NATIONAL QUALITY FORUM
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Memo

June 29, 2021

To: Consensus Standards Approval Committee (CSAC)

From: Cardiovascular Project Team

Re: Cardiovascular Fall 2020 Measures

CSAC Action Required

The CSAC will review recommendations from the Cardiovascular 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. **Cardiovascular 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

Heart disease is a significant burden in the United States (U.S.), leading to approximately one in four deaths per year.[1] In addition to being the leading cause of death in the U.S., heart disease is the highest direct health expenditure in the U.S.[2] Considering the effect of cardiovascular disease (CVD), measures that assess clinical care performance and patient outcomes are critical to reducing its negative impact.

The measures in the Cardiovascular portfolio have been grouped into various topic areas related to cardiovascular health. These topic areas include primary prevention and screening, coronary artery disease (CAD), ischemic vascular disease (IVD), acute myocardial infarction (AMI), cardiac catheterization, percutaneous catheterization intervention (PCI), heart failure (HF), rhythm disorders, implantable cardioverter-defibrillators (ICDs), cardiac imaging, cardiac rehabilitation, and high blood pressure.

For this project the Cardiovascular Standing Committee evaluated four measures undergoing maintenance endorsement consideration against the National Quality Forum's (NQF) evaluation criteria.

For this project, the Cardiovascular Standing Committee evaluated two measures undergoing maintenance review against the National Quality Forum's (NQF) standard evaluation criteria. The Standing Committee recommended both measures for endorsement. The recommended measures are listed below:

- **NQF #0229** Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization ()/Yale Center for Outcomes Research & Evaluation (CORE)/Centers for Medicare & Medicaid Services (CMS)

- **NQF #0230** Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Acute Myocardial Infarction (AMI) Hospitalization (Yale CORE/CMS)

Draft Report

The Cardiovascular fall 2020 draft report presents the results of the evaluation of two measures considered under the Consensus Development Process (CDP). Both are recommended for endorsement.

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

Measures	Maintenance	New	Total
Measures under review	2	0	2
Measures recommended for endorsement	2	0	2
Measures not recommended for endorsement	0	0	0
Reasons for not recommending	Importance – 0 Scientific Acceptability -0 Use - 0 Overall - 0 Competing Measure – 0	Importance – 0 Scientific Acceptability -0 Use - 0 Overall - 0 Competing Measure – 0	0

CSAC Action Required

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

Measures Recommended for Endorsement

- **NQF #0229** Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization (Yale CORE/CMS)

Overall Suitability for Endorsement (denominator = 18): Yes-18; No-0

- **NQF #0230** Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Acute Myocardial Infarction (AMI) Hospitalization (Yale CORE/CMS)

Overall Suitability for Endorsement (denominator = 17): Yes-17; No-0

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Comments and Their Disposition

NQF received five comments from three organizations (including two member organizations) and individuals 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 Cardiovascular project webpage.

Comment Themes 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 reviewed the content of the comments and were in consensus that no new issues or information was presented in the post-meeting comments.

No comments received required a Standing Committee response.

Themed Comments

Two major themes were identified in the post-evaluation comments, as follows:

1. Reliability testing thresholds
2. Social risk adjustment

Theme 1 – Reliability Testing Thresholds

Two commenters expressed concern with the reliability testing results for NQF #0229 and NQF #0230, particularly at lower case counts. These commenters stated that the developer should increase the minimum sample size until a reliability threshold of 0.70 is met for all allowed case counts.

> **Measure Steward/Developer Response:**
> 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 0.428. The split-sample reliability score represents the lower bound of estimate of the true measure reliability.
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> We also calculated the signal-to-noise reliability score for each hospital with at least 25 admissions. The median reliability score was 0.59, the 25th and 75th percentiles were 0.41 and 0.72, respectively.
>
> REFERENCE
>
> 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.

Proposed Committee Response:
Both measures were reviewed by the NQF Scientific Methods Panel (SMP), and both received a moderate rating for reliability. It is worth noting that reliability thresholds are an ongoing topic of discussion for the SMP and at this time it has not adopted a hard threshold for reliability ratings. Both the SMP and the Committee noted that the reliability for low case counts is not ideal but is acceptable.

Theme 2 – Social Risk Adjustment

One commenter expressed concern with the developer's decision to not include social risk factors in its risk adjustment for NQF #0229 and NQF #0230. Both developers stated that 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) was flawed due to its lack of guidance on how to handle risk adjustment for measures used in more than one program.

Measure Steward/Developer Response:
While there is a conceptual pathway by which patients with social risk factors could experience worse outcomes, the empiric evidence does not support risk adjustment at the hospital level.

As presented in the testing attachment of the NQF submission for this measure, our main empiric finding is that adjusting for social risk has little impact on measure scores – mean changes in measure scores are small, and correlations between measure scores calculated with and without adjustment for social risk are near 1.

In additional analyses we have shown that there is little correlation, or even a negative correlation between measure scores and hospitals' proportion of patients with social risk (DE and low AHRQ SES) across all hospitals. Furthermore, for hospitals that treat the highest proportion of patients with social risk (those in the fifth quintile for the proportion of patients with socials risk) we see either no significant correlation (for the dual eligibility variable) or a weak negative correlation (for the low AHRQ SES variable).

Given these empiric findings, ASPE's recommendation to not risk adjust publicly reported quality measures for social risk (ASPE, 2020), and complex pathways which could explain the relationship between SRFs and mortality (and do not all support risk-adjustment), CMS chose to not incorporate SRF variables in this measure.

VARIATION IN MEASURE SCORE

The analyses submitting with our testing attachment show meaningful differences in performance and therefore substantial opportunity for improvement. The range in performance is 8.8%-18.1% with a mean of 12.7%.

Please note that performance categories are an implementation issue – CMS chooses to identify outliers based on 95% interval estimates, akin to 95% confidence intervals, which is a conservative approach to identifying performance outliers. We note that the median odds ratio suggests a meaningful increase in the risk of mortality if a patient is admitted with AMI at a higher risk hospital compared to a lower risk hospital. A value of 1.19 indicates that a patient

has a 19% increase in the odds of mortality at higher-risk hospital compared to a lower-risk hospital, indicating that the measure can identify meaningful differences in hospital performance.

REFERENCE

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.

Proposed Committee Response:
Both measures were reviewed by the SMP, and both received a moderate rating for validity. The Committee discussed the risk model and reviewed the results the developer provided for its testing of dual eligible status and AHRQ SES Index. For NQF #0229, results were negatively correlated with dual eligibility. Adjusting for this factor would result in a penalty to providers with a higher proportion of dual-eligible patients.

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 expressions of support or non-support.

Removal of NQF Endorsement

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

Measure	Measure Description	Reason for Removal of Endorsement
NQF #0730 Acute Myocardial Infarction (AMI) Mortality Rate (IQI 15)	In-hospital deaths per 1,000 hospital discharges with acute myocardial infarction (AMI) as a principal diagnosis for patients ages 18 years and older. Excludes cases in hospice care at admission, obstetric discharges, and transfers to another hospital.	Developer is not seeking re-endorsement.
NQF #0358 Heart Failure Mortality Rate (IQI 16)	In-hospital deaths per 1,000 hospital discharges with heart failure as a principal diagnosis for patients ages 18 years and older. Excludes obstetric discharges and transfers to another hospital.	Developer is not seeking re-endorsement.

References

[1] Murphy S. Mortality in the United States, 2017. *NCHS Data Brief*. 2018;328:1-8.

[2] Benjamin E. Heart Disease and Stroke Statistics – 2017 Update: A Report From the American Heart Association. *Circulation.* 2017;135:e146-e603.

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.	No	*
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.	No	*

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Appendix B: Measures Not Recommended for Endorsement

The Cardiovascular Standing Committee recommends all candidate measures for endorsement.

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. Quorum (17 out of 25 Standing Committee members) was met and maintained for the entirety of the February 9, 2021 measure evaluation meeting.

Measures Recommended

NQF #0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Submission

Description: The measure estimates a hospital-level 30-day, all-cause, risk-standardized mortality rate for patients discharged from the hospital with a principal diagnosis of HF. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. 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.

Numerator Statement: The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients 65 and older hospitalized with a principal diagnosis of HF.

Denominator Statement: This claims-based measure is used for a cohort of patients aged 65 years or older.

The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of HF 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.

Exclusions: The mortality measures exclude index admissions for patients in the following categories:

1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility
2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data
3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission
4. Discharged against medical advice (AMA)
5. Patients undergoing left ventricular assist device (LVAD) implantation or heart transplantation during an index admission or who have a history of LVAD or heart transplant in the preceding year

For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort for each year.

Adjustment/Stratification: Statistical Risk Model

Level of Analysis: Facility

Setting of Care: Inpatient/Hospital

Type of Measure: Outcome

Data Source: Claims, Enrollment Data, Other

Measure Steward: Centers for Medicare & Medicaid Services

STANDING COMMITTEE MEETING February 9, 2021

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

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

1a. Evidence: **Pass-19; No Pass-0 (denominator = 19)**; 1b. Performance Gap: **H-4; M-15; L-0; I-0 (denominator = 19)**

Rationale:

- As part of the previous submission in 2015, the developer provided numerous studies demonstrating the following observations: (1) Appropriate and timely treatment for HF patients is tied to a reduction in risk of mortality within 30 days of hospital admission; (2) Trials of interventions that improve patient education upon discharge have been shown to improve survival for HF patients; and (3) Hospitals have been able to reduce mortality rates through these quality-of-care initiatives.
- In this submission, the developer provided information on the lifetime risk, prevalence, and cost of HF. The developer also provided new evidence tying coordinated care for HF patients to reductions in all-cause mortality after HF admission. The additional evidence provided strengthens support for the previous conclusions in 2015.
- The Standing Committee noted that the evidence provided is directionally the same, yet stronger than the evidence submitted during the previous endorsement cycle and concluded that the evidence clearly demonstrates actions that providers can take to reduce HF mortality.
- The developer provided three-year, hospital-level, risk-standardized mortality rates (RSMRs) using Medicare claims and VA administrative data (1,081,897 admissions from 4,637 hospitals) from July 1, 2016, to June 30, 2019. The RSMRs had a mean of 11.4%, a standard deviation of 1.6, and a range from 5.3 – 18.5%. The median risk-standardized rate was also 11.4%.
- The developer also provided these results stratified into quartiles by proportion of dual-eligible patients and by proportion of the Agency for Healthcare Research and Quality's (AHRQ) Socio-Economic Status (SES) Index Scores. Facilities with the highest proportion of dual-eligible patients performed slightly better than those with the lowest proportion. There were no differences in results between the lowest and highest quartiles of AHRQ SES Index Score.
- The Standing Committee agreed this is an important focus area of measurement and observed that the measure still has a performance gap and variation in results with room for improvement.
  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: **Accepted Scientific Methods Panel (SMP) Rating (Moderate)**; 2b. Validity: **Accepted Scientific Methods Panel (SMP) Rating (Moderate)**

Rationale:

- This measure was reviewed by the 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 method (i.e., test-retest), and then estimated the facility-level reliability (signal-to-noise reliability).
    o Using the Spearman-Brown prediction formula, the developers estimated that the agreement between the two independent assessments of the RSMR for each hospital with 25 admissions was 0.632.
    o The median reliability (signal-to-noise) score was 0.79, ranging from 0.34 to 0.99, and the 25th and 75th percentiles were 0.58 and 0.9, respectively, for the signal-to-noise testing for each hospital with at least 25 admissions.
- Most SMP members agreed that the reliability tests were appropriate and that the results show moderate reliability. One SMP member voiced concerns about low reliability for the bottom 10% hospitals in the signal-to-noise ratio analysis (r<0.44) and split-sample reliability (0.63), stating this was acceptable but not ideal.

- In response to the concerns and questions raised by the SMP, the developer clarified that the 25-case minimum is established by CMS and aligned across all mortality and readmission measures for public reporting.
- The SMP rated this measure moderate for reliability: H-4; M-4; L-3; I-0
- The Standing Committee expressed no concerns regarding the reliability of the measure and voted unanimously to accept the SMP's rating: Yes-19; No-0 (denominator = 19)
- The developers conducted validity testing at the performance measure score level, including both empirical validity testing (by comparing CMS' Star-Rating mortality scores and Star-Rating summary scores), and systematic assessment of face validity.
    - The correlation between HF RSMRs and the Star-Rating mortality score was -0.676, which suggests that hospitals with lower HF RSMRs are more likely to have higher Star-Rating mortality scores.
    - The correlation between HF RSMRs and the Star-Rating summary score was -0.114, which suggests that hospitals with lower HF RSMRs are more likely to have higher Star-Rating summary scores.
- The risk model includes 24 clinical and demographic risk factors. Dual eligibility and AHRQ SES index were tested but not included in the final model.
- The developers noted that the addition of any of these variables into the hierarchical model has little to no effect on hospital performance (c-statistic remains 0.73). The developer showed that there was little impact on measure scores as gauged by the difference between measure scores calculated with versus without the social risk factors in the model.
- The SMP rated this measure moderate for validity: H-0; M-6; L-1; I-1
- A Standing Committee member asked whether patterns in admissions could account for part of the variation in performance, stating that some areas or providers may only admit severely ill patients, resulting in a higher mortality rate among those admissions. The developer responded by explaining that they have not performed that analysis but could include it in their next re-evaluation list.
- The Standing Committee urged the developer to consider the extensive discussions of the SMP regarding the inclusion of social risk factors in risk adjustment and the circular nature of the validity analyses using the Medicare Star Ratings, noting that NQF #0229 is included as part of the star rating calculation.
- The developer reminded the Standing Committee that results on this measure are negatively correlated with dual eligibility, meaning that dual-eligible patients have lower mortality rates than non-dual-eligible patients. They noted that adjusting for dual eligibility would result in a penalty to providers with a higher proportion of dual-eligible patients.
- The Standing Committee voted unanimously to accept the SMP's validity rating: Yes-19; No-0 (denominator = 19)

3. **Feasibility: H-13; M-6; L-0; I-0 (denominator = 19)**

(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 of 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 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-8; M-9; L-1; 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 the 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.
- A Standing Committee member asked how patients and patient advocates can use this measure to make care decisions, noting that if a patient is transported via ambulance, they may not have a choice of hospital. The developer noted that as part of the CMS Care Compare program, results of this measure are publicly available for use by the public and groups that publish hospital ratings. Other Standing Committee members shared that leadership in their organizations pays close attention to the results and implements corrective action, as necessary.
- The Standing Committee noted improvement in the measure results over time and no significant unintended consequences.

5. **Related and Competing Measures**

- This measure is related to the following measures:
    - NQF #0330 Hospital 30-Day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Heart Failure (HF) Hospitalization
    - NQF #0358 Heart Failure Mortality Rate (IQI 16)
    - NQF #0468 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Pneumonia Hospitalization
    - NQF #1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
    - NQF #1893 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Chronic Obstructive Pulmonary Disease (COPD) Hospitalization
    - NQF #3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
    - NQF #3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
- The developer stated that the measure specifications are harmonized to the extent possible. They noted that they focused on related outcome measures (mortality and readmissions) 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 May 27, 2021 and did not raise any questions or concerns.

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

7. **Public and Member Comment**

- NQF received three comments on this measure. The commenters raised concerns regarding the measure's reliability, particularly at lower case counts, the decision to not include social risk adjustment. These concerns led the commenters to not support the Committee's recommendation for re-endorsement.

    Committee Response:

    Both measures were reviewed by the SMP, and both received a moderate rating for validity. The Committee discussed the risk model and reviewed the results the developer provided for its testing of dual eligible status and AHRQ SES Index. For NQF #0229, results were negatively correlated with dual eligibility. Adjusting for this factor would result in a penalty to providers with a higher proportion of dual-eligible patients.

Measure Steward/Developer Response:

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 0.428. 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 0.59, the 25th and 75th percentiles were 0.41 and 0.72, respectively.

While there is a conceptual pathway by which patients with social risk factors could experience worse outcomes, the empiric evidence does not support risk adjustment at the hospital level.

As presented in the testing attachment of the NQF submission for this measure, our main empiric finding is that adjusting for social risk has little impact on measure scores – mean changes in measure scores are small, and correlations between measure scores calculated with and without adjustment for social risk are near 1.

In additional analyses we have shown that there is little correlation, or even a negative correlation between measure scores and hospitals' proportion of patients with social risk (DE and low AHRQ SES) across all hospitals. Furthermore, for hospitals that treat the highest proportion of patients with social risk (those in the fifth quintile for the proportion of patients with socials risk) we see either no significant correlation (for the dual eligibility variable) or a weak negative correlation (for the low AHRQ SES variable). Given these empiric findings, ASPE's recommendation to not risk adjust publicly reported quality measures for social risk (ASPE, 2020), and complex pathways which could explain the relationship between SRFs and mortality (and do not all support risk-adjustment), CMS chose to not incorporate SRF variables in this measure.

VARIATION IN MEASURE SCORE

The analyses submitting with our testing attachment show meaningful differences in performance and therefore substantial opportunity for improvement. The range in performance is 8.8%-18.1% with a mean of 12.7%.

Please note that performance categories are an implementation issue – CMS chooses to identify outliers based on 95% interval estimates, akin to 95% confidence intervals, which is a conservative approach to identifying performance outliers. We note that the median odds ratio suggests a meaningful increase in the risk of mortality if a patient is admitted with AMI at a higher risk hospital compared to a lower risk hospital. A value of 1.19 indicates that a patient has a 19% increase in the odds of mortality at higher-risk hospital compared to a lower-risk hospital, indicating that the measure can identify meaningful differences in hospital performance.

- One commenter raised a concern that the exclusions are inadequate (patients receiving palliative care or advanced therapies are not excluded) and questioned the adequacy of the risk-adjustment model.

Measure Steward/Developer Response:

We thank the commenters for their input.

CMS's 30-day heart failure mortality measure is a highly credible measure, having been originally NQF endorsed in 2007, and re-endorsed several times since then. In addition, in the current round of NQF endorsement, experts on both the Scientific Methods Panel and the Cardiovascular Standing Committee voted in favor of its scientific acceptability. The HF mortality measure's specifications are intentionally aligned with the HF readmission measure, so that the mortality measure can serve as a balancing measure for the unintended consequences of measuring readmission.

However, we understand and appreciate the commenters concerns, and we address them separately below.

The commenter suggested that the measure include an exclusion not only for hospice care (which the measure currently has) but also an exclusion for the use of palliative care. The use of palliative care, in contrast to hospice care, is not necessarily an indication that a patient is no longer seeking life-sustaining measures. Palliative care is focused on providing patients with relief of symptoms. It is increasingly used by patients who are not at the end of life and, therefore, should not be used to exclude patients from a mortality measure. For the vast majority of patients admitted for HF, the goal of their hospitalization is survival. Furthermore, as a claims-based measure we are limited in our ability to adequately determine the nuances of palliative care provided.

We agree with the commenter that patients with advanced heart failure treatments should be excluded from the measure because they are a clinically distinct group of patients. In 2016, we updated the heart failure cohort specifications (for mortality, readmission, excess days in acute care, and payment measures) to exclude patients with a left-ventricular assistive device (LVAD) implantation or heart transplantation during the index admission or in the 12 months prior to the index admission. We do this by using the claims history of the patient from the prior 12 months. While we agree that ideally we would exclude patients who had the procedure at any time, when we made this update to the measure there was no reliable way to identify a longer-term history of these treatments. However our measure coding and re-evaluation teams are in the process of investigating the reliability and validity of history codes that could be used to indicate if a patient has had an LVAD or heart transplant in the past.

While we did make this change to the measure cohort, we have found that hospitals caring for LVAD and transplant patients do not have substantially different risk-standardized outcome rates than other hospitals, likely because LVAD and transplant patients represent a small proportion of hospitals' overall patients and because much of the difference in observed outcome rates is explained by comorbidities and severity of illness in these patients that are captured in the risk-standardized models (Brandt et al., 2020). In our testing attachment we show that patients receiving an LVAD or heart transplant during the index admission or in the year prior to admission accounted for only 0.32% of the overall measure cohort for the mortality measure, and when we originally made the change to the measure in 2016, we found that measure scores are not significantly different based on whether these admissions are included or excluded from the estimates.

In our analyses presented in the testing attachment, we have shown that the risk adjustment methodology is adequate, and that the risk model for the claims-based measure performs similarly to a medical-records model (Krumholz, 2006). During original measure development we validated the claims-based model by comparing state-level standardized estimates with state-level standardized estimates calculated from a medical record model. Correlation between risk-standardized state mortality rates from claims data and rates derived from medical record data was 0.95 (SE=0.015). The median difference between the claims-based state risk-standardized estimates and the chart-based rates was <0.001 (25th percentile=-0.003; 75th percentile=0.002). Furthermore, the risk-decile plots, shown in our testing attachment, show good calibration between predicted and observed risk, indicating good performance of the model using current data.

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

NQF #0230 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Acute Myocardial Infarction (AMI) Hospitalization

Submission

Description: The measure estimates a hospital-level 30-day risk-standardized mortality rate (RSMR) for patients discharged from the hospital with a principal diagnosis of AMI. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. CMS annually reports the measure for patients who are 65 years or older and are either Medicare fee-for-service (FFS) beneficiaries and hospitalized in non-federal hospitals or are hospitalized in Veterans Health Administration (VA) facilities.

Numerator Statement: The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients hospitalized with a principal diagnosis of AMI.

Denominator Statement: This claims-based measure is used for patients aged 65 years or older.

The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of AMI 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.

Exclusions: The mortality measures exclude index admissions for patients in the following categories:

1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility
2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data
3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission
4. Discharged against medical advice (AMA)

For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort.

Adjustment/Stratification: Statistical Risk Model **Level of Analysis:** Facility

Setting of Care: Inpatient/Hospital

Type of Measure: Outcome

Data Source: Claims, Enrollment Data, Other

Measure Steward: Centers for Medicare & Medicaid Services

STANDING COMMITTEE MEETING February 9, 2021

NATIONAL QUALITY FORUM

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-14; M-2; L-1; I-0 (denominator = 17)**

Rationale:
- As part of the previous submission in 2015, the developer included a logic model that suggests that prevention of complications, use of appropriate medications, timely percutaneous coronary interventions, discharge planning, improved communication and management of care transitions, medication reconciliation, patient education, and disease management strategies lead to improved patient health and decreased risk of mortality following acute myocardial infarction (AMI) hospitalization.
- The developer provided empirical data and references from various studies demonstrating a relationship between decreased risk of mortality following AMI hospitalization and hospital-level interventions.
- In this submission, the developer provided updated citations for the rationale for measure development and included more recent studies that provide additional support for the previous conclusions in 2015.
- The Standing Committee noted that the evidence provided is directionally the same, yet stronger than the evidence submitted during the previous endorsement cycle in 2015 and concluded that the evidence clearly demonstrates actions that providers can take to reduce AMI mortality.
- The developer provided three-year, hospital-level, risk-standardized mortality rates (RSMRs) using Medicare claims and VA administrative data (470,621 admissions from 4,246 hospitals) from July 1, 2016 to June 30, 2019. The RSMRs had a mean of 12.7%, a standard deviation of 0.8, and a range from 8.8 – 18.1%. The median risk-standardized rate was 12.7%.
- The developer also provided these results stratified into quartiles by proportion of dual-eligible patients and by proportion of AHRQ SES Index Scores. The results were very similar for the lowest and highest quartiles of both dual-eligible proportion and proportion of AHRQ SES Index Scores.
- The Standing Committee noted that despite the tendency for risk-standardization to narrow performance range, the results still demonstrate a range of performance and room for improvement.

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: **Accepted Scientific Methods Panel (SMP) Rating (Moderate)**; 2b. Validity: **Accepted Scientific Methods Panel (SMP) Rating (Moderate)**

Rationale:
- This measure was reviewed by the SMP. A summary of the SMP 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 method (i.e., test-retest) , and then estimated the facility-level reliability (signal-to-noise reliability).
  - Using the Spearman-Brown prediction formula, the developers estimated that the agreement between the two independent assessments of the RSMR for each hospital with 25 admissions was 0.428.
  - The median reliability (signal-to-noise) score was 0.59, ranging from 0.20 to 0.93, and the 25th and 75th percentiles were 0.41 and 0.72, respectively, for the signal-to-noise testing for each hospital with at least 25 admissions.
- Most SMP members agreed that the reliability tests were appropriate and that the results show moderate reliability. Some SMP members voiced concerns regarding the level of reliability. The 75th percentile of the SNR reliability estimate was 0.72, suggesting that 70-75% of providers assessed did not meet a reliability of 0.7. It is worth noting that the SMP has not adopted a hard threshold for reliability at this time. One SMP member asked for clarification of how the 25-case threshold was established and one expressed disagreement with using the Landis modifiers in the split sample testing.

- In response to the concerns and questions raised, the developer noted that the split-sample reliability of 0.428 was moderate under the standards established by Landis and Koch (1977). The developer also provided additional studies supporting the interpretation as moderate (Hall et al., 2006; Cruz et al., 2009; Hand et al., 2006). The developer then clarified that the 25-case minimum is established by CMS and is aligned across all mortality and readmission measures for public reporting.
- The SMP rated this measure moderate for reliability: H-0; M-5; L-3; I-0
- The Standing Committee expressed no concerns regarding the reliability of the measure and voted unanimously to accept the SMP's rating: Yes-17; No-0 (denominator = 17)
- The developers conducted validity testing at the performance measure score level, including both empirical validity testing (by comparing CMS Star-Ratings mortality scores and Star-Rating summary scores), and systematic assessment of face validity.
  - The correlation between AMI RSMRs and the Star-Rating mortality score was -0.409, which suggests that hospitals with lower AMI RSMRs are more likely to have higher Star-Rating mortality scores.
  - The correlation between AMI RSMRs and the Star-Rating summary score was -0.204, which suggests that hospitals with lower AMI RSMRs are more likely to have higher Star-Rating summary scores.
  - The median absolute change in hospitals' RSMRs when adding a dual eligibility indicator is 0.07% (interquartile range [IQR] -0.005% – 0.009%), with a correlation coefficient between RSMRs for each hospital with and without dual eligibility added of 0.999. The median absolute change in hospitals' RSMRs when adding a low AHRQ SES Index score indicator to the model is 0.049% (IQR 0.021% – 0.068%), with a correlation coefficient between RSMRs for each hospital with and without an indicator for a low AHRQ SES Index score adjusted for the cost of living at the census block group level of 0.978.
  - The developers noted that the addition of any of these variables into the hierarchical model has little to no effect on hospital performance (c-statistic remains 0.73).
- The developer also validated the performance of the claims-based model using a medical records-based model and found the performance similar. The areas under the receiver operating characteristic (ROC) curve were 0.69 and 0.77, respectively, for the two models. The developers estimated hospital-level RSMRs using the corresponding hierarchical logistic regression administrative and medical record models for the linked patient sample. Then, they examined the linear relationship between the two sets of estimates using regression techniques and weighting by the total number of cases in each hospital. The correlation coefficient of the standardized rates from the administrative and medical record models was 0.91.
- Most SMP members agreed that the validity tests are appropriate, the results demonstrate moderate validity, and that the exclusions are appropriate. Most members also thought the risk adjustment model was appropriate; however, questions were raised regarding the developer's rationale for not including social risk factors in the model due to no added predictive power and no change in hospital performance rankings. The SMP noted that it would be useful to know the rate of hospitals that would have changed rank if social-risk factors would have been included and the rationale explaining why the inclusion of other risk factors with nonsignificant coefficients did not apply to social risk factors.
- In response to the concerns and questions raised, the developer provided additional information on its risk-model development methodology. For maintenance of endorsed measures, it builds on the original measure development work, starting with the original model, and validates its performance using current data. The developer performed statistical testing and interpreted the predictive ability; the c-statistic indicated that the model remains valid for use with current data.
- The SMP rated this measure moderate for validity: H-0; M-6; L-1; I-1
- Although the Standing Committee accepted the SMP's moderate rating on validity, it highlighted concerns similar to those raised during the discussion of NQF #0229. The Standing Committee noted concerns regarding the correlation analysis utilized by the developers, which establishes concurrent validity but does not demonstrate construct or empirical validity.

- The Standing Committee questioned whether the developers had tested against the Star Ratings with the AMI mortality measure having been removed. This would address the concern regarding circularity due to AMI mortality being included in the ratings.
- The developers clarified that the version of Star Ratings referenced is based on a latent variable model, which makes removing AMI mortality challenging and could be the reason that the correlation with NQF #0230 is lower than it was for NQF #0229. The developers also noted challenges in using process measures to validate because they are often topped out. The developers further noted that the lack of data availability makes demonstrating empirical validity challenging.
- Some Standing Committee members questioned whether the exclusion of patients with an inpatient stay of less than two days would exclude lower-risk patients from the measure.
- The Standing Committee also noted that the diagnostic criteria for AMI have changed, with AMI being diagnosed at lower troponin levels than in the past.
- The developer responded by confirming that they will include an analysis of the effect of these changes on their re-evaluation list for next year.
- The Standing Committee voted to accept the SMP's validity rating: Yes-15; No-2 (denominator = 17)

3. **Feasibility: H-11; M-6; L-0; 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 of 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 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-16; No Pass-1 (denominator = 17)** *4b. Usability:* **H-5; M-12; 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.
- The Standing Committee had no questions or concerns regarding the 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 Standing Committee agreed that most of the discussion on usability of the previous measure (NQF #0229) also applies to this measure (NQF #0230). The Standing Committee noted that the measure would not be usable by individual patients in acute decision making.
- The Standing Committee noted improvement in the measure results over time and no significant unintended consequences.

5. **Related and Competing Measures**
- This measure is related to the following measures:
   - NQF #0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization
   - NQF #0330 Hospital 30-Day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Heart Failure (HF) Hospitalization
   - NQF #0468 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Pneumonia Hospitalization
   - NQF #0505 Hospital 30-Day All-Cause Risk-Standardized Readmission Rate (RSRR) Following Acute Myocardial Infarction (AMI) Hospitalization

- o NQF #0506 Hospital 30-Day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization
- o NQF #0730 Acute Myocardial Infarction (AMI) Mortality Rate
- o NQF #1893 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Chronic Obstructive Pulmonary Disease (COPD) Hospitalization
- o NQF #2431 Hospital-Level, Risk-Standardized Payment Associated With a 30-Day Episode-of-Care for Acute Myocardial Infarction (AMI)
- o NQF #3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
- o NQF #3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
- The developer stated that the measure specifications are harmonized to the extent possible. They noted that they focused on related outcome measures (mortality and readmissions) 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 May 27, 2021 and did not raise any questions or concerns.
6. **Standing Committee Recommendation for Endorsement**: **Yes-17; No-0 (denominator = 17)**
7. **Public and Member Comment**
- Two comments were received for this measure. The commenters raised concerns regarding the measure's reliability, particularly at lower case counts, the decision to not include social risk adjustment, and questioned whether the performance variation was sufficient to adequately distinguish performance. These concerns led the commenters to not support the Committee's recommendation for re-endorsement.

Committee Response:
The Standing Committee felt that these concerns had been thoroughly discussed by both the SMP and during the measure evaluation web meetings. They noted that reliability thresholds are an ongoing topic of discussion for the SMP and at this time it has not adopted a hard threshold for reliability ratings. Both the SMP and the Committee noted that the reliability for low case counts is not ideal but is acceptable at this time.

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 0.428. 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 0.59, the 25th and 75th percentiles were 0.41 and 0.72, 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 does not support risk adjustment at the hospital level.

As presented in the testing attachment of the NQF submission for this measure, our main empiric finding is that adjusting for social risk has little impact on measure scores – mean changes in measure scores are small, and correlations between measure scores calculated with and without adjustment for social risk are near 1.

In additional analyses we have shown that there is little correlation, or even a negative correlation between measure scores and hospitals' proportion of patients with social risk (DE and low AHRQ SES) across all hospitals. Furthermore, for hospitals that treat the highest proportion of patients with social risk (those in the fifth quintile for the proportion of patients with socials risk) we see either no significant correlation (for the dual eligibility variable) or a weak negative correlation (for the low AHRQ SES variable).

Given these empiric findings, ASPE's recommendation to not risk adjust publicly reported quality measures for social risk (ASPE, 2020), and complex pathways which could explain the relationship between SRFs and mortality (and do not all support risk-adjustment), CMS chose to not incorporate SRF variables in this measure.

