not statistically significant, the ratings would each be 2 stars. If however, for the overall composite, the point estimate is lower than the STS average, AND this difference is statistically significant, the overall participant star rating is 1 star. The fact that statistical significance was achieved for the composite score but not the individual domains reflects the greater precision of the composite score compared to

individual endpoints. This precision is achieved by aggregating information across multiple endpoints instead of a single endpoint.

Additional details regarding the AVR+CABG Composite Score are provided in the manuscript:

Shahian DM, He X, Jacobs JP, et al. The STS AVR + CABG Composite Score: A Report of the STS Quality Measurement Task Force. Ann Thorac Surg 2014;97(5),1604-9.

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

See response in S.4. Numerator Statement for complete description of measure specifications.

Patient Population: The analysis population consists of patients aged 18 years or older who undergo isolated MVRR with or without concomitant tricuspid valve repair (TVr), surgical ablation for atrial fibrillation (AF), or repair of atrial septal defect (ASD).

Denominator Details

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

See response in S.7. Denominator Statement

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Please see S.6 above

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

See response in S.6 Denominator Statement

Exclusions

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 25 MVRR + CABG procedures in the patient population.

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Please see S.6 above

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Data Completeness Requirement: Participants are excluded from the analysis if they have fewer than 36 isolated MVRR procedures in the patient population.

Exclusion Details

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

See response in S.8. Denominator Exclusions

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Please see S.6 above

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

See response in S.8. Denominator Exclusions

Risk Adjustment

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Statistical risk model

111855| 114638| 152617

111855| 114638| 152617

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Statistical risk model

111855| 137290| 114638| 141015

111855| 137290| 114638| 141015

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Statistical risk model

111855| 114638| 152617

111855| 114638| 152617

Stratification

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

N/A

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

N/A

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

N/A

Type Score

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Rate/proportion better quality = higher score

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Rate/proportion better quality = higher score

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Rate/proportion better quality = higher score

Algorithm

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

Please see discussion under section S.4 and attached manuscripts. 111855| 114638| 152617

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

Please see S.4 and S.6 above 111855| 137290| 114638| 141015

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

Please see discussion under section S.4 and attached manuscripts. 111855| 114638| 152617

Submission items

3032 STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score

5.1 Identified measures:

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

2563 STS Aortic Valve Replacement (AVR) + Coronary Artery Bypass Graft (CABG) Composite Score

5.1 Identified measures: 0123 : Risk-Adjusted Operative Mortality for Aortic Valve Replacement (AVR) + CABG Surgery

0131 : Risk-Adjusted Stroke/Cerebrovascular Accident

0115 : Risk-Adjusted Surgical Re-exploration

0130 : Risk-Adjusted Deep Sternal Wound Infection

0114 : Risk-Adjusted Postoperative Renal Failure

0129 : Risk-Adjusted Postoperative Prolonged Intubation (Ventilation)

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

3031 STS Mitral Valve Repair/Replacement (MVRR) Composite Score

5.1 Identified measures:

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: N/A

5b.1 If competing, why superior or rationale for additive value: N/A

Appendix F: Pre-Evaluation Comments

Comments received as of January 26, 2021.

Topic	Commenter	Comment
NQF #0117 Beta Blockade at Discharge	The Society of Thoracic Surgeons	STS Response to Preliminary Analyses for Measures 0117, 0127, 0134 Definitions for low- and high-performance groups The preliminary analyses for these three process measures found that "It is unclear how low and high-performance groups were defined" for known-group validity testing. This is in reference to the "low performance." "mid performance," and "high performance" categories to which we refer in sect. 2b1.3 in the testing forms. The definitions of these categories are as described in sect. 2b4.1: "Since higher value indicates better performance, an STS participant is designated as having higher/lower than average performance for the measure if the 95% CI [confidence interval] lies entirely above/below the STS average. The remaining participants are labeled as not distinguishable from the STS average performance. For the simplicity of this report, we call the three groups high performance, low performance and mid performance respectively." The high-, low-, and mid-performance groups are thus comparable to the STS "star rating" categories ("higher-than-expected," "lower-than-expected," "as-expected"), although the star ratings are applied to STS composite (outcome) measures only, not to individual process measures. STS Response to Preliminary Analyses for Measures 0117, 0127, 0134 "Insufficient" ratings for Validity We are aware that the NQF validity evaluation algorithm calls for other analyses (sensitivity, specificity, positive predictive value, negative predictive value) in addition to percent agreement. We believe, however, that the validity of our measures at the data element level is adequately demonstrated by the results of the exceptional external audit process that the STS has conducted annually since 2006. The STS audit of the Adult Cardiac Surgery Database (ACSD) is designed to evaluate the accuracy, consistency and comprehensiveness of data collection, and ultimately validate the integrity of the data stored in the Database. Each year, 10% of active ACSD participant sites are randomly selected for audit. In order to evaluate the comprehensiveness of the Database, a list of all cases that are submitted to our analytics center (Duke Clinical Research Institute [DCRI]) from three randomly selected months are compared to the hospital logs of all cases that are performed that year. The data managers provide the auditors with documentation of all cases performed. Each site must demonstrate an effective process to assure that all eligible cases are submitted to the Database.

Topic	Commenter	Comment
		DCRI randomly selects 20 CABG-only and 10 isolated valve cases that are performed in the calendar year for audit at each site; 12 CABG-only and 8 isolated valve cases are re-abstracted at each site. An over-sample is provided to allow for the possibility that a medical record cannot be located by the site and is therefore unavailable for re-abstraction. A specified group of data variables are evaluated each year, utilizing the current version of the STS Adult Cardiac Surgery Data Specifications; the number of variables increases every year. (For example, 82 variables were evaluated in 2015; 86 in 2017; 91 in 2019.) Agreement rates are calculated for each of the individual variables, each variable category and overall. The overall aggregate agreement rate for the most recent five audits is shown in the table below: Audit Year Total Cases Total Mismatch Overall Aggregate Agreement Rate 2019 203,840 14,313 92.98% 2018 222,500 10,346 95.35% 2017 144,920 5,010 96.54% 2016 144,368 5,494 96.19% 2015 141,047 5,409 96.17% These results, and the rigorous audit process through which they are obtained, demonstrate the accuracy and completeness of the data in the STS ACSD. This conclusion is further supported by comments received from our external auditors in each year's final audit report. Two examples follow: [2015] "There were 141,047 total variables abstracted and there were 135,638 variables that matched, resulting in an overall agreement rate of 96.17% (95.73% in 2014). This overall performance rate reflects a high level of accuracy in data collection and evidence that the data contained in the ACSD are valid." Source: The Society of Thoracic Surgeons Adult Cardiac Surgery Database Audit – Telligen Final Report.Telligen, December 2015. [2018] "The overall aggregate agreement rate was 95.4%, demonstrating that the data contained in the ACSD is both comprehensive and highly accurate… The surgeons and staff that perform the data collection and submission to the ACSD were found to be committed to the STS goal of collecting quality data." Source: The Society of Thoracic Surgeons Adult Cardiac Surgery Database Audit – Final Audit Report 2018.Cardiac Registry Support, LLC, November 2019. In summary, we believe that the additional information provided here adequately demonstrates the validity of STS measures 0117, 0127, 0134 at the data element level, and will appreciate a reconsideration of the preliminary "insufficient" rating.