VARIATION IN MEASURE SCORE

The analyses submitting with our testing attachment show meaningful differences in performance and therefore substantial opportunity for improvement. The range in performance is 8.8%-18.1% with a mean of 12.7%.

Please note that performance categories are an implementation issue – CMS chooses to identify outliers based on 95% interval estimates, akin to 95% confidence intervals, which is a conservative approach to identifying performance outliers. We note that the median odds ratio suggests a meaningful increase in the risk of mortality if a patient is admitted with AMI at a higher risk hospital compared to a lower risk hospital. A value of 1.19 indicates that a patient has a 19% increase in the odds of mortality at higher-risk hospital compared to a lower-risk hospital, indicating that the measure can identify meaningful differences in hospital performance.

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

Cardiovascular Fall 2020 Review Cycle

CSAC Review

June 29-30, 2021

Standing Committee Recommendations

- Two measures reviewed for fall 2020
  - Both measures were reviewed by the Scientific Methods Panel (*SMP passed both measures on Scientific Acceptability criterion)*

- Two measures recommended for endorsement
  - **NQF #0229** Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization (Yale CORE/CMS) (maintenance)
  - **NQF #0230** Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Acute Myocardial Infarction (AMI) (Yale CORE/CMS) Hospitalization (maintenance)

Public and Member Comment and Member Expressions of Support

- Five comments received
  - All five comments were not supportive of the measures under review (three comments for NQF #0229 and two comments for NQF #0230)
    - » Measure reliability, particularly at lower case counts, does not meet reliability standards
    - » Decision to not include social risk adjustment
    - » Inadequate exclusions
    - » Inadequate number of outliers for performance

- No NQF member or non-member expressions of support received

Questions?

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

- Project webpage: http://www.qualityforum.org/Cardiovascular.aspx

- Project email address: cardiovascular@qualityforum.org

Cardiovascular, Fall 2020 Cycle: CDP Report

DRAFT TECHNICAL REPORT FOR CSAC REVIEW
JUNE 29, 2021

http://www.qualityforum.org

Contents

Executive Summary

Heart disease is a significant burden in the United States (U.S.), leading to approximately one in four deaths per year.[1] In addition to being the leading cause of death in the U.S., heart disease is the highest direct health expenditure in the U.S.[2] Considering the effect of cardiovascular disease (CVD), measures that assess clinical care performance and patient outcomes are critical to reducing its negative impact.

For this project, the Cardiovascular Standing Committee evaluated two measures undergoing maintenance review against the National Quality Forum's (NQF) standard evaluation criteria. The Standing Committee recommended both measures for endorsement. The recommended measures are listed below:

- **NQF #0229** Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization (Centers for Medicare & Medicaid Services (CMS)/Yale Center for Outcomes Research & Evaluation (CORE))
- **NQF #0230** Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Acute Myocardial Infarction (AMI) Hospitalization (CMS/Yale CORE)

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

Heart disease is the leading cause of death in the U.S.[3] The American Heart Association estimates that the direct costs of heart disease were $214 billion during the 2014 calendar year and projects that these costs will continue to increase through 2035 for patients ages 45 and older.[4] Costs related to hospitalization account for the majority of these direct health costs.[5]

The measures in the Cardiovascular portfolio have been grouped into various topic areas related to cardiovascular health. These topic areas include primary prevention and screening, coronary artery disease (CAD), ischemic vascular disease (IVD), acute myocardial infarction (AMI), cardiac catheterization, percutaneous catheterization intervention (PCI), heart failure (HF), rhythm disorders, implantable cardioverter-defibrillators (ICDs), cardiac imaging, cardiac rehabilitation, and high blood pressure.

NQF Portfolio of Performance Measures for Cardiovascular Conditions

The Cardiovascular Standing Committee (Appendix C) oversees NQF's portfolio of cardiovascular measures (Appendix B), which includes measures for AMI, cardiac catheterization, PCI, CAD/IVD, cardiac imaging, HF, hyperlipidemia, hypertension, ICDs, rhythm disorders, and survival after cardiac arrest. This portfolio contains 41 endorsed measures: 19 process, 17 outcome and resource use measures, and five composite measures (see Table 1).

Table 1. NQF Cardiovascular Portfolio of Measures

Measures	Process	Outcome/Resource Use	Composite
Acute myocardial infarction (AMI)	5	3	1
Cardiac catheterization/percutaneous coronary intervention (PCI)	0	8	1
CAD/ischemic vascular disease (IVD)	6	1	1
HF	5	2	0
Hyperlipidemia	1	0	0
Hypertension	0	1	0
Implantable cardiovascular devices (ICDs)	1	0	2
Rhythm disorders	1	1	0
Survival after cardiac arrest	0	1	0
Total	19	17	5

Additional measures have been assigned to other portfolios. These include readmissions measures for AMI and HF (All-Cause Admissions/Readmissions), measures for coronary artery bypass graft (CABG) (Surgery), and measures for primary prevention of cardiovascular diseases (Prevention and Population Health).

Cardiovascular Measure Evaluation

On February 9, 2021, the Cardiovascular Standing Committee evaluated two measures undergoing maintenance review against NQF's standard measure evaluation criteria.

Table 2. Cardiovascular Measure Evaluation Summary

Measures	Maintenance	New	Total
Measures under review	2	0	2
Measures recommended for endorsement	2	0	2

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 17, 2020, and closed on April 28, 2021. Pre-meeting commenting closed on January 21, 2021. As of that date, two comments were submitted. The commenters expressed concern for both measures regarding the reliability results at the minimum case count and the decision not to include social risks in the risk model. In addition, the commenter shared concerns regarding the usability of NQF #0230 for accountability purposes, given the small number of outliers. These comments were shared with the Standing Committee prior to the measure evaluation meeting (Appendix F).

Comments Received After Standing Committee Evaluation

The continuous 16-week public commenting period with NQF member support closed on April 29, 2021. Following the Standing Committee's evaluation of the measures under review, NQF received five comments from three organizations (including three member organizations) and individuals pertaining to the draft report and to the measures under review. Two major themes were identified from these comments, which focused on reliability testing thresholds and social risk adjustment. Three comments were submitted for measure NQF #0229 and two comments were submitted for measure NQF #0230. All five comments were not supportive of the Standing Committee's recommendation to endorse the measure. 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.

NQF #0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization (CMS/Yale CORE): Recommended

Description: The measure estimates a hospital-level 30-day, all-cause, risk-standardized mortality rate for patients discharged from the hospital with a principal diagnosis of HF. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. 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.; **Measure Type**: Outcome; **Level of Analysis**: Facility; **Setting of Care**: Inpatient/Hospital; **Data Source**: Claims, Enrollment Data, Other

Prior to the Standing Committee meeting, this measure was reviewed by the NQF Scientific Methods Panel (SMP). The SMP did not note any specific areas of concern and passed the measure with a moderate rating for both reliability and validity.

The Standing Committee noted that the evidence provided is directionally the same, yet stronger than the evidence submitted during the previous endorsement cycle. The Standing Committee concluded that the evidence clearly demonstrated actions that providers can take to reduce HF mortality and passed the measure on evidence. The Standing Committee agreed this is an important focus area of measurement and observed that the measure still has a performance gap and variation in results with room for improvement.

While the Standing Committee voted unanimously to accept the SMP's ratings for both reliability and validity, it raised a couple of issues for discussion. The Standing Committee noted that the specifications had been updated to exclude patients with left ventricular assist devices (LVAD) and was supportive of this change. A Standing Committee member asked whether patterns in admissions could account for part of the variation in performance, stating that some areas or providers may only admit severely ill patients, resulting in a higher mortality rate among those admissions. The developer responded by explaining that they have not performed that analysis but could include it in their next re-evaluation list. The Standing Committee urged the developer to consider the extensive discussions of the SMP regarding the inclusion of social risk factors in risk adjustment and the circular nature of the validity analyses using the Medicare Overall Star Ratings and Hospital Star Rating mortality group score, noting that measure #0229 is included as part of these comparisons. The developer noted that the results from this measure are negatively correlated with dual eligibility, meaning that dual-eligible patients have lower mortality rates than non-dual-eligible patients. The developer also noted that adjusting for dual eligibility would result in a penalty to providers with a higher proportion of dual-eligible patients.

The Standing Committee expressed no concerns regarding the feasibility of the measure. It also expressed no concerns regarding use of the measure, noting it is both publicly reported and used in CMS programs. A Standing Committee member asked how patients and patient advocates can use this measure to make care decisions, noting that if a patient is transported via ambulance, they may not have a choice of hospital. The developer noted that as part of the CMS Care Compare program, results of this measure are publicly available for use by the public and groups that publish hospital ratings. Other Standing Committee members shared that leadership in their organizations pays close attention to the results and implements corrective action, as necessary. The Standing Committee noted

improvement in the measure's results over time and no significant unintended consequences. The Standing Committee discussed related and competing measures during the post-comment web meeting on May 27, 2021. The Standing Committee did not highlight any comments or concerns.

NQF #0230 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Acute Myocardial Infarction (AMI) Hospitalization (CMS/Yale CORE): Recommended

Description: The measure estimates a hospital-level 30-day risk-standardized mortality rate (RSMR) for patients discharged from the hospital with a principal diagnosis of AMI. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. CMS annually reports the measure for patients who are 65 years or older and are either Medicare fee-for-service (FFS) beneficiaries and hospitalized in non-federal hospitals or are hospitalized in Veterans Health Administration (VA) facilities.; **Measure Type**: Outcome; **Level of Analysis**: Facility; **Setting of Care**: Inpatient/Hospital; **Data Source**: Claims, Enrollment Data, Other

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

All participants agreed that most of the discussion regarding the previous measure (#0229) also applies to this measure (#0230). The Standing Committee noted that the evidence is directionally the same, yet stronger than the evidence submitted during the previous endorsement cycle. The Standing Committee agreed that the measure passes the evidence sub-criterion. The Standing Committee also noted that despite the tendency for risk-standardization to narrow performance range, the results still demonstrate a range of performance and room for improvement. The Standing Committee did not express any concerns and passed the measure on performance gap.

The Standing Committee was satisfied with the SMP's rating and review of reliability and accepted the SMP's results unanimously. Although the Standing Committee accepted the SMP's moderate rating on validity, it highlighted concerns similar to those raised during the discussion of measure #0229. The Standing Committee noted concerns regarding the correlation analysis utilized by the developers, which establishes concurrent validity but does not demonstrate construct or empirical validity. The Standing Committee questioned whether the developers had tested against the Star Ratings with the AMI mortality measure having been removed This would address the concern regarding circularity due to AMI mortality being included in the ratings. The developers clarified that the version of Star Ratings referenced is based on a latent variable model, which makes removing AMI mortality challenging and could be the reason that the correlation with NQF #0230 is lower than it was for NQF #0229. The developers also noted challenges in using process measures to validate because they are often topped out. The developers further noted that the lack of data availability makes demonstrating empirical validity challenging. Some Standing Committee members questioned whether the exclusion of patients with an inpatient stay of less than two days would exclude lower-risk patients from the measure. The Standing Committee also noted that the diagnostic criteria for AMI have changed, with AMI being diagnosed at lower troponin levels than in the past. The developer responded by confirming that they will include an analysis of the effect of these changes on their re-evaluation list for next year.

The Standing Committee expressed no concerns regarding the feasibility of this claims-based measure. In its discussions related to usability and use, the Standing Committee noted that the measure would not be usable by individual patients in acute decision making; nonetheless, the measure is reported on CMS' Care Compare website and used in CMS' Hospital Value-Based Purchasing Program. The Standing Committee noted improvement over time with no significant unintended consequences and passed the measure on use and usability. The Standing Committee discussed related and competing measures during the post-comment web meeting on May 27, 2021. The Standing Committee did not highlight any comments or concerns.

Measures Withdrawn from Consideration

Two 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 #0730 Acute Myocardial Infarction (AMI) Mortality Rate (IQI 15)	Developer is not seeking re-endorsement.
NQF #0358 Heart Failure Mortality Rate (IQI 16)	Developer is not seeking re-endorsement.

References

[1] Murphy S. Mortality in the United States, 2017. *NCHS Data Brief*. 2018;328:1-8.

[2] Benjamin E. Heart Disease and Stroke Statistics – 2017 Update: A Report From the American Heart Association. *Circulation.* 2017;135:e146-e603.

[3] Murphy S. Deaths: Final Data for 2018. *Natl Vital Stat Rep Cent Dis Control Prev Natl Cent Health Stat Natl Vital Stat Syst*. 2021;69(13):1-83.

[4] Virani S. Heart Disease and Stroke Statistics – 2020 Update: A Report From the American Heart Association. *Circulation.* 2020;141:e139-e596.

[5] Benjamin E. Heart Disease and Stroke Statistics – 2017 Update: A Report From the American Heart Association. *Circulation.* 2017;135:e146-e603.

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. Quorum (17 out of 25 Standing Committee members) was met and maintained for the entirety of the February 9, 2021 measure evaluation meeting.

Measures Recommended

NQF #0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Submission **|** Specifications

Description: The measure estimates a hospital-level 30-day, all-cause, risk-standardized mortality rate for patients discharged from the hospital with a principal diagnosis of HF. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. 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.

Numerator Statement: The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients 65 and older hospitalized with a principal diagnosis of HF.

Denominator Statement: This claims-based measure is used for a cohort of patients aged 65 years or older.

The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of HF 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.

Exclusions: The mortality measures exclude index admissions for patients in the following categories:

1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility
2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data
3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission
4. Discharged against medical advice (AMA)
5. Patients undergoing left ventricular assist device (LVAD) implantation or heart transplantation during an index admission or who have a history of LVAD or heart transplant in the preceding year

For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort for each year.

Adjustment/Stratification: Statistical Risk Model

Level of Analysis: Facility

Setting of Care: Inpatient/Hospital

Type of Measure: Outcome

Data Source: Claims, Enrollment Data, Other

Measure Steward: Centers for Medicare & Medicaid Services

STANDING COMMITTEE MEETING February 9, 2021

1. Importance to Measure and Report: The measure meets the Importance criteria.
(1a. Evidence, 1b. Performance Gap)

1a. Evidence: **Pass-19; No Pass-0 (denominator = 19)**; 1b. Performance Gap: **H-4; M-15; L-0; I-0 (denominator = 19)**

Rationale:
- As part of the previous submission in 2015, the developer provided numerous studies demonstrating the following observations: (1) Appropriate and timely treatment for HF patients is tied to a reduction in risk of mortality within 30 days of hospital admission; (2) Trials of interventions that improve patient education upon discharge have been shown to improve survival for HF patients; and (3) Hospitals have been able to reduce mortality rates through these quality-of-care initiatives.
- In this submission, the developer provided information on the lifetime risk, prevalence, and cost of HF. The developer also provided new evidence tying coordinated care for HF patients to reductions in all-cause mortality after HF admission. The additional evidence provided strengthens support for the previous conclusions in 2015.
- The Standing Committee noted that the evidence provided is directionally the same, yet stronger than the evidence submitted during the previous endorsement cycle and concluded that the evidence clearly demonstrates actions that providers can take to reduce HF mortality.
- The developer provided three-year, hospital-level, risk-standardized mortality rates (RSMRs) using Medicare claims and VA administrative data (1,081,897 admissions from 4,637 hospitals) from July 1, 2016, to June 30, 2019. The RSMRs had a mean of 11.4%, a standard deviation of 1.6, and a range from 5.3 – 18.5%. The median risk-standardized rate was also 11.4%.
- The developer also provided these results stratified into quartiles by proportion of dual-eligible patients and by proportion of the Agency for Healthcare Research and Quality's (AHRQ) Socio-Economic Status (SES) Index Scores. Facilities with the highest proportion of dual-eligible patients performed slightly better than those with the lowest proportion. There were no differences in results between the lowest and highest quartiles of AHRQ SES Index Score.
- The Standing Committee agreed this is an important focus area of measurement and observed that the measure still has a performance gap and variation in results with room for improvement.

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: **Accepted Scientific Methods Panel (SMP) Rating (Moderate)**; 2b. Validity: **Accepted Scientific Methods Panel (SMP) Rating (Moderate)**

Rationale:
- This measure was reviewed by the 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 method (i.e., test-retest), and then estimated the facility-level reliability (signal-to-noise reliability).

- o Using the Spearman-Brown prediction formula, the developers estimated that the agreement between the two independent assessments of the RSMR for each hospital with 25 admissions was 0.632.
- o The median reliability (signal-to-noise) score was 0.79, ranging from 0.34 to 0.99, and the 25th and 75th percentiles were 0.58 and 0.9, respectively, for the signal-to-noise testing for each hospital with at least 25 admissions.
- Most SMP members agreed that the reliability tests were appropriate and that the results show moderate reliability. One SMP member voiced concerns about low reliability for the bottom 10% hospitals in the signal-to-noise ratio analysis (r<0.44) and split-sample reliability (0.63), stating this was acceptable but not ideal.
- In response to the concerns and questions raised by the SMP, the developer clarified that the 25-case minimum is established by CMS and aligned across all mortality and readmission measures for public reporting.
- The SMP rated this measure moderate for reliability: H-4; M-4; L-3; I-0
- The Standing Committee expressed no concerns regarding the reliability of the measure and voted unanimously to accept the SMP's rating: Yes-19; No-0 (denominator = 19)
- The developers conducted validity testing at the performance measure score level, including both empirical validity testing (by comparing CMS' Star-Rating mortality scores and Star-Rating summary scores), and systematic assessment of face validity.
  - o The correlation between HF RSMRs and the Star-Rating mortality score was -0.676, which suggests that hospitals with lower HF RSMRs are more likely to have higher Star-Rating mortality scores.
  - o The correlation between HF RSMRs and the Star-Rating summary score was -0.114, which suggests that hospitals with lower HF RSMRs are more likely to have higher Star-Rating summary scores.
- The risk model includes 24 clinical and demographic risk factors. Dual eligibility and AHRQ SES index were tested but not included in the final model.
- The developers noted that the addition of any of these variables into the hierarchical model has little to no effect on hospital performance (c-statistic remains 0.73). The developer showed that there was little impact on measure scores as gauged by the difference between measure scores calculated with versus without the social risk factors in the model.
- The SMP rated this measure moderate for validity: H-0; M-6; L-1; I-1
- A Standing Committee member asked whether patterns in admissions could account for part of the variation in performance, stating that some areas or providers may only admit severely ill patients, resulting in a higher mortality rate among those admissions. The developer responded by explaining that they have not performed that analysis but could include it in their next re-evaluation list.
- The Standing Committee urged the developer to consider the extensive discussions of the SMP regarding the inclusion of social risk factors in risk adjustment and the circular nature of the validity analyses using the Medicare Star Ratings, noting that NQF #0229 is included as part of the star rating calculation.
- The developer reminded the Standing Committee that results on this measure are negatively correlated with dual eligibility, meaning that dual-eligible patients have lower mortality rates

than non-dual-eligible patients. They noted that adjusting for dual eligibility would result in a penalty to providers with a higher proportion of dual-eligible patients.

- The Standing Committee voted unanimously to accept the SMP's validity rating: Yes-19; No-0 (denominator = 19)

3. Feasibility: H-13; M-6; L-0; I-0 (denominator = 19)
(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 of 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 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-8; M-9; L-1; 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 the 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.
- A Standing Committee member asked how patients and patient advocates can use this measure to make care decisions, noting that if a patient is transported via ambulance, they may not have a choice of hospital. The developer noted that as part of the CMS Care Compare program, results of this measure are publicly available for use by the public and groups that publish hospital ratings. Other Standing Committee members shared that leadership in their organizations pays close attention to the results and implements corrective action, as necessary.
- The Standing Committee noted improvement in the measure results over time and no significant unintended consequences.

5. Related and Competing Measures

- This measure is related to the following measures:
  - NQF #0330 Hospital 30-Day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Heart Failure (HF) Hospitalization
  - NQF #0358 Heart Failure Mortality Rate (IQI 16)
  - NQF #0468 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Pneumonia Hospitalization
  - NQF #1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

- o NQF #1893 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Chronic Obstructive Pulmonary Disease (COPD) Hospitalization
- o NQF #3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
- o NQF #3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
- The developer stated that the measure specifications are harmonized to the extent possible. They noted that they focused on related outcome measures (mortality and readmissions) 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 May 27, 2021 and did not raise any questions or concerns.

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

7. Public and Member Comment

- NQF received three comments on this measure. The commenters raised concerns regarding the measure's reliability, particularly at lower case counts, the decision to not include social risk adjustment. These concerns led the commenters to not support the Committee's recommendation for re-endorsement.

  Committee Response:
- Both measures were reviewed by the SMP, and both received a moderate rating for validity. The Committee discussed the risk model and reviewed the results the developer provided for its testing of dual eligible status and AHRQ SES Index. For NQF #0229, results were negatively correlated with dual eligibility. Adjusting for this factor would result in a penalty to providers with a higher proportion of dual-eligible patients.

  Measure Steward/Developer Response:
- 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 0.428. 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 0.59, the 25th and 75th percentiles were 0.41 and 0.72, respectively.
- While there is a conceptual pathway by which patients with social risk factors could experience worse outcomes, the empiric evidence does not support risk adjustment at the hospital level.
- As presented in the testing attachment of the NQF submission for this measure, our main empiric finding is that adjusting for social risk has little impact on measure scores – mean changes in measure scores are small, and correlations between measure scores calculated with and without adjustment for social risk are near 1.
- In additional analyses we have shown that there is little correlation, or even a negative

correlation between measure scores and hospitals' proportion of patients with social risk (DE and low AHRQ SES) across all hospitals. Furthermore, for hospitals that treat the highest proportion of patients with social risk (those in the fifth quintile for the proportion of patients with socials risk) we see either no significant correlation (for the dual eligibility variable) or a weak negative correlation (for the low AHRQ SES variable).

- Given these empiric findings, ASPE's recommendation to not risk adjust publicly reported quality measures for social risk (ASPE, 2020), and complex pathways which could explain the relationship between SRFs and mortality (and do not all support risk-adjustment), CMS chose to not incorporate SRF variables in this measure.
- VARIATION IN MEASURE SCORE
- The analyses submitting with our testing attachment show meaningful differences in performance and therefore substantial opportunity for improvement. The range in performance is 8.8%-18.1% with a mean of 12.7%.
- Please note that performance categories are an implementation issue – CMS chooses to identify outliers based on 95% interval estimates, akin to 95% confidence intervals, which is a conservative approach to identifying performance outliers. We note that the median odds ratio suggests a meaningful increase in the risk of mortality if a patient is admitted with AMI at a higher risk hospital compared to a lower risk hospital. A value of 1.19 indicates that a patient has a 19% increase in the odds of mortality at higher-risk hospital compared to a lower-risk hospital, indicating that the measure can identify meaningful differences in hospital performance.

- One commenter raised a concern that the exclusions are inadequate (patients receiving palliative care or advanced therapies are not excluded) and questioned the adequacy of the risk-adjustment model.

  Measure Steward/Developer Response:
  CMS's 30-day heart failure mortality measure is a highly credible measure, having been originally NQF endorsed in 2007, and re-endorsed several times since then. In addition, in the current round of NQF endorsement, experts on both the Scientific Methods Panel and the Cardiovascular Standing Committee voted in favor of its scientific acceptability. The HF mortality measure's specifications are intentionally aligned with the HF readmission measure, so that the mortality measure can serve as a balancing measure for the unintended consequences of measuring readmission.
  However, we understand and appreciate the commenters concerns, and we address them separately below.
  The commenter suggested that the measure include an exclusion not only for hospice care (which the measure currently has) but also an exclusion for the use of palliative care. The use of palliative care, in contrast to hospice care, is not necessarily an indication that a patient is no longer seeking life-sustaining measures. Palliative care is focused on providing patients with relief of symptoms. It is increasingly used by patients who are not at the end of life and, therefore, should not be used to exclude patients from a mortality measure. For the vast majority of patients admitted for HF, the goal of their hospitalization is survival. Furthermore, as a claims-based measure we are limited in our ability to adequately determine the nuances of palliative care provided.
  We agree with the commenter that patients with advanced heart failure treatments should be excluded from the measure because they are a clinically distinct group of

patients. In 2016, we updated the heart failure cohort specifications (for mortality, readmission, excess days in acute care, and payment measures) to exclude patients with a left-ventricular assistive device (LVAD) implantation or heart transplantation during the index admission or in the 12 months prior to the index admission. We do this by using the claims history of the patient from the prior 12 months. While we agree that ideally we would exclude patients who had the procedure at any time, when we made this update to the measure there was no reliable way to identify a longer-term history of these treatments. However our measure coding and re-evaluation teams are in the process of investigating the reliability and validity of history codes that could be used to indicate if a patient has had an LVAD or heart transplant in the past.

While we did make this change to the measure cohort, we have found that hospitals caring for LVAD and transplant patients do not have substantially different risk-standardized outcome rates than other hospitals, likely because LVAD and transplant patients represent a small proportion of hospitals' overall patients and because much of the difference in observed outcome rates is explained by comorbidities and severity of illness in these patients that are captured in the risk-standardized models (Brandt et al., 2020). In our testing attachment we show that patients receiving an LVAD or heart transplant during the index admission or in the year prior to admission accounted for only 0.32% of the overall measure cohort for the mortality measure, and when we originally made the change to the measure in 2016, we found that measure scores are not significantly different based on whether these admissions are included or excluded from the estimates.

In our analyses presented in the testing attachment, we have shown that the risk adjustment methodology is adequate, and that the risk model for the claims-based measure performs similarly to a medical-records model (Krumholz, 2006). During original measure development we validated the claims-based model by comparing state-level standardized estimates with state-level standardized estimates calculated from a medical record model. Correlation between risk-standardized state mortality rates from claims data and rates derived from medical record data was 0.95 (SE=0.015). The median difference between the claims-based state risk-standardized estimates and the chart-based rates was <0.001 (25th percentile=-0.003; 75th percentile=0.002). Furthermore, the risk-decile plots, shown in our testing attachment, show good calibration between predicted and observed risk, indicating good performance of the model using current data.

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

9. Appeals

NQF #0230 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Acute Myocardial Infarction (AMI) Hospitalization

Submission | Specifications

Description: The measure estimates a hospital-level 30-day risk-standardized mortality rate (RSMR) for patients discharged from the hospital with a principal diagnosis of AMI. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. CMS annually reports the measure for patients who are 65 years or older and are either Medicare fee-for-service (FFS) beneficiaries and hospitalized in non-federal hospitals or are hospitalized in Veterans Health Administration (VA) facilities.

Numerator Statement: The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients hospitalized with a principal diagnosis of AMI.

Denominator Statement: This claims-based measure is used for patients aged 65 years or older.

The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of AMI 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.

Exclusions: The mortality measures exclude index admissions for patients in the following categories:

1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility

2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data

3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission

4. Discharged against medical advice (AMA)

For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort.

Adjustment/Stratification: Statistical Risk Model **Level of Analysis:** Facility

Setting of Care: Inpatient/Hospital

Type of Measure: Outcome

Data Source: Claims, Enrollment Data, Other

Measure Steward: Centers for Medicare & Medicaid Services

STANDING COMMITTEE MEETING February 9, 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-14; M-2; L-1; I-0 (denominator = 17)**
Rationale:

- As part of the previous submission in 2015, the developer included a logic model that suggests that prevention of complications, use of appropriate medications, timely percutaneous coronary interventions, discharge planning, improved communication and management of care transitions, medication reconciliation, patient education, and disease management strategies lead to improved patient health and decreased risk of mortality following acute myocardial infarction (AMI) hospitalization.

- The developer provided empirical data and references from various studies demonstrating a relationship between decreased risk of mortality following AMI hospitalization and hospital-level interventions.

- In this submission, the developer provided updated citations for the rationale for measure development and included more recent studies that provide additional support for the previous conclusions in 2015.

- The Standing Committee noted that the evidence provided is directionally the same, yet stronger than the evidence submitted during the previous endorsement cycle in 2015 and concluded that the evidence clearly demonstrates actions that providers can take to reduce AMI mortality.

- The developer provided three-year, hospital-level, risk-standardized mortality rates (RSMRs) using Medicare claims and VA administrative data (470,621 admissions from 4,246 hospitals) from July 1, 2016 to June 30, 2019. The RSMRs had a mean of 12.7%, a standard deviation of 0.8, and a range from 8.8 – 18.1%. The median risk-standardized rate was 12.7%.
- The developer also provided these results stratified into quartiles by proportion of dual-eligible patients and by proportion of AHRQ SES Index Scores. The results were very similar for the lowest and highest quartiles of both dual-eligible proportion and proportion of AHRQ SES Index Scores.
- The Standing Committee noted that despite the tendency for risk-standardization to narrow performance range, the results still demonstrate a range of performance and room for improvement.

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: **Accepted Scientific Methods Panel (SMP) Rating (Moderate)**; 2b. Validity: **Accepted Scientific Methods Panel (SMP) Rating (Moderate)**

Rationale:
- This measure was reviewed by the SMP. A summary of the SMP 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 method (i.e., test-retest) , and then estimated the facility-level reliability (signal-to-noise reliability).
  - Using the Spearman-Brown prediction formula, the developers estimated that the agreement between the two independent assessments of the RSMR for each hospital with 25 admissions was 0.428.
  - The median reliability (signal-to-noise) score was 0.59, ranging from 0.20 to 0.93, and the 25th and 75th percentiles were 0.41 and 0.72, respectively, for the signal-to-noise testing for each hospital with at least 25 admissions.
- Most SMP members agreed that the reliability tests were appropriate and that the results show moderate reliability. Some SMP members voiced concerns regarding the level of reliability. The 75th percentile of the SNR reliability estimate was 0.72, suggesting that 70-75% of providers assessed did not meet a reliability of 0.7. It is worth noting that the SMP has not adopted a hard threshold for reliability at this time. One SMP member asked for clarification of how the 25-case threshold was established and one expressed disagreement with using the Landis modifiers in the split sample testing.
- In response to the concerns and questions raised, the developer noted that the split-sample reliability of 0.428 was moderate under the standards established by Landis and Koch (1977). The developer also provided additional studies supporting the interpretation as moderate (Hall et al., 2006; Cruz et al., 2009; Hand et al., 2006). The developer then clarified that the 25-case minimum is established by CMS and is aligned across all mortality and readmission measures for public reporting.
- The SMP rated this measure moderate for reliability: H-0; M-5; L-3; I-0

- The Standing Committee expressed no concerns regarding the reliability of the measure and voted unanimously to accept the SMP's rating: Yes-17; No-0 (denominator = 17)
- The developers conducted validity testing at the performance measure score level, including both empirical validity testing (by comparing CMS Star-Ratings mortality scores and Star-Rating summary scores), and systematic assessment of face validity.
  - The correlation between AMI RSMRs and the Star-Rating mortality score was -0.409, which suggests that hospitals with lower AMI RSMRs are more likely to have higher Star-Rating mortality scores.
  - The correlation between AMI RSMRs and the Star-Rating summary score was -0.204, which suggests that hospitals with lower AMI RSMRs are more likely to have higher Star-Rating summary scores.
  - The median absolute change in hospitals' RSMRs when adding a dual eligibility indicator is 0.07% (interquartile range [IQR] -0.005% – 0.009%), with a correlation coefficient between RSMRs for each hospital with and without dual eligibility added of 0.999. The median absolute change in hospitals' RSMRs when adding a low AHRQ SES Index score indicator to the model is 0.049% (IQR 0.021% – 0.068%), with a correlation coefficient between RSMRs for each hospital with and without an indicator for a low AHRQ SES Index score adjusted for the cost of living at the census block group level of 0.978.
  - The developers noted that the addition of any of these variables into the hierarchical model has little to no effect on hospital performance (c-statistic remains 0.73).
- The developer also validated the performance of the claims-based model using a medical records-based model and found the performance similar. The areas under the receiver operating characteristic (ROC) curve were 0.69 and 0.77, respectively, for the two models. The developers estimated hospital-level RSMRs using the corresponding hierarchical logistic regression administrative and medical record models for the linked patient sample. Then, they examined the linear relationship between the two sets of estimates using regression techniques and weighting by the total number of cases in each hospital. The correlation coefficient of the standardized rates from the administrative and medical record models was 0.91.
- Most SMP members agreed that the validity tests are appropriate, the results demonstrate moderate validity, and that the exclusions are appropriate. Most members also thought the risk adjustment model was appropriate; however, questions were raised regarding the developer's rationale for not including social risk factors in the model due to no added predictive power and no change in hospital performance rankings. The SMP noted that it would be useful to know the rate of hospitals that would have changed rank if social-risk factors would have been included and the rationale explaining why the inclusion of other risk factors with nonsignificant coefficients did not apply to social risk factors.
- In response to the concerns and questions raised, the developer provided additional information on its risk-model development methodology. For maintenance of endorsed measures, it builds on the original measure development work, starting with the original model, and validates its performance using current data. The developer performed statistical testing and interpreted the predictive ability; the c-statistic indicated that the model remains valid for use with current data.
- The SMP rated this measure moderate for validity: H-0; M-6; L-1; I-1

- Although the Standing Committee accepted the SMP's moderate rating on validity, it highlighted concerns similar to those raised during the discussion of NQF #0229. The Standing Committee noted concerns regarding the correlation analysis utilized by the developers, which establishes concurrent validity but does not demonstrate construct or empirical validity.
- The Standing Committee questioned whether the developers had tested against the Star Ratings with the AMI mortality measure having been removed. This would address the concern regarding circularity due to AMI mortality being included in the ratings.
- The developers clarified that the version of Star Ratings referenced is based on a latent variable model, which makes removing AMI mortality challenging and could be the reason that the correlation with NQF #0230 is lower than it was for NQF #0229. The developers also noted challenges in using process measures to validate because they are often topped out. The developers further noted that the lack of data availability makes demonstrating empirical validity challenging.
- Some Standing Committee members questioned whether the exclusion of patients with an inpatient stay of less than two days would exclude lower-risk patients from the measure.
- The Standing Committee also noted that the diagnostic criteria for AMI have changed, with AMI being diagnosed at lower troponin levels than in the past.
- The developer responded by confirming that they will include an analysis of the effect of these changes on their re-evaluation list for next year.
- The Standing Committee voted to accept the SMP's validity rating: Yes-15; No-2 (denominator = 17)

3. Feasibility: H-11; M-6; L-0; 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 of 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 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-16; No Pass-1 (denominator = 17)** *4b. Usability:* **H-5; M-12; 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.
- The Standing Committee had no questions or concerns regarding the 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 Standing Committee agreed that most of the discussion on usability of the previous measure (NQF #0229) also applies to this measure (NQF #0230). The Standing Committee noted that the measure would not be usable by individual patients in acute decision making.
- The Standing Committee noted improvement in the measure results over time and no significant unintended consequences.

5. Related and Competing Measures
- This measure is related to the following measures:
  - NQF #0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization
  - NQF #0330 Hospital 30-Day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Heart Failure (HF) Hospitalization
  - NQF #0468 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Pneumonia Hospitalization
  - NQF #0505 Hospital 30-Day All-Cause Risk-Standardized Readmission Rate (RSRR) Following Acute Myocardial Infarction (AMI) Hospitalization
  - NQF #0506 Hospital 30-Day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization
  - NQF #0730 Acute Myocardial Infarction (AMI) Mortality Rate
  - NQF #1893 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Chronic Obstructive Pulmonary Disease (COPD) Hospitalization
  - NQF #2431 Hospital-Level, Risk-Standardized Payment Associated With a 30-Day Episode-of-Care for Acute Myocardial Infarction (AMI)
  - NQF #3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
  - NQF #3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
- The developer stated that the measure specifications are harmonized to the extent possible. They noted that they focused on related outcome measures (mortality and readmissions) 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 May 27, 2021 and did not raise any questions or concerns.

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

7. Public and Member Comment
- Two comments were received for this measure. The commenters raised concerns regarding the measure's reliability, particularly at lower case counts, the decision to not include social risk adjustment, and questioned whether the performance variation was sufficient to adequately distinguish performance. These concerns led the commenters to not support the Committee's recommendation for re-endorsement.

  Committee Response:

The Standing Committee felt that these concerns had been thoroughly discussed by both the SMP and during the measure evaluation web meetings. They noted that reliability thresholds are an ongoing topic of discussion for the SMP and at this time it has not adopted a hard threshold for reliability ratings. Both the SMP and the Committee noted that the reliability for low case counts is not ideal but is acceptable at this time.

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 0.428. 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 0.59, the 25th and 75th percentiles were 0.41 and 0.72, 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 does not support risk adjustment at the hospital level.
As presented in the testing attachment of the NQF submission for this measure, our main empiric finding is that adjusting for social risk has little impact on measure scores – mean changes in measure scores are small, and correlations between measure scores calculated with and without adjustment for social risk are near 1.
In additional analyses we have shown that there is little correlation, or even a negative correlation between measure scores and hospitals' proportion of patients with social risk (DE and low AHRQ SES) across all hospitals. Furthermore, for hospitals that treat the highest proportion of patients with social risk (those in the fifth quintile for the proportion of patients with socials risk) we see either no significant correlation (for the dual eligibility variable) or a weak negative correlation (for the low AHRQ SES variable).
Given these empiric findings, ASPE's recommendation to not risk adjust publicly reported quality measures for social risk (ASPE, 2020), and complex pathways which could explain the relationship between SRFs and mortality (and do not all support risk-adjustment), CMS chose to not incorporate SRF variables in this measure.
VARIATION IN MEASURE SCORE
The analyses submitting with our testing attachment show meaningful differences in performance and therefore substantial opportunity for improvement. The range in performance is 8.8%-18.1% with a mean of 12.7%.

Please note that performance categories are an implementation issue – CMS chooses to identify outliers based on 95% interval estimates, akin to 95% confidence intervals, which is a conservative approach to identifying performance outliers. We note that the median odds ratio suggests a meaningful increase in the risk of mortality if a patient is admitted with AMI at a higher risk hospital compared to a lower risk hospital. A value of 1.19 indicates that a patient has a 19% increase in the odds of mortality at higher-risk hospital compared to a lower-risk hospital, indicating that the measure can identify meaningful differences in hospital performance.

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

9. Appeals

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

NQF #	Title	Federal Programs: Finalized or Implemented as of June 22, 2020
0018	Controlling High Blood Pressure	Medicare Shared Savings Program (Implemented), Merit-Based Incentive Payment System (MIPS) Program (Implemented), Marketplace Quality Rating System (QRS) (Implemented), Medicaid (Implemented)
0066	Coronary Artery Disease (CAD): Angiotensin-Converting Enzyme (ACE) Inhibitor or Angiotensin Receptor Blocker (ARB) Therapy – Diabetes or Left Ventricular Systolic Dysfunction (LVEF <40%)	MIPS (Implemented)
0067	Chronic Stable Coronary Artery Disease: Antiplatelet Therapy	MIPS (Implemented)
0068	Ischemic Vascular Disease (IVD): Use of Aspirin or Another Antiplatelet	None
0070/ 0070e	Coronary Artery Disease (CAD): Beta-Blocker Therapy – Prior Myocardial Infarction (MI) or Left Ventricular Systolic Dysfunction (LVEF <40%)	MIPS (Implemented), Medicaid Promoting Interoperability Program for Eligible Professionals (Implemented)
0071	Persistence of Beta-Blocker Treatment After a Heart Attack	None
0073	Ischemic Vascular Disease (IVD): Blood Pressure Control	None
0076	Optimal Vascular Care	None
0079	Heart Failure: Left Ventricular Ejection Fraction Assessment (Outpatient Setting)	None
0081/ 0081e	Heart Failure (HF): Angiotensin-Converting Enzyme (ACE) Inhibitor or Angiotensin Receptor Blocker (ARB) Therapy for Left Ventricular Systolic Dysfunction (LVSD)	MIPS (Implemented), Medicaid Promoting Interoperability Program for Eligible Professionals (Implemented)
0083/ 0083e	Heart Failure (HF): Beta-Blocker Therapy for Left Ventricular Systolic Dysfunction (LVSD)	MIPS (Implemented), Medicaid Promoting Interoperability Program for Eligible Professionals (Implemented)
0133	In-Hospital Risk-Adjusted Rate of Mortality for Patients Undergoing PCI	None
0229	Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization for Patients 18 and Older	Hospital Value-Based Purchasing (VBP) (Implemented)

[a] Per CMS Measures Inventory Tool, last accessed 02/10/2021

NQF #	Title	Federal Programs: Finalized or Implemented as of June 22, 2020
0230	Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Acute Myocardial Infarction (AMI) Hospitalization for Patients 18 and Older	Hospital Value-Based Purchasing (VBP) (Implemented)
0290	Median Time to Transfer to Another Facility for Acute Coronary Intervention	Hospital Outpatient Quality Reporting (Hospital OQR) (Implemented)
0355	Bilateral Cardiac Catheterization Rate (IQI 25)	None
0358	Heart Failure Mortality Rate (IQI 16)	None
0535	30-Day All-Cause Risk-Standardized Mortality Rate Following Percutaneous Coronary Intervention (PCI) for Patients Without ST Segment Elevation Myocardial Infarction (STEMI) and Without Cardiogenic Shock	None
0536	30-Day All-Cause Risk-Standardized Mortality Rate Following Percutaneous Coronary Intervention (PCI) for Patients With ST Segment Elevation Myocardial Infarction (STEMI) or Cardiogenic Shock	None
0642	Cardiac Rehabilitation Patient Referral From an Inpatient Setting	None
0643	Cardiac Rehabilitation Patient Referral From an Outpatient Setting	MIPS (Implemented)
0669	Cardiac Imaging for Preoperative Risk Assessment for Non-Cardiac, Low-Risk Surgery	Hospital OQR (Implemented)
0694	Hospital-Level Risk-Standardized Complication Rate Following Implantation of Implantable Cardioverter-Defibrillator	None
0730	Acute Myocardial Infarction (AMI) Mortality Rate	None
0964	Therapy With Aspirin, P2Y12 Inhibitor, and Statin at Discharge Following PCI in Eligible Patients	None
0965	Discharge Medications (ACE/ARB and Beta Blockers) in Eligible ICD Implant Patients	None
1525	Atrial Fibrillation and Atrial Flutter: Chronic Anticoagulation Therapy	MIPS (Implemented)
2377	Defect Free Care for AMI	None
2379	Adherence to Antiplatelet Therapy After Stent Implantation	None
2438	Beta-Blocker Therapy (i.e., Bisoprolol, Carvedilol, or Sustained-Release Metoprolol Succinate) for LVSD Prescribed at Discharge	None
2439	Post-Discharge Appointment for Heart Failure Patients	None

NQF #	Title	Federal Programs: Finalized or Implemented as of June 22, 2020
2443	Post-Discharge Evaluation for Heart Failure Patients	None
2450	Heart Failure: Symptom and Activity Assessment	None
2455	Heart Failure: Post-Discharge Appointment for Heart Failure Patients	None
2459	In-Hospital Risk-Adjusted Rate of Bleeding Events for Patients Undergoing PCI	None
2461	In-Person Evaluation Following Implantation of a Cardiovascular Implantable Electronic Device (CIED)	None
2473	Hybrid Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Acute Myocardial Infarction (AMI)	None
2474	Cardiac Tamponade and/or Pericardiocentesis Following Atrial Fibrillation Ablation	MIPS (Implemented)
2764/2764e	Fixed-Dose Combination of Hydralazine and Isosorbide Dinitrate Therapy for Self-Identified Black or African American Patients With Heart Failure and LVEF <40% on ACEI or ARB and Beta-blocker Therapy	None
3309	Risk-Standardized Survival Rate (RSSR) for In-Hospital Cardiac Arrest	None
3534	30 Day All-Cause, Risk-Standardized Mortality Odds Ratio Following Transcatheter Aortic Valve Replacement (TAVR)	None

Appendix C: Cardiovascular Standing Committee and NQF Staff

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Appendix D: Measure Specifications

NQF #0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

STEWARD

Centers for Medicare & Medicaid Services

DESCRIPTION

The measure estimates a hospital-level 30-day, all-cause, risk-standardized mortality rate for patients discharged from the hospital with a principal diagnosis of HF. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. 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

DATA SOURCE

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, skilled nursing facility care, some home health agency 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 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): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score.

References:

Fleming C, Fisher ES, Chang CH, Bubolz TA, Malenka DJ. 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 all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients 65 and older hospitalized with a principal diagnosis of HF.

NUMERATOR DETAILS

The measure counts all deaths (including in-hospital deaths) for any cause within 30 days of the date of the index HF admission.

Identifying deaths in the FFS measure

As currently reported, we identify deaths for FFS Medicare patients 65 years and older in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.

DENOMINATOR STATEMENT

This claims-based measure is used for a cohort of patients aged 65 years or older.

The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of HF 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 inclusion criteria:

1. Principal discharge diagnosis of heart failure
2. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of the index admission and Part A during the index admission, or those who are VA beneficiaries
3. Aged 65 or over
4. Not transferred from another acute care facility

We have explicitly tested the measure for those aged 65+ years and those aged 65+ years (see Testing Attachment for details).

EXCLUSIONS

The mortality measures exclude index admissions for patients:

1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility;
2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data;
3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission;
4. Discharged against medical advice (AMA); or

5. Patients undergoing left ventricular assist device (LVAD) implantation or heart transplantation during an index admission or who have a history of LVAD or heart transplant in the preceding year.

> For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort for each year.

EXCLUSION DETAILS

1. The discharge disposition indicator is used to identify patients alive at discharge. Transfers are identified in the claims when a patient with a qualifying admission is discharged from an acute care hospital and admitted to another acute care hospital on the same day or next day. Patient length of stay and condition is identified from the admission claim.

> Rationale: This exclusion prevents inclusion of patients who likely did not have clinically significant HF.

2. Inconsistent vital status or unreliable data are identified if any of the following conditions are met 1) the patient's age is greater than 115 years: 2) if the discharge date for a hospitalization is before the admission date; 3) if the patient has a sex other than 'male' or 'female'.

> Rationale: Reliable and consistent data are necessary for valid calculation of the measure.

3. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice data and the Inpatient standard analytic file (SAF).

> Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care.

4. 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.

> 5. Patients with LVAD implantation or heart transplantation during an index admission or in the previous 12 months are identified by the corresponding codes for these procedures included in claims data.

> Rationale: Patients undergoing implantation of an LVAD designed to offer intermediate to long-term support (weeks to years) as a bridge to heart transplant or destination therapy represent a clinically distinct, highly-selected group of patients cared for at highly specialized medical centers.

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 RSMRs following hospitalization for HF 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 mortality 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 mortality 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 RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality.

The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. The estimated hospital-specific intercept is added 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 deaths (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 [https://qualitynet.org/inpatient/measures/mortality/methodology].

References:

1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 118210| 112469| 146637| 141015| 150289

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N/A

NQF #0230 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Acute Myocardial Infarction (AMI) Hospitalization

STEWARD

Centers for Medicare & Medicaid Services

DESCRIPTION

The measure estimates a hospital-level 30-day risk-standardized mortality rate (RSMR) for patients discharged from the hospital with a principal diagnosis of AMI. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. CMS annually reports the measure for patients who are 65 years or older and are either Medicare fee-for-service (FFS) beneficiaries and hospitalized in non-federal hospitals or are hospitalized in Veterans Health Administration (VA) facilities.

TYPE

Outcome

DATA SOURCE

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, skilled nursing facility care, some home health agency 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 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): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score.

References:

Fleming C, Fisher ES, Chang CH, Bubolz TA, Malenka DJ. 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 all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients hospitalized with a principal diagnosis of AMI.

NUMERATOR DETAILS

The measure counts all deaths (including in-hospital deaths) for any cause to any acute care hospital within 30 days of the date of the index AMI hospitalization.

Identifying deaths in the FFS measure

As currently reported, we identify deaths for FFS Medicare patients 65 years and older in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.

DENOMINATOR STATEMENT

This claims-based measure is used for patients aged 65 years or older.

The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of AMI 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 inclusion criteria:

1. Having a principal discharge diagnosis of AMI;
2. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of the index admission and Part A during the index admission, or those who are VA beneficiaries;
3. Aged 65 or over; and
4. Not transferred from another acute care facility.

   We have explicitly tested the measure for those aged 65+ years (see Testing Attachment for details).

EXCLUSIONS

The mortality measures exclude index admissions for patients:

1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility;
2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data;
3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission; or
4. Discharged against medical advice (AMA).

   For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort.

EXCLUSION DETAILS

1. The discharge disposition indicator is used to identify patients alive at discharge. Transfers are identified in the claims when a patient with a qualifying admission is discharged from an acute care hospital and admitted to another acute care hospital on the same day or next day. Patient length of stay and condition is identified from the admission claim.

    Rationale: This exclusion prevents inclusion of patients who likely did not have clinically significant AMI.

2. Inconsistent vital status or unreliable data are identified if any of the following conditions are met 1) the patient's age is greater than 115 years; 2) if the discharge date for a hospitalization is before the admission date; and 3) if the patient has a sex other than 'male' or 'female'.

    Rationale: Reliable and consistent data are necessary for valid calculation of the measure.

3. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice data. This exclusion applies when the measure is used in Medicare FFS patients only.

    Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care.

4. 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.

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 RSMRs 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 mortality 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 mortality 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 RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality.

The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. The estimated hospital-specific intercept is added 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 deaths (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 [https://qualitynet.org/inpatient/measures/mortality/methodology].

References:

1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226.

2. Krumholz H, Normand S, Galusha D, et al. Risk-Adjustment Models for AMI and HF 30-Day Mortality Methodology. 2005. 118210| 112469| 146637| 150289

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N/A

Appendix E1: Related and Competing Measures (tabular)

Comparison of NQF #0229, NQF #0330 and NQF #0358

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization	0358 Heart Failure Mortality Rate (IQI 16)
Steward	Centers for Medicare & Medicaid Services	Centers for Medicare & Medicaid Services	Agency for Healthcare Research and Quality
Description	The measure estimates a hospital-level 30-day, all-cause, risk-standardized mortality rate for patients discharged from the hospital with a principal diagnosis of HF. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. 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 risk-standardized readmission rate (RSRR) for patients discharged from the hospital with a principal diagnosis of heart failure (HF). 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. The target population is patients age 65 and over. The Centers for Medicare & Medicaid Services (CMS) annually reports the measure for patients who are 65 years or older and are enrolled in fee-for-service (FFS) Medicare and hospitalized in non-federal hospitals or are patients hospitalized in Veterans Health Administration (VA) facilities.	In-hospital deaths per 1,000 hospital discharges with heart failure as a principal diagnosis for patients ages 18 years and older. Excludes obstetric discharges and transfers to another hospital. [NOTE: The software provides the rate per hospital discharge. However, common practice reports the measure as per 1,000 discharges. The user must multiply the rate obtained from the software by 1,000 to report in-hospital deaths per 1,000 hospital discharges.]
Type	Outcome	Outcome	Outcome
Data Source	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, skilled nursing facility care, some home health agency services, as well as inpatient and outpatient	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, and inpatient and outpatient physician claims for the 12 months prior to an index admission.	Claims The data source is hospital discharge data such as the HCUP State Inpatient Databases (SID) or equivalent using UB-04 coding standards. The data collection instrument is public-use AHRQ QI software available in SAS or Windows versions. URL Attachment IQI_Regression_Coefficients-

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization	0358 Heart Failure Mortality Rate (IQI 16)
	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.	_Code_Tables_and_Value_Sets-635560593483470264.xlsx
	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 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.	
	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 AHRQ SES index score at the patient nine-digit zip code level for use in studying the association between our measure and SRFs.	
	The American Community Survey (2013-2017): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ)	References Fleming C., Fisher ES, Chang CH, Bubolz D, Malenda J. Studying outcomes and hospital	

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization	0358 Heart Failure Mortality Rate (IQI 16)
	Socioeconomic Status (SES) composite index score. References: Fleming C, Fisher ES, Chang CH, Bubolz TA, Malenka DJ. 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 NQF_datadictionary_HFmortality_Fall2020_final_7.22.20.xlsx	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 NQF_datadictionary_HFreadmission_Fall2020_final_7.22.20.xlsx	
Level	Facility	Facility	Population : Community, County or City, Facility, Population : Regional and State
Setting	Inpatient/Hospital	Inpatient/Hospital	Inpatient/Hospital
Numerator Statement	The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients 65 and older hospitalized with a principal diagnosis of HF.	The outcome for this measure is 30-day readmissions. We define readmissions as any inpatient acute care admission, with the exception of certain planned readmissions, within 30 days from the date of discharge from an index admission with a principal discharge diagnosis of HF in patients 65and older. 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	Number of deaths (DISP=20) among cases meeting the inclusion and exclusion rules for the denominator.

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization	0358 Heart Failure Mortality Rate (IQI 16)
		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.	
Numerator Details	The measure counts all deaths (including in-hospital deaths) for any cause within 30 days of the date of the index HF admission. Identifying deaths in the FFS measure As currently reported, we identify deaths for FFS Medicare patients 65 years and older in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.	The measure counts readmissions to any acute care hospital for any cause within 30 days of the date of discharge of the index HF 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 (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 Hospital-Wide Readmission measure. In 2013, CMS applied the algorithm to its other readmission measures.	Number of deaths (DISP=20) among cases meeting the inclusion and exclusion rules for the denominator.

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization	0358 Heart Failure Mortality Rate (IQI 16)
		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. For the HF readmission measure, CMS used the Planned Readmission Algorithm without modifications. The planned readmission algorithm and associated code tables are attached in data field S.2b (Data Dictionary or Code Table).	
Denominator Statement	This claims-based measure is used for a cohort of patients aged 65 years or older. The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of HF 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.	The cohort includes admissions for patients aged 65years and older discharged from the hospital with a principal discharge diagnosis of HF, 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	Discharges, for patients ages 18 years and older, with a principal ICD-9-CM diagnosis code for heart failure.
Denominator Details	To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria: 1. Principal discharge diagnosis of heart failure 2. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior	To be included in the measure cohort used in public reporting, patients must meet the following additional inclusion criteria: 1. Principal discharge diagnosis of HF; 2. 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	ICD-9-CM Heart failure diagnosis codes: 39891 RHEUMATIC HEART FAILURE 40201 MAL HYPERT HRT DIS W CHF 40211 BENIGN HYP HRT DIS W CHF 40291 HYPERTEN HEART DIS W CHF 40401 MAL HYPER HRT/REN W CHF

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization	0358 Heart Failure Mortality Rate (IQI 16)
	to the date of the index admission and Part A during the index admission, or those who are VA beneficiaries 3. Aged 65 or over 4. Not transferred from another acute care facility We have explicitly tested the measure for those aged 65+ years and those aged 65+ years (see Testing Attachment for details).	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. Not transferred to another acute care facility.	40403 MAL HYP HRT/REN W CHF&RF 40411 BEN HYPER HRT/REN W CHF 40413 BEN HYP HRT/REN W CHF&RF 40491 HYPER HRT/REN NOS W CHF 40493 HYP HT/REN NOS W CHF&RF 4280 CONGESTIVE HEART FAILURE 4281 LEFT HEART FAILURE 42820 SYSTOLIC HRT FAILURE NOS 42821 AC SYSTOLIC HRT FAILURE 42822 CHR SYSTOLIC HRT FAILURE 42823 AC ON CHR SYST HRT FAIL 42830 DIASTOLC HRT FAILURE NOS 42831 AC DIASTOLIC HRT FAILURE 42832 CHR DIASTOLIC HRT FAIL 42833 AC ON CHR DIAST HRT FAIL 42840 SYST/DIAST HRT FAIL NOS 42841 AC SYST/DIASTOL HRT FAIL 42842 CHR SYST/DIASTL HRT FAIL 42843 AC/CHR SYST/DIA HRT FAIL 4289 HEART FAILURE NOS
Exclusions	The mortality measures exclude index admissions for patients: 1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility; 2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data; 3. Enrolled in the Medicare hospice program or used VA hospice services any time in	The 30-day HF 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. Admitted within 30 days of a prior index admission for HF; and 4. With a procedure code for LVAD implantation or heart transplantation either during the	Exclude cases: • transferring to another short-term hospital (DISP=2) • MDC 14 (pregnancy, childbirth, and puerperium) • with missing discharge disposition (DISP=missing), gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing) or principal diagnosis (DX1=missing)

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization	0358 Heart Failure Mortality Rate (IQI 16)
	the 12 months prior to the index admission, including the first day of the index admission; 4. Discharged against medical advice (AMA); or 5. Patients undergoing left ventricular assist device (LVAD) implantation or heart transplantation during an index admission or who have a history of LVAD or heart transplant in the preceding year. For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort for each year.	index admission or in the 12 months prior to the index admission.	
Exclusion Details	1. The discharge disposition indicator is used to identify patients alive at discharge. Transfers are identified in the claims when a patient with a qualifying admission is discharged from an acute care hospital and admitted to another acute care hospital on the same day or next day. Patient length of stay and condition is identified from the admission claim. Rationale: This exclusion prevents inclusion of patients who likely did not have clinically significant HF. 2. Inconsistent vital status or unreliable data are identified if any of the following conditions are met 1) the patient's age is greater than 115 years: 2) if the discharge date for a hospitalization is before the	The HF 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. 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.	Exclude cases: • transferring to another short-term hospital (DISP=2) • MDC 14 (pregnancy, childbirth, and puerperium) • with missing discharge disposition (DISP=missing), gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing) or principal diagnosis (DX1=missing)

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization	0358 Heart Failure Mortality Rate (IQI 16)
	admission date; 3) if the patient has a sex other than 'male' or 'female'. Rationale: Reliable and consistent data are necessary for valid calculation of the measure. 3. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice data and the Inpatient standard analytic file (SAF). Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care. 4. 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. 5. Patients with LVAD implantation or heart transplantation during an index admission or in the previous 12 months are identified by the corresponding codes for these procedures included in claims data. Rationale: Patients undergoing implantation of an LVAD designed to offer intermediate to long-term support (weeks to years) as a bridge to heart transplant or destination therapy represent a clinically distinct, highly-selected group of patients cared for at highly specialized medical centers.	3. HF admissions within 30 days of discharge from a qualifying HF index admission are identified by comparing the discharge date from the index admission with subsequent admission dates. Rationale: Additional HF 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. 4. With a procedure code for LVAD implantation or heart transplantation either during the index admission or in the 12 months prior to the index admission, which are identified by the corresponding codes included in claims data (codes can be found in attached Data Dictionary). Rationale: Patients with these procedures are a clinically distinct group with a different risk of the readmission outcome.	
Risk Adjustment	Statistical risk model 118210| 112469| 146637| 141015| 150289	Statistical risk model 117446| 141973| 137977| 112469| 146637| 150289	Statistical risk model 130177| 132112| 138848| 138827

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization	0358 Heart Failure Mortality Rate (IQI 16)
	118210| 112469| 146637| 141015| 150289	117446| 141973| 137977| 112469| 146637| 150289	130177| 132112| 138848| 138827
Stratification	N/A	N/A	Gender, age (5-year age groups), race / ethnicity, primary payer, custom
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 RSMRs following hospitalization for HF 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 mortality 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 mortality 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 RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality	The measure estimates hospital-level 30-day all-cause RSRRs following hospitalization for HF 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 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" readmissions to the number of "expected" readmissions, multiplied by the national unadjusted readmission rate. For each hospital, the numerator of the ratio ("predicted")	RATE: Each Inpatient Quality Indicator (IQI) expressed as a rate, is defined as outcome of interest/population at risk or numerator/denominator. The Quality Indicators software performs five steps to produce the IQI rates. 1) Discharge-level data is used to mark inpatient records containing outcomes of interest. 2) Identify populations at risk. 3) Calculate observed rates. 4) For rates that are not risk-adjusted, the risk-adjusted rate equals the observed rate. 5) Create multivariate signal extraction (MSX) smoothed rates. Shrinkage factors are applied to the risk-adjusted rates for each PQI in the MSX process. For each IQI, the shrinkage estimate reflects a reliability adjustment unique to each indicator. Full information on IQI algorithms and specification can be found at http://qualityindicators.ahrq.gov/Iqi_download.htm. 130177| 132112| 138848| 138827

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization	0358 Heart Failure Mortality Rate (IQI 16)
	rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality. The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. The estimated hospital-specific intercept is added 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 deaths (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	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 ("expected") is the number of readmissions expected on the basis of 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, or better quality, and a higher ratio indicates higher-than-expected readmission, 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 effect 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 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 log transformed and summed over all patients in the hospital to get an expected value. To assess hospital performance for each	

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization	0358 Heart Failure Mortality Rate (IQI 16)
	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 [https://qualitynet.org/inpatient/measures/mortality/methodology]. References: 1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 118210| 112469| 146637| 141015| 150289	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 (Krumholz et al., 2005). References: 1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 2. 2. Krumholz H, Normand S, Galusha D, et al. Risk-Adjustment Models for HF and HF 30-Day Readmission Methodology. 2005. 117446| 141973| 137977| 112469| 146637| 150289	
Submission items	5.1 Identified measures: 0330 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization 0358 : Heart Failure Mortality Rate (IQI 16) 0468 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization 1789 : Hospital-Wide All-Cause Unplanned Readmission Measure (HWR) 1893 : Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	5.1 Identified measures: 0505 : Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization. 0229 : Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization 1789 : Hospital-Wide All-Cause Unplanned Readmission Measure (HWR) 1891 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following chronic obstructive pulmonary disease (COPD) hospitalization	5.1 Identified measures: 5a.1 Are specs completely harmonized? 5a.2 If not completely harmonized, identify difference, rationale, impact: 5b.1 If competing, why superior or rationale for additive value: The AHRQ measure provides a real-time indication of hospital performances, reflects the patient's experience in the hospital, and is available for all-payers

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization	0358 Heart Failure Mortality Rate (IQI 16)
	3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure 3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure 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. Our measure cohort was heavily vetted by clinical experts, a technical expert panel, and a public comment period. Additionally, the measure, with the specified cohort, has been publicly reported since 2008. 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	2879 : Hybrid Hospital-Wide Readmission (HWR) Measure with Claims and Electronic Health Record Data 2880 : Excess days in acute care (EDAC) after hospitalization for heart failure (HF) 2886 : Risk-Standardized Acute Admission Rates for Patients with Heart Failure 2888 : Accountable Care Organization Risk-Standardized Acute Hospital Admission Rate for Patients with Multiple Chronic Conditions 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	Related Measures: CMS CHF Mortality Measure

Comparison of NQF #0229, NQF #0468 and NQF #1789

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	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 30-day, all-cause, risk-standardized mortality rate for patients discharged from the hospital with a principal diagnosis of HF. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. 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 risk-standardized mortality rate (RSMR). Mortality is defined as death for any cause within 30 days after the date of admission for the index admission, 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 diagnosis of pneumonia (including aspiration pneumonia) coded as present on admission (POA). CMS annually reports the measure for patients who are 65 years or older and are either Medicare fee-for-service (FFS) beneficiaries and hospitalized in non-federal hospitals or patients hospitalized in Veterans Health Administration (VA) facilities.	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

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
			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, 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, skilled nursing facility care, some home health agency 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	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	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

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
	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 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): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score. References: Fleming C, Fisher ES, Chang CH, Bubolz TA, Malenka DJ. Studying outcomes and hospital utilization in the elderly: The advantages of a	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 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): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score. 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.	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 DelAP_4-107f_NQF1789HWR_DataDictionary_Final082819-637263622402629808.xlsx

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
	merged data base for Medicare and Veterans Affairs hospitals. Medical Care. 1992; 30(5): 377-91. No data collection instrument provided Attachment NQF_datadictionary_HFmortality_Fall2020_final_7.22.20.xlsx	No data collection instrument provided Attachment NQF_datadictionary_PNmortality_Fall2020_final_7.22.20.xlsx	
Level	Facility	Facility	Facility
Setting	Inpatient/Hospital	Inpatient/Hospital	Inpatient/Hospital, Outpatient Services
Numerator Statement	The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients 65 and older hospitalized with a principal diagnosis of HF.	The outcome for this measure is 30-day all-cause mortality (including in-hospital deaths). We define mortality as death from any cause within 30 days of the index admission datefrom the date of admission for patients hospitalized 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.	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.

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
Numerator Details	The measure counts all deaths (including in-hospital deaths) for any cause within 30 days of the date of the index HF admission. Identifying deaths in the FFS measure As currently reported, we identify deaths for FFS Medicare patients 65 years and older in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.	The measure counts all deaths (including in-hospital deaths) for any cause within 30 days of the date of admission of the index pneumonia hospitalization. Identifying deaths in the FFS measure As currently reported, we identify deaths for FFS Medicare patients 65 years or over in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.	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.