Topic	Commenter	Comment
		STS Response to Preliminary Analyses for Measures 0117 & 0134 "Low" ratings for Opportunity for Improvement We understand but respectfully disagree with the assessment that these two STS measures are "topped out" and therefore subject to loss of endorsement. We ask that you please consider the following: *The STS believes that these evidence based, guideline-directed measures are significantly responsible for the dramatic improvement we have demonstrated in outcomes and in process-of-care compliance, as documented in a 2019 Joint Commission Journal on Quality and Patient Safety article (1). Table 2 shows a 54% improvement in compliance with the Discharge Beta-Blocker measure (#0117) between 2002 and 2016, and a 32% improvement in compliance with the IMA Use measure (#0134) between 1998 and 2016.* *It is inappropriate to view these improvements as a rationale to remove endorsement for these measures and risk a deterioration in results due to the perception that these measures are no longer important. Cardiac surgeries are high-stakes procedures in which small errors or deviations from standardized care processes can lead to death. From our perspective, a residual 1-2 % failure rate for individual process measures is not acceptable.* *Cardiac surgery is comparable to the airline industry in that we must strive for high reliability; our goal is a 100% success rate.* *Even small failure rates may result in a participant rating below the STS average, providing the potential to identify statistically meaningful differences in performance.* *Furthermore, the continued use and endorsement of these measures does not contribute to an excessive data entry burden for clinicians or their staff. The data for these processes of care is routinely collected – in a data registry with over 95% participation in the U.S. – for the STS CABG Composite for which these are component measures, along with mortality and morbidity outcomes. Concerns related to measures becoming "topped out" are more relevant to non-registry measures for which data collection may require the allocation of additional resources.* We therefore believe that the "topped out" assessment for measures 0117 & 0134 is unwarranted and ask NQF staff and the Surgery Standing Committee to consider a higher Opportunity for Improvement rating for each measure. 1. Shahian DM. Professional Society Leadership in Health Care Quality: The Society of Thoracic Surgeons Experience. Joint Commission journal on quality and patient safety / Joint Commission Resources. 2019;45(7):466-79.
NQF #0127 Preoperative Beta Blockade	The Society of Thoracic Surgeons	STS Response to Preliminary Analyses for Measures 0117, 0127, 0134 Definitions for low- and high-performance groups The preliminary analyses for these three process measures found that "It is unclear how low and high-performance groups were defined" for known-group validity testing. This is in reference to the "low performance." "mid

Topic	Commenter	Comment
		performance," and "high performance" categories to which we refer in sect. 2b1.3 in the testing forms. The definitions of these categories are as described in sect. 2b4.1: "Since higher value indicates better performance, an STS participant is designated as having higher/lower than average performance for the measure if the 95% CI [confidence interval] lies entirely above/below the STS average. The remaining participants are labeled as not distinguishable from the STS average performance. For the simplicity of this report, we call the three groups high performance, low performance and mid performance respectively." The high-, low-, and mid-performance groups are thus comparable to the STS "star rating" categories ("higher-than-expected," "lower-than-expected," "as-expected"), although the star ratings are applied to STS composite (outcome) measures only, not to individual process measures. STS Response to Preliminary Analyses for Measures 0117, 0127, 0134 "Insufficient" ratings for Validity We are aware that the NQF validity evaluation algorithm calls for other analyses (sensitivity, specificity, positive predictive value, negative predictive value) in addition to percent agreement. We believe, however, that the validity of our measures at the data element level is adequately demonstrated by the results of the exceptional external audit process that the STS has conducted annually since 2006. The STS audit of the Adult Cardiac Surgery Database (ACSD) is designed to evaluate the accuracy, consistency and comprehensiveness of data collection, and ultimately validate the integrity of the data stored in the Database. Each year, 10% of active ACSD participant sites are randomly selected for audit. In order to evaluate the comprehensiveness of the Database, a list of all cases that are submitted to our analytics center (Duke Clinical Research Institute [DCRI]) from three randomly selected months are compared to the hospital logs of all cases that are performed that year. The data managers provide the auditors with documentation of all cases performed. Each site must demonstrate an effective process to assure that all eligible cases are submitted to the Database. DCRI randomly selects 20 CABG-only and 10 isolated valve cases that are performed in the calendar year for audit at each site; 12 CABG-only and 8 isolated valve cases are re-abstracted at each site. An over-sample is provided to allow for the possibility that a medical record cannot be located by the site and is therefore unavailable for re-abstraction. A specified group of data variables are evaluated each year, utilizing the current version of the STS Adult Cardiac Surgery Data Specifications; the number of variables increases every year. (For example, 82 variables were evaluated in 2015; 86 in 2017; 91 in 2019.) Agreement rates are calculated for each of the individual variables, each variable category and overall. The overall aggregate agreement rate for the most recent five audits is shown in the table below: Audit Year Total Cases Total Mismatch Overall Aggregate Agreement Rate

Topic	Commenter	Comment
		2019 203,840 14,313 92.98% 2018 222,500 10,346 95.35% 2017 144,920 5,010 96.54% 2016 144,368 5,494 96.19% 2015 141,047 5,409 96.17% These results, and the rigorous audit process through which they are obtained, demonstrate the accuracy and completeness of the data in the STS ACSD. This conclusion is further supported by comments received from our external auditors in each year's final audit report. Two examples follow: [2015] "There were 141,047 total variables abstracted and there were 135,638 variables that matched, resulting in an overall agreement rate of 96.17% (95.73% in 2014). This overall performance rate reflects a high level of accuracy in data collection and evidence that the data contained in the ACSD are valid." Source: The Society of Thoracic Surgeons Adult Cardiac Surgery Database Audit – Telligen Final Report.Telligen, December 2015. [2018] "The overall aggregate agreement rate was 95.4%, demonstrating that the data contained in the ACSD is both comprehensive and highly accurate… The surgeons and staff that perform the data collection and submission to the ACSD were found to be committed to the STS goal of collecting quality data." Source: The Society of Thoracic Surgeons Adult Cardiac Surgery Database Audit – Final Audit Report 2018.Cardiac Registry Support, LLC, November 2019. In summary, we believe that the additional information provided here adequately demonstrates the validity of STS measures 0117, 0127, 0134 at the data element level, and will appreciate a reconsideration of the preliminary "insufficient" rating.
NQF #0134 Use of Internal Mammary Artery (IMA) in Coronary Artery Bypass Graft (CABG)	The Society of Thoracic Surgeons	STS Response to Preliminary Analyses for Measures 0117, 0127, 0134 Definitions for low- and high-performance groups The preliminary analyses for these three process measures found that "It is unclear how low and high-performance groups were defined" for known-group validity testing. This is in reference to the "low performance." "mid performance," and "high performance" categories to which we refer in sect. 2b1.3 in the testing forms. The definitions of these categories are as described in sect. 2b4.1: "Since higher value indicates better performance, an STS participant is designated as having higher/lower than average performance for the measure if the 95% CI [confidence interval] lies entirely above/below the STS average.

Topic	Commenter	Comment
		The remaining participants are labeled as not distinguishable from the STS average performance. For the simplicity of this report, we call the three groups high performance, low performance and mid performance respectively." The high-, low-, and mid-performance groups are thus comparable to the STS "star rating" categories ("higher-than-expected," "lower-than-expected," "as-expected"), although the star ratings are applied to STS composite (outcome) measures only, not to individual process measures. STS Response to Preliminary Analyses for Measures 0117, 0127, 0134 "Insufficient" ratings for Validity We are aware that the NQF validity evaluation algorithm calls for other analyses (sensitivity, specificity, positive predictive value, negative predictive value) in addition to percent agreement. We believe, however, that the validity of our measures at the data element level is adequately demonstrated by the results of the exceptional external audit process that the STS has conducted annually since 2006. The STS audit of the Adult Cardiac Surgery Database (ACSD) is designed to evaluate the accuracy, consistency and comprehensiveness of data collection, and ultimately validate the integrity of the data stored in the Database. Each year, 10% of active ACSD participant sites are randomly selected for audit. In order to evaluate the comprehensiveness of the Database, a list of all cases that are submitted to our analytics center (Duke Clinical Research Institute [DCRI]) from three randomly selected months are compared to the hospital logs of all cases that are performed that year. The data managers provide the auditors with documentation of all cases performed. Each site must demonstrate an effective process to assure that all eligible cases are submitted to the Database. DCRI randomly selects 20 CABG-only and 10 isolated valve cases that are performed in the calendar year for audit at each site; 12 CABG-only and 8 isolated valve cases are re-abstracted at each site. An over-sample is provided to allow for the possibility that a medical record cannot be located by the site and is therefore unavailable for re-abstraction. A specified group of data variables are evaluated each year, utilizing the current version of the STS Adult Cardiac Surgery Data Specifications; the number of variables increases every year. (For example, 82 variables were evaluated in 2015; 86 in 2017; 91 in 2019.) Agreement rates are calculated for each of the individual variables, each variable category and overall. The overall aggregate agreement rate for the most recent five audits is shown in the table below: Audit Year Total Cases Total Mismatch Overall Aggregate Agreement Rate 2019 203,840 14,313 92.98% 2018 222,500 10,346 95.35% 2017 144,920 5,010 96.54% 2016 144,368 5,494 96.19%

Topic	Commenter	Comment
		2015 141,047 5,409 96.17% These results, and the rigorous audit process through which they are obtained, demonstrate the accuracy and completeness of the data in the STS ACSD. This conclusion is further supported by comments received from our external auditors in each year's final audit report. Two examples follow: [2015] "There were 141,047 total variables abstracted and there were 135,638 variables that matched, resulting in an overall agreement rate of 96.17% (95.73% in 2014). This overall performance rate reflects a high level of accuracy in data collection and evidence that the data contained in the ACSD are valid." Source: The Society of Thoracic Surgeons Adult Cardiac Surgery Database Audit – Telligen Final Report.Telligen, December 2015. [2018] "The overall aggregate agreement rate was 95.4%, demonstrating that the data contained in the ACSD is both comprehensive and highly accurate… The surgeons and staff that perform the data collection and submission to the ACSD were found to be committed to the STS goal of collecting quality data." Source: The Society of Thoracic Surgeons Adult Cardiac Surgery Database Audit – Final Audit Report 2018.Cardiac Registry Support, LLC, November 2019. In summary, we believe that the additional information provided here adequately demonstrates the validity of STS measures 0117, 0127, 0134 at the data element level, and will appreciate a reconsideration of the preliminary "insufficient" rating. STS Response to Preliminary Analyses for Measures 0117 & 0134 "Low" ratings for Opportunity for Improvement We understand but respectfully disagree with the assessment that these two STS measures are "topped out" and therefore subject to loss of endorsement. We ask that you please consider the following: The STS believes that these evidence based, guideline-directed measures are significantly responsible for the dramatic improvement we have demonstrated in outcomes and in process-of-care compliance, as documented in a 2019 Joint Commission Journal on Quality and Patient Safety article (1). Table 2 shows a 54% improvement in compliance with the Discharge Beta-Blocker measure (#0117) between 2002 and 2016, and a 32% improvement in compliance with the IMA Use measure (#0134) between 1998 and 2016. It is inappropriate to view these improvements as a rationale to remove endorsement for these measures and risk a deterioration in results due to the perception that these measures are no longer important. Cardiac surgeries are high-stakes procedures in which small errors or deviations from standardized care processes can lead to death. From our perspective, a residual 1-2 % failure rate for individual process measures is not acceptable.

Topic	Commenter	Comment
		Cardiac surgery is comparable to the airline industry in that we must strive for high reliability; our goal is a 100% success rate. Even small failure rates may result in a participant rating below the STS average, providing the potential to identify statistically meaningful differences in performance. Furthermore, the continued use and endorsement of these measures does not contribute to an excessive data entry burden for clinicians or their staff. The data for these processes of care is routinely collected – in a data registry with over 95% participation in the U.S. – for the STS CABG Composite for which these are component measures, along with mortality and morbidity outcomes. Concerns related to measures becoming "topped out" are more relevant to non-registry measures for which data collection may require the allocation of additional resources. We therefore believe that the "topped out" assessment for measures 0117 & 0134 is unwarranted and ask NQF staff and the Surgery Standing Committee to consider a higher Opportunity for Improvement rating for each measure. Shahian DM. Professional Society Leadership in Health Care Quality: The Society of Thoracic Surgeons Experience. Joint Commission journal on quality and patient safety / Joint Commission Resources. 2019;45(7):466-79.
NQF #1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	American Medical Association	The American Medical Association (AMA) appreciates the opportunity to comment on the NQF Measure #1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA). In reviewing the calculation, we are disappointed to see the minimum measure score reliability result calculated at 0.46 and the intraclass correlation coefficient (ICC) calculated at 0.524 using a minimum case number of just 25 patients. We believe that measures must meet minimum acceptable thresholds of 0.7 for reliability and require higher case minimums to allow the overwhelming majority of hospitals to achieve an ICC of 0.6 or higher. The AMA is also extremely concerned that the measure developer used the recommendation to exclude social risk factors in the risk adjustment models for measures that are publicly reported as outlined in the recent report to Congress by Assistant Secretary for Planning and Evaluation (ASPE) on Social Risk Factors and Performance in Medicare's Value-based Purchasing program (ASPE, 2020). We believe that while the current testing may not have produced results that would indicate incorporation of the two social risk factors included in testing, this measure is currently used both for public reporting and value-based purchasing. A primary limitation of the ASPE report was that none of the recommendations adequately addressed whether it was or appropriate to adjust for social risk factors in the same measure used for more than one accountability purpose, which is the case here. This discrepancy along with the fact that the additional analysis using the American Community Survey is not yet released must be addressed prior to any reliance on the recommendations within this report. In addition, we question whether the measure continues to be useful to distinguish hospital performance and drive improvements based on the distribution of hospital's performance scores where only 60 hospitals performed better

Topic	Commenter	Comment
		than the national rate and 50 hospitals performed worse (as noted in section 2b4 and the discussion on improvement in section 4b1 of the measure submission form), and where there was only an increase of 0.1 absolute percentage points between July 2016-June 2017 and July 2018-June 2019. We request that the Standing Committee evaluate whether the measure continues to meet the measure evaluation criteria required for endorsement. Reference: Office of the Assistant Secretary for Planning and Evaluation, U.S. Department of Health & Human Services. Second Report to Congress on Social Risk Factors and Performance in Medicare's Value-Based Purchasing Program. 2020.
NQF #1550 Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	Federation of American Hospitals	The Federation of American Hospitals (FAH) appreciates the opportunity to comment on Measure #1550, Hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA). The FAH is concerned that even though the median reliability score was 0.87 for hospitals with at least 25 cases, reliability ranged from 0.46 to 1.00 and that the intraclass correlation coefficients (ICC) was 0.524. The FAH believes that the developer must increase the minimum sample size to a higher number to produce a minimum reliability threshold of sufficient magnitude (e.g. 0.7 or higher) and an ICC of 0.6 or higher. In addition, the FAH is very concerned to see that the measure developer's rationale to not include social risk factors in the risk adjustment model was in part based on the recommendations from the report to Congress by Assistant Secretary for Planning and Evaluation (ASPE) on Social Risk Factors and Performance in Medicare's Value-based Purchasing program released in March of last year (ASPE, 2020). A fundament flaw within the ASPE report was the lack of any recommendation addressing how a single measure with multiple accountability uses should address inclusion of social risk factors as is the case with this measure, which is both publicly reported and included in the Hospital Value-Based Purchasing program. Regardless of whether the testing of social risk factors produced results that were sufficiently significant, the FAH believes that no developer should rely on the recommendations of this report until the question of how to handle multiple uses is addressed along with the additional analysis using the American Community Survey. Lastly, the FAH is concerned that there is insufficient variation in performance across hospitals and limited opportunities for improvement to support this measure's continued use in accountability programs. Specifically, the performance scores reported in 2b4. Identification of Statistically Significant and Meaningful Difference in Performance are generally low with only 60 hospitals identified as better than the national rate and 50 are worse than the national rate. We base our concerns on these results along with the discussion on improvement in section