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	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 (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

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
			Specifications Report: Hospital-Wide Readmission" Wallace Lori, Grady J, Djordjevic Darinka, et al. 2019 All-Cause Hospital Wide Measure Updates and Specifications Report. https://www.qualitynet.org/dcs/ContentServer?c=Page&pagename=QnetPublic%2FPage%2FQnetTier4&cid=1219069855841
Denominator Statement	This claims-based measure is used for a cohort of patients aged 65 years or older. The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of HF 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.	This claims-based measure is used for a cohort of patients aged 65 years or over older. The cohort includes admissions for patients aged 65 years and older discharged from the hospital with 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 but no secondary discharge diagnosis of severe sepsis; and with a complete claims history for the 12 months prior to admission. The measure will be publicly reported by CMS for those patients 65 years or older who are Medicare FFS beneficiaries admitted to non-federal hospitals or patients admitted to VA hospitals. Additional details are provided in S.9 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. 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 inclusion criteria: 1. Principal discharge diagnosis of heart failure	To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria: 1. Principal discharge diagnosis of pneumonia, including aspiration pneumonia; or	To be included in the measure cohort, patients must meet the following inclusion criteria: 1. Enrolled in Medicare FFS Part A for the 12 months prior to the date of

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
	2. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of the index admission and Part A during the index admission, or those who are VA beneficiaries 3. Aged 65 or over 4. Not transferred from another acute care facility We have explicitly tested the measure for those aged 65+ years and those aged 65+ years (see Testing Attachment for details).	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); 3. Aged 65 or over; 4. Not transferred from another acute care facility; and 5. Enrolled in 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. We have explicitly tested the measure for those aged 65 years or over (see Testing Attachment for details).	admission and during the index admission; 2. Aged 65 or older; 3. Discharged alive from a non-federal short-term acute care hospital; and 4. 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

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
			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 mortality measures exclude index admissions for patients: 1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility; 2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data; 3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission; 4. Discharged against medical advice (AMA); or	The mortality measure excludes index admissions for patients: 1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility; 2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data; 3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission; or 4. Discharged against medical advice (AMA).	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.

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
	5. Patients undergoing left ventricular assist device (LVAD) implantation or heart transplantation during an index admission or who have a history of LVAD or heart transplant in the preceding year. For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort for each year.	For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort.	
Exclusion Details	1. The discharge disposition indicator is used to identify patients alive at discharge. Transfers are identified in the claims when a patient with a qualifying admission is discharged from an acute care hospital and admitted to another acute care hospital on the same day or next day. Patient length of stay and condition is identified from the admission claim. Rationale: This exclusion prevents inclusion of patients who likely did not have clinically significant HF. 2. Inconsistent vital status or unreliable data are identified if any of the following conditions are met 1) the patient's age is greater than 115 years: 2) if the discharge date for a hospitalization is before the admission date; 3) if the patient has a sex other than 'male' or 'female'. Rationale: Reliable and consistent data are necessary for valid calculation of the measure. 3. Hospice enrollment in the 12 months prior to or on the index admission is identified	1. The discharge disposition indicator is used to identify patients alive at discharge. Transfers are identified in the claims when a patient with a qualifying admission is discharged from an acute care hospital and admitted to another acute care hospital on the same day or next day. Patient length of stay and condition is identified from the admission claim. Rationale: This exclusion prevents inclusion of patients who likely did not have clinically significant pneumonia. 2. Inconsistent vital status or unreliable data are identified if any of the following conditions are met 1) the patient's age is greater than 115 years; 2) if the discharge date for a hospitalization is before the admission date; or 3) if the patient has a sex other than 'male' or 'female'. Rationale: Reliable and consistent data are necessary for valid calculation of the measure. 3. Hospice enrollment in the 12 months prior to or on the index admission is	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.

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
	using hospice data and the Inpatient standard analytic file (SAF). Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care. 4. 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. 5. Patients with LVAD implantation or heart transplantation during an index admission or in the previous 12 months are identified by the corresponding codes for these procedures included in claims data. Rationale: Patients undergoing implantation of an LVAD designed to offer intermediate to long-term support (weeks to years) as a bridge to heart transplant or destination therapy represent a clinically distinct, highly-selected group of patients cared for at highly specialized medical centers.	identified using hospice enrollment data. Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care. 4. Discharges against medical advice (AMA) are identified using the discharge disposition indicator. Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge. After all exclusions are applied, the measure randomly selects one index admission per patient per year for inclusion in the cohort so that each episode of care is mutually independent with the similar probability of the outcome. For each patient, the probability of death may increase with each subsequent admission, and therefore, the episodes of care are not mutually independent. Also, for the three-year combined data, when index admissions occur during the transition between measure reporting periods (June and July of each year) and both are randomly selected for inclusion in the measure, the measure includes only the June admission. The July admissions are excluded to avoid assigning a single death to two admissions.	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	Statistical risk model 118210| 112469| 146637| 141015| 150289 118210| 112469| 146637| 141015| 150289	Statistical risk model 107491| 118210| 112469| 146637| 150289 107491| 118210| 112469| 146637| 150289	Statistical risk model 112469| 118210| 135810| 141973| 146637| 146313

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
			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 RSMRs following hospitalization for HF 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 mortality 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 mortality 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 RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality	The measure estimates hospital-level 30-day all-cause RSMRs 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 mortality 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 mortality 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 RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the	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

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
	rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality. The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. The estimated hospital-specific intercept is added 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 deaths (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	number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality. The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. 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 deaths (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.	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

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
	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 [https://qualitynet.org/inpatient/measures/mortality/methodology]. References: 1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 118210| 112469| 146637| 141015| 150289	This calculation transforms the ratio of predicted over expected into a rate that is compared to the national observed mortality rate. The hierarchical logistic regression models are described fully in the original methodology report posted on QualityNet: https://qualitynet.org/inpatient/measures/mortality/methodology. References: Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 107491| 118210| 112469| 146637| 150289	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

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
			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; https://www.qualitynet.org/dcs/ContentServer?c=Page&pagename=QnetPublic%2FPage%2FQnetTier4&cid=1219069855841 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: 0330 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization 0358 : Heart Failure Mortality Rate (IQI 16) 0468 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization 1789 : Hospital-Wide All-Cause Unplanned Readmission Measure (HWR) 1893 : Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	5.1 Identified measures: 0231 : Pneumonia Mortality Rate (IQI #20) 0506 : Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization 0279 : Community Acquired Pneumonia Admission Rate (PQI 11) 1891 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following chronic obstructive pulmonary disease (COPD) hospitalization 1893 : Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	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

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
	3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure 3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure 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. Our measure cohort was heavily vetted by clinical experts, a technical expert panel, and a public comment period. Additionally, the measure, with the specified cohort, has been publicly reported since 2008. 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	2579 : Hospital-level, risk-standardized payment associated with a 30-day episode of care for pneumonia (PN) 3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure 3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure 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 (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). Lastly, this measure and the NQF Inpatient Pneumonia Mortality (AHRQ) Measure #0231 are complementary rather than competing measures. Although they both assess mortality for patients admitted to acute care hospitals with a principal discharge diagnosis of pneumonia, the specified outcomes are different. This measure assesses 30-day	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

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
		mortality while #0231 assesses inpatient mortality. Assessment of 30-day and inpatient mortality outcomes have distinct advantages and uses which make them complementary as opposed to competing. For example, the 30-day period provides a broader perspective on hospital care and utilizes standard time period to examine hospital performance to avoid bias by differences in length of stay among hospitals. However, in some settings it may not be feasible to capture post-discharge mortality making the inpatient measure more useable. We have previously consulted with AHRQ to examine harmonization of complementary measures of mortality for patients with AMI and stroke. We have found that the measures are harmonized to the extent possible given that small differences in cohort inclusion and exclusion criteria are warranted on the basis of the use of different outcomes. However, this current measure includes patients with a principal discharge diagnosis of sepsis and a secondary discharge diagnosis of pneumonia that is present on admission. The cohort was also expanded to include patients with a principal discharge diagnosis of aspiration pneumonia. Thus, the current measure cohort is still not harmonized with measure #0231.

5b.1 If competing, why superior or rationale for additive value: N/A | 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). |

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
			5b.1 If competing, why superior or rationale for additive value: N/A

Comparison of NQF #0229, NQF #1893 and NQF #3502

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
Steward	Centers for Medicare & Medicaid Services	Centers for Medicare & Medicaid Services	Centers for Medicare & Medicaid Services
Description	The measure estimates a hospital-level 30-day, all-cause, risk-standardized mortality rate for patients discharged from the hospital with a principal diagnosis of HF. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. 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 risk-standardized mortality rate (RSMR), defined as death from any cause within 30 days after the index admission date, for patients discharged from the hospital with either a principal discharge diagnosis of COPD or a principal discharge diagnosis of respiratory failure with a secondary discharge diagnosis of acute exacerbation of COPD. 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 risk-standardized mortality rate (RSMR), defined as death from any cause within 30 days after the index admission date for patients who are between the ages of 50 and 94. Please note that in parallel with the hybrid HWM measure, we are submitting a claims-only HWM measure. Note that ultimately the claims and hybrid measures will be harmonized and use the same exact cohort specifications. The intent is that prior to implementation, the two measures will be exactly the same, with the exception of the additional risk adjustment added by the CCDE in the hybrid measure. This is analogous to the currently endorsed and implemented hybrid hospital-wide readmissions measure (NQF 1789 and NQF 2879e).

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
			Because of the homology between the claims and hybrid HWM measures, there is no reason to suspect that the results of analyses done for the claims-only measure would differ in any significant way from results of analyses for a nationally representative hybrid measure. Below we highlight the differences between the two measures, including specifications, data used, and testing which reflect limitations of data availability, as well as actual intended differences in the measure (risk adjustment). Differences in the measure, data, and testing that reflect limitations in data availability 1. Dataset used for development, some testing (see below for differences), and measure results: a. The claims-only measure uses nation-wide Medicare FFS claims and the enrollment database. b. The hybrid measure uses an electronic health record (EHR) database from 21 hospitals in the Kaiser Permanente network which includes inpatient claims data information.

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
			2. Age of patients in cohort: a. The claims-only measure includes Medicare FFS patients, age 65-94. b. The hybrid measure includes all patients age 50-94 (see later discussion for justification) 3. External empiric validity testing a. Not possible for the hybrid measure, due to limited data availability. We provide results from the claims-only measure within the hybrid testing form. 4. Socioeconomic risk factor analyses a. Not possible for the hybrid measure, due to limited data availability. We provide results from the claims-only measure within the hybrid testing form. 5. Exclusion analyses a. To be representative of what we expect the impact would be of the measures' exclusions in a nation-wide sample,

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

			we provide the results from the claims-only measure.
			6. Meaningful differences
			  a. To be representative of what we expect the range of performance would be in a nation-wide sample, we provide the distribution results from the claims-only measure.
			Difference between the two measures when fully harmonized, prior to implementation:
			1. Risk adjustment:
			  a. The claims-only measure uses administrative claims data only for risk adjustment
			  b. The hybrid measure adds 10 clinical risk variables, derived from a set of core clinical data elements (CCDE) extracted from the EHR.

Type	Outcome	Outcome	Outcome
Data Source	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	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:	Claims, Electronic Health Records, Other Clinical-Hybrid Dataset Constructed using Kaiser Permanente Northern California matched administrative claims and electronic

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
	services including: Medicare inpatient hospital care, outpatient hospital services, skilled nursing facility care, some home health agency 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 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.	Medicare inpatient hospital care, outpatient hospital services, skilled nursing facility care, some home health agency 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 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): The American Community Survey data is collected annually and an aggregated 5-years	health record (EHR) data, admission dates from October 1, 2015 – December 30, 2016. This data source was used for measure testing. (An earlier Kaiser dataset from that included all admissions for adult patients to any of their member hospitals between January 1, 2009 and June 30, 2015 was used for measure development, as described in the attached methodology report). The two data sources listed below were used for testing the claims-based measure; the hybrid testing form includes some testing data from the claims-based measure (for example, for the social risk factor and external validation analyses). HWM claims-only datasets: Medicare Part A Inpatient Claims Data The index dataset contains administrative inpatient hospitalization data for Medicare FFS beneficiaries, aged 65-94 on admission. The history dataset includes administrative inpatient hospitalization data on each patient for the 12 months prior to the index admission. This data was used along with the Medicare Enrollment Database (EDB) for testing the claims-based measure. Medicare Enrollment Database (EDB) This database contains Medicare beneficiary demographic, benefit/coverage, and vital status

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
	The American Community Survey (2013-2017): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score. References: Fleming C, Fisher ES, Chang CH, Bubolz TA, Malenka DJ. 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 NQF_datadictionary_HFmortality_Fall2020_final_7.22.20.xlsx	data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score. References: Fleming C, Fisher ES, Chang CH, Bubolz TA, Malenka DJ. 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 NQF_datadictionary_COPDmortality_Fall2020_final_7.22.20.xlsx	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. It was also used to determine hospice enrollment. No data collection instrument provided Attachment Del18b2HOP5HWMHybridDataDictionary01072019.xlsx
Level	Facility	Facility	Facility
Setting	Inpatient/Hospital	Inpatient/Hospital	Inpatient/Hospital, Other Home-based primary care and home-based palliative care); Settings include: Home, Boarding home, Domiciliary, Assisted Living Facilities, Rest Home or Custodial Care Services
Numerator Statement	The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients 65 and older hospitalized with a principal diagnosis of HF.	The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients hospitalized with either a principal diagnosis of COPD or a principal diagnosis of respiratory failure with a secondary diagnosis of acute exacerbation of COPD.	The outcome for this measure is 30-day, all-cause mortality. Mortality is defined as death from any cause, either during or after admission, within 30 days of the index admission date.

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
Numerator Details	The measure counts all deaths (including in-hospital deaths) for any cause within 30 days of the date of the index HF admission. Identifying deaths in the FFS measure As currently reported, we identify deaths for FFS Medicare patients 65 years and older in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.	The measure counts all deaths (including in-hospital deaths) for any cause within 30 days of the date of the index COPD admission. Identifying deaths in the FFS measure As currently reported, we identify deaths for FFS Medicare patients 65 years and older in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.	The measure outcome is death from any cause within 30 days of the admission date of the index admission. The numerator is a binary variable (1=yes/0=no) that indicates whether the patient died within 30 days of the index admission date.
Denominator Statement	This claims-based measure is used for a cohort of patients aged 65 years or older. The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of HF 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.	This claims-based measure is used for a cohort of patients aged 65 years or older. The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of COPD 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.	The cohort includes inpatient admissions for a wide variety of conditions for patients aged between 50 and 94 years old who were discharged from short-term acute care hospitals. If a patient has more than one admission during the measurement year, one admission is randomly selected for inclusion in the measure. Additional details are provided in S.7 Denominator Details. The age range for this measure differs from that of the claims-only measure due to the limited size of the dataset used for testing. The intent is to harmonize the age range of the hybrid measure with the age range of the claims-only measure, so that both will include admissions for patients age 65-94.
Denominator Details	To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria: 1. Principal discharge diagnosis of heart failure 2. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior	To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria: 1. Principal discharge diagnosis of COPD or a principal discharge diagnosis of respiratory failure with a secondary discharge diagnosis of acute exacerbation of COPD	The index cohort includes all inpatient admissions for patients aged 50-94 years old. (Note: The intention is to fully harmonize the cohort definition with the claims-only measure so that both measures will capture admissions for patients age 65-94. We deviated from

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
	to the date of the index admission and Part A during the index admission, or those who are VA beneficiaries 3. Aged 65 or over 4. Not transferred from another acute care facility We have explicitly tested the measure for those aged 65+ years and those aged 65+ years (see Testing Attachment for details).	2. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of the index admission and Part A during the index admission, or those who are VA beneficiaries 3. Aged 65 or over 4. Not transferred from another acute care facility. This measure can also be used for an all-payer population aged 40 years and older. We have explicitly tested the measure in both patients aged 40+ years and those aged 65+ years (see Testing Attachment for details).	that definition during development and testing due to the limited dataset available that included the EHR data elements needed to calculate this measure. Note that the risk model already includes age in years, as a risk variable.) An index admission is the hospitalization to which the mortality outcome is attributed and includes admissions for patients: 1. Not transferred from another acute care facility Rationale: Admissions to an acute cate hospital within one day of discharge from another acute care hospital are considered transfers. Transferred patients are included in the measure cohort, but it is the initial hospitalization rather than any "transfer-in" hospitalization(s), that is included as the hospitalization to which the mortality outcome is attributed (the index admission). 2. Aged between 50 and 94 years The hybrid measure is intended for the Medicare FFS population but was tested in a limited dataset due to the EHR data elements included. The use of a small dataset required that we expand the sample by including admissions from patients ages 50 to 94 years. Note that the measure already adjusts for age.

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
			3. Not admitted for primary psychiatric diagnoses Rationale: Patients admitted for psychiatric treatment are typically cared for in separate psychiatric facilities that are not comparable to short-term acute care hospitals (see data dictionary, HWM Non-Acute Care Inclusion tab). 4. Not admitted for rehabilitation Rationale: These admissions are not typically to a short-term acute care hospital and are not for acute care (see data dictionary, HWM Non-Acute Care Inclusion tab). 5. Not enrolled in hospice at the time of, or 12 months prior to, their index admission Rationale: Patients enrolled in hospice in the prior 12 months or at the time of admission are unlikely to have 30-day survival as a primary goal 6. Not enrolled in hospice within two days of admission Rationale: There is not a single, correct approach regarding patients enrolled in hospice during admission or upon discharge – mortality may or may not represent a quality signal for this group of patients and hospice enrollment is inadequate to differentiate this issue. However, for most patients and/or families who had the discussion and

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
			agreed to enroll in hospice within two days of admission, 30-day survival is not likely the primary goal due to their condition and not the quality of care received. 7. Not with a principal diagnosis of cancer and enrolled in hospice during their index admission Rationale: Patients admitted primarily for cancer who are enrolled in hospice during admission are unlikely to have 30-day survival as a primary goal of care. (see data dictionary, HWM Cancer Inclusion tab). 8. Without any diagnosis of metastatic cancer Rationale: Although some patients admitted with a diagnosis of metastatic cancer will have 30-day survival as a primary goal of care, for many such patients admitted to the hospital, death may be a clinically reasonable and patient-centered outcome. (see data dictionary, HWM Metastatic Cancer Inclusion tab). 9. Not with a principal discharge diagnosis, or a secondary diagnosis that is present on admission (POA) for a condition which hospitals have limited ability to influence survival Rationale: Hospitals have little ability to impact mortality for some conditions. This

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
			list of conditions (see data dictionary, HWM ICD-10 Inclusion tab) was determined through independent review, by several clinicians, of conditions associated with high mortality. The decisions were also reviewed with our Technical Expert Panel (TEP) and Technical Work Group. Admissions are not included in the cohort if the patient had a principal diagnosis code that is on this list, or a secondary code with POA that is on the list. In addition, for patients with multiple admissions, the measure selects only one admission, at random, for inclusion. There is no practical statistical modeling approach that can account or adjust for the complex relationship between the number of admissions and risk of mortality in the context of a hospital-wide mortality measure. Random selection ensures that providers are not penalized for a "last" admission during the measurement period; selecting the last admission would not be as accurate a reflection of the risk of death as random selection, as the last admission is inherently associated with a higher mortality risk. Random selection is also used in CMS's condition-specific mortality measures. Note that random selection reduces the number of admissions, but

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
			does not exclude any patients from the measure.
			The cohort is defined using ICD-10 Clinical Modification codes identified in Medicare Part A Inpatient claims data. The measure aggregates the ICD-10 principal diagnosis and all procedure codes of the index admission into clinically coherent groups of conditions and procedures (condition categories or procedure categories) using the Agency for Healthcare Research and Quality (AHRQ) Clinical Classifications System (CCS). There is a total of 285 mutually exclusive AHRQ condition categories, most of which are single, homogenous diseases such as pneumonia or acute myocardial infarction. Some are aggregates of conditions, such as "other bacterial infections". There is a total of 231 mutually exclusive procedure categories. Using the AHRQ CCS procedure and condition categories, the measure assigns each index hospitalization to one of 15 mutually exclusive divisions. The divisions were created based upon clinical coherence, consistency of mortality risk, adequate patient and hospital case volume for stable results reporting, and input from clinicians, patients, and patient caregivers on usability.
			The measure first assigns admissions with qualifying AHRQ procedure categories to

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			one of six surgery divisions by identifying a defining surgical procedure. The defining surgical procedure is identified using the following algorithm: 1) if a patient only has one major surgical procedure then that procedure is the defining surgical procedure; 2) if a patient has more than one major surgical procedure, the first dated procedure performed during the index admission is the defining surgical procedure; 3) if there is more than one major surgical procedure on that earliest date, the procedure with the highest mortality rate is the defining surgical procedure. These divisions include admissions likely cared for by surgical teams. The surgical divisions are: Surgical Cancer (see note below), Cardiothoracic Surgery, General Surgery, Neurosurgery, Orthopedic Surgery, and Other Surgical Procedures. For the Surgical Cancer division, any admission that includes a surgical procedure and a principal discharge diagnosis code of cancer is assigned to the Surgical Cancer division. This division and the logic behind it was implemented in response to feedback from our Technical Expert Panel. The measure then assigns the remaining admissions into one of the nine non-surgical divisions based on the AHRQ

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
			diagnostic CCS of the principal discharge diagnosis. The non-surgical divisions are: Cancer, Cardiac, Gastrointestinal, Infectious Disease, Neurology, Orthopedic, Pulmonary, Renal, Other Conditions. The full list of the specific diagnosis and procedure AHRQ CCS categories used to define the divisions are attached in the Data Dictionary.
Exclusions	The mortality measures exclude index admissions for patients: 1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility; 2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data; 3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission; 4. Discharged against medical advice (AMA); or 5. Patients undergoing left ventricular assist device (LVAD) implantation or heart transplantation during an index admission or who have a history of LVAD or heart transplant in the preceding year. For patients with more than one admission for a given condition in a given year, only one	The mortality measures exclude index admissions for patients: 1. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data; 2. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission; or 3. Discharged against medical advice (AMA). For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort for each year.	The measure excludes index admissions for patients: 1. With inconsistent or unknown vital status (from claims data) or other unreliable claims data; 2. Discharged against medical advice (AMA); 3. With an admission for spinal cord injury (CCS 227), skull and face fractures (CCS 228), Intracranial Injury (CCS 233), Crushing injury or internal injury (CCS 234), Open wounds of head/neck/trunk (CCS 235), and burns (CCS 240); and 4. With a principal discharge diagnosis within a CCS with fewer than 100 admissions in that division within the measurement year.

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
	index admission for that condition is randomly selected for inclusion in the cohort for each year.		

Exclusion Details	1. The discharge disposition indicator is used to identify patients alive at discharge. Transfers are identified in the claims when a patient with a qualifying admission is discharged from an acute care hospital and admitted to another acute care hospital on the same day or next day. Patient length of stay and condition is identified from the admission claim.
	
	Rationale: This exclusion prevents inclusion of patients who likely did not have clinically significant HF.
	
	2. Inconsistent vital status or unreliable data are identified if any of the following conditions are met
	
	   1) the patient's age is greater than 115 years:
	   2) if the discharge date for a hospitalization is before the admission date;
	   3) if the patient has a sex other than 'male' or 'female'.
	
	Rationale: Reliable and consistent data are necessary for valid calculation of the measure.
	
	3. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice data and the Inpatient standard analytic file (SAF).
		1. Inconsistent vital status or unreliable data are identified if any of the following conditions are met
		
		   1) the patient's age is greater than 115 years:
		   2) if the discharge date for a hospitalization is before the admission date;
		   3) if the patient has a sex other than 'male' or 'female'.
		
		Rationale: Reliable and consistent data are necessary for valid calculation of the measure.
		
		2. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice data.
		
		Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care.
		
		3. 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.
			1. With inconsistent or unknown vital status (from claims data) or other unreliable claims data.
			
			Rationale: The measure does not include stays for patients where the admission date is after the date of death, or where the date of death occurs before the date of discharge but the patient was discharged alive because these are likely errors in the data.
			
			2. Discharged against medical advice (AMA)
			
			Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.
			
			3. With an admission for spinal cord injury (CCS 227), skull and face fractures (CCS 228), Intracranial Injury (CCS 233), Crushing injury or internal injury (CCS 234), Open wounds of head/neck/trunk (CCS 235), and burns (CCS 240).
			
			Rationale: Even though a hospital likely can influence the outcome of some of these conditions, in many cases death events are not a signal of poor quality of care when patients present with these conditions. These conditions are also

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
	Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care. 4. 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. 5. Patients with LVAD implantation or heart transplantation during an index admission or in the previous 12 months are identified by the corresponding codes for these procedures included in claims data. Rationale: Patients undergoing implantation of an LVAD designed to offer intermediate to long-term support (weeks to years) as a bridge to heart transplant or destination therapy represent a clinically distinct, highly-selected group of patients cared for at highly specialized medical centers.		infrequent events that are unlikely to be uniformly distributed across hospitals. 4. With a principal discharge diagnosis within a CCS with fewer than 100 admissions in that division within the measurement year. Rationale: To calculate a stable and precise risk model, there are a minimum number of admissions that are needed. In addition, a minimum number of admissions and/or outcome events are required to inform grouping admissions into larger categories. These admissions present challenges to both accurate risk prediction and coherent risk grouping and are therefore excluded. Note: During measure development we analyzed different volume cut-offs (25, 50 and 100). Using cut-off values below 100 resulted in too many CCS codes in some of the divisions (the CCS category codes are used in risk adjustment) which resulted in non-convergence of those division-level risk models. The total number of patients excluded is very small (13,597 or 0.21% of admissions for a cut off of 100). During measure development we also explored the option of pooling low-volume CCS codes (CCS<100 patients) into one group, however, the heterogeneity in mortality rates for the individual ICD-10 codes in those groups would preclude adequate

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
			risk adjustment. The TEP supported excluding these admissions.
Risk Adjustment	Statistical risk model 118210| 112469| 146637| 141015| 150289 118210| 112469| 146637| 141015| 150289	Statistical risk model 112469| 118210| 146637| 150289 112469| 118210| 146637| 150289	Statistical risk model 146637| 110639| 141015| 110874| 146313 146637| 110639| 141015| 110874| 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 RSMRs following hospitalization for HF 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 mortality 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 mortality 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 measure estimates hospital-level 30-day all-cause RSMRs following hospitalization for COPD 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 mortality 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 mortality 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	The measure estimates hospital-level, risk-standardized mortality rates (RSMRs) within 30 days of hospital admission using hierarchical logistical regression models through a Bayesian Markov Chain Monte Carlo (MCMC) procedure. In brief, we used hierarchical logistic regression to model the log-odds of mortality for each of the 15 service-line divisions. Death within 30 days was modeled as a function of patient-level demographic and clinical characteristics and a random hospital-level intercept. This model specification accounts for within-hospital correlation of the observed outcomes and models the assumption that underlying differences in quality among the health care facilities being evaluated lead to systematic differences in outcomes. We estimated a separate hierarchical logistic regression model for each service-line division. In

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
	the hospital intercepts should be identical across all hospitals. The RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality. The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. The estimated hospital-specific intercept is added 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	for patient risk, the hospital intercepts should be identical across all hospitals. The RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality. The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. The estimated hospital-specific intercept is added 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 deaths (the denominator) is obtained in the same manner,	order to obtain the variance and interval estimates, we fit the hierarchical model under the Bayesian framework along with the Markov Chain Monte Carlo (MCMC) technique. Admissions are assigned to one of 15 mutually exclusive divisions (groups of discharge condition categories and procedure categories). For each division and each hospital with patients in that division, the standardized mortality ratio (SMR) is calculated as the ratio of the number of "predicted" deaths to the number of "expected" deaths at a given hospital. The predicted number of deaths is based on the hospital's performance with its observed case mix and service mix, and is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific effect on the risk of mortality. 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 transformed via an inverse logit function and summed over all patients attributed to a hospital to get a predicted value. The expected number of deaths is based on the nation's performance with that hospital's case mix and service mix and is obtained in the same manner, but a common effect using all hospitals in our

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
	deaths (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 [https://qualitynet.org/inpatient/measures/mortality/methodology]. References: 1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 118210| 112469| 146637| 141015| 150289	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: https://qualitynet.org/inpatient/measures/mortality/methodology. References: 1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 112469| 118210| 146637| 150289	sample is added in place of the hospital-specific effect. The results are transformed via an inverse logit function and summed over all patients in the hospital to get an expected value. 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 mortality rates or better quality, while a higher ratio indicates higher-than-expected mortality rates or worse quality. To assess hospital performance for each reporting period, the measure re-estimates the model coefficients using the data in that period. The division-level SMRs are then pooled for each hospital using an inverse variance-weighted geometric mean to create a hospital-wide composite SMR. (Note that in the case of the hybrid measure, we are presenting data from 9 of the total 15 divisions due to limitations in availability of electronic health records data). The hospital-wide SMR is then multiplied by the national observed mortality rate to produce the RSMR.

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
			146637| 110639| 141015| 110874| 146313
Submission items	5.1 Identified measures: 0330 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization 0358 : Heart Failure Mortality Rate (IQI 16) 0468 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization 1789 : Hospital-Wide All-Cause Unplanned Readmission Measure (HWR) 1893 : Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization 3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure 3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure 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. Our measure cohort was heavily vetted by	5.1 Identified measures: 0468 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization 0506 : Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization 0275 : Chronic Obstructive Pulmonary Disease (COPD) or Asthma in Older Adults Admission Rate (PQI 05) 1891 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following chronic obstructive pulmonary disease (COPD) hospitalization 2888 : Accountable Care Organization Risk-Standardized Acute Hospital Admission Rate for Patients with Multiple Chronic Conditions 3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure 3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure 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. Our measure cohort	5.1 Identified measures: 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: This hybrid HWM measure incorporates patient-level clinical data from the EHR into the risk adjustment model, compared to the claims-only hospital-wide mortality measure. This hybrid HWM measure is intended to complement the existing CMS Hospital-Wide All-Cause Risk-Standardized Readmission Measure (NQF #1789) to allow assessment of trends in hospital performance for both readmission and mortality outcomes, similar to other complementary pairs of readmission and mortality measures for specific conditions and procedures. By measuring mortality outcomes across almost all hospitalized patients, this measure will provide an important additional performance assessment that will complement condition- and procedure-specific or other more narrowly defined mortality measures and allow a greater number of patients and hospitals to be evaluated. This HWM measure captures a similarly

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
	clinical experts, a technical expert panel, and a public comment period. Additionally, the measure, with the specified cohort, has been publicly reported since 2008. 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	was heavily vetted by clinical experts, a technical expert panel, and a public comment period. Additionally, the measure, with the specified cohort, has been publicly reported since 2008. 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	broad cohort to the CMS Hospital-Wide All-Cause Risk-Standardized Readmission Measure (NQF #1789), and a broader cohort than those of other CMS condition-specific measures. Because the mortality measure is focused on a different outcome, it differs from the existing CMS Hospital-Wide All-Cause Risk Standardized Readmission Measure (NQF #1789) in a couple of ways. First, this HWM measure includes patients with a principal discharge diagnosis of cancer, whereas those patients are not included in the readmission measure. Cancer patients are appropriate to include as many have survival as their primary goal, however due to cancer treatment plans, readmissions are frequently part of the plan and expected and therefore are not a reasonable signal of quality. Another difference between the two measures is the number of divisions or specialty cohorts the patients are divided into in order to more accurately risk adjust for case-mix and service-mix. The readmission measure divides patients into six categories, or "specialty cohorts", while the mortality measure uses 15. This is because the risk of mortality is much more closely related to patient factors than readmission is related to patient factors. PSI-02 (NQF #0357) is another complementary mortality measure, which

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
			captures a different patient population and a different outcome compared with the HWM measure submitted with this application. PSI-02 captures patients 18 years of age or older, or obstetric patients, whereas the HWM measure captures patients between the ages of 65 and 94. PSI-02 captures DRGs with less than 0.5% mortality rate, whereas the HWM measure captures all patients within all CCSs, regardless of mortality rate. HWM captures mortality up to 30 days past admission, where AHRQ PSI-02 only captures in-hospital mortality. IQI 90 (NQF #0530) is another complimentary mortality measure, which is a composite measure of the number of in-hospital deaths for a narrow range of conditions (CHF, stroke, hip fracture, pneumonia, acute myocardial infarction and GI hemorrhage). The HWM measure presented in this application captures all deaths after 30 days of admission, for all conditions and procedures. 5b.1 If competing, why superior or rationale for additive value: There are no competing NQF-endorsed measures.