Topic	Commenter	Comment
		4b1 of the measure submission form where only an increase of 0.1 absolute percentage points between July 2016-June 2017 and July 2018-June 2019 was found. As a result, the FAH requests that the Standing Committee carefully consider whether the measure as specified should continue to be endorsed. Reference: Office of the Assistant Secretary for Planning and Evaluation, U.S. Department of Health & Human Services. Second Report to Congress on Social Risk Factors and Performance in Medicare's Value-Based Purchasing Program. 2020.
NQF #1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	American Medical Association	The American Medical Association (AMA) appreciates the opportunity to comment on NQF Measure #1551, Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA). We are disappointed to see the minimum measure score reliability results calculated at 0.29 and the intraclass correlation coefficient (ICC) calculated at 0.454 using a minimum case number of just 25 patients. We believe that measures must meet minimum acceptable thresholds of 0.7 for reliability and require higher case minimums to allow the overwhelming majority of hospitals to achieve an ICC of 0.6 or higher. In reviewing the calculation, the AMA is also extremely concerned to see that the measure developer used the recommendation to not include social risk factors in the risk adjustment models for measures that are publicly reported as outlined in the recent report to Congress by Assistant Secretary for Planning and Evaluation (ASPE) on Social Risk Factors and Performance in Medicare's Value-based Purchasing program (ASPE, 2020). We believe that while the current testing may not have produced results that would indicate incorporation of the two social risk factors included in testing, this measure is currently used both for public reporting and value-based purchasing. A primary limitation of the ASPE report was that none of the recommendations adequately addressed whether it was appropriate to adjust for social risk factors in the same measure used for more than one accountability purpose, which is the case here. This discrepancy along with the fact that the additional analysis using the American Community Survey is not yet released must be addressed prior to any reliance on the recommendations within this report. In addition, we question whether the measure continues to be useful to distinguish hospital performance and drive improvements based on the distribution of hospital's performance scores where only 44 hospitals performed better than the national rate and 24 hospitals were worse (as noted in section 2b4 and the discussion on improvement in section 4b1 of the measure submission form), and where there was only an increase of 0.1 absolute percentage points between July 2016-June 2017 and July 2018-June 2019.

Topic	Commenter	Comment
		We request that the Standing Committee evaluate whether the measure continues to meet the measure evaluation criteria required for endorsement. Reference: Office of the Assistant Secretary for Planning and Evaluation, U.S. Department of Health & Human Services. Second Report to Congress on Social Risk Factors and Performance in Medicare's Value-Based Purchasing Program. 2020.
NQF #1551 Hospital-level 30-day risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA)	Federation of American Hospitals	The Federation of American Hospitals (FAH) appreciates the opportunity to comment on Measure #1551, Hospital-level risk-standardized readmission rate (RSRR) following elective primary total hip arthroplasty (THA) and/or total knee arthroplasty (TKA). The FAH is concerned that even though the median reliability score was 0.77 for hospitals with at least 25 cases, reliability ranged from 0.29 to 0.99 and that the intraclass correlation coefficients (ICC) was 0.454. The FAH believes that the developer must increase the minimum sample size to a higher number to produce a minimum reliability threshold of sufficient magnitude (e.g. 0.7 or higher) and an ICC of 0.6 or higher. In addition, the FAH is very concerned to see that the measure developer's rationale to not include social risk factors in the risk adjustment model was in part based on the recommendations from the report to Congress by Assistant Secretary for Planning and Evaluation (ASPE) on Social Risk Factors and Performance in Medicare's Value-based Purchasing program released in March of last year (ASPE, 2020). A fundament flaw within the ASPE report was the lack of any recommendation addressing how a single measure with multiple accountability uses should address inclusion of social risk factors as is the case with this measure, which is both publicly reported and included in the Hospital Value-Based Purchasing program. Regardless of whether the testing of social risk factors produced results that were sufficiently significant, the FAH believes that no developer should rely on the recommendations of this report until the question of how to handle multiple uses is addressed along with the additional analysis using the American Community Survey. Lastly, the FAH is concerned that there is insufficient variation in performance across hospitals and limited opportunities for improvement to support this measure's continued use in accountability programs. Specifically, the performance scores reported in 2b4. Identification of Statistically Significant and Meaningful Difference in Performance are generally low with only 44 hospitals identified as better than the national rate and 24 are worse than the national rate. We base our concerns on these results along with the discussion on improvement in section 4b1 of the measure submission form where only an increase of 0.1 absolute percentage points between July 2016-June 2017 and July 2018-June 2019 was found. As a result, the FAH requests that the Standing Committee carefully consider whether the measure as specified should continue to be endorsed.

<table>
<tr><th>Topic</th><th>Commenter</th><th>Comment</th></tr>
<tr><td></td><td></td><td>Reference:
Office of the Assistant Secretary for Planning and Evaluation, U.S. Department of Health & Human Services. Second Report to Congress on Social Risk Factors and Performance in Medicare's Value-Based Purchasing Program. 2020.</td></tr>
<tr><td>NQF #3030 STS Individual Surgeon Composite Measure for Adult Cardiac Surgery</td><td>The Society of Thoracic Surgeons</td><td>STS Updates to Measure Testing Document Section 1b.4
1b.4. Provide disparities data from the measure as specified (current and over time) by population group, e.g., by race/ethnicity, gender, age, insurance status, socioeconomic status, and/or disability.
In order to shed light on disparities, we used logistic regression to study the associations of race, ethnicity and insurance status with operative mortality and major morbidity while adjusting for covariates included in any of the 2018 risk adjustment models (see other sections for details of covariate adjustment – we used the most recent 2018 CABG, valve and valve+CABG models for mortality and major morbidity). Odds ratios with 95% confidence intervals (CI's) and p-values are summarized in the table below.
<table>
<tr><th>Insurance Status</th><th>Mortality Adjusted OR (95% CI)</th><th>p-value</th><th>Major Morbidity Adjusted OR (95% CI)</th><th>p-value</th></tr>
<tr><td>Insurance status among patients age>=65

Medicare without Medicaid/Commercial-HMO</td><td>(ref)</td><td>*</td><td>(ref)</td><td>*</td></tr>
<tr><td>Insurance status among patients age>=65

Medicare Medicaid dual eligible</td><td>0.95 (0.87, 1.03)</td><td>0.2178</td><td>1.05 (1.00, 1.09)</td><td>0.0537</td></tr>
<tr><td>Insurance status among patients age>=65

Medicare Commercial-HMO without Medicaid</td><td>0.93 (0.89, 0.97)</td><td>0.0003</td><td>0.97 (0.95, 0.99)</td><td>0.0095</td></tr>
<tr><td>Insurance status among patients age>=65

Commercial-HMO without Medicare</td><td>0.97 (0.90, 1.05)</td><td>0.448</td><td>1.00 (0.96, 1.04)</td><td>0.9403</td></tr>
<tr><td>Insurance status among patients age<65</td><td>(ref)</td><td>*</td><td>(ref)</td><td>*</td></tr>
</table>
</td></tr>
</table>

Topic	Commenter	Comment

Commercial-HMO without Medicare/Medicaid				
Insurance status among patients age<65 Medicare or Medicaid	1.08 (1.01, 1.17)	0.0332	1.16 (1.12, 1.19)	<.0001
Insurance status among patients age<65 None/Self Paid	1.10 (0.98, 1.22)	0.099	1.08 (1.03, 1.13)	0.0022
Insurance status among patients age<65 Other	1.11 (0.96, 1.28)	0.151	1.03 (0.96, 1.09)	0.4283
Black Race	1.01 (0.95, 1.07)	0.8042	1.18 (1.15, 1.22)	<.0001
Hispanic ethnicity	1.00 (0.94, 1.07)	0.9194	1.01 (0.97, 1.04)	0.6444

*Cell intentionally left blank

STS Response to Preliminary Analyses for Measures 3030, 3031, 3032 "Insufficient" ratings for Validity
For each of these composite measures, the Preliminary Analysis states that "Demonstrating a relationship between performance on the overall composite and the composite domains may not be a valid assessment of composite score validity." As in past endorsement and endorsement maintenance reviews for our composite measures, we believe it to be a reasonable approach to use our morbidity and mortality component scores as the "gold standard" against which to demonstrate construct or criterion validity of the composite scores across our three performance categories: "higher-than-expected," "lower-than-expected," and "as-expected" (as defined in 2b1.2 in our composite testing forms). If participants/surgeons with "higher-than-expected" composite ratings have consistently lower risk-adjusted mortality and lower risk-adjusted morbidity compared to participants/surgeons with "lower-than-expected" ratings, we believe the validity of the composite score is demonstrated. The STS has the most sophisticated outcomes data and methodology available for heart surgery, in a database with over 95% penetration across cardiac surgery practices in the U.S.; we therefore have no other "gold standard" against which to compare our results.

Topic	Commenter	Comment
		NQF staff have suggested the use of an external standard – e.g., a measure for a different cardiothoracic surgery procedure – for testing the validity of our composite measures. However, published studies have shown that excellent performance on one surgical procedure does not necessarily correlate with excellent performance on another procedure. We therefore maintain that the approach described above is appropriate for demonstrating the validity of our composite measures. STS Updates to Measure Testing Document Section 1.8 for Measures NQF#s 3030, 3031, 3032 - PART 1 1.8 What were the social risk factors that were available and analyzed? The STS position on inclusion of social risk factors (e.g., SES/SDS/race) as risk model variables is best summarized in this excerpt from our 2018 risk model publication [1]. We describe in detail the controversies about such variables, and how we have attempted to reconcile them: "Whether outcomes measures, and the public reporting and reimbursement programs based on them, should consider socioeconomic status (SES) or sociodemographic factors (eg, race, ethnicity, education, income, payer [eg, Medicare-Medicaid dual eligible status]) is a topic of intense health policy debate. Some argue that in the absence of adjustment for these variables, the outcomes of hospitals that care for a disproportionate percentage of low SES patients will be unfairly disadvantaged, perhaps leading to financial or reputational penalties. Opponents argue that inclusion of SES factors in risk models may "adjust away" disparities in quality of care, and they advocate the use of stratified analyses instead. Also, readily available SES factors have often not demonstrated significant impact on outcomes, perhaps because they are not sufficiently granular or relevant. Finally, even SES proponents agree that these factors make more sense conceptually for some outcomes (eg, readmission) than for others (hospital mortality, complications). Notably, as part of a National Quality Forum pilot project, the STS specifically studied dual eligible status in the STS readmission measure and found minimal impact. In developing the new STS risk models, we avoided these more philosophical and health policy arguments regarding SES adjustment and based our modeling decisions on empiric findings and consideration of the model's primary intended purpose—optimal case mix adjustment. Conceptually, our goal was to adjust for all preoperative factors that are independently and significantly associated with outcomes and that vary across STS participants. For example, race will continue to be in our risk models as it has been previously, but not conceptually as a SES indicator [Note: nor as a surrogate for such factors]. Race has an empiric association with outcomes and has the potential to confound the interpretation of a hospital's outcomes, although we do not know the underlying mechanism (eg, genetic factors, differential effectiveness of certain medications, rates of certain associated diseases such as diabetes and hypertension, and potentially SES for some outcomes such as readmission)."

Topic	Commenter	Comment
		STS is aware of the recent NEJM paper by Vyas and colleagues [2] and has directly communicated with the lead author to explain why race is included in STS models, and to correct several misinterpretations and misrepresentations in this article. Dr. Vyas acknowledged that they included extended quotes from our risk model paper precisely because we were one of the few risk model developers that thoroughly described our rationale for race inclusion, as noted in the excerpt above. Documents produced by NQF [3, 4], the National Academy of Medicine [5-8], the Office of the Assistant Secretary for Planning and Evaluation (Social Risk Factors and Performance Under Medicare's Value-Based Purchasing Programs) [9], and as part of the 21st Century Cures Act legislation [10] are particularly instructive. They summarize the arguments for and against inclusion of SDS/SES/racial adjustment in risk models; context-specific considerations for when they might be appropriate or inappropriate; strategies to avoid the potential adverse unintended consequences of such adjustment; concomitant monitoring for social and racial inequities through stratification; and special approaches for providers who care for high proportions of disadvantaged populations (e.g., payment adjustments, additional resources). Adjustment for SDS/SES/racial factors has generally been regarded as acceptable (e.g., in NQF white papers) when there is both an empirical association AND a plausible conceptual association of the risk variable with an outcome. For example, an SES/SDS/racial risk factor might be appropriate as a risk variable for readmission or mortality risk models, but not for CAUTI (catheter-associated urinary tract infections), CLABSI (central line-associated bloodstream infection), or process measures. For many outcomes, SES/SDS/racial adjustment is warranted to optimize risk model accuracy. For example, recent STS and Duke Clinical Research Institute analyses show that if race variables are excluded from some STS models, the resulting outcomes estimates are markedly different than the actual observed outcomes, and the O/E ratios are significantly different than unity, especially when the models are applied to racial minority subpopulations—in other words, the models are less well calibrated, an essential feature of any risk model. This miscalibration persisted even when an SES/SDS indicator (specifically, dual eligible status) was simultaneously included in the models (i.e., thus addressing the hypothesis that the putative association of race and various outcomes is actually mediated by SES/SDS). Use of risk estimates from such models for patient counseling and shared decision-making would be misleading to patients and would inaccurately portray (and unfairly disadvantage) the risk-adjusted performance of providers, especially those caring for minority populations. Importantly, STS and its analytic center re-estimate risk factor coefficients several times annually, so that any changes in the association of race with outcomes will be implemented in the newest estimates. Further, STS is geocoding it adult cardiac surgery records and will use this information to derive an Area Deprivation Index for all patients with a valid address, thus providing us with the ability to further study the impact of race and SES/SDS using the what is arguably the most sensitive and comprehensive