Comparison of NQF #0229 and NQF #3504

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
Steward	Centers for Medicare & Medicaid Services	Centers for Medicare & Medicaid Services
Description	The measure estimates a hospital-level 30-day, all-cause, risk-standardized mortality rate for patients discharged from the hospital with a principal diagnosis of HF. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. 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.	e measure estimates a hospital-level 30-day hospital-wide risk-standardized mortality rate (RSMR), defined as death from any cause within 30 days after the index admission date, for Medicare fee-for-service (FFS) patients who are between the ages of 65 and 94. ase note that in parallel with the claims-only HWM measure, we are submitting a hybrid HWM measure. Note that ultimately the claims and hybrid measures will be harmonized and use the same exact cohort specifications. The intent is that prior to implementation, the two measures will be exactly the same, with the exception of the additional risk adjustment added by the CCDE in the hybrid measure. This is analogous to the currently endorsed and implemented hybrid hospital-wide readmissions measure (NQF 1789 and NQF 2879e). cause of the homology between the claims and hybrid HWM measures, there is no reason to suspect that the results of analyses done for the claims-only measure would differ in any significant way from results of analyses for a nationally representative hybrid measure. ow we highlight the differences between the two measures, including specifications, data used, and testing which reflect limitations of data availability, as well as actual intended differences in the measure (risk adjustment). ferences in the measure, data, and testing that reflect limitations in data availability 1. Dataset used for development, some testing (see below for differences), and measure results: a. The claims-only measure uses nation-wide Medicare FFS claims and the enrollment database.

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

		b. The hybrid measure uses an electronic health record (EHR) database from 21 hospitals in the Kaiser Permanente network which includes inpatient claims data information.
		
		 2. Age of patients in cohort:
		    a. The claims-only measure includes Medicare FFS patients, age 65-94.
		    b. The hybrid measure includes all patients age 50-94 (see later discussion for justification)
		
		 3. External empiric validity testing
		    a. Not possible for the hybrid measure, due to limited data availability. We provide results from the claims-only measure within the hybrid testing form.
		
		 4. Socioeconomic risk factor analyses
		    a. Not possible for the hybrid measure, due to limited data availability. We provide results from the claims-only measure within the hybrid testing form.
		
		 5. Exclusion analyses
		    a. To be representative of what we expect the impact would be of the measures' exclusions in a nation-wide sample, we provide the results from the claims-only measure.
		
		 6. Meaningful differences
		    a. To be representative of what we expect the range of performance would be in a nation-wide sample, we provide the distribution results from the claims-only measure.

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

		Difference between the two measures when fully harmonized, prior to implementation:
		1. Risk adjustment:
		   a. The claims-only measure uses administrative claims data only for risk adjustment
		   b. The hybrid measure adds 10 clinical risk variables, derived from a set of core clinical data elements (CCDE) extracted from the EHR.

Type	Outcome	Outcome
Data Source	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, skilled nursing facility care, some home health agency 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 data for VA inpatient and outpatient services including: inpatient hospital care, outpatient hospital services, skilled nursing facility care, some home health agency services,	Claims, Enrollment Data, Other Data sources for the Medicare FFS measure: 1. Medicare Part A Inpatient: The index dataset contains administrative inpatient hospitalization data for Medicare FFS beneficiaries, aged 65-94 on admission, hospitalized from July 1, 2016-June 30, 2017. The history dataset includes administrative inpatient hospitalization data on each patient for the 12 months prior to the index admission. 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 as well as vital status. It was also used to determine hospice enrollment. No data collection instrument provided Attachment Del18b1HOP5HWMClaimsDataDictionary01072019.xlsx

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
	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): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score. References: Fleming C, Fisher ES, Chang CH, Bubolz TA, Malenka DJ. 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 NQF_datadictionary_HFmortality_Fall2020_final_7.22.20.xlsx	
Level	Facility	Facility
Setting	Inpatient/Hospital	Inpatient/Hospital
Numerator Statement	The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients 65 and older hospitalized with a principal diagnosis of HF.	The outcome for this measure is 30-day, all-cause mortality. Mortality is defined as death from any cause, either during or after admission, within 30 days of the index admission date.
Numerator Details	The measure counts all deaths (including in-hospital deaths) for any cause within 30 days of the date of the index HF admission. Identifying deaths in the FFS measure As currently reported, we identify deaths for FFS Medicare patients 65 years and older in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.	The measure outcome is death from any cause within 30 days of the admission date of the index admission, for Medicare FFS patients identified using the Medicare Enrollment Database (EDB). The numerator is a binary variable (1=yes/0=no) that indicates whether the patient died within 30 days of the index admission date.
Denominator Statement	This claims-based measure is used for a cohort of patients aged 65 years or older. The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge	The cohort includes inpatient admissions for a wide variety of conditions for Medicare FFS patients aged between 65 and 94 years old who were admitted to short-term acute care hospitals. If a patient has more than one admission

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
	diagnosis of HF 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.	during the measurement year, one admission is randomly selected for inclusion in the measure. 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 inclusion criteria: 1. Principal discharge diagnosis of heart failure 2. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of the index admission and Part A during the index admission, or those who are VA beneficiaries 3. Aged 65 or over 4. Not transferred from another acute care facility We have explicitly tested the measure for those aged 65+ years and those aged 65+ years (see Testing Attachment for details).	An index admission is the hospitalization to which the mortality outcome is attributed and includes admissions for patients: 1. Enrolled in Medicare FFS Part A for at least 12 months prior to the date of admission and during the index admission Rationale: Claims data are consistently available only for Medicare FFS beneficiaries. The 12-month prior enrollment criterion ensures a full year of administrative data is available for risk adjustment. 2. Not transferred from another acute care facility Rationale: Admissions to an acute cate hospital within one day of discharge from another acute care hospital are considered transfers. Transferred patients are included in the measure cohort, but it is the initial hospitalization rather than any "transfer-in" hospitalization(s), that is included as the hospitalization to which the mortality outcome is attributed (the index admission). 3. Aged between 65 and 94 years Rationale: Medicare patients younger than 65 are not included in the measure because they usually qualify for the program due to severe disability and are considered to be clinically distinct from Medicare patients 65 and over. Patients over age 94 are not included to avoid holding hospitals responsible for the survival of the very elderly patients, who may be less likely to have survival as a primary goal.

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
		Note that the hybrid measure (submitted for NQF endorsement in parallel with the claims-only measure) differs from the claims-only measure in terms of the age range of included admissions; the hybrid measure includes all inpatient admissions for patients aged 50-94 years old. The intention is to fully harmonize the cohort definitions for the two measures, so that both measures will capture admissions for patients age 65-94. We deviated from that definition during development and testing for the hybrid measure due to the limited dataset available that included the EHR data elements needed to calculate the hybrid measure. Note that the risk model already includes age in years, as a risk variable.) 4. Not admitted for primary psychiatric diagnoses Rationale: Patients admitted for psychiatric treatment are typically cared for in separate psychiatric facilities that are not comparable to short-term acute care hospitals (see data dictionary, HWM Non-Acute Care Inclusion tab). 5. Not admitted for rehabilitation Rationale: These admissions are not typically to a short-term acute care hospital and are not for acute care (see data dictionary, HWM Non-Acute Care Inclusion tab). 6. Not enrolled in hospice at the time of, or 12 months prior to, their index admission Rationale: Patients enrolled in hospice in the prior 12 months or at the time of admission are unlikely to have 30-day survival as a primary goal. 7. Not enrolled in hospice within two days of admission Rationale: There is not a single, correct approach regarding patients enrolled in hospice during admission or upon discharge – mortality may or may not represent a quality signal for this group of patients and hospice enrollment is inadequate to differentiate this issue. However, for most patients and/or families who had the discussion and agreed

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
		to enroll in hospice within two days of admission, 30-day survival is not likely the primary goal due to their condition and not the quality of care received. 8. Not with a principal diagnosis of cancer and enrolled in hospice during their index admission Rationale: Patients admitted primarily for cancer who are enrolled in hospice during admission are unlikely to have 30-day survival as a primary goal of care. (see data dictionary, HWM Cancer Inclusion tab). 9. Without any diagnosis of metastatic cancer Rationale: Although some patients admitted with a diagnosis of metastatic cancer will have 30-day survival as a primary goal of care, for many such patients admitted to the hospital, death may be a clinically reasonable and patient-centered outcome. (see data dictionary, HWM Metastatic Cancer Inclusion tab). 10. Not with a principal discharge diagnosis, or a secondary diagnosis that is present on admission (POA) for a condition which hospitals have limited ability to influence survival Rationale: Hospitals have little ability to impact mortality for some conditions. This list of conditions (see data dictionary, HWM ICD-10 Inclusion tab) was determined through independent review, by several clinicians, of conditions associated with high mortality. The decisions were also reviewed with our Technical Expert Panel (TEP) and Technical Work Group. Admissions are not included in the cohort if the patient had a principal diagnosis code that is on this list, or a secondary code with POA that is on the list. In addition, for patients with multiple admissions, the measure selects only one admission, at random, for inclusion. There is no practical statistical modeling approach that can account or adjust for the complex relationship between the number of admissions and risk of

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
		mortality in the context of a hospital-wide mortality measure. Random selection ensures that providers are not penalized for a "last" admission during the measurement period; selecting the last admission would not be as accurate a reflection of the risk of death as random selection, as the last admission is inherently associated with a higher mortality risk. Random selection is also used in CMS's condition-specific mortality measures. Note that random selection reduces the number of admissions, but does not exclude any patients from the measure.
		The cohort is defined using ICD-10 Clinical Modification codes identified in Medicare Part A Inpatient claims data. The measure aggregates the ICD-10 principal diagnosis and all procedure codes of the index admission into clinically coherent groups of conditions and procedures (condition categories or procedure categories) using the Agency for Healthcare Research and Quality (AHRQ) Clinical Classifications System (CCS). There is a total of 285 mutually exclusive AHRQ condition categories, most of which are single, homogenous diseases such as pneumonia or acute myocardial infarction. Some are aggregates of conditions, such as "other bacterial infections". There is a total of 231 mutually exclusive procedure categories. Using the AHRQ CCS procedure and condition categories, the measure assigns each index hospitalization to one of 15 mutually exclusive divisions. The divisions were created based upon clinical coherence, consistency of mortality risk, adequate patient and hospital case volume for stable results reporting, and input from clinicians, patients, and patient caregivers on usability.
		The measure first assigns admissions with qualifying AHRQ procedure categories to one of six surgery divisions by identifying a defining surgical procedure. The defining surgical procedure is identified using the following algorithm:

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
		1) if a patient only has one major surgical procedure then that procedure is the defining surgical procedure; 2) if a patient has more than one major surgical procedure, the first dated procedure performed during the index admission is the defining surgical procedure; 3) if there is more than one major surgical procedure on that earliest date, the procedure with the highest mortality rate is the defining surgical procedure. These divisions include admissions likely cared for by surgical teams. The surgical divisions are: Surgical Cancer (see note below), Cardiothoracic Surgery, General Surgery, Neurosurgery, Orthopedic Surgery, and Other Surgical Procedures. For the Surgical Cancer division, any admission that includes a surgical procedure and a principal discharge diagnosis code of cancer is assigned to the Surgical Cancer division. This division and the logic behind it was implemented in response to feedback from our Technical Expert Panel. The measure then assigns the remaining admissions into one of the nine non-surgical divisions based on the AHRQ diagnostic CCS of the principal discharge diagnosis. The non-surgical divisions are: Cancer, Cardiac, Gastrointestinal, Infectious Disease, Neurology, Orthopedic, Pulmonary, Renal, Other Conditions. The full list of the specific diagnosis and procedure AHRQ CCS categories used to define the divisions are attached in the Data Dictionary.
Exclusions	The mortality measures exclude index admissions for patients: 1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility; 2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data;	The measure excludes index admissions for patients: 1. With inconsistent or unknown vital status (from claims data) or other unreliable claims data; 2. Discharged against medical advice (AMA); 3. With an admission for spinal cord injury (CCS 227), skull and face fractures (CCS 228), Intracranial Injury (CCS

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
	3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission; 4. Discharged against medical advice (AMA); or 5. Patients undergoing left ventricular assist device (LVAD) implantation or heart transplantation during an index admission or who have a history of LVAD or heart transplant in the preceding year. For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort for each year.	233), Crushing injury or internal injury (CCS 234), Open wounds of head/neck/trunk (CCS 235), and burns (CCS 240); and 4. With a principal discharge diagnosis within a CCS with fewer than 100 admissions within the measurement year.

Exclusion Details	1. The discharge disposition indicator is used to identify patients alive at discharge. Transfers are identified in the claims when a patient with a qualifying admission is discharged from an acute care hospital and admitted to another acute care hospital on the same day or next day. Patient length of stay and condition is identified from the admission claim.
	
	 Rationale: This exclusion prevents inclusion of patients who likely did not have clinically significant HF.
	 2. Inconsistent vital status or unreliable data are identified if any of the following conditions are met
	     1) the patient's age is greater than 115 years:
	     2) if the discharge date for a hospitalization is before the admission date;
	     3) if the patient has a sex other than 'male' or 'female'.
	
	 Rationale: Reliable and consistent data are necessary for valid calculation of the measure.
		1. With inconsistent or unknown vital status (from claims data) or other unreliable claims data
		
		 Rationale: The measure does not include stays for patients where the admission date is after the date of death in the Medicare Enrollment Database, or where the date of death occurs before the date of discharge but the patient was discharged alive because these are likely errors in the data.
		 2. Discharged against medical advice (AMA)
		
		 Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.
		 3. With an admission for spinal cord injury (CCS 227), skull and face fractures (CCS 228), Intracranial Injury (CCS 233), Crushing injury or internal injury (CCS 234), Open wounds of head/neck/trunk (CCS 235), and burns (CCS 240)
		
		 Rationale: Even though a hospital likely can influence the outcome of some of these conditions, in many cases death events are not a signal of poor quality of care when patients present with these conditions. These conditions are also

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
	3. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice data and the Inpatient standard analytic file (SAF). Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care. 4. 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. 5. Patients with LVAD implantation or heart transplantation during an index admission or in the previous 12 months are identified by the corresponding codes for these procedures included in claims data. Rationale: Patients undergoing implantation of an LVAD designed to offer intermediate to long-term support (weeks to years) as a bridge to heart transplant or destination therapy represent a clinically distinct, highly-selected group of patients cared for at highly specialized medical centers.	infrequent events that are unlikely to be uniformly distributed across hospitals. 4. With a principal discharge diagnosis within a CCS with fewer than 100 admissions in that division within the measurement year. Rationale: To calculate a stable and precise risk model, there are a minimum number of admissions that are needed. In addition, a minimum number of admissions and/or outcome events are required to inform grouping admissions into larger categories. These admissions present challenges to both accurate risk prediction and coherent risk grouping and are therefore excluded. Note: During measure development we analyzed different volume cut-offs (25, 50 and 100). Using cut-off values below 100 resulted in too many CCS codes in some of the divisions (the CCS category codes are used in risk adjustment) which resulted in non-convergence of those division-level risk models. The total number of patients excluded is very small (13,597 or 0.21% of admissions for a cut off of 100). During measure development we also explored the option of pooling low-volume CCS codes (CCS<100 patients) into one group, however, the heterogeneity in mortality rates for the individual ICD-10 codes in those groups would preclude adequate risk adjustment. The TEP supported excluding these admissions.
Risk Adjustment	Statistical risk model 118210| 112469| 146637| 141015| 150289 118210| 112469| 146637| 141015| 150289	Statistical risk model 146637| 144762| 110639| 141015| 110874| 146313 146637| 144762| 110639| 141015| 110874| 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 RSMRs following hospitalization for HF using hierarchical logistic regression models. In brief, the approach simultaneously	The measure estimates hospital-level, risk-standardized mortality rates (RSMRs) within 30 days of hospital admission using hierarchical logistical regression models through a

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
	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 mortality 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 mortality 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 RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality. The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. The estimated hospital-specific intercept is added coefficients multiplied by the patient characteristics. The results are transformed and summed over all patients attributed to a	Bayesian Markov Chain Monte Carlo (MCMC) procedure. In brief, we used hierarchical logistic regression to model the log-odds of mortality for each of the 15 service-line divisions. Death within 30 days was modeled as a function of patient-level demographic and clinical characteristics and a random hospital-level intercept. This model specification accounts for within-hospital correlation of the observed outcomes and models the assumption that underlying differences in quality among the health care facilities being evaluated lead to systematic differences in outcomes. We estimated a separate hierarchical logistic regression model for each service-line division. In order to obtain the variance and interval estimates, we fit the hierarchical model under the Bayesian framework along with the Markov Chain Monte Carlo (MCMC) technique. Admissions are assigned to one of 15 mutually exclusive divisions (groups of discharge condition categories and procedure categories). For each division and each hospital with patients in that division, the standardized mortality ratio (SMR) is calculated as the ratio of the number of "predicted" deaths to the number of "expected" deaths at a given hospital. The predicted number of deaths is based on the hospital's performance with its observed case mix and service mix, and is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific effect on the risk of mortality. 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 transformed via an inverse logit function and summed over all patients attributed to a hospital to get a predicted value. The expected number of deaths is based on the nation's performance with that hospital's case mix and service mix and is obtained in the same manner, but a common effect using all hospitals in our sample is added in place of the

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
	hospital to get a predicted value. The "expected" number of deaths (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 [https://qualitynet.org/inpatient/measures/mortality/methodology]. References: 1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 118210| 112469| 146637| 141015| 150289	hospital-specific effect. The results are transformed via an inverse logit function and summed over all patients in the hospital to get an expected value. 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 mortality rates or better quality, while a higher ratio indicates higher-than-expected mortality rates or worse quality. To assess hospital performance for each reporting period, the measure re-estimates the model coefficients using the data in that period. The division-level SMRs are then pooled for each hospital using an inverse variance-weighted geometric mean to create a hospital-wide composite SMR. The hospital-wide SMR is then multiplied by the national observed mortality rate to produce the RSMR. 146637| 144762| 110639| 141015| 110874| 146313
Submission items	5.1 Identified measures: 0330 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization 0358 : Heart Failure Mortality Rate (IQI 16) 0468 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization 1789 : Hospital-Wide All-Cause Unplanned Readmission Measure (HWR) 1893 : Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization 3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	5.1 Identified measures: 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: This claims-only hospital-wide mortality (HWM) measure is intended to complement the existing CMS Hospital-Wide All-Cause Risk-Standardized Readmission Measure (NQF #1789) to allow assessment of trends in hospital performance for both readmission and mortality outcomes, similar to other complementary pairs of readmission and mortality measures for specific conditions and procedures. By measuring mortality outcomes across almost all hospitalized patients, this measure will provide an

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
	3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure 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. Our measure cohort was heavily vetted by clinical experts, a technical expert panel, and a public comment period. Additionally, the measure, with the specified cohort, has been publicly reported since 2008. 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	important additional performance assessment that will complement condition- and procedure-specific or other more narrowly defined mortality measures and allow a greater number of patients and hospitals to be evaluated. This HWM measure captures a similarly broad cohort to the CMS Hospital-Wide All-Cause Risk-Standardized Readmission Measure (NQF #1789), and a broader cohort than those of other CMS condition-specific measures. Because the mortality measure is focused on a different outcome, it differs from the existing CMS Hospital-Wide All-Cause Risk Standardized Readmission Measure (NQF #1789) in a couple of ways. First, this HWM measure includes patients with a principal discharge diagnosis of cancer (with some exceptions), whereas those patients are not included in the readmission measure. Cancer patients are appropriate to include in the HWM measure as many have survival as their primary goal; however due to cancer treatment plans, readmissions are frequently part of the plan and expected and therefore, are not a reasonable signal of quality. Another difference between the two measures is the number of divisions or specialty cohorts the patients are divided into, to more accurately risk adjust for case-mix and service-mix. The readmission measure divides patients into five categories, or "specialty cohorts", while the mortality measure uses 15. This is because the risk of mortality is much more closely related to patient factors than readmission is related to patient factors. PSI-02 (NQF #0357) is another complementary mortality measure, which captures a different patient population and a different outcome compared with the HWM measure submitted with this application. PSI-02 captures patients 18 years of age or older, or obstetric patients, whereas the HWM measure captures patients between the ages of 65 and 94. PSI-02 captures DRGs with less than 0.5% mortality rate, whereas the HWM measure captures all patients within all CCSs,

Measures	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
		regardless of mortality rate. Hospital-wide mortality captures mortality up to 30 days past admission, where AHRQ PSI-02 only captures in-hospital mortality. IQI 90 (NQF #0530) is another complimentary mortality measure, which is a composite measure of the number of in-hospital deaths for a narrow range of conditions (CHF, stroke, hip fracture, pneumonia, acute myocardial infarction and GI hemorrhage). The HWM measure presented in this application captures all deaths after 30 days of admission, for all conditions and procedures. 5b.1 If competing, why superior or rationale for additive value: There are no competing NQF-endorsed measures.

Comparison of NQF #0230, NQF #0229 and NQF #0330

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization
Steward	Centers for Medicare & Medicaid Services	Centers for Medicare & Medicaid Services	Centers for Medicare & Medicaid Services
Description	The measure estimates a hospital-level 30-day risk-standardized mortality rate (RSMR) for patients discharged from the hospital with a principal diagnosis of AMI. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. CMS annually reports the measure for patients who are 65 years or older and are either Medicare fee-for-service (FFS) beneficiaries and hospitalized in non-federal hospitals or are hospitalized	The measure estimates a hospital-level 30-day, all-cause, risk-standardized mortality rate for patients discharged from the hospital with a principal diagnosis of HF. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. 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 risk-standardized readmission rate (RSRR) for patients discharged from the hospital with a principal diagnosis of heart failure (HF). 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. The target population is patients age 65 and over. The Centers for Medicare &

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization
	in Veterans Health Administration (VA) facilities.		Medicaid Services (CMS) annually reports the measure for patients who are 65 years or older and are 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, 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, skilled nursing facility care, some home health agency 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	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, skilled nursing facility care, some home health agency 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	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, and 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

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization
	Medicare beneficiaries including dual eligible status. Years 2016-2019 were used.	including dual eligible status. Years 2016-2019 were used.	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.	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.	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): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score.	The American Community Survey (2013-2017): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score.	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:	References:	References
	Fleming C, Fisher ES, Chang CH, Bubolz TA, Malenka DJ. 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.	Fleming C, Fisher ES, Chang CH, Bubolz TA, Malenka DJ. 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.	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	No data collection instrument provided Attachment	No data collection instrument provided Attachment

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization
	NQF_datadictionary_AMImortality_Fall2020_final_7.22.20.xlsx	NQF_datadictionary_HFmortality_Fall2020_final_7.22.20.xlsx	NQF_datadictionary_HFreadmission_Fall2020_final_7.22.20.xlsx
Level	Facility	Facility	Facility
Setting	Inpatient/Hospital	Inpatient/Hospital	Inpatient/Hospital
Numerator Statement	The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients hospitalized with a principal diagnosis of AMI.	The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients 65 and older hospitalized with a principal diagnosis of HF.	The outcome for this measure is 30-day readmissions. We define readmissions as any inpatient acute care admission, with the exception of certain planned readmissions, within 30 days from the date of discharge from an index admission with a principal discharge diagnosis of HF in patients 65and older. 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. Additional details are provided in S.5 Numerator Details.

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization
Numerator Details	The measure counts all deaths (including in-hospital deaths) for any cause to any acute care hospital within 30 days of the date of the index AMI hospitalization. Identifying deaths in the FFS measure As currently reported, we identify deaths for FFS Medicare patients 65 years and older in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.	The measure counts all deaths (including in-hospital deaths) for any cause within 30 days of the date of the index HF admission. Identifying deaths in the FFS measure As currently reported, we identify deaths for FFS Medicare patients 65 years and older in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.	The measure counts readmissions to any acute care hospital for any cause within 30 days of the date of discharge of the index HF 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 (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 Hospital-Wide Readmission measure. In 2013, CMS applied the

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization
			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. For the HF readmission measure, CMS used the Planned Readmission Algorithm without modifications.
			The planned readmission algorithm and associated code tables are attached in data field S.2b (Data Dictionary or Code Table).
Denominator Statement	This claims-based measure is used for patients aged 65 years or older. The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of AMI 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.	This claims-based measure is used for a cohort of patients aged 65 years or older. The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of HF 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.	The cohort includes admissions for patients aged 65years and older discharged from the hospital with a principal discharge diagnosis of HF, 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

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization
Denominator Details	To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria: 1. Having a principal discharge diagnosis of AMI; 2. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of the index admission and Part A during the index admission, or those who are VA beneficiaries; 3. Aged 65 or over; and 4. Not transferred from another acute care facility. We have explicitly tested the measure for those aged 65+ years (see Testing Attachment for details).	To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria: 1. Principal discharge diagnosis of heart failure 2. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of the index admission and Part A during the index admission, or those who are VA beneficiaries 3. Aged 65 or over 4. Not transferred from another acute care facility We have explicitly tested the measure for those aged 65+ years and those aged 65+ years (see Testing Attachment for details).	To be included in the measure cohort used in public reporting, patients must meet the following additional inclusion criteria: 1. Principal discharge diagnosis of HF; 2. 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, 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. Not transferred to another acute care facility.
Exclusions	The mortality measures exclude index admissions for patients: 1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility; 2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data; 3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission; or	The mortality measures exclude index admissions for patients: 1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility; 2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data; 3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission;	The 30-day HF 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. Admitted within 30 days of a prior index admission for HF; and 4. With a procedure code for LVAD implantation or heart transplantation either during the index admission or in

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization
	4. Discharged against medical advice (AMA). For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort.	4. Discharged against medical advice (AMA); or 5. Patients undergoing left ventricular assist device (LVAD) implantation or heart transplantation during an index admission or who have a history of LVAD or heart transplant in the preceding year. For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort for each year.	the 12 months prior to the index admission.
Exclusion Details	1. The discharge disposition indicator is used to identify patients alive at discharge. Transfers are identified in the claims when a patient with a qualifying admission is discharged from an acute care hospital and admitted to another acute care hospital on the same day or next day. Patient length of stay and condition is identified from the admission claim. Rationale: This exclusion prevents inclusion of patients who likely did not have clinically significant AMI. 2. Inconsistent vital status or unreliable data are identified if any of the following conditions are met 1) the patient's age is greater than 115 years; 2) if the discharge date for a hospitalization is before the admission	1. The discharge disposition indicator is used to identify patients alive at discharge. Transfers are identified in the claims when a patient with a qualifying admission is discharged from an acute care hospital and admitted to another acute care hospital on the same day or next day. Patient length of stay and condition is identified from the admission claim. Rationale: This exclusion prevents inclusion of patients who likely did not have clinically significant HF. 2. Inconsistent vital status or unreliable data are identified if any of the following conditions are met 1) the patient's age is greater than 115 years: 2) if the discharge date for a hospitalization is before the admission date; 3) if the patient has a sex other than 'male' or 'female'.	The HF 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. 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.

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization
	date; and 3) if the patient has a sex other than 'male' or 'female'. Rationale: Reliable and consistent data are necessary for valid calculation of the measure. 3. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice data. This exclusion applies when the measure is used in Medicare FFS patients only. Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care. 4. 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.	Rationale: Reliable and consistent data are necessary for valid calculation of the measure. 3. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice data and the Inpatient standard analytic file (SAF). Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care. 4. 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. 5. Patients with LVAD implantation or heart transplantation during an index admission or in the previous 12 months are identified by the corresponding codes for these procedures included in claims data. Rationale: Patients undergoing implantation of an LVAD designed to offer intermediate to long-term support (weeks to years) as a bridge to heart transplant or destination therapy represent a clinically distinct, highly-selected group of patients cared for at highly specialized medical centers.	3. HF admissions within 30 days of discharge from a qualifying HF index admission are identified by comparing the discharge date from the index admission with subsequent admission dates. Rationale: Additional HF 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. 4. With a procedure code for LVAD implantation or heart transplantation either during the index admission or in the 12 months prior to the index admission, which are identified by the corresponding codes included in claims data (codes can be found in attached Data Dictionary). Rationale: Patients with these procedures are a clinically distinct group with a different risk of the readmission outcome.
Risk Adjustment	Statistical risk model 118210| 112469| 146637| 150289	Statistical risk model 118210| 112469| 146637| 141015| 150289	Statistical risk model

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization
	118210| 112469| 146637| 150289	118210| 112469| 146637| 141015| 150289	117446| 141973| 137977| 112469| 146637| 150289 117446| 141973| 137977| 112469| 146637| 150289
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 RSMRs 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 mortality 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 mortality 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	The measure estimates hospital-level 30-day all-cause RSMRs following hospitalization for HF 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 mortality 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 mortality 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 measure estimates hospital-level 30-day all-cause RSRRs following hospitalization for HF 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 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

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization
	intercepts should be identical across all hospitals.	The RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality.	patient risk, the hospital intercepts should be identical across all hospitals.
	The RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality.		The RSRR is calculated as the ratio of the number of "predicted" readmissions to the number of "expected" readmissions, multiplied by the national unadjusted readmission rate. For each hospital, the numerator of the ratio ("predicted") 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 ("expected") is the number of readmissions expected on the basis of 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, or better quality, and a higher ratio indicates higher-than-expected readmission, or worse quality.
	The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. The estimated hospital-specific intercept is added coefficients multiplied by the patient characteristics. The results are transformed and summed over	The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. The estimated hospital-specific intercept is added 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 deaths (the denominator) is obtained in the same manner, but a common intercept using	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 effect is added to the sum of the estimated regression

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization
	all patients attributed to a hospital to get a predicted value. The "expected" number of deaths (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 [https://qualitynet.org/inpatient/measures/mortality/methodology]. References: 1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 2. Krumholz H, Normand S, Galusha D, et al. Risk-Adjustment Models for AMI and HF 30-Day Mortality Methodology. 2005. 118210| 112469| 146637| 150289	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 [https://qualitynet.org/inpatient/measures/mortality/methodology]. References: 1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 118210| 112469| 146637| 141015| 150289	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 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 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 readmission rate. The hierarchical logistic regression models are described fully in the original methodology report (Krumholz et al., 2005). References: 1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 2. Krumholz H, Normand S, Galusha D, et al. Risk-Adjustment Models for HF and HF 30-Day Readmission Methodology.

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization
			2005. 117446| 141973| 137977| 112469| 146637| 150289
Submission items	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 0468 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia 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 0229 : Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization 1893 : Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization 2431 : Hospital-level, risk-standardized payment associated with a 30-day episode-of-care for Acute Myocardial Infarction (AMI) 3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	5.1 Identified measures: 0330 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization 0358 : Heart Failure Mortality Rate (IQI 16) 0468 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization 1789 : Hospital-Wide All-Cause Unplanned Readmission Measure (HWR) 1893 : Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization 3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure 3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure 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. Our measure cohort was heavily vetted by	5.1 Identified measures: 0505 : Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization. 0229 : Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization 1789 : Hospital-Wide All-Cause Unplanned Readmission Measure (HWR) 1891 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following chronic obstructive pulmonary disease (COPD) hospitalization 2879 : Hybrid Hospital-Wide Readmission (HWR) Measure with Claims and Electronic Health Record Data 2880 : Excess days in acute care (EDAC) after hospitalization for heart failure (HF) 2886 : Risk-Standardized Acute Admission Rates for Patients with Heart Failure 2888 : Accountable Care Organization Risk-Standardized Acute Hospital Admission Rate for Patients with Multiple Chronic Conditions 5a.1 Are specs completely harmonized? Yes

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization
	3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure 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. Our measure cohort was heavily vetted by clinical experts, a technical expert panel, and a public comment period. Additionally, the measure, with the specified cohort, has been publicly reported since 2008. 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	clinical experts, a technical expert panel, and a public comment period. Additionally, the measure, with the specified cohort, has been publicly reported since 2008. 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 (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 #0230, NQF #0468 and NQF #0505

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization
Steward	Centers for Medicare & Medicaid Services	Centers for Medicare & Medicaid Services	Centers for Medicare & Medicaid Services
Description	The measure estimates a hospital-level 30-day risk-standardized mortality rate (RSMR) for patients discharged from the hospital with a principal diagnosis of AMI. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. CMS annually reports the measure for patients who are 65 years or older and are either Medicare fee-for-service (FFS) beneficiaries and hospitalized in non-federal hospitals or are hospitalized in Veterans Health Administration (VA) facilities.	The measure estimates a hospital-level 30-day risk-standardized mortality rate (RSMR). Mortality is defined as death for any cause within 30 days after the date of admission for the index admission, 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 diagnosis of pneumonia (including aspiration pneumonia) coded as present on admission (POA). CMS annually reports the measure for patients who are 65 years or older and are either Medicare fee-for-service (FFS) beneficiaries and hospitalized in non-federal hospitals or 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 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.
Type	Outcome	Outcome	Outcome
Data Source	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, skilled nursing facility care, some home health agency services, as well as inpatient and	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.	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.