Topic	Commenter	Comment
		SES/SDS indicator. Finally, STS is aware of the recommendation in the ASPE report of October 2020 that functional status indicators be included in risk models as it may account for some of the impact on outcomes associated that is currently attributed to race. Although STS has a well-documented frailty indicator (5 meter walk test), it has not been collected with sufficient consistency by our participants to allow its inclusion in our models. Accordingly, STS has established a new working group on Frailty/functional indicators whose goal is to develop a new indicator that can be captured for virtually all patients using a combination of history, lab data, functional status, etc. Once developed, it will be added to STS models. Although SDS/SES/racial risk adjustment may be indicated to assure optimal risk model estimates based on current data, it is widely believed that such adjustment could potentially obscure disparities in care. To avoid this potential unintended consequence, most of the national guidance documents cited above recommend that any risk model results that are adjusted for SES/SDS/racial factors also present concomitant results in which outcomes are stratified by the same variables. This is a much more direct and explicit approach to monitor disparities and inequities and has been followed by STS in its risk modeling and performance measures. Please refer to the race-specific disparities data provided for each of the domains (mortality and morbidity) of measure 3030 under question 1b.4 (Importance tab) of the submission form (to be completed by the November submission deadline), which we believe will suffice to comply with this recommendation. STS Updates to Measure Testing Document Section 1.8 for Measures NQF #s 3030, 3031, 3032 - PART 2 1.8 What were the social risk factors that were available and analyzed? *Shahian DM, Jacobs JP, Badhwar V, Kurlansky PA, Furnary AP, Cleveland JC, Jr., et al. The Society of Thoracic Surgeons 2018 Adult Cardiac Surgery Risk Models: Part 1-Background, Design Considerations, and Model Development. Ann Thorac Surg. 2018;105(5):1411-8.* *Vyas DA, Eisenstein LG, Jones DS. Hidden in Plain Sight — Reconsidering the Use of Race Correction in Clinical Algorithms. New England Journal of Medicine. 2020.* *National Quality Forum. Risk adjustment for Socioeconomic Status or other Sociodemographic Factors, accessed at http://www.qualityforum.org/Publications/2014/08/Risk_Adjustment_for_Socioeconomic_Status_or_Other_Sociodemographic_Factors.aspx on June 24, 2020. 2014.* *The National Quality Forum. Evaluation of the NQF Trial Period for Risk Adjustment for Social Risk Factors. January 15, 2017. Available from: https://www.qualityforum.org/Publications/2017/07/Social_Risk_Trial_Final_Report.aspx.* *National Academies of Sciences, Engineering, and Medicine. Accounting for social risk factors in Medicare payment. Washington, DC: The National Academies Press; 2017.*

Topic	Commenter	Comment
		National Academies of Sciences, Engineering, and Medicine. Accounting for social risk factors in Medicare payment: Data. Washington, DC; 2016. *National Academies of Sciences, Engineering, Medicine. Accounting for Social Risk Factors in Medicare Payment: Criteria, Factors, and Methods. Washington, DC: The National Academies Press; 2016.* *National Academies of Sciences, Engineering, Medicine,. Accounting for Social Risk Factors in Medicare Payment: Identifying Social Risk Factors. Washington, DC: The National Academies Press; 2016. 110 p.* *Office of the Assistant Secretary for Planning and Evaluation USDoHaHS. Report to Congress: Social Risk Factors and Performance Under Medicare's Value-Based Purchasing Programs. A Report Required by the Improving Medicare Post-Acute Care Transformation (IMPACT) Act of 2014. Washington, DC; 2016.* *114th Congress of the United States. 21st Century Cures Act (Public Law 114–255). Washington, DC; 2016.*
STS Mitral Valve Repair/Replacement (MVRR) Composite Score	The Society of Thoracic Surgeons	STS Response to Preliminary Analyses for Measures 3030, 3031, 3032 "Insufficient" ratings for Validity For each of these composite measures, the Preliminary Analysis states that "Demonstrating a relationship between performance on the overall composite and the composite domains may not be a valid assessment of composite score validity." As in past endorsement and endorsement maintenance reviews for our composite measures, we believe it to be a reasonable approach to use our morbidity and mortality component scores as the "gold standard" against which to demonstrate construct or criterion validity of the composite scores across our three performance categories: "higher-than-expected," "lower-than-expected," and "as-expected" (as defined in 2b1.2 in our composite testing forms). If participants/surgeons with "higher-than-expected" composite ratings have consistently lower risk-adjusted mortality and lower risk-adjusted morbidity compared to participants/surgeons with "lower-than-expected" ratings, we believe the validity of the composite score is demonstrated. The STS has the most sophisticated outcomes data and methodology available for heart surgery, in a database with over 95% penetration across cardiac surgery practices in the U.S.; we therefore have no other "gold standard" against which to compare our results. NQF staff have suggested the use of an external standard – e.g., a measure for a different cardiothoracic surgery procedure – for testing the validity of our composite measures. However, published studies have shown that excellent performance on one surgical procedure does not necessarily correlate with excellent performance on another procedure. We therefore maintain that the approach described above is appropriate for demonstrating the validity of our composite measures. STS Updates to Measure Testing Document Section 1.8 for Measures NQF#s 3030, 3031, 3032 - PART 1 1.8 What were the social risk factors that were available and analyzed?

Topic	Commenter	Comment
		The STS position on inclusion of social risk factors (e.g., SES/SDS/race) as risk model variables is best summarized in this excerpt from our 2018 risk model publication [1]. We describe in detail the controversies about such variables, and how we have attempted to reconcile them: "Whether outcomes measures, and the public reporting and reimbursement programs based on them, should consider socioeconomic status (SES) or sociodemographic factors (eg, race, ethnicity, education, income, payer [eg, Medicare-Medicaid dual eligible status]) is a topic of intense health policy debate. Some argue that in the absence of adjustment for these variables, the outcomes of hospitals that care for a disproportionate percentage of low SES patients will be unfairly disadvantaged, perhaps leading to financial or reputational penalties. Opponents argue that inclusion of SES factors in risk models may "adjust away" disparities in quality of care, and they advocate the use of stratified analyses instead. Also, readily available SES factors have often not demonstrated significant impact on outcomes, perhaps because they are not sufficiently granular or relevant. Finally, even SES proponents agree that these factors make more sense conceptually for some outcomes (eg, readmission) than for others (hospital mortality, complications). Notably, as part of a National Quality Forum pilot project, the STS specifically studied dual eligible status in the STS readmission measure and found minimal impact. In developing the new STS risk models, we avoided these more philosophical and health policy arguments regarding SES adjustment and based our modeling decisions on empiric findings and consideration of the model's primary intended purpose—optimal case mix adjustment. Conceptually, our goal was to adjust for all preoperative factors that are independently and significantly associated with outcomes and that vary across STS participants. For example, race will continue to be in our risk models as it has been previously, but not conceptually as a SES indicator [Note: nor as a surrogate for such factors]. Race has an empiric association with outcomes and has the potential to confound the interpretation of a hospital's outcomes, although we do not know the underlying mechanism (eg, genetic factors, differential effectiveness of certain medications, rates of certain associated diseases such as diabetes and hypertension, and potentially SES for some outcomes such as readmission)." STS is aware of the recent NEJM paper by Vyas and colleagues [2] and has directly communicated with the lead author to explain why race is included in STS models, and to correct several misinterpretations and misrepresentations in this article. Dr. Vyas acknowledged that they included extended quotes from our risk model paper precisely because we were one of the few risk model developers that thoroughly described our rationale for race inclusion, as noted in the excerpt above. Documents produced by NQF [3, 4], the National Academy of Medicine [5-8], the Office of the Assistant Secretary for Planning and Evaluation (Social Risk Factors and Performance Under Medicare's Value-Based Purchasing Programs) [9], and as part of the 21st Century Cures Act legislation [10] are particularly instructive. They summarize the arguments for and against inclusion of SDS/SES/racial adjustment in risk models; context-specific considerations for

Topic	Commenter	Comment
		when they might be appropriate or inappropriate; strategies to avoid the potential adverse unintended consequences of such adjustment; concomitant monitoring for social and racial inequities through stratification; and special approaches for providers who care for high proportions of disadvantaged populations (e.g., payment adjustments, additional resources). Adjustment for SDS/SES/racial factors has generally been regarded as acceptable (e.g., in NQF white papers) when there is both an empirical association AND a plausible conceptual association of the risk variable with an outcome. For example, an SES/SDS/racial risk factor might be appropriate as a risk variable for readmission or mortality risk models, but not for CAUTI (catheter-associated urinary tract infections), CLABSI (central line-associated bloodstream infection), or process measures. For many outcomes, SES/SDS/racial adjustment is warranted to optimize risk model accuracy. For example, recent STS and Duke Clinical Research Institute analyses show that if race variables are excluded from some STS models, the resulting outcomes estimates are markedly different than the actual observed outcomes, and the O/E ratios are significantly different than unity, especially when the models are applied to racial minority subpopulations—in other words, the models are less well calibrated, an essential feature of any risk model. This miscalibration persisted even when an SES/SDS indicator (specifically, dual eligible status) was simultaneously included in the models (i.e., thus addressing the hypothesis that the putative association of race and various outcomes is actually mediated by SES/SDS). Use of risk estimates from such models for patient counseling and shared decision-making would be misleading to patients and would inaccurately portray (and unfairly disadvantage) the risk-adjusted performance of providers, especially those caring for minority populations. Importantly, STS and its analytic center re-estimate risk factor coefficients several times annually, so that any changes in the association of race with outcomes will be implemented in the newest estimates. Further, STS is geocoding it adult cardiac surgery records and will use this information to derive an Area Deprivation Index for all patients with a valid address, thus providing us with the ability to further study the impact of race and SES/SDS using the what is arguably the most sensitive and comprehensive SES/SDS indicator. Finally, STS is aware of the recommendation in the ASPE report of October 2020 that functional status indicators be included in risk models as it may account for some of the impact on outcomes associated that is currently attributed to race. Although STS has a well-documented frailty indicator (5 meter walk test), it has not been collected with sufficient consistency by our participants to allow its inclusion in our models. Accordingly, STS has established a new working group on Frailty/functional indicators whose goal is to develop a new indicator that can be captured for virtually all patients using a combination of history, lab data, functional status, etc. Once developed, it will be added to STS models. Although SDS/SES/racial risk adjustment may be indicated to assure optimal risk model estimates based on current data, it is widely believed that such adjustment could potentially obscure disparities in care. To avoid this potential unintended consequence, most of the national guidance documents cited above recommend that any risk model

Topic	Commenter	Comment
		results that are adjusted for SES/SDS/racial factors also present concomitant results in which outcomes are stratified by the same variables. This is a much more direct and explicit approach to monitor disparities and inequities and has been followed by STS in its risk modeling and performance measures. Please refer to the race-specific disparities data provided for each of the domains (mortality and morbidity) of measure 3030 under question 1b.4 (Importance tab) of the submission form (to be completed by the November submission deadline), which we believe will suffice to comply with this recommendation. STS Updates to Measure Testing Document Section 1.8 for Measures NQF #s 3030, 3031, 3032 - PART 2 1.8 What were the social risk factors that were available and analyzed? 1. Shahian DM, Jacobs JP, Badhwar V, Kurlansky PA, Furnary AP, Cleveland JC, Jr., et al. The Society of Thoracic Surgeons 2018 Adult Cardiac Surgery Risk Models: Part 1-Background, Design Considerations, and Model Development. Ann Thorac Surg. 2018;105(5):1411-8. 2. Vyas DA, Eisenstein LG, Jones DS. Hidden in Plain Sight — Reconsidering the Use of Race Correction in Clinical Algorithms. New England Journal of Medicine. 2020. 3. National Quality Forum. Risk adjustment for Socioeconomic Status or other Sociodemographic Factors, accessed at http://www.qualityforum.org/Publications/2014/08/Risk_Adjustment_for_Socioeconomic_Status_or_Other_Sociodemographic_Factors.aspx on June 24, 2020. 2014. 4. The National Quality Forum. Evaluation of the NQF Trial Period for Risk Adjustment for Social Risk Factors. January 15, 2017. Available from: https://www.qualityforum.org/Publications/2017/07/Social_Risk_Trial_Final_Report.aspx. 5. National Academies of Sciences, Engineering, and Medicine. Accounting for social risk factors in Medicare payment. Washington, DC: The National Academies Press; 2017. 6. National Academies of Sciences, Engineering, and Medicine. Accounting for social risk factors in Medicare payment: Data. Washington, DC; 2016. 7. National Academies of Sciences, Engineering, Medicine. Accounting for Social Risk Factors in Medicare Payment: Criteria, Factors, and Methods. Washington, DC: The National Academies Press; 2016. 8. National Academies of Sciences, Engineering, Medicine,. Accounting for Social Risk Factors in Medicare Payment: Identifying Social Risk Factors. Washington, DC: The National Academies Press; 2016. 110 p. 9. Office of the Assistant Secretary for Planning and Evaluation USDoHaHS. Report to Congress: Social Risk Factors and Performance Under Medicare's Value-Based Purchasing Programs. A Report Required by the Improving Medicare Post-Acute Care Transformation (IMPACT) Act of 2014. Washington, DC; 2016.

Topic	Commenter	Comment
		10. 114th Congress of the United States. 21st Century Cures Act (Public Law 114–255). Washington, DC; 2016.
STS Mitral Valve Repair/Replacement (MVRR) + Coronary Artery Bypass Graft (CABG) Composite Score	The Society of Thoracic Surgeons	STS Response to Preliminary Analyses for Measures 3030, 3031, 3032 "Insufficient" ratings for Validity For each of these composite measures, the Preliminary Analysis states that "Demonstrating a relationship between performance on the overall composite and the composite domains may not be a valid assessment of composite score validity." As in past endorsement and endorsement maintenance reviews for our composite measures, we believe it to be a reasonable approach to use our morbidity and mortality component scores as the "gold standard" against which to demonstrate construct or criterion validity of the composite scores across our three performance categories: "higher-than-expected," "lower-than-expected," and "as-expected" (as defined in 2b1.2 in our composite testing forms). If participants/surgeons with "higher-than-expected" composite ratings have consistently lower risk-adjusted mortality and lower risk-adjusted morbidity compared to participants/surgeons with "lower-than-expected" ratings, we believe the validity of the composite score is demonstrated. The STS has the most sophisticated outcomes data and methodology available for heart surgery, in a database with over 95% penetration across cardiac surgery practices in the U.S.; we therefore have no other "gold standard" against which to compare our results. NQF staff have suggested the use of an external standard – e.g., a measure for a different cardiothoracic surgery procedure – for testing the validity of our composite measures. However, published studies have shown that excellent performance on one surgical procedure does not necessarily correlate with excellent performance on another procedure. We therefore maintain that the approach described above is appropriate for demonstrating the validity of our composite measures. STS Updates to Measure Testing Document Section 1.8 for Measures NQF#s 3030, 3031, 3032 - PART 1 1.8 What were the social risk factors that were available and analyzed? The STS position on inclusion of social risk factors (e.g., SES/SDS/race) as risk model variables is best summarized in this excerpt from our 2018 risk model publication [1]. We describe in detail the controversies about such variables, and how we have attempted to reconcile them: "Whether outcomes measures, and the public reporting and reimbursement programs based on them, should consider socioeconomic status (SES) or sociodemographic factors (eg, race, ethnicity, education, income, payer [eg, Medicare-Medicaid dual eligible status]) is a topic of intense health policy debate. Some argue that in the absence of adjustment for these variables, the outcomes of hospitals that care for a disproportionate percentage of low SES patients will be unfairly disadvantaged, perhaps leading to financial or reputational penalties. Opponents argue that inclusion of SES factors in risk models may "adjust away" disparities in quality of care, and they advocate the use of stratified analyses instead. Also, readily available SES factors have often not demonstrated significant impact on