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization
	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 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): The American Community Survey data is collected annually and an aggregated 5-	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 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): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score. Reference:	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

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization
	years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score. References: Fleming C, Fisher ES, Chang CH, Bubolz TA, Malenka DJ. 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 NQF_datadictionary_AMImortality_Fall2020_final_7.22.20.xlsx	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 NQF_datadictionary_PNmortality_Fall2020_final_7.22.20.xlsx	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 NQF_datadictionary_AMIreadmission_Fall2020_final_7.22.20.xlsx
Level	Facility	Facility	Facility
Setting	Inpatient/Hospital	Inpatient/Hospital	Inpatient/Hospital
Numerator Statement	The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients hospitalized with a principal diagnosis of AMI.	The outcome for this measure is 30-day all-cause mortality (including in-hospital deaths). We define mortality as death from any cause within 30 days of the index admission datefrom the date of admission for patients hospitalized 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.	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

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization
			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.
Numerator Details	The measure counts all deaths (including in-hospital deaths) for any cause to any acute care hospital within 30 days of the date of the index AMI hospitalization. Identifying deaths in the FFS measure As currently reported, we identify deaths for FFS Medicare patients 65 years and older in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.	The measure counts all deaths (including in-hospital deaths) for any cause within 30 days of the date of admission of the index pneumonia hospitalization. Identifying deaths in the FFS measure As currently reported, we identify deaths for FFS Medicare patients 65 years or over in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.	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

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization
			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 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).
Denominator Statement	This claims-based measure is used for patients aged 65 years or older. The cohort includes admissions for patients aged 65 years and older discharged from the	This claims-based measure is used for a cohort of patients aged 65 years or over older. The cohort includes admissions for patients aged 65 years and older discharged from the hospital	The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal diagnosis of AMI; and with a

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization
	hospital with a principal discharge diagnosis of AMI 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.	with 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 but no secondary discharge diagnosis of severe sepsis; and with a complete claims history for the 12 months prior to admission. The measure will be publicly reported by CMS for those patients 65 years or older who are Medicare FFS beneficiaries admitted to non-federal hospitals or patients admitted to VA hospitals. Additional details are provided in S.9 Denominator Details.	complete claims history for the 12 months prior to admission. 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 inclusion criteria: 1. Having a principal discharge diagnosis of AMI; 2. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of the index admission and Part A during the index admission, or those who are VA beneficiaries; 3. Aged 65 or over; and 4. Not transferred from another acute care facility. We have explicitly tested the measure for those aged 65+ years (see Testing Attachment for details).	To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria: 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); 3. Aged 65 or over; 4. Not transferred from another acute care facility; and 5. Enrolled in Part A and Part B Medicare for the 12 months prior to the date of	To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria: 1. Principal discharge diagnosis of AMI; 2. 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; 3. Aged 65 or over; 4. Discharged alive from a non-federal short-term acute care hospital or VA hospital; and, 5. Not transferred to another acute care facility.

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization
		admission and enrolled in Part A during the index admission. We have explicitly tested the measure for those aged 65 years or over (see Testing Attachment for details).	
Exclusions	The mortality measures exclude index admissions for patients: 1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility; 2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data; 3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission; or 4. Discharged against medical advice (AMA). For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort.	The mortality measure excludes index admissions for patients: 1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility; 2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data; 3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission; or 4. Discharged against medical advice (AMA). For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort.	The 30-day AMI readmission measure excludes index admissions for patients: 4) Without at least 30 days of post-discharge enrollment in Medicare FFS (in the case of patients who are not VA beneficiaries); 5) Discharged against medical advice (AMA); 6) Same-day discharges; or 7) Admitted within 30 days of a prior index admission for AMI.
Exclusion Details	1. The discharge disposition indicator is used to identify patients alive at discharge. Transfers are identified in the claims when a patient with a qualifying admission is discharged from an acute care hospital and admitted to another acute care hospital on the same day or next day. Patient length of stay and	1. The discharge disposition indicator is used to identify patients alive at discharge. Transfers are identified in the claims when a patient with a qualifying admission is discharged from an acute care hospital and admitted to another acute care hospital on the same day or next day. Patient length of stay and condition is identified from the admission claim.	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.

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization

	condition is identified from the admission claim.
	
	Rationale: This exclusion prevents inclusion of patients who likely did not have clinically significant AMI.
	
	2. Inconsistent vital status or unreliable data are identified if any of the following conditions are met
	
	   1) the patient's age is greater than 115 years;
	
	   2) if the discharge date for a hospitalization is before the admission date; and
	
	   3) if the patient has a sex other than 'male' or 'female'.
	
	Rationale: Reliable and consistent data are necessary for valid calculation of the measure.
	
	3. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice data. This exclusion applies when the measure is used in Medicare FFS patients only.
	
	Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care.
	
	4. Discharges against medical advice (AMA) are identified using the discharge disposition indicator in claims data.
		Rationale: This exclusion prevents inclusion of patients who likely did not have clinically significant pneumonia.
		
		2. Inconsistent vital status or unreliable data are identified if any of the following conditions are met
		
		   1) the patient's age is greater than 115 years;
		
		   2) if the discharge date for a hospitalization is before the admission date; or
		
		   3) if the patient has a sex other than 'male' or 'female'.
		
		Rationale: Reliable and consistent data are necessary for valid calculation of the measure.
		
		3. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice enrollment data.
		
		Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care.
		
		4. Discharges against medical advice (AMA) are identified using the discharge disposition indicator.
		
		Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.
		
		After all exclusions are applied, the measure randomly selects one index admission per patient per year for inclusion in the cohort so that each episode of care is mutually
			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.

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization
	Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.	independent with the similar probability of the outcome. For each patient, the probability of death may increase with each subsequent admission, and therefore, the episodes of care are not mutually independent. Also, for the three-year combined data, when index admissions occur during the transition between measure reporting periods (June and July of each year) and both are randomly selected for inclusion in the measure, the measure includes only the June admission. The July admissions are excluded to avoid assigning a single death to two admissions.	
Risk Adjustment	Statistical risk model 118210| 112469| 146637| 150289 118210| 112469| 146637| 150289	Statistical risk model 107491| 118210| 112469| 146637| 150289 107491| 118210| 112469| 146637| 150289	Statistical risk model 118210| 112469| 146637 118210| 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 RSMRs 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 mortality 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	The measure estimates hospital-level 30-day all-cause RSMRs 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 mortality 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 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

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization
	normal distribution. The hospital intercept represents the underlying risk of a mortality 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 RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality. The "predicted" number of deaths (the numerator) is calculated by using the	The hospital intercept represents the underlying risk of a mortality 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 RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality. The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of	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-

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization
	coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. The estimated hospital-specific intercept is added 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 deaths (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 [https://qualitynet.org/inpatient/measures/mortality/methodology]. References: 1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226.	mortality. 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 deaths (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 mortality rate. The hierarchical logistic regression models are described fully in the original methodology report posted on QualityNet: https://qualitynet.org/inpatient/measures/mortality/methodology. References: Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 107491| 118210| 112469| 146637| 150289	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

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization
	2. Krumholz H, Normand S, Galusha D, et al. Risk-Adjustment Models for AMI and HF 30-Day Mortality Methodology. 2005. 118210| 112469| 146637| 150289		posted on QualityNet (https://qualitynet.org/inpatient/measures/readmission/methodology) 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
Submission items	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 0468 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia 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 0229 : Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization 1893 : Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	5.1 Identified measures: 0231 : Pneumonia Mortality Rate (IQI #20) 0506 : Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization 0279 : Community Acquired Pneumonia Admission Rate (PQI 11) 1891 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following chronic obstructive pulmonary disease (COPD) hospitalization 1893 : Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization 2579 : Hospital-level, risk-standardized payment associated with a 30-day episode of care for pneumonia (PN) 3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	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

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization
	2431 : Hospital-level, risk-standardized payment associated with a 30-day episode-of-care for Acute Myocardial Infarction (AMI) 3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure 3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure 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. Our measure cohort was heavily vetted by clinical experts, a technical expert panel, and a public comment period. Additionally, the measure, with the specified cohort, has been publicly reported since 2008. 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).	3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure 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 (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). Lastly, this measure and the NQF Inpatient Pneumonia Mortality (AHRQ) Measure #0231 are complementary rather than competing measures. Although they both assess mortality for patients admitted to acute care hospitals with a principal discharge diagnosis of pneumonia, the specified outcomes are different. This measure assesses 30-day mortality while #0231 assesses inpatient mortality. Assessment of 30-day and inpatient mortality outcomes have distinct advantages and uses which make them complementary as opposed to competing. For example, the 30-day	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

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization
	5b.1 If competing, why superior or rationale for additive value: N/A	period provides a broader perspective on hospital care and utilizes standard time period to examine hospital performance to avoid bias by differences in length of stay among hospitals. However, in some settings it may not be feasible to capture post-discharge mortality making the inpatient measure more useable. We have previously consulted with AHRQ to examine harmonization of complementary measures of mortality for patients with AMI and stroke. We have found that the measures are harmonized to the extent possible given that small differences in cohort inclusion and exclusion criteria are warranted on the basis of the use of different outcomes. However, this current measure includes patients with a principal discharge diagnosis of sepsis and a secondary discharge diagnosis of pneumonia that is present on admission. The cohort was also expanded to include patients with a principal discharge diagnosis of aspiration pneumonia. Thus, the current measure cohort is still not harmonized with measure #0231. 5b.1 If competing, why superior or rationale for additive value: N/A	

Comparison of NQF #0230, NQF #0506 and NQF #0730

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization	0730 Acute Myocardial Infarction (AMI) Mortality Rate
Steward	Centers for Medicare & Medicaid Services	Centers for Medicare & Medicaid Services	Agency for Healthcare Research and Quality
Description	The measure estimates a hospital-level 30-day risk-standardized mortality rate (RSMR) for patients discharged from the hospital with a principal diagnosis of AMI. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. CMS annually reports the measure for patients who are 65 years or older and are either Medicare fee-for-service (FFS) beneficiaries and hospitalized in non-federal hospitals or are 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.	In-hospital deaths per 1,000 hospital discharges with acute myocardial infarction (AMI) as a principal diagnosis for patients ages 18 years and older. Excludes cases in hospice care at admission, obstetric discharges, and transfers to another hospital.
Type	Outcome	Outcome	Outcome
Data Source	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, skilled nursing facility care, some home	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	Claims While the measure is tested and specified using data from the Healthcare Cost and Utilization Project (HCUP) (see section 1.1 and 1.2 of the measure testing form), the measure specifications and software are specified to be used with any ICD-9-CM-coded administrative billing/claims/discharge dataset with Present on Admission (POA) information.

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization	0730 Acute Myocardial Infarction (AMI) Mortality Rate
	health agency 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 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): The American Community Survey data	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	Note that in Version 5.0, the AHRQ QI software no longer supports prediction of POA status using an embedded prediction module. Users are expected to provide POA data. Available at measure-specific web page URL identified in S.1 Attachment IQI_15_Acute_Myocardial_Infarction_Mortality_Rate.xlsx

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization	0730 Acute Myocardial Infarction (AMI) Mortality Rate
	is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score. References: Fleming C, Fisher ES, Chang CH, Bubolz TA, Malenka DJ. 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 NQF_datadictionary_AMImortality_Fall2020 _final_7.22.20.xlsx	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 NQF_datadictionary_PNreadmission_Fall2020_fin al_7.22.20.xlsx	
Level	Facility	Facility	Facility
Setting	Inpatient/Hospital	Inpatient/Hospital	Hospital
Numerator Statement	The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients hospitalized with a principal diagnosis of AMI.	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	Number of deaths (DISP=20) among cases meeting the inclusion and exclusion rules for the denominator

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization	0730 Acute Myocardial Infarction (AMI) Mortality Rate
		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	The measure counts all deaths (including in-hospital deaths) for any cause to any acute care hospital within 30 days of the date of the index AMI hospitalization. Identifying deaths in the FFS measure As currently reported, we identify deaths for FFS Medicare patients 65 years and older in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.	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);	N/A

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization	0730 Acute Myocardial Infarction (AMI) Mortality Rate
		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 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	This claims-based measure is used for patients aged 65 years or older. The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of AMI 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.	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	Discharges, for patients ages 18 years and older, with a principal ICD-10-CM diagnosis code for AMI

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization	0730 Acute Myocardial Infarction (AMI) Mortality Rate
	Additional details are provided in S.7 Denominator Details.	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 inclusion criteria: 1. Having a principal discharge diagnosis of AMI; 2. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of the index admission and Part A during the index admission, or those who are VA beneficiaries; 3. Aged 65 or over; and 4. Not transferred from another acute care facility. We have explicitly tested the measure for those aged 65+ years (see Testing Attachment for details).	To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria: 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. Not transferred from another acute care facility.	AMI diagnosis codes: (MRTAMID) I2101 ST elevation (STEMI) myocardial infarction involving left main coronary artery I2102 ST elevation (STEMI) myocardial infarction involving left anterior descending coronary artery I2109 ST elevation (STEMI) myocardial infarction involving other coronary artery of anterior wall I2111 ST elevation (STEMI) myocardial infarction involving right coronary artery I2119 ST elevation (STEMI) myocardial infarction involving other coronary artery of inferior wall I2121 ST elevation (STEMI) myocardial infarction involving left circumflex coronary artery I2129 ST elevation (STEMI) myocardial infarction involving other sites I213 ST elevation (STEMI) myocardial infarction of unspecified site I214 Non-ST elevation (NSTEMI) myocardial infarction I220 Subsequent ST elevation (STEMI) myocardial infarction of anterior wall

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization	0730 Acute Myocardial Infarction (AMI) Mortality Rate
			I221　　Subsequent ST elevation (STEMI) myocardial infarction of inferior wall I222　　Subsequent non-ST elevation (NSTEMI) myocardial infarction I228　　Subsequent ST elevation (STEMI) myocardial infarction of other sites I229　　Subsequent ST elevation (STEMI) myocardial infarction of unspecified site
Exclusions	The mortality measures exclude index admissions for patients: 1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility; 2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data; 3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission; or 4. Discharged against medical advice (AMA). For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort.	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. Admitted within 30 days of a prior index admission for pneumonia.	Exclude cases transferring to another short-term hospital (DISP=2); cases in hospice care at admission (PointOFOriginUB04=F); MDC 14 (pregnancy, childbirth, and puerperium); with missing discharge disposition (DISP=missing), gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing), or principal diagnosis (DX1=missing).
Exclusion Details	1. The discharge disposition indicator is used to identify patients alive at	The pneumonia readmission measure excludes index admissions for patients:	N/A

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization	0730 Acute Myocardial Infarction (AMI) Mortality Rate
	discharge. Transfers are identified in the claims when a patient with a qualifying admission is discharged from an acute care hospital and admitted to another acute care hospital on the same day or next day. Patient length of stay and condition is identified from the admission claim. Rationale: This exclusion prevents inclusion of patients who likely did not have clinically significant AMI. 2. Inconsistent vital status or unreliable data are identified if any of the following conditions are met 1) the patient's age is greater than 115 years; 2) if the discharge date for a hospitalization is before the admission date; and 3) if the patient has a sex other than 'male' or 'female'. Rationale: Reliable and consistent data are necessary for valid calculation of the measure. 3. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice data. This exclusion applies when the measure is used in Medicare FFS patients only. Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care.	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.	

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization	0730 Acute Myocardial Infarction (AMI) Mortality Rate
	4. 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.		
Risk Adjustment	Statistical risk model 118210| 112469| 146637| 150289 118210| 112469| 146637| 150289	Statistical risk model 141973| 112469| 146637 141973| 112469| 146637	No risk adjustment or risk stratification 130177| 132112| 138848| 138827 130177| 132112| 138848| 138827
Stratification	N/A	N/A	Not applicable
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 RSMRs 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 mortality 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 mortality at the hospital, after accounting for patient risk. The hospital-specific intercepts are given a distribution to account for the	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	The observed rate is the number of discharge records where the patient experienced the QI adverse event divided by the number of discharge records at risk for the event. Risk adjustment is available for the AHRQ QI ICD-9-CM v6.0 specifications. However, risk adjustment is not currently included in the ICD-10-CM/PCS v6.0 of the AHRQ QI specifications, due to the transition to ICD-10-CM/PCS (October 1, 2015). At least one full year of data coded in ICD-10-CM/PCS is needed in order to develop robust risk adjustment models. A full year of ICD-10-CM/PCS coded all-payer data will not be available until mid-2017. AHRQ will announce an anticipated date as soon as one is known.

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization	0730 Acute Myocardial Infarction (AMI) Mortality Rate
	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 RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality. The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. The estimated hospital-	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	The AHRQ QI v6.0 software (SAS and WinQI) for use with ICD-10-CM/PCS produces observed rates, which may be used to evaluate performance within hospitals. However, caution should be used when comparing observed rates across hospitals because observed rates do not account for differences in patient populations (i.e., case mix). 130177| 132112| 138848| 138827

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization	0730 Acute Myocardial Infarction (AMI) Mortality Rate
	specific intercept is added 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 deaths (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 [https://qualitynet.org/inpatient/measures/mortality/methodology]. References: 1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 2. Krumholz H, Normand S, Galusha D, et al. Risk-Adjustment Models for AMI and HF 30-Day Mortality Methodology.	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 (https://qualitynet.org/inpatient/measures/readmission/methodology). References: Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 141973| 112469| 146637	

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization	0730 Acute Myocardial Infarction (AMI) Mortality Rate
	2005. 118210| 112469| 146637| 150289		
Submission items	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 0468 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia 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 0229 : Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization 1893 : Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization 2431 : Hospital-level, risk-standardized payment associated with a 30-day episode-of-care for Acute Myocardial Infarction (AMI) 3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	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).	5.1 Identified measures: 0230 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization for patients 18 and older 2473 : Hybrid hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) 5a.1 Are specs completely harmonized? No 5a.2 If not completely harmonized, identify difference, rationale, impact: The indicators referenced above include 30-day mortality 1) for patients age 18 years and older 2) specified as an e-measure and 3) for patients age 65 and older. Inpatient mortality and 30-day mortality are different concepts, although capturing the same ultimate outcome. Harmonization is not appropriate. 5b.1 If competing, why superior or rationale for additive value: IQI 15 and the Centers for Medicare & Medicaid Services' NQF-endorsed measures concerning AMI mortality (0230 and 2473) use the same ICD-9-CM codes to identify AMI, but they differ in two important respects: (1) whereas the CMS measures concern only

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization	0730 Acute Myocardial Infarction (AMI) Mortality Rate
	3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure 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. Our measure cohort was heavily vetted by clinical experts, a technical expert panel, and a public comment period. Additionally, the measure, with the specified cohort, has been publicly reported since 2008. 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	5b.1 If competing, why superior or rationale for additive value: N/A	Medicare fee-for-service and VA beneficiaries 65 years or older, IQI 15 measures mortality among hospitalizations of patients 18 years or older at non-federal acute care hospitals for all payers; and (2) while the CMS measures evaluate 30-day mortality, IQI 15—because it is based only on UB-04 data elements—is limited to inpatient mortality. The latter difference is a potential disadvantage in that the time at risk is not uniform for all patients and 30-day mortality is typically greater than inpatient mortality, but the former difference is an advantage because IQI 15 encompasses a greater proportion of the entire population at risk. We therefore believe that #0730 complements #0230 by offering an alternative specification for users who are interested in patients of all ages and all payers, just as #2473 offers an alternative e-measure specification for those with electronic health data.

Comparison of NQF #0230, NQF #1893 and NQF #2431

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	2431 Care Coordination
Steward	Centers for Medicare & Medicaid Services	Centers for Medicare & Medicaid Services	
Description	The measure estimates a hospital-level 30-day risk-standardized mortality rate (RSMR) for patients discharged from the hospital with a principal diagnosis of AMI. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. CMS annually reports the measure for patients who are 65 years or older and are either Medicare fee-for-service (FFS) beneficiaries and hospitalized in non-federal hospitals or are hospitalized in Veterans Health Administration (VA) facilities.	The measure estimates a hospital-level 30-day risk-standardized mortality rate (RSMR), defined as death from any cause within 30 days after the index admission date, for patients discharged from the hospital with either a principal discharge diagnosis of COPD or a principal discharge diagnosis of respiratory failure with a secondary discharge diagnosis of acute exacerbation of COPD. 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.	Inpatient/Hospital
Type	Outcome	Outcome	Cardiovascular : Coronary Artery Disease (AMI)
Data Source	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, skilled nursing facility care, some home health agency 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	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, skilled nursing facility care, some home health agency 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	We do not impute missing data for any of the variables included in the measure. However, if a hospitalization is missing a DRG or DRG weight, we exclude it as an index admission. Inpatient services: Inpatient facility services; Inpatient services: Evaluation and management; Inpatient services: Procedures and surgeries; Inpatient services: Imaging and diagnostic; Inpatient services: Lab services; Inpatient services: Admissions/discharges; Inpatient services: Labor (hours, FTE, etc.); Other inpatient services; Ambulatory services: Outpatient facility services;

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	2431 Care Coordination
	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 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): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score. References:	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 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): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score. References:	Ambulatory services: Emergency Department; Ambulatory services: Pharmacy; Ambulatory services: Evaluation and management; Ambulatory services: Procedures and surgeries; Ambulatory services: Imaging and diagnostic; Ambulatory services: Lab services; Ambulatory services: Labor (hours, FTE, etc.); Other ambulatory services; Durable Medical Equipment (DME); Other services not listed See S.7.8 for a full list of care settings included Data Sources Medicare Inpatient and Outpatient Administrative Claims: This data source contains claims data for FFS inpatient and outpatient services including: Medicare inpatient hospital care, outpatient hospital services, skilled nursing facility care, some home health agency services, as well as inpatient and outpatient physician claims. The 2020 reporting period for these analyses include Medicare administrative claims and enrollment information for patients with hospitalizations between July 1, 2016 and June 30, 2019. Medicare administrative claims for the 12 months prior to and during the index admission are used for risk adjustment. The period for public reporting of the AMI payment measure aligns with the 30-day AMI mortality and readmission measures for harmonization purposes.

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	2431 Care Coordination
	Fleming C, Fisher ES, Chang CH, Bubolz TA, Malenka DJ. 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 NQF_datadictionary_AMImortality_Fall2020_final_7.22.20.xlsx	Fleming C, Fisher ES, Chang CH, Bubolz TA, Malenka DJ. 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 NQF_datadictionary_COPDmortality_Fall2020_final_7.22.20.xlsx	The datasets also contain price-standardized payments for Medicare patients across all Medicare settings, services, and supplies (that is, inpatient, outpatient, SNF, home health agency, hospice, physician/clinical laboratory/ambulance services, and durable medical equipment, prosthetics/orthotics, and supplies). The CMS Standardization Methodology for Allowed Amount for 2009 through 2019 was applied to the claims to calculate the measures. Price-standardized payments for Medicare patients across all Medicare settings, services, and supplies (that is, inpatient, outpatient, SNF, home health agency, hospice, physician/clinical laboratory/ambulance services, and durable medical equipment, prosthetics/orthotics, and supplies) were calculated using standardized methodology specific to services reimbursed through Medicare parts A and B (for specific values see https://www.resdac.org/articles/cms-price-payment-standardization-overview). Medicare Enrollment Database (EDB) This database contains Medicare beneficiary demographic, benefit/coverage, and vital status information. This dataset was used to obtain information on enrollment, date of birth, and post-discharge mortality status. These data have previously been shown to

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	2431 Care Coordination
			accurately reflect patient vital status (Fleming et al. 1992).
			Medicare Fee Schedules
			Fee schedules are lists of pre-determined reimbursement amounts for certain services and supplies (e.g. physician services, independent clinical labs, ambulance services, durable medical equipment) and are used by Medicare in the calculation of payment to providers. We used the applicable fee schedules when calculating payments for claims that occurred in each care setting.
			Federal Register Final Rules for Medicare Prospective Payment Systems and Payment Policies
			Certain data necessary to calculate payments (e.g. annual base payments and conversion factors, DRG weights, wage indexes, and average length of stay) were taken from applicable Federal Register Final Rules.
			CMS-published Wage Index Data
			Wage index data not published in Federal Register Final Rules (such as the wage index data for Renal Dialysis Facilities) were obtained through the CMS website.
			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

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	2431 Care Coordination
			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, E., Chang, C., Bubolz, T., & Malenka, D. (1992). Studying Outcomes and Hospital Utilization in the Elderly: The Advantages of a Merged Data Base for Medicare and Veterans Affairs Hospitals. Medical Care, 30(5), 377-391.
Level	Facility	Facility	See S.7.8 for a full list of care settings included
Setting	Inpatient/Hospital	Inpatient/Hospital	See S.7.8 for a full list of care settings included To estimate payments for a 30-day episode of care for AMI we included payments for all care settings, services, and supplies, except drugs covered under Part D Medicare claims. We did not include Part D since a large proportion of Medicare beneficiaries are not enrolled in Part D and there is variation in enrollment status across and within states. Including payments for Part D services would thus bias payments upwards for hospitals with high Part D enrollment. By following patients through an episode of care for AMI, CMS and hospitals can gain key insights into the drivers of payments and how practice patterns vary across providers.

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	2431 Care Coordination
			We include payments for the following care settings below in the measure: Inpatient hospital facility and physician Outpatient hospital facility and physician Skilled nursing facility and physician Hospice facility and physician Home health facility and physician Inpatient psychiatric facility and physician Inpatient rehab facility and physician Long-term care hospital facility Clinical labs facility and physician Comprehensive outpatient rehab facility and physician Outpatient rehab facility and physician Renal dialysis facility and physician Community mental health centers facility and physician DME/POS/PEN Observation stay facility Part B drugs Ambulance and ambulance physician Emergency department facility and physician Physician office Federally qualified health centers facility and physician Rural health clinics facility and physician Ambulatory surgical centers facility and physician

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	2431 Care Coordination
			We also include physician payments for the following care settings: Indian health service free-stand facility Indian health service provider facility Tribal free-standing facility Tribal facility Military treatment facility Independent clinic State or local health clinic Mass immunization center Walk-in retail health clinic Urgent care facility Unassigned Pharmacy School Homeless Shelter Prison Group Home Mobile Unit Temporary Lodging Birthing Center Intermediary Care/Mentally Retarded Residential Substance Abuse Psychiatric Residential Facility Non-Residential Substance Abuse Other Physician Other carrier claims with HCPCS codes P9603 or P9604

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	2431 Care Coordination
			In order to determine how to assign claims, we examine the place of service code for physician claims and a combination of claim type and facility type codes to determine the facility in which care was provided. Depending on the facility and physician codes we standardize payments differently. Information on how we standardize claims can be found in the methodology report available here: https://qualitynet.cms.gov/files/5d0d398a764be766b01038ea?filename=AMI_Pymnt_Mthdlgy_Rprt.pdf
Numerator Statement	The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients hospitalized with a principal diagnosis of AMI.	The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients hospitalized with either a principal diagnosis of COPD or a principal diagnosis of respiratory failure with a secondary diagnosis of acute exacerbation of COPD.	
Numerator Details	The measure counts all deaths (including in-hospital deaths) for any cause to any acute care hospital within 30 days of the date of the index AMI hospitalization. Identifying deaths in the FFS measure As currently reported, we identify deaths for FFS Medicare patients 65 years and older in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.	The measure counts all deaths (including in-hospital deaths) for any cause within 30 days of the date of the index COPD admission. Identifying deaths in the FFS measure As currently reported, we identify deaths for FFS Medicare patients 65 years and older in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.	
Denominator Statement	This claims-based measure is used for patients aged 65 years or older.	This claims-based measure is used for a cohort of patients aged 65 years or older.	This measure estimates hospital-level, risk-standardized payments for a 30-day

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	2431 Care Coordination
	The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of AMI 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.	The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of COPD 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.	episode of care for AMI. To this end, we constructed a cohort of AMI patients by examining the principal discharge diagnosis in administrative claims data. Specifically, we included Medicare fee-for-service patients 65 or older with a principal discharge diagnosis of an AMI (defined by ICD-10 codes in attached data dictionary). We then applied several exclusion criteria as detailed in S.9.1. Once our cohort was finalized we examined all payments for these patients (including co-pays, co-insurance, and deductibles) that occurred within 30 days of the index admission. We included payments for all care settings, except Part D Medicare claims. We standardized payments across providers by removing or averaging geographic differences and removing policy adjustments from the total payment for that service. These payments were then assigned to the initial admitting hospital. As part of our model, we risk adjusted these payments for patient comorbidities listed in outpatient and inpatient claims in the 12 months prior to the index admission as well as the secondary diagnoses included in the index admission. We then used hierarchical generalized linear regression models to calculate a risk-standardized payment for each hospital.

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	2431 Care Coordination
Denominator Details	To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria: 1. Having a principal discharge diagnosis of AMI; 2. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of the index admission and Part A during the index admission, or those who are VA beneficiaries; 3. Aged 65 or over; and 4. Not transferred from another acute care facility. We have explicitly tested the measure for those aged 65+ years (see Testing Attachment for details).	To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria: 1. Principal discharge diagnosis of COPD or a principal discharge diagnosis of respiratory failure with a secondary discharge diagnosis of acute exacerbation of COPD 2. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of the index admission and Part A during the index admission, or those who are VA beneficiaries 3. Aged 65 or over 4. Not transferred from another acute care facility. This measure can also be used for an all-payer population aged 40 years and older. We have explicitly tested the measure in both patients aged 40+ years and those aged 65+ years (see Testing Attachment for details).	To construct the measure, we use Medicare administrative claims data. These data contain claims for all care settings, supplies, and services as outlined in Section S.7.8. (except Part D). Claim payment data are organized by the setting, supply, or service in which they were rendered. Standard Medicare payment rates were assigned to each service based on claim type, facility type, and place of service codes. These payments are then summed by individual patients. To create a hospital-level measure, we aggregate the payments for all eligible patients at each hospital.
Exclusions	The mortality measures exclude index admissions for patients: 1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility; 2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data; 3. Enrolled in the Medicare hospice program or used VA hospice services any time in	The mortality measures exclude index admissions for patients: 1. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data; 2. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission; or	URL

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	2431 Care Coordination
	the 12 months prior to the index admission, including the first day of the index admission; or 4. Discharged against medical advice (AMA). For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort.	3. Discharged against medical advice (AMA). For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort for each year.	

Exclusion Details	1. The discharge disposition indicator is used to identify patients alive at discharge. Transfers are identified in the claims when a patient with a qualifying admission is discharged from an acute care hospital and admitted to another acute care hospital on the same day or next day. Patient length of stay and condition is identified from the admission claim.
	Rationale: This exclusion prevents inclusion of patients who likely did not have clinically significant AMI.
	2. Inconsistent vital status or unreliable data are identified if any of the following conditions are met
	   1) the patient's age is greater than 115 years;
	   2) if the discharge date for a hospitalization is before the admission date; and
	   3) if the patient has a sex other than 'male' or 'female'.
	Rationale: Reliable and consistent data are necessary for valid calculation of the measure.
		1. Inconsistent vital status or unreliable data are identified if any of the following conditions are met
		   a. the patient's age is greater than 115 years:
		   b. if the discharge date for a hospitalization is before the admission date;
		   c. if the patient has a sex other than 'male' or 'female'.
		Rationale: Reliable and consistent data are necessary for valid calculation of the measure.
		2. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice data.
		Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care.
		3. Discharges against medical advice (AMA) are identified using the discharge disposition indicator in claims data.
			https://qualitynet.cms.gov/files/5d0d398a764be766b01038ea?filename=AMI_Pymnt_Mthdlgy_Rprt.pdf

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	2431 Care Coordination
	3. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice data. This exclusion applies when the measure is used in Medicare FFS patients only. Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care. 4. 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.	Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.	
Risk Adjustment	Statistical risk model 118210| 112469| 146637| 150289 118210| 112469| 146637| 150289	Statistical risk model 112469| 118210| 146637| 150289 112469| 118210| 146637| 150289	118210| 112469| 135810| 146637| 141015| 146313 118210| 112469| 135810| 146637| 141015| 146313
Stratification	N/A	N/A	
Type Score	Rate/proportion better quality = lower score	Rate/proportion better quality = lower score	This measure examines payments for a 30-day episode of care beginning with an admission for AMI and extending to 30-days post-admission. We determine if a patient has an AMI by examining the principal discharge diagnosis code in the administrative data. If a patient has a principal discharge diagnosis of any other condition, even if this includes a secondary diagnosis of AMI, this admission is not considered as an index admission.

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	2431 Care Coordination
			Therefore, the concurrency of clinical events is not an issue when determining what triggers the episode of care. Once, an episode is triggered, however, we include payments for all care settings, except Part D Medicare claims. The model risk adjusts for comorbidities listed in outpatient and inpatient claims in the 12 months prior to the index admission as well as the secondary diagnoses included in the index admission that are not considered complications of care. The measure includes payments for all care settings, except Part D, that occur during the 30-day window. If a claim for a complimentary service was filed in the study window, then it would be included in the measure.
Algorithm	The measure estimates hospital-level 30-day all-cause RSMRs 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 mortality 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 mortality at the hospital, after accounting for patient risk.	The measure estimates hospital-level 30-day all-cause RSMRs following hospitalization for COPD 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 mortality 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 mortality at the hospital, after accounting for patient risk.	118210| 112469| 135810| 146637| 141015| 146313

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	2431 Care Coordination
	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 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 RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality.	The RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality.	
	The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. The estimated hospital-	The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. The estimated hospital-	

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	2431 Care Coordination
	specific intercept is added 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 deaths (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 [https://qualitynet.org/inpatient/measures/mortality/methodology]. References: 1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 2. Krumholz H, Normand S, Galusha D, et al. Risk-Adjustment Models for AMI and HF 30-Day Mortality Methodology. 2005. 118210| 112469| 146637| 150289	specific intercept is added 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 deaths (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: https://qualitynet.org/inpatient/measures/mortality/methodology. References: 1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 112469| 118210| 146637| 150289	

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	2431 Care Coordination
Submission items	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 0468 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia 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 0229 : Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization 1893 : Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization 2431 : Hospital-level, risk-standardized payment associated with a 30-day episode-of-care for Acute Myocardial Infarction (AMI) 3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure 3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	5.1 Identified measures: 0468 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization 0506 : Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization 0275 : Chronic Obstructive Pulmonary Disease (COPD) or Asthma in Older Adults Admission Rate (PQI 05) 1891 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following chronic obstructive pulmonary disease (COPD) hospitalization 2888 : Accountable Care Organization Risk-Standardized Acute Hospital Admission Rate for Patients with Multiple Chronic Conditions 3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure 3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure 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. Our measure cohort was heavily vetted by	5.1 Identified measures: As part of the measure methodology we compare payments for a hospital with the expected payment amounts for an average hospital with the same case mix. While we include all hospitals when estimating the risk-adjustment model, we do not report RSPs for hospitals with fewer than 25 AMI admissions, since estimates for hospitals with fewer procedures are less reliable and CMS's past approach to public reporting has been not to report these results. 5a.1 Are specs completely harmonized? Comparative estimates are provided by classifying hospitals as less than average, no different than average, or greater than average payment depending on the span of their confidence interval in comparison with the national average payment amount (i.e., the benchmark). To categorize hospital payments, we estimate each hospital's RSP and the corresponding 95% interval estimate. As with all estimates, there is a degree of uncertainty associated with the RSP. The interval estimate is a range of probable values around the RSP that characterizes the amount of uncertainty associated with the estimate. A 95% interval estimate indicates that there is 95% probability that the true value of the RSP lies between the lower limit and the upper limit of the interval. In an effort to

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization	2431 Care Coordination
	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. Our measure cohort was heavily vetted by clinical experts, a technical expert panel, and a public comment period. Additionally, the measure, with the specified cohort, has been publicly reported since 2008. 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	clinical experts, a technical expert panel, and a public comment period. Additionally, the measure, with the specified cohort, has been publicly reported since 2008. 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	provide fair comparisons, we provide three categories (less than, no different than, or greater than the national average payment amount), which allows for conservative discrimination of hospital RSPs. 5a.2 If not completely harmonized, identify difference, rationale, impact: 5b.1 If competing, why superior or rationale for additive value:

Comparison of NQF #0230, NQF #3502 and NQF #3504

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
Steward	Centers for Medicare & Medicaid Services	Centers for Medicare & Medicaid Services	Centers for Medicare & Medicaid Services
Description	The measure estimates a hospital-level 30-day risk-standardized mortality rate (RSMR) for patients discharged from the hospital with a principal diagnosis of AMI. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. CMS annually reports the measure for patients who are 65 years or older and are either Medicare fee-for-service (FFS) beneficiaries and hospitalized in non-federal hospitals or are hospitalized in Veterans Health Administration (VA) facilities.	The measure estimates a hospital-level 30-day risk-standardized mortality rate (RSMR), defined as death from any cause within 30 days after the index admission date for patients who are between the ages of 50 and 94. Please note that in parallel with the hybrid HWM measure, we are submitting a claims-only HWM measure. Note that ultimately the claims and hybrid measures will be harmonized and use the same exact cohort specifications. The intent is that prior to implementation, the two measures will be exactly the same, with the exception of the additional risk adjustment added by the CCDE in the hybrid measure. This is analogous to the currently endorsed and implemented hybrid hospital-wide readmissions measure (NQF 1789 and NQF 2879e). Because of the homology between the claims and hybrid HWM measures, there is no reason to suspect that the results of analyses done for the claims-only measure would differ in any significant way from results of analyses for a nationally representative hybrid measure. Below we highlight the differences between the two measures, including specifications, data used, and testing which reflect limitations of data availability, as well as actual intended differences in the measure (risk adjustment).	The measure estimates a hospital-level 30-day hospital-wide risk-standardized mortality rate (RSMR), defined as death from any cause within 30 days after the index admission date, for Medicare fee-for-service (FFS) patients who are between the ages of 65 and 94. Please note that in parallel with the claims-only HWM measure, we are submitting a hybrid HWM measure. Note that ultimately the claims and hybrid measures will be harmonized and use the same exact cohort specifications. The intent is that prior to implementation, the two measures will be exactly the same, with the exception of the additional risk adjustment added by the CCDE in the hybrid measure. This is analogous to the currently endorsed and implemented hybrid hospital-wide readmissions measure (NQF 1789 and NQF 2879e). Because of the homology between the claims and hybrid HWM measures, there is no reason to suspect that the results of analyses done for the claims-only measure would differ in any significant way from results of analyses for a nationally representative hybrid measure. Below we highlight the differences between the two measures, including specifications,

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

		Differences in the measure, data, and testing that reflect limitations in data availability
		1. Dataset used for development, some testing (see below for differences), and measure results:
		   a. The claims-only measure uses nation-wide Medicare FFS claims and the enrollment database.
		   b. The hybrid measure uses an electronic health record (EHR) database from 21 hospitals in the Kaiser Permanente network which includes inpatient claims data information.
		2. Age of patients in cohort:
		   a. The claims-only measure includes Medicare FFS patients, age 65-94.
		   b. The hybrid measure includes all patients age 50-94 (see later discussion for justification)
		3. External empiric validity testing
		   a. Not possible for the hybrid measure, due to limited data availability. We provide results from the claims-only measure within the hybrid testing form.
		4. Socioeconomic risk factor analyses
			data used, and testing which reflect limitations of data availability, as well as actual intended differences in the measure (risk adjustment).
			Differences in the measure, data, and testing that reflect limitations in data availability
			2. Dataset used for development, some testing (see below for differences), and measure results:
			   a. The claims-only measure uses nation-wide Medicare FFS claims and the enrollment database.
			   b. The hybrid measure uses an electronic health record (EHR) database from 21 hospitals in the Kaiser Permanente network which includes inpatient claims data information.
			3. Age of patients in cohort:
			   a. The claims-only measure includes Medicare FFS patients, age 65-94.
			   b. The hybrid measure includes all patients age 50-94 (see later discussion for justification)
			4. External empiric validity testing

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

		a. Not possible for the hybrid measure, due to limited data availability. We provide results from the claims-only measure within the hybrid testing form.
		
		5. Exclusion analyses
		   a. To be representative of what we expect the impact would be of the measures' exclusions in a nation-wide sample, we provide the results from the claims-only measure.
		
		6. Meaningful differences
		   a. To be representative of what we expect the range of performance would be in a nation-wide sample, we provide the distribution results from the claims-only measure.
		
		Difference between the two measures when fully harmonized, prior to implementation:
		1. Risk adjustment:
		   a. The claims-only measure uses administrative claims data only for risk adjustment
		   b. The hybrid measure adds 10 clinical risk variables, derived from a set of core clinical
			c. Not possible for the hybrid measure, due to limited data availability. We provide results from the claims-only measure within the hybrid testing form.
			
			4. Socioeconomic risk factor analyses
			   a. Not possible for the hybrid measure, due to limited data availability. We provide results from the claims-only measure within the hybrid testing form.
			
			5. Exclusion analyses
			   a. To be representative of what we expect the impact would be of the measures' exclusions in a nation-wide sample, we provide the results from the claims-only measure.
			
			6. Meaningful differences
			   a. To be representative of what we expect the range of performance would be in a nation-wide sample, we provide the distribution results from the claims-only measure.

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
		data elements (CCDE) extracted from the EHR.	Difference between the two measures when fully harmonized, prior to implementation: 1. Risk adjustment: a. The claims-only measure uses administrative claims data only for risk adjustment b. The hybrid measure adds 10 clinical risk variables, derived from a set of core clinical data elements (CCDE) extracted from the EHR.
Type	Outcome	Outcome	Outcome
Data Source	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, skilled nursing facility care, some home health agency 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	Claims, Electronic Health Records, Other Clinical-Hybrid Dataset Constructed using Kaiser Permanente Northern California matched administrative claims and electronic health record (EHR) data, admission dates from October 1, 2015 – December 30, 2016. This data source was used for measure testing. (An earlier Kaiser dataset from that included all admissions for adult patients to any of their member hospitals between January 1, 2009 and June 30, 2015 was used for measure development, as described in the attached methodology report). The two data sources listed below were used for testing the claims-based measure; the hybrid testing form includes some testing data from the claims-based measure (for example,	Claims, Enrollment Data, Other Data sources for the Medicare FFS measure: 1. Medicare Part A Inpatient: The index dataset contains administrative inpatient hospitalization data for Medicare FFS beneficiaries, aged 65-94 on admission, hospitalized from July 1, 2016-June 30, 2017. The history dataset includes administrative inpatient hospitalization data on each patient for the 12 months prior to the index admission. 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

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
	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 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): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score. References:	for the social risk factor and external validation analyses). HWM claims-only datasets: Medicare Part A Inpatient Claims Data The index dataset contains administrative inpatient hospitalization data for Medicare FFS beneficiaries, aged 65-94 on admission. The history dataset includes administrative inpatient hospitalization data on each patient for the 12 months prior to the index admission. This data was used along with the Medicare Enrollment Database (EDB) for testing the claims-based measure. 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. It was also used to determine hospice enrollment. No data collection instrument provided Attachment Del18b2HOP5HWMHybridDataDictionary01072019.xlsx	inclusion/exclusion indicators such as Medicare status on admission as well as vital status. It was also used to determine hospice enrollment. No data collection instrument provided Attachment Del18b1HOP5HWMClaimsDataDictionary01072019.xlsx

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
	Fleming C, Fisher ES, Chang CH, Bubolz TA, Malenka DJ. 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 NQF_datadictionary_AMImortality_Fall2020_final_7.22.20.xlsx		
Level	Facility	Facility	Facility
Setting	Inpatient/Hospital	Inpatient/Hospital, Other Home-based primary care and home-based palliative care); Settings include: Home, Boarding home, Domiciliary, Assisted Living Facilities, Rest Home or Custodial Care Services	Inpatient/Hospital
Numerator Statement	The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients hospitalized with a principal diagnosis of AMI.	The outcome for this measure is 30-day, all-cause mortality. Mortality is defined as death from any cause, either during or after admission, within 30 days of the index admission date.	The outcome for this measure is 30-day, all-cause mortality. Mortality is defined as death from any cause, either during or after admission, within 30 days of the index admission date.
Numerator Details	The measure counts all deaths (including in-hospital deaths) for any cause to any acute care hospital within 30 days of the date of the index AMI hospitalization. Identifying deaths in the FFS measure As currently reported, we identify deaths for FFS Medicare patients 65 years and older in the Medicare Enrollment	The measure outcome is death from any cause within 30 days of the admission date of the index admission. The numerator is a binary variable (1=yes/0=no) that indicates whether the patient died within 30 days of the index admission date.	The measure outcome is death from any cause within 30 days of the admission date of the index admission, for Medicare FFS patients identified using the Medicare Enrollment Database (EDB). The numerator is a binary variable (1=yes/0=no) that indicates whether the patient died within 30 days of the index admission date.

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
	Database (EDB) and for VA patients in the VA data.		
Denominator Statement	This claims-based measure is used for patients aged 65 years or older. The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of AMI 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.	The cohort includes inpatient admissions for a wide variety of conditions for patients aged between 50 and 94 years old who were discharged from short-term acute care hospitals. If a patient has more than one admission during the measurement year, one admission is randomly selected for inclusion in the measure. Additional details are provided in S.7 Denominator Details. The age range for this measure differs from that of the claims-only measure due to the limited size of the dataset used for testing. The intent is to harmonize the age range of the hybrid measure with the age range of the claims-only measure, so that both will include admissions for patients age 65-94.	The cohort includes inpatient admissions for a wide variety of conditions for Medicare FFS patients aged between 65 and 94 years old who were admitted to short-term acute care hospitals. If a patient has more than one admission during the measurement year, one admission is randomly selected for inclusion in the measure. 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 inclusion criteria: 1. Having a principal discharge diagnosis of AMI; 2. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of the index admission and Part A during the index admission, or those who are VA beneficiaries; 3. Aged 65 or over; and 4. Not transferred from another acute care facility.	The index cohort includes all inpatient admissions for patients aged 50-94 years old. (Note: The intention is to fully harmonize the cohort definition with the claims-only measure so that both measures will capture admissions for patients age 65-94. We deviated from that definition during development and testing due to the limited dataset available that included the EHR data elements needed to calculate this measure. Note that the risk model already includes age in years, as a risk variable.)	An index admission is the hospitalization to which the mortality outcome is attributed and includes admissions for patients: 1. Enrolled in Medicare FFS Part A for at least 12 months prior to the date of admission and during the index admission Rationale: Claims data are consistently available only for Medicare FFS beneficiaries. The 12-month prior enrollment criterion ensures a full year of administrative data is available for risk adjustment.

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
	We have explicitly tested the measure for those aged 65+ years (see Testing Attachment for details).	An index admission is the hospitalization to which the mortality outcome is attributed and includes admissions for patients: 1. Not transferred from another acute care facility Rationale: Admissions to an acute cate hospital within one day of discharge from another acute care hospital are considered transfers. Transferred patients are included in the measure cohort, but it is the initial hospitalization rather than any "transfer-in" hospitalization(s), that is included as the hospitalization to which the mortality outcome is attributed (the index admission). 2. Aged between 50 and 94 years The hybrid measure is intended for the Medicare FFS population but was tested in a limited dataset due to the EHR data elements included. The use of a small dataset required that we expand the sample by including admissions from patients ages 50 to 94 years. Note that the measure already adjusts for age. 3. Not admitted for primary psychiatric diagnoses Rationale: Patients admitted for psychiatric treatment are typically cared for in separate psychiatric facilities that are not comparable to short-term acute care hospitals (see data dictionary, HWM Non-Acute Care Inclusion tab). 4. Not admitted for rehabilitation	2. Not transferred from another acute care facility Rationale: Admissions to an acute cate hospital within one day of discharge from another acute care hospital are considered transfers. Transferred patients are included in the measure cohort, but it is the initial hospitalization rather than any "transfer-in" hospitalization(s), that is included as the hospitalization to which the mortality outcome is attributed (the index admission). 3. Aged between 65 and 94 years Rationale: Medicare patients younger than 65 are not included in the measure because they usually qualify for the program due to severe disability and are considered to be clinically distinct from Medicare patients 65 and over. Patients over age 94 are not included to avoid holding hospitals responsible for the survival of the very elderly patients, who may be less likely to have survival as a primary goal. Note that the hybrid measure (submitted for NQF endorsement in parallel with the claims-only measure) differs from the claims-only measure in terms of the age range of included admissions; the hybrid measure includes all inpatient admissions for patients aged 50-94 years old. The intention is to fully harmonize the cohort definitions for the two measures, so that both measures will capture admissions for patients age 65-94. We deviated from that

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
		Rationale: These admissions are not typically to a short-term acute care hospital and are not for acute care (see data dictionary, HWM Non-Acute Care Inclusion tab). 5. Not enrolled in hospice at the time of, or 12 months prior to, their index admission Rationale: Patients enrolled in hospice in the prior 12 months or at the time of admission are unlikely to have 30-day survival as a primary goal 6. Not enrolled in hospice within two days of admission Rationale: There is not a single, correct approach regarding patients enrolled in hospice during admission or upon discharge – mortality may or may not represent a quality signal for this group of patients and hospice enrollment is inadequate to differentiate this issue. However, for most patients and/or families who had the discussion and agreed to enroll in hospice within two days of admission, 30-day survival is not likely the primary goal due to their condition and not the quality of care received. 7. Not with a principal diagnosis of cancer and enrolled in hospice during their index admission Rationale: Patients admitted primarily for cancer who are enrolled in hospice during admission are unlikely to have 30-day survival as a primary goal of care. (see data dictionary, HWM Cancer Inclusion tab).	definition during development and testing for the hybrid measure due to the limited dataset available that included the EHR data elements needed to calculate the hybrid measure. Note that the risk model already includes age in years, as a risk variable.) 4. Not admitted for primary psychiatric diagnoses Rationale: Patients admitted for psychiatric treatment are typically cared for in separate psychiatric facilities that are not comparable to short-term acute care hospitals (see data dictionary, HWM Non-Acute Care Inclusion tab). 5. Not admitted for rehabilitation Rationale: These admissions are not typically to a short-term acute care hospital and are not for acute care (see data dictionary, HWM Non-Acute Care Inclusion tab). 6. Not enrolled in hospice at the time of, or 12 months prior to, their index admission Rationale: Patients enrolled in hospice in the prior 12 months or at the time of admission are unlikely to have 30-day survival as a primary goal. 7. Not enrolled in hospice within two days of admission Rationale: There is not a single, correct approach regarding patients enrolled in hospice during admission or upon discharge

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
		8. Without any diagnosis of metastatic cancer Rationale: Although some patients admitted with a diagnosis of metastatic cancer will have 30-day survival as a primary goal of care, for many such patients admitted to the hospital, death may be a clinically reasonable and patient-centered outcome. (see data dictionary, HWM Metastatic Cancer Inclusion tab). 9. Not with a principal discharge diagnosis, or a secondary diagnosis that is present on admission (POA) for a condition which hospitals have limited ability to influence survival Rationale: Hospitals have little ability to impact mortality for some conditions. This list of conditions (see data dictionary, HWM ICD-10 Inclusion tab) was determined through independent review, by several clinicians, of conditions associated with high mortality. The decisions were also reviewed with our Technical Expert Panel (TEP) and Technical Work Group. Admissions are not included in the cohort if the patient had a principal diagnosis code that is on this list, or a secondary code with POA that is on the list. In addition, for patients with multiple admissions, the measure selects only one admission, at random, for inclusion. There is no practical statistical modeling approach that can account or adjust for the complex relationship between the number of	– mortality may or may not represent a quality signal for this group of patients and hospice enrollment is inadequate to differentiate this issue. However, for most patients and/or families who had the discussion and agreed to enroll in hospice within two days of admission, 30-day survival is not likely the primary goal due to their condition and not the quality of care received. 8. Not with a principal diagnosis of cancer and enrolled in hospice during their index admission Rationale: Patients admitted primarily for cancer who are enrolled in hospice during admission are unlikely to have 30-day survival as a primary goal of care. (see data dictionary, HWM Cancer Inclusion tab). 9. Without any diagnosis of metastatic cancer Rationale: Although some patients admitted with a diagnosis of metastatic cancer will have 30-day survival as a primary goal of care, for many such patients admitted to the hospital, death may be a clinically reasonable and patient-centered outcome. (see data dictionary, HWM Metastatic Cancer Inclusion tab). 10. Not with a principal discharge diagnosis, or a secondary diagnosis that is present on admission (POA) for a condition

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
		admissions and risk of mortality in the context of a hospital-wide mortality measure. Random selection ensures that providers are not penalized for a "last" admission during the measurement period; selecting the last admission would not be as accurate a reflection of the risk of death as random selection, as the last admission is inherently associated with a higher mortality risk. Random selection is also used in CMS's condition-specific mortality measures. Note that random selection reduces the number of admissions, but does not exclude any patients from the measure. The cohort is defined using ICD-10 Clinical Modification codes identified in Medicare Part A Inpatient claims data. The measure aggregates the ICD-10 principal diagnosis and all procedure codes of the index admission into clinically coherent groups of conditions and procedures (condition categories or procedure categories) using the Agency for Healthcare Research and Quality (AHRQ) Clinical Classifications System (CCS). There is a total of 285 mutually exclusive AHRQ condition categories, most of which are single, homogenous diseases such as pneumonia or acute myocardial infarction. Some are aggregates of conditions, such as "other bacterial infections". There is a total of 231 mutually exclusive procedure categories. Using the AHRQ CCS procedure and condition categories, the measure assigns each index	which hospitals have limited ability to influence survival Rationale: Hospitals have little ability to impact mortality for some conditions. This list of conditions (see data dictionary, HWM ICD-10 Inclusion tab) was determined through independent review, by several clinicians, of conditions associated with high mortality. The decisions were also reviewed with our Technical Expert Panel (TEP) and Technical Work Group. Admissions are not included in the cohort if the patient had a principal diagnosis code that is on this list, or a secondary code with POA that is on the list. In addition, for patients with multiple admissions, the measure selects only one admission, at random, for inclusion. There is no practical statistical modeling approach that can account or adjust for the complex relationship between the number of admissions and risk of mortality in the context of a hospital-wide mortality measure. Random selection ensures that providers are not penalized for a "last" admission during the measurement period; selecting the last admission would not be as accurate a reflection of the risk of death as random selection, as the last admission is inherently associated with a higher mortality risk. Random selection is also used in CMS's condition-specific mortality measures. Note that random selection

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
		hospitalization to one of 15 mutually exclusive divisions. The divisions were created based upon clinical coherence, consistency of mortality risk, adequate patient and hospital case volume for stable results reporting, and input from clinicians, patients, and patient caregivers on usability. The measure first assigns admissions with qualifying AHRQ procedure categories to one of six surgery divisions by identifying a defining surgical procedure. The defining surgical procedure is identified using the following algorithm: 1) if a patient only has one major surgical procedure then that procedure is the defining surgical procedure; 2) if a patient has more than one major surgical procedure, the first dated procedure performed during the index admission is the defining surgical procedure; 3) if there is more than one major surgical procedure on that earliest date, the procedure with the highest mortality rate is the defining surgical procedure. These divisions include admissions likely cared for by surgical teams. The surgical divisions are: Surgical Cancer (see note below), Cardiothoracic Surgery, General Surgery, Neurosurgery, Orthopedic Surgery, and Other Surgical Procedures. For the Surgical Cancer division, any admission that includes a surgical procedure and a principal discharge diagnosis code of cancer is assigned to the Surgical Cancer division. This division and the logic behind it was	reduces the number of admissions, but does not exclude any patients from the measure. The cohort is defined using ICD-10 Clinical Modification codes identified in Medicare Part A Inpatient claims data. The measure aggregates the ICD-10 principal diagnosis and all procedure codes of the index admission into clinically coherent groups of conditions and procedures (condition categories or procedure categories) using the Agency for Healthcare Research and Quality (AHRQ) Clinical Classifications System (CCS). There is a total of 285 mutually exclusive AHRQ condition categories, most of which are single, homogenous diseases such as pneumonia or acute myocardial infarction. Some are aggregates of conditions, such as "other bacterial infections". There is a total of 231 mutually exclusive procedure categories. Using the AHRQ CCS procedure and condition categories, the measure assigns each index hospitalization to one of 15 mutually exclusive divisions. The divisions were created based upon clinical coherence, consistency of mortality risk, adequate patient and hospital case volume for stable results reporting, and input from clinicians, patients, and patient caregivers on usability. The measure first assigns admissions with qualifying AHRQ procedure categories to one of six surgery divisions by identifying a defining surgical procedure. The defining

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
		implemented in response to feedback from our Technical Expert Panel. The measure then assigns the remaining admissions into one of the nine non-surgical divisions based on the AHRQ diagnostic CCS of the principal discharge diagnosis. The non-surgical divisions are: Cancer, Cardiac, Gastrointestinal, Infectious Disease, Neurology, Orthopedic, Pulmonary, Renal, Other Conditions. The full list of the specific diagnosis and procedure AHRQ CCS categories used to define the divisions are attached in the Data Dictionary.	surgical procedure is identified using the following algorithm: 1) if a patient only has one major surgical procedure then that procedure is the defining surgical procedure; 2) if a patient has more than one major surgical procedure, the first dated procedure performed during the index admission is the defining surgical procedure; 3) if there is more than one major surgical procedure on that earliest date, the procedure with the highest mortality rate is the defining surgical procedure. These divisions include admissions likely cared for by surgical teams. The surgical divisions are: Surgical Cancer (see note below), Cardiothoracic Surgery, General Surgery, Neurosurgery, Orthopedic Surgery, and Other Surgical Procedures. For the Surgical Cancer division, any admission that includes a surgical procedure and a principal discharge diagnosis code of cancer is assigned to the Surgical Cancer division. This division and the logic behind it was implemented in response to feedback from our Technical Expert Panel. The measure then assigns the remaining admissions into one of the nine non-surgical divisions based on the AHRQ diagnostic CCS of the principal discharge diagnosis. The non-surgical divisions are: Cancer, Cardiac,

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
			Gastrointestinal, Infectious Disease, Neurology, Orthopedic, Pulmonary, Renal, Other Conditions. The full list of the specific diagnosis and procedure AHRQ CCS categories used to define the divisions are attached in the Data Dictionary.
Exclusions	The mortality measures exclude index admissions for patients: 1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility; 2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data; 3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission; or 4. Discharged against medical advice (AMA). For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort.	The measure excludes index admissions for patients: 1. With inconsistent or unknown vital status (from claims data) or other unreliable claims data; 2. Discharged against medical advice (AMA); 3. With an admission for spinal cord injury (CCS 227), skull and face fractures (CCS 228), Intracranial Injury (CCS 233), Crushing injury or internal injury (CCS 234), Open wounds of head/neck/trunk (CCS 235), and burns (CCS 240); and 4. With a principal discharge diagnosis within a CCS with fewer than 100 admissions in that division within the measurement year.	The measure excludes index admissions for patients: 1. With inconsistent or unknown vital status (from claims data) or other unreliable claims data; 2. Discharged against medical advice (AMA); 3. With an admission for spinal cord injury (CCS 227), skull and face fractures (CCS 228), Intracranial Injury (CCS 233), Crushing injury or internal injury (CCS 234), Open wounds of head/neck/trunk (CCS 235), and burns (CCS 240); and 4. With a principal discharge diagnosis within a CCS with fewer than 100 admissions within the measurement year.
Exclusion Details	1. The discharge disposition indicator is used to identify patients alive at discharge. Transfers are identified in the claims when a patient with a	1. With inconsistent or unknown vital status (from claims data) or other unreliable claims data.	1. With inconsistent or unknown vital status (from claims data) or other unreliable claims data

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
	qualifying admission is discharged from an acute care hospital and admitted to another acute care hospital on the same day or next day. Patient length of stay and condition is identified from the admission claim. Rationale: This exclusion prevents inclusion of patients who likely did not have clinically significant AMI. 2. Inconsistent vital status or unreliable data are identified if any of the following conditions are met 1) the patient's age is greater than 115 years; 2) if the discharge date for a hospitalization is before the admission date; and 3) if the patient has a sex other than 'male' or 'female'. Rationale: Reliable and consistent data are necessary for valid calculation of the measure. 3. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice data. This exclusion applies when the measure is used in Medicare FFS patients only. Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care. 4. Discharges against medical advice (AMA) are identified using the	Rationale: The measure does not include stays for patients where the admission date is after the date of death, or where the date of death occurs before the date of discharge but the patient was discharged alive because these are likely errors in the data. 2. Discharged against medical advice (AMA) Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge. 3. With an admission for spinal cord injury (CCS 227), skull and face fractures (CCS 228), Intracranial Injury (CCS 233), Crushing injury or internal injury (CCS 234), Open wounds of head/neck/trunk (CCS 235), and burns (CCS 240). Rationale: Even though a hospital likely can influence the outcome of some of these conditions, in many cases death events are not a signal of poor quality of care when patients present with these conditions. These conditions are also infrequent events that are unlikely to be uniformly distributed across hospitals. 4. With a principal discharge diagnosis within a CCS with fewer than 100 admissions in that division within the measurement year. Rationale: To calculate a stable and precise risk model, there are a minimum number of admissions that are needed. In addition, a minimum number of admissions and/or	Rationale: The measure does not include stays for patients where the admission date is after the date of death in the Medicare Enrollment Database, or where the date of death occurs before the date of discharge but the patient was discharged alive because these are likely errors in the data. 2. Discharged against medical advice (AMA) Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge. 3. With an admission for spinal cord injury (CCS 227), skull and face fractures (CCS 228), Intracranial Injury (CCS 233), Crushing injury or internal injury (CCS 234), Open wounds of head/neck/trunk (CCS 235), and burns (CCS 240) Rationale: Even though a hospital likely can influence the outcome of some of these conditions, in many cases death events are not a signal of poor quality of care when patients present with these conditions. These conditions are also infrequent events that are unlikely to be uniformly distributed across hospitals. 4. With a principal discharge diagnosis within a CCS with fewer than 100 admissions in that division within the measurement year. Rationale: To calculate a stable and precise risk model, there are a minimum number of

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
	discharge disposition indicator in claims data. Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.	outcome events are required to inform grouping admissions into larger categories. These admissions present challenges to both accurate risk prediction and coherent risk grouping and are therefore excluded. Note: During measure development we analyzed different volume cut-offs (25, 50 and 100). Using cut-off values below 100 resulted in too many CCS codes in some of the divisions (the CCS category codes are used in risk adjustment) which resulted in non-convergence of those division-level risk models. The total number of patients excluded is very small (13,597 or 0.21% of admissions for a cut off of 100). During measure development we also explored the option of pooling low-volume CCS codes (CCS<100 patients) into one group, however, the heterogeneity in mortality rates for the individual ICD-10 codes in those groups would preclude adequate risk adjustment. The TEP supported excluding these admissions.	admissions that are needed. In addition, a minimum number of admissions and/or outcome events are required to inform grouping admissions into larger categories. These admissions present challenges to both accurate risk prediction and coherent risk grouping and are therefore excluded. Note: During measure development we analyzed different volume cut-offs (25, 50 and 100). Using cut-off values below 100 resulted in too many CCS codes in some of the divisions (the CCS category codes are used in risk adjustment) which resulted in non-convergence of those division-level risk models. The total number of patients excluded is very small (13,597 or 0.21% of admissions for a cut off of 100). During measure development we also explored the option of pooling low-volume CCS codes (CCS<100 patients) into one group, however, the heterogeneity in mortality rates for the individual ICD-10 codes in those groups would preclude adequate risk adjustment. The TEP supported excluding these admissions.
Risk Adjustment	Statistical risk model 118210| 112469| 146637| 150289 118210| 112469| 146637| 150289	Statistical risk model 146637| 110639| 141015| 110874| 146313 146637| 110639| 141015| 110874| 146313	Statistical risk model 146637| 144762| 110639| 141015| 110874| 146313 146637| 144762| 110639| 141015| 110874| 146313
Stratification	N/A	N/A	N/A