Topic	Commenter	Comment
		outcomes, perhaps because they are not sufficiently granular or relevant. Finally, even SES proponents agree that these factors make more sense conceptually for some outcomes (eg, readmission) than for others (hospital mortality, complications). Notably, as part of a National Quality Forum pilot project, the STS specifically studied dual eligible status in the STS readmission measure and found minimal impact. In developing the new STS risk models, we avoided these more philosophical and health policy arguments regarding SES adjustment and based our modeling decisions on empiric findings and consideration of the model's primary intended purpose—optimal case mix adjustment. Conceptually, our goal was to adjust for all preoperative factors that are independently and significantly associated with outcomes and that vary across STS participants. For example, race will continue to be in our risk models as it has been previously, but not conceptually as a SES indicator [Note: nor as a surrogate for such factors]. Race has an empiric association with outcomes and has the potential to confound the interpretation of a hospital's outcomes, although we do not know the underlying mechanism (eg, genetic factors, differential effectiveness of certain medications, rates of certain associated diseases such as diabetes and hypertension, and potentially SES for some outcomes such as readmission)." STS is aware of the recent NEJM paper by Vyas and colleagues [2] and has directly communicated with the lead author to explain why race is included in STS models, and to correct several misinterpretations and misrepresentations in this article. Dr. Vyas acknowledged that they included extended quotes from our risk model paper precisely because we were one of the few risk model developers that thoroughly described our rationale for race inclusion, as noted in the excerpt above. Documents produced by NQF [3, 4], the National Academy of Medicine [5-8], the Office of the Assistant Secretary for Planning and Evaluation (Social Risk Factors and Performance Under Medicare's Value-Based Purchasing Programs) [9], and as part of the 21st Century Cures Act legislation [10] are particularly instructive. They summarize the arguments for and against inclusion of SDS/SES/racial adjustment in risk models; context-specific considerations for when they might be appropriate or inappropriate; strategies to avoid the potential adverse unintended consequences of such adjustment; concomitant monitoring for social and racial inequities through stratification; and special approaches for providers who care for high proportions of disadvantaged populations (e.g., payment adjustments, additional resources). Adjustment for SDS/SES/racial factors has generally been regarded as acceptable (e.g., in NQF white papers) when there is both an empirical association AND a plausible conceptual association of the risk variable with an outcome. For example, an SES/SDS/racial risk factor might be appropriate as a risk variable for readmission or mortality risk models, but not for CAUTI (catheter-associated urinary tract infections), CLABSI (central line-associated bloodstream infection), or process measures.

Topic	Commenter	Comment
		For many outcomes, SES/SDS/racial adjustment is warranted to optimize risk model accuracy. For example, recent STS and Duke Clinical Research Institute analyses show that if race variables are excluded from some STS models, the resulting outcomes estimates are markedly different than the actual observed outcomes, and the O/E ratios are significantly different than unity, especially when the models are applied to racial minority subpopulations—in other words, the models are less well calibrated, an essential feature of any risk model. This miscalibration persisted even when an SES/SDS indicator (specifically, dual eligible status) was simultaneously included in the models (i.e., thus addressing the hypothesis that the putative association of race and various outcomes is actually mediated by SES/SDS). Use of risk estimates from such models for patient counseling and shared decision-making would be misleading to patients and would inaccurately portray (and unfairly disadvantage) the risk-adjusted performance of providers, especially those caring for minority populations. Importantly, STS and its analytic center re-estimate risk factor coefficients several times annually, so that any changes in the association of race with outcomes will be implemented in the newest estimates. Further, STS is geocoding it adult cardiac surgery records and will use this information to derive an Area Deprivation Index for all patients with a valid address, thus providing us with the ability to further study the impact of race and SES/SDS using the what is arguably the most sensitive and comprehensive SES/SDS indicator. Finally, STS is aware of the recommendation in the ASPE report of October 2020 that functional status indicators be included in risk models as it may account for some of the impact on outcomes associated that is currently attributed to race. Although STS has a well-documented frailty indicator (5 meter walk test), it has not been collected with sufficient consistency by our participants to allow its inclusion in our models. Accordingly, STS has established a new working group on Frailty/functional indicators whose goal is to develop a new indicator that can be captured for virtually all patients using a combination of history, lab data, functional status, etc. Once developed, it will be added to STS models. Although SDS/SES/racial risk adjustment may be indicated to assure optimal risk model estimates based on current data, it is widely believed that such adjustment could potentially obscure disparities in care. To avoid this potential unintended consequence, most of the national guidance documents cited above recommend that any risk model results that are adjusted for SES/SDS/racial factors also present concomitant results in which outcomes are stratified by the same variables. This is a much more direct and explicit approach to monitor disparities and inequities and has been followed by STS in its risk modeling and performance measures. Please refer to the race-specific disparities data provided for each of the domains (mortality and morbidity) of measure 3030 under question 1b.4 (Importance tab) of the submission form (to be completed by the November submission deadline), which we believe will suffice to comply with this recommendation. STS Updates to Measure Testing Document Section 1.8 for Measures NQF #s 3030, 3031, 3032 - PART 2

Topic	Commenter	Comment
		1.8 What were the social risk factors that were available and analyzed? 1. Shahian DM, Jacobs JP, Badhwar V, Kurlansky PA, Furnary AP, Cleveland JC, Jr., et al. The Society of Thoracic Surgeons 2018 Adult Cardiac Surgery Risk Models: Part 1-Background, Design Considerations, and Model Development. Ann Thorac Surg. 2018;105(5):1411-8. 2. Vyas DA, Eisenstein LG, Jones DS. Hidden in Plain Sight — Reconsidering the Use of Race Correction in Clinical Algorithms. New England Journal of Medicine. 2020. 3. National Quality Forum. Risk adjustment for Socioeconomic Status or other Sociodemographic Factors, accessed at http://www.qualityforum.org/Publications/2014/08/Risk_Adjustment_for_Socioeconomic_Status_or_Other_Sociodemographic_Factors.aspx on June 24, 2020. 2014. 4. The National Quality Forum. Evaluation of the NQF Trial Period for Risk Adjustment for Social Risk Factors. January 15, 2017. Available from: https://www.qualityforum.org/Publications/2017/07/Social_Risk_Trial_Final_Report.aspx. 5. National Academies of Sciences, Engineering, and Medicine. Accounting for social risk factors in Medicare payment. Washington, DC: The National Academies Press; 2017. 6. National Academies of Sciences, Engineering, and Medicine. Accounting for social risk factors in Medicare payment: Data. Washington, DC; 2016. 7. National Academies of Sciences, Engineering, Medicine. Accounting for Social Risk Factors in Medicare Payment: Criteria, Factors, and Methods. Washington, DC: The National Academies Press; 2016. 8. National Academies of Sciences, Engineering, Medicine,. Accounting for Social Risk Factors in Medicare Payment: Identifying Social Risk Factors. Washington, DC: The National Academies Press; 2016. 110 p. 9. Office of the Assistant Secretary for Planning and Evaluation USDoHaHS. Report to Congress: Social Risk Factors and Performance Under Medicare's Value-Based Purchasing Programs. A Report Required by the Improving Medicare Post-Acute Care Transformation (IMPACT) Act of 2014. Washington, DC; 2016. 10. 114th Congress of the United States. 21st Century Cures Act (Public Law 114–255). Washington, DC; 2016.

National Quality Forum
1099 14th Street NW, Suite 500
Washington, DC 20005
http://www.qualityforum.org