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
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 RSMRs 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 mortality 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 mortality 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 RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of	The measure estimates hospital-level, risk-standardized mortality rates (RSMRs) within 30 days of hospital admission using hierarchical logistical regression models through a Bayesian Markov Chain Monte Carlo (MCMC) procedure. In brief, we used hierarchical logistic regression to model the log-odds of mortality for each of the 15 service-line divisions. Death within 30 days was modeled as a function of patient-level demographic and clinical characteristics and a random hospital-level intercept. This model specification accounts for within-hospital correlation of the observed outcomes and models the assumption that underlying differences in quality among the health care facilities being evaluated lead to systematic differences in outcomes. We estimated a separate hierarchical logistic regression model for each service-line division. In order to obtain the variance and interval estimates, we fit the hierarchical model under the Bayesian framework along with the Markov Chain Monte Carlo (MCMC) technique. Admissions are assigned to one of 15 mutually exclusive divisions (groups of discharge condition categories and procedure categories). For each division and each hospital with patients in that division, the standardized mortality ratio (SMR) is calculated as the ratio of the number of	The measure estimates hospital-level, risk-standardized mortality rates (RSMRs) within 30 days of hospital admission using hierarchical logistical regression models through a Bayesian Markov Chain Monte Carlo (MCMC) procedure. In brief, we used hierarchical logistic regression to model the log-odds of mortality for each of the 15 service-line divisions. Death within 30 days was modeled as a function of patient-level demographic and clinical characteristics and a random hospital-level intercept. This model specification accounts for within-hospital correlation of the observed outcomes and models the assumption that underlying differences in quality among the health care facilities being evaluated lead to systematic differences in outcomes. We estimated a separate hierarchical logistic regression model for each service-line division. In order to obtain the variance and interval estimates, we fit the hierarchical model under the Bayesian framework along with the Markov Chain Monte Carlo (MCMC) technique. Admissions are assigned to one of 15 mutually exclusive divisions (groups of discharge condition categories and procedure categories). For each division and each hospital with patients in that division, the standardized mortality ratio (SMR) is

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
	deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality. The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. The estimated hospital-specific intercept is added 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 deaths (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	"predicted" deaths to the number of "expected" deaths at a given hospital. The predicted number of deaths is based on the hospital's performance with its observed case mix and service mix, and is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific effect on the risk of mortality. 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 transformed via an inverse logit function and summed over all patients attributed to a hospital to get a predicted value. The expected number of deaths is based on the nation's performance with that hospital's case mix and service mix and 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 transformed via an inverse logit function and summed over all patients in the hospital to get an expected value. 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 mortality rates or better quality, while a higher ratio indicates higher-	calculated as the ratio of the number of "predicted" deaths to the number of "expected" deaths at a given hospital. The predicted number of deaths is based on the hospital's performance with its observed case mix and service mix, and is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific effect on the risk of mortality. 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 transformed via an inverse logit function and summed over all patients attributed to a hospital to get a predicted value. The expected number of deaths is based on the nation's performance with that hospital's case mix and service mix and 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 transformed via an inverse logit function and summed over all patients in the hospital to get an expected value. 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

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
	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 [https://qualitynet.org/inpatient/measures/mortality/methodology]. References: 1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 2. Krumholz H, Normand S, Galusha D, et al. Risk-Adjustment Models for AMI and HF 30-Day Mortality Methodology. 2005. 118210| 112469| 146637| 150289	than-expected mortality rates or worse quality. To assess hospital performance for each reporting period, the measure re-estimates the model coefficients using the data in that period. The division-level SMRs are then pooled for each hospital using an inverse variance-weighted geometric mean to create a hospital-wide composite SMR. (Note that in the case of the hybrid measure, we are presenting data from 9 of the total 15 divisions due to limitations in availability of electronic health records data). The hospital-wide SMR is then multiplied by the national observed mortality rate to produce the RSMR. 146637| 110639| 141015| 110874| 146313	mortality rates or better quality, while a higher ratio indicates higher-than-expected mortality rates or worse quality. To assess hospital performance for each reporting period, the measure re-estimates the model coefficients using the data in that period. The division-level SMRs are then pooled for each hospital using an inverse variance-weighted geometric mean to create a hospital-wide composite SMR. The hospital-wide SMR is then multiplied by the national observed mortality rate to produce the RSMR. 146637| 144762| 110639| 141015| 110874| 146313
Submission items	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 0468 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization	5.1 Identified measures: 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: This hybrid HWM measure incorporates patient-level clinical data from the EHR into the risk	5.1 Identified measures: 5a.1 Are specs completely harmonized? Yes 5a.2 If not completely harmonized, identify difference, rationale, impact: This claims-only hospital-wide mortality (HWM) measure is intended to complement the

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
	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 0229 : Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization 1893 : Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization 2431 : Hospital-level, risk-standardized payment associated with a 30-day episode-of-care for Acute Myocardial Infarction (AMI) 3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure 3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure 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	adjustment model, compared to the claims-only hospital-wide mortality measure. This hybrid HWM measure is intended to complement the existing CMS Hospital-Wide All-Cause Risk-Standardized Readmission Measure (NQF #1789) to allow assessment of trends in hospital performance for both readmission and mortality outcomes, similar to other complementary pairs of readmission and mortality measures for specific conditions and procedures. By measuring mortality outcomes across almost all hospitalized patients, this measure will provide an important additional performance assessment that will complement condition- and procedure-specific or other more narrowly defined mortality measures and allow a greater number of patients and hospitals to be evaluated. This HWM measure captures a similarly broad cohort to the CMS Hospital-Wide All-Cause Risk-Standardized Readmission Measure (NQF #1789), and a broader cohort than those of other CMS condition-specific measures. Because the mortality measure is focused on a different outcome, it differs from the existing CMS Hospital-Wide All-Cause Risk Standardized Readmission Measure (NQF #1789) in a couple of ways. First, this HWM measure includes patients with a principal discharge diagnosis of cancer, whereas those patients are not included in the readmission measure. Cancer patients are appropriate to include as many have survival as their primary	existing CMS Hospital-Wide All-Cause Risk-Standardized Readmission Measure (NQF #1789) to allow assessment of trends in hospital performance for both readmission and mortality outcomes, similar to other complementary pairs of readmission and mortality measures for specific conditions and procedures. By measuring mortality outcomes across almost all hospitalized patients, this measure will provide an important additional performance assessment that will complement condition- and procedure-specific or other more narrowly defined mortality measures and allow a greater number of patients and hospitals to be evaluated. This HWM measure captures a similarly broad cohort to the CMS Hospital-Wide All-Cause Risk-Standardized Readmission Measure (NQF #1789), and a broader cohort than those of other CMS condition-specific measures. Because the mortality measure is focused on a different outcome, it differs from the existing CMS Hospital-Wide All-Cause Risk Standardized Readmission Measure (NQF #1789) in a couple of ways. First, this HWM measure includes patients with a principal discharge diagnosis of cancer (with some exceptions), whereas those patients are not included in the readmission measure. Cancer patients are appropriate to include in the HWM measure as many have survival as their primary goal; however due to

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
	measures any non-outcome (e.g., process) measures with the same target population as our measure. Our measure cohort was heavily vetted by clinical experts, a technical expert panel, and a public comment period. Additionally, the measure, with the specified cohort, has been publicly reported since 2008. 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 | goal, however due to cancer treatment plans, readmissions are frequently part of the plan and expected and therefore are not a reasonable signal of quality. Another difference between the two measures is the number of divisions or specialty cohorts the patients are divided into in order to more accurately risk adjust for case-mix and service-mix. The readmission measure divides patients into six categories, or "specialty cohorts", while the mortality measure uses 15. This is because the risk of mortality is much more closely related to patient factors than readmission is related to patient factors. PSI-02 (NQF #0357) is another complementary mortality measure, which captures a different patient population and a different outcome compared with the HWM measure submitted with this application. PSI-02 captures patients 18 years of age or older, or obstetric patients, whereas the HWM measure captures patients between the ages of 65 and 94. PSI-02 captures DRGs with less than 0.5% mortality rate, whereas the HWM measure captures all patients within all CCSs, regardless of mortality rate. HWM captures mortality up to 30 days past admission, where AHRQ PSI-02 only captures in-hospital mortality. IQI 90 (NQF #0530) is another complimentary mortality measure, which is a composite measure of the number of in-hospital deaths for a narrow range of conditions (CHF, stroke, hip fracture, pneumonia, acute myocardial infarction and | cancer treatment plans, readmissions are frequently part of the plan and expected and therefore, are not a reasonable signal of quality. Another difference between the two measures is the number of divisions or specialty cohorts the patients are divided into, to more accurately risk adjust for case-mix and service-mix. The readmission measure divides patients into five categories, or "specialty cohorts", while the mortality measure uses 15. This is because the risk of mortality is much more closely related to patient factors than readmission is related to patient factors. PSI-02 (NQF #0357) is another complementary mortality measure, which captures a different patient population and a different outcome compared with the HWM measure submitted with this application. PSI-02 captures patients 18 years of age or older, or obstetric patients, whereas the HWM measure captures patients between the ages of 65 and 94. PSI-02 captures DRGs with less than 0.5% mortality rate, whereas the HWM measure captures all patients within all CCSs, regardless of mortality rate. Hospital-wide mortality captures mortality up to 30 days past admission, where AHRQ PSI-02 only captures in-hospital mortality. IQI 90 (NQF #0530) is another complimentary mortality measure, which is a composite measure of the number of in-hospital deaths for a narrow range of |

Measures	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure	3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure
		GI hemorrhage). The HWM measure presented in this application captures all deaths after 30 days of admission, for all conditions and procedures. 5b.1 If competing, why superior or rationale for additive value: There are no competing NQF-endorsed measures.	conditions (CHF, stroke, hip fracture, pneumonia, acute myocardial infarction and GI hemorrhage). The HWM measure presented in this application captures all deaths after 30 days of admission, for all conditions and procedures. 5b.1 If competing, why superior or rationale for additive value: There are no competing NQF-endorsed measures.

Appendix E2: Related and Competing Measures (narrative)

Comparison of NQF #0229, NQF #0330 and NQF #0358

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

0358 Heart Failure Mortality Rate (IQI 16)

Steward

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Centers for Medicare & Medicaid Services

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

Centers for Medicare & Medicaid Services

0358 Heart Failure Mortality Rate (IQI 16)

Agency for Healthcare Research and Quality

Description

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

The measure estimates a hospital-level 30-day, all-cause, risk-standardized mortality rate for patients discharged from the hospital with a principal diagnosis of HF. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. 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.

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

The measure estimates a hospital-level risk-standardized readmission rate (RSRR) for patients discharged from the hospital with a principal diagnosis of heart failure (HF). 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. The target population is patients age 65 and over. The Centers for Medicare & Medicaid Services (CMS) annually reports the measure for patients who are 65 years or older and are enrolled in fee-for-service (FFS) Medicare and hospitalized in non-federal hospitals or are patients hospitalized in Veterans Health Administration (VA) facilities.

0358 Heart Failure Mortality Rate (IQI 16)

In-hospital deaths per 1,000 hospital discharges with heart failure as a principal diagnosis for patients ages 18 years and older. Excludes obstetric discharges and transfers to another hospital.

[NOTE: The software provides the rate per hospital discharge. However, common practice reports the measure as per 1,000 discharges. The user must multiply the rate obtained from the software by 1,000 to report in-hospital deaths per 1,000 hospital discharges.]

Type

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Outcome

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

Outcome

0358 Heart Failure Mortality Rate (IQI 16)

Outcome

Data Source

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) 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, skilled nursing facility care, some home health agency 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 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): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score.

References:

Fleming C, Fisher ES, Chang CH, Bubolz TA, Malenka DJ. 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 NQF_datadictionary_HFmortality_Fall2020_final_7.22.20.xlsx

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) 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, and 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 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 NQF_datadictionary_HFreadmission_Fall2020_final_7.22.20.xlsx

0358 Heart Failure Mortality Rate (IQI 16)

Claims The data source is hospital discharge data such as the HCUP State Inpatient Databases (SID) or equivalent using UB-04 coding standards. The data collection instrument is public-use AHRQ QI software available in SAS or Windows versions.

URL Attachment IQI_Regression_Coefficients-_Code_Tables_and_Value_Sets-635560593483470264.xlsx

Level

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Facility

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

Facility

0358 Heart Failure Mortality Rate (IQI 16)

Population : Community, County or City, Facility, Population : Regional and State

Setting

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Inpatient/Hospital

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

Inpatient/Hospital

0358 Heart Failure Mortality Rate (IQI 16)

Inpatient/Hospital

Numerator Statement

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients 65 and older hospitalized with a principal diagnosis of HF.

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

The outcome for this measure is 30-day readmissions. We define readmissions as any inpatient acute care admission, with the exception of certain planned readmissions, within 30 days from the date of discharge from an index admission with a principal discharge diagnosis of HF in patients 65and older. 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.

Additional details are provided in S.5 Numerator Details.

0358 Heart Failure Mortality Rate (IQI 16)

Number of deaths (DISP=20) among cases meeting the inclusion and exclusion rules for the denominator.

Numerator Details

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

The measure counts all deaths (including in-hospital deaths) for any cause within 30 days of the date of the index HF admission.

Identifying deaths in the FFS measure

As currently reported, we identify deaths for FFS Medicare patients 65 years and older in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

The measure counts readmissions to any acute care hospital for any cause within 30 days of the date of discharge of the index HF 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 (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 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. For the HF readmission measure, CMS used the Planned Readmission Algorithm without modifications.

The planned readmission algorithm and associated code tables are attached in data field S.2b (Data Dictionary or Code Table).

0358 Heart Failure Mortality Rate (IQI 16)

Number of deaths (DISP=20) among cases meeting the inclusion and exclusion rules for the denominator.

Denominator Statement

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

This claims-based measure is used for a cohort of patients aged 65 years or older.

The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of HF 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.

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

The cohort includes admissions for patients aged 65years and older discharged from the hospital with a principal discharge diagnosis of HF, 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

0358 Heart Failure Mortality Rate (IQI 16)

Discharges, for patients ages 18 years and older, with a principal ICD-9-CM diagnosis code for heart failure.

Denominator Details

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria:

1. Principal discharge diagnosis of heart failure
2. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of the index admission and Part A during the index admission, or those who are VA beneficiaries
3. Aged 65 or over
4. Not transferred from another acute care facility

We have explicitly tested the measure for those aged 65+ years and those aged 65+ years (see Testing Attachment for details).

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

To be included in the measure cohort used in public reporting, patients must meet the following additional inclusion criteria:

1. Principal discharge diagnosis of HF;
2. 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, 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. Not transferred to another acute care facility.

0358 Heart Failure Mortality Rate (IQI 16)

ICD-9-CM Heart failure diagnosis codes:

39891 RHEUMATIC HEART FAILURE

40201 MAL HYPERT HRT DIS W CHF

40211 BENIGN HYP HRT DIS W CHF

40291 HYPERTEN HEART DIS W CHF

40401 MAL HYPER HRT/REN W CHF

40403 MAL HYP HRT/REN W CHF&RF

40411 BEN HYPER HRT/REN W CHF

40413 BEN HYP HRT/REN W CHF&RF

40491 HYPER HRT/REN NOS W CHF

40493 HYP HT/REN NOS W CHF&RF

4280 CONGESTIVE HEART FAILURE

4281 LEFT HEART FAILURE

42820 SYSTOLIC HRT FAILURE NOS

42821 AC SYSTOLIC HRT FAILURE

42822 CHR SYSTOLIC HRT FAILURE

42823 AC ON CHR SYST HRT FAIL

42830 DIASTOLC HRT FAILURE NOS

42831 AC DIASTOLIC HRT FAILURE

42832 CHR DIASTOLIC HRT FAIL

42833 AC ON CHR DIAST HRT FAIL

42840 SYST/DIAST HRT FAIL NOS

42841 AC SYST/DIASTOL HRT FAIL

42842 CHR SYST/DIASTL HRT FAIL

42843 AC/CHR SYST/DIA HRT FAIL

4289 HEART FAILURE NOS

Exclusions

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

The mortality measures exclude index admissions for patients:

1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility;
2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data;
3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission;
4. Discharged against medical advice (AMA); or
5. Patients undergoing left ventricular assist device (LVAD) implantation or heart transplantation during an index admission or who have a history of LVAD or heart transplant in the preceding year.

> For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort for each year.

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

The 30-day HF 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. Admitted within 30 days of a prior index admission for HF; and
4. With a procedure code for LVAD implantation or heart transplantation either during the index admission or in the 12 months prior to the index admission.

0358 Heart Failure Mortality Rate (IQI 16)

Exclude cases:

- transferring to another short-term hospital (DISP=2)
- MDC 14 (pregnancy, childbirth, and puerperium)
- with missing discharge disposition (DISP=missing), gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing) or principal diagnosis (DX1=missing)

Exclusion Details

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

1. The discharge disposition indicator is used to identify patients alive at discharge. Transfers are identified in the claims when a patient with a qualifying admission is discharged from an acute care hospital and admitted to another acute care hospital on the same day or next day. Patient length of stay and condition is identified from the admission claim.

    Rationale: This exclusion prevents inclusion of patients who likely did not have clinically significant HF.

2. Inconsistent vital status or unreliable data are identified if any of the following conditions are met 1) the patient's age is greater than 115 years: 2) if the discharge date for a hospitalization is before the admission date; 3) if the patient has a sex other than 'male' or 'female'.

    Rationale: Reliable and consistent data are necessary for valid calculation of the measure.

3. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice data and the Inpatient standard analytic file (SAF).

    Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care.

4. 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.

5. Patients with LVAD implantation or heart transplantation during an index admission or in the previous 12 months are identified by the corresponding codes for these procedures included in claims data.

    Rationale: Patients undergoing implantation of an LVAD designed to offer intermediate to long-term support (weeks to years) as a bridge to heart transplant or destination therapy represent a clinically distinct, highly-selected group of patients cared for at highly specialized medical centers.

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

The HF 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. 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. HF admissions within 30 days of discharge from a qualifying HF index admission are identified by comparing the discharge date from the index admission with subsequent admission dates.

Rationale: Additional HF 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.

4. With a procedure code for LVAD implantation or heart transplantation either during the index admission or in the 12 months prior to the index admission, which are identified by the corresponding codes included in claims data (codes can be found in attached Data Dictionary).

Rationale: Patients with these procedures are a clinically distinct group with a different risk of the readmission outcome.

0358 Heart Failure Mortality Rate (IQI 16)

Exclude cases:

- transferring to another short-term hospital (DISP=2)
- MDC 14 (pregnancy, childbirth, and puerperium)
- with missing discharge disposition (DISP=missing), gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing) or principal diagnosis (DX1=missing)

Risk Adjustment

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Statistical risk model

118210| 112469| 146637| 141015| 150289

118210| 112469| 146637| 141015| 150289

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

Statistical risk model

117446| 141973| 137977| 112469| 146637| 150289

117446| 141973| 137977| 112469| 146637| 150289

0358 Heart Failure Mortality Rate (IQI 16)

Statistical risk model

130177| 132112| 138848| 138827

130177| 132112| 138848| 138827

Stratification

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

N/A

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

N/A

0358 Heart Failure Mortality Rate (IQI 16)

Gender, age (5-year age groups), race / ethnicity, primary payer, custom

Type Score

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Rate/proportion better quality = lower score

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

Rate/proportion better quality = lower score

0358 Heart Failure Mortality Rate (IQI 16)

Rate/proportion better quality = lower score

Algorithm

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

The measure estimates hospital-level 30-day all-cause RSMRs following hospitalization for HF 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 mortality 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 mortality 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 RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality.

The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. The estimated hospital-specific intercept is added 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 deaths (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 [https://qualitynet.org/inpatient/measures/mortality/methodology].

References:

1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 118210| 112469| 146637| 141015| 150289

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

The measure estimates hospital-level 30-day all-cause RSRRs following hospitalization for HF 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 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" readmissions to the number of "expected" readmissions, multiplied by the national unadjusted readmission rate. For each hospital, the numerator of the ratio ("predicted") 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 ("expected") is the number of readmissions expected on the basis of 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, or better quality, and a higher ratio indicates higher-than-expected readmission, 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 effect 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 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 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 readmission rate. The hierarchical logistic regression models are described fully in the original methodology report (Krumholz et al., 2005).

References:

1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226.

2. Krumholz H, Normand S, Galusha D, et al. Risk-Adjustment Models for HF and HF 30-Day Readmission Methodology. 2005. 117446| 141973| 137977| 112469| 146637| 150289

0358 Heart Failure Mortality Rate (IQI 16)

RATE: Each Inpatient Quality Indicator (IQI) expressed as a rate, is defined as outcome of interest/population at risk or numerator/denominator. The Quality Indicators software performs five steps to produce the IQI rates.

1) Discharge-level data is used to mark inpatient records containing outcomes of interest.

2) Identify populations at risk.

3) Calculate observed rates.

4) For rates that are not risk-adjusted, the risk-adjusted rate equals the observed rate.

5) Create multivariate signal extraction (MSX) smoothed rates. Shrinkage factors are applied to the risk-adjusted rates for each PQI in the MSX process. For each IQI, the shrinkage estimate reflects a reliability adjustment unique to each indicator. Full information on IQI algorithms and specification can be found at http://qualityindicators.ahrq.gov/Iqi_download.htm. 130177| 132112| 138848| 138827

Submission items

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

5.1 Identified measures: 0330 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

0358 : Heart Failure Mortality Rate (IQI 16)

0468 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

1789 : Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

1893 : Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

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. Our measure cohort was heavily vetted by clinical experts, a technical expert panel, and a public comment period. Additionally, the measure, with the specified cohort, has been publicly reported since 2008. 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

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

5.1 Identified measures: 0505 : Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

0229 : Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

1789 : Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

1891 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following chronic obstructive pulmonary disease (COPD) hospitalization

2879 : Hybrid Hospital-Wide Readmission (HWR) Measure with Claims and Electronic Health Record Data

2880 : Excess days in acute care (EDAC) after hospitalization for heart failure (HF)

2886 : Risk-Standardized Acute Admission Rates for Patients with Heart Failure

2888 : Accountable Care Organization Risk-Standardized Acute Hospital Admission Rate for Patients with Multiple Chronic Conditions

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

0358 Heart Failure Mortality Rate (IQI 16)

5.1 Identified measures:

5a.1 Are specs completely harmonized?

5a.2 If not completely harmonized, identify difference, rationale, impact:

5b.1 If competing, why superior or rationale for additive value: The AHRQ measure provides a real-time indication of hospital performances, reflects the patient's experience in the hospital, and is available for all-payers

Related Measures: CMS CHF Mortality Measure

Comparison of NQF #0229, NQF #0468 and NQF #1789

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization
0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

Steward

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Centers for Medicare & Medicaid Services

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

Centers for Medicare & Medicaid Services

1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

Centers for Medicare & Medicaid Services

Description

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

The measure estimates a hospital-level 30-day, all-cause, risk-standardized mortality rate for patients discharged from the hospital with a principal diagnosis of HF. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. 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.

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

The measure estimates a hospital-level 30-day risk-standardized mortality rate (RSMR). Mortality is defined as death for any cause within 30 days after the date of admission for the index admission, 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 diagnosis of pneumonia (including aspiration pneumonia) coded as present on admission (POA). CMS annually reports the measure for patients who are 65 years or older and are either Medicare fee-for-service (FFS) beneficiaries and hospitalized in non-federal hospitals or patients hospitalized in Veterans Health Administration (VA) facilities.

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

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Outcome

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

Outcome

1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

Outcome

Data Source

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) 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, skilled nursing facility care, some home health agency 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 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): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score.

References:

Fleming C, Fisher ES, Chang CH, Bubolz TA, Malenka DJ. 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 NQF_datadictionary_HFmortality_Fall2020_final_7.22.20.xlsx

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) 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 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): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score.

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 NQF_datadictionary_PNmortality_Fall2020_final_7.22.20.xlsx

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 DelAP_4-107f_NQF1789HWR_DataDictionary_Final082819-637263622402629808.xlsx

Level

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization
Facility

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization
Facility

1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
Facility

Setting

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization
Inpatient/Hospital

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization
Inpatient/Hospital

1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)
Inpatient/Hospital, Outpatient Services

Numerator Statement

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients 65 and older hospitalized with a principal diagnosis of HF.

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

The outcome for this measure is 30-day all-cause mortality (including in-hospital deaths). We define mortality as death from any cause within 30 days of the index admission datefrom the date of admission for patients hospitalized 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.

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

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

The measure counts all deaths (including in-hospital deaths) for any cause within 30 days of the date of the index HF admission.

Identifying deaths in the FFS measure

As currently reported, we identify deaths for FFS Medicare patients 65 years and older in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

The measure counts all deaths (including in-hospital deaths) for any cause within 30 days of the date of admission of the index pneumonia hospitalization.

Identifying deaths in the FFS measure

As currently reported, we identify deaths for FFS Medicare patients 65 years or over in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.

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:

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.

https://www.qualitynet.org/dcs/ContentServer?c=Page&pagename=QnetPublic%2FPage%2FQnetTier4&cid=1219069855841

Denominator Statement

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

This claims-based measure is used for a cohort of patients aged 65 years or older.

The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of HF 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.

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

This claims-based measure is used for a cohort of patients aged 65 years or over older.

The cohort includes admissions for patients aged 65 years and older discharged from the hospital with 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 but no secondary discharge diagnosis of severe sepsis; and with a complete claims history for the 12 months prior to admission. The measure will be publicly reported by CMS for those patients 65 years or older who are Medicare FFS beneficiaries admitted to non-federal hospitals or patients admitted to VA hospitals.

Additional details are provided in S.9 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

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria:

1. Principal discharge diagnosis of heart failure
2. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of the index admission and Part A during the index admission, or those who are VA beneficiaries
3. Aged 65 or over
4. Not transferred from another acute care facility

We have explicitly tested the measure for those aged 65+ years and those aged 65+ years (see Testing Attachment for details).

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria:

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);

3. Aged 65 or over;

4. Not transferred from another acute care facility; and

5. Enrolled in 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.

We have explicitly tested the measure for those aged 65 years or over (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:

1. Enrolled in Medicare FFS Part A for the 12 months prior to the date of admission and during the index admission;

2. Aged 65 or older;

3. Discharged alive from a non-federal short-term acute care hospital; and

4. 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

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

The mortality measures exclude index admissions for patients:

1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility;
2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data;
3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission;
4. Discharged against medical advice (AMA); or
5. Patients undergoing left ventricular assist device (LVAD) implantation or heart transplantation during an index admission or who have a history of LVAD or heart transplant in the preceding year.

> For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort for each year.

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

> The mortality measure excludes index admissions for patients:

1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility;
2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data;
3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission; or
4. Discharged against medical advice (AMA).

> For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort.

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 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.

Exclusion Details

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

1. The discharge disposition indicator is used to identify patients alive at discharge. Transfers are identified in the claims when a patient with a qualifying admission is discharged from an acute care hospital and admitted to another acute care hospital on the same day or next day. Patient length of stay and condition is identified from the admission claim.

> Rationale: This exclusion prevents inclusion of patients who likely did not have clinically significant HF.

2. Inconsistent vital status or unreliable data are identified if any of the following conditions are met

> 1) the patient's age is greater than 115 years:

2) if the discharge date for a hospitalization is before the admission date;

3) if the patient has a sex other than 'male' or 'female'.

Rationale: Reliable and consistent data are necessary for valid calculation of the measure.

3. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice data and the Inpatient standard analytic file (SAF).

Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care.

4. 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.

5. Patients with LVAD implantation or heart transplantation during an index admission or in the previous 12 months are identified by the corresponding codes for these procedures included in claims data.

Rationale: Patients undergoing implantation of an LVAD designed to offer intermediate to long-term support (weeks to years) as a bridge to heart transplant or destination therapy represent a clinically distinct, highly-selected group of patients cared for at highly specialized medical centers.

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

1. The discharge disposition indicator is used to identify patients alive at discharge. Transfers are identified in the claims when a patient with a qualifying admission is discharged from an acute care hospital and admitted to another acute care hospital on the same day or next day. Patient length of stay and condition is identified from the admission claim.

Rationale: This exclusion prevents inclusion of patients who likely did not have clinically significant pneumonia.

2. Inconsistent vital status or unreliable data are identified if any of the following conditions are met 1) the patient's age is greater than 115 years; 2) if the discharge date for a hospitalization is before the admission date; or 3) if the patient has a sex other than 'male' or 'female'.

Rationale: Reliable and consistent data are necessary for valid calculation of the measure.

3. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice enrollment data.

Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care.

4. Discharges against medical advice (AMA) are identified using the discharge disposition indicator.

Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.

After all exclusions are applied, the measure randomly selects one index admission per patient per year for inclusion in the cohort so that each episode of care is mutually independent with the similar probability of the outcome. For each patient, the probability of death may increase with each subsequent admission, and therefore, the episodes of care are not mutually independent. Also, for the three-year combined data, when index admissions occur during the transition between measure reporting periods (June and July of each year) and both are randomly selected for inclusion in the measure, the measure includes only the June admission. The July admissions are excluded to avoid assigning a single death to two admissions.

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

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Statistical risk model

118210| 112469| 146637| 141015| 150289

118210| 112469| 146637| 141015| 150289

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

Statistical risk model

107491| 118210| 112469| 146637| 150289

107491| 118210| 112469| 146637| 150289

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

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

N/A

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

N/A

1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

N/A

Type Score

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Rate/proportion better quality = lower score

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

Rate/proportion better quality = lower score

1789 Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

Rate/proportion better quality = lower score

Algorithm

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

The measure estimates hospital-level 30-day all-cause RSMRs following hospitalization for HF 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 mortality 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 mortality 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 RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality.

The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. The estimated hospital-specific intercept is added 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 deaths (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 [https://qualitynet.org/inpatient/measures/mortality/methodology].

References:

1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 118210| 112469| 146637| 141015| 150289

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

The measure estimates hospital-level 30-day all-cause RSMRs 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 mortality 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 mortality 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 RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality.

The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. 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 deaths (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 mortality rate. The hierarchical logistic regression models are described fully in the original methodology report posted on QualityNet: https://qualitynet.org/inpatient/measures/mortality/methodology.

References:

Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 107491| 118210| 112469| 146637| 150289

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;

https://www.qualitynet.org/dcs/ContentServer?c=Page&pagename=QnetPublic%2FPage%2FQnet Tier4&cid=1219069855841

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

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

5.1 Identified measures: 0330 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

0358 : Heart Failure Mortality Rate (IQI 16)

0468 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

1789 : Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

1893 : Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

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. Our measure cohort was heavily vetted by clinical experts, a technical expert panel, and a public comment period. Additionally, the measure, with the specified cohort, has been publicly reported since 2008. 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

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

5.1 Identified measures: 0231 : Pneumonia Mortality Rate (IQI #20)

0506 : Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

0279 : Community Acquired Pneumonia Admission Rate (PQI 11)

1891 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following chronic obstructive pulmonary disease (COPD) hospitalization

1893 : Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

2579 : Hospital-level, risk-standardized payment associated with a 30-day episode of care for pneumonia (PN)

3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

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 (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). Lastly, this measure and the NQF Inpatient Pneumonia Mortality (AHRQ) Measure #0231 are complementary rather than competing measures. Although they both assess mortality for patients admitted to acute care hospitals with a principal discharge diagnosis of pneumonia, the specified outcomes are different. This measure assesses 30-day mortality while #0231 assesses inpatient mortality. Assessment of 30-day and inpatient mortality outcomes have distinct advantages and uses which make them complementary as opposed to competing. For example, the 30-day period provides a broader perspective on hospital care and utilizes standard time period to examine hospital performance to avoid bias by differences in length of stay among hospitals. However, in some settings it may not be feasible to capture post-discharge mortality making the inpatient measure more useable. We have previously consulted with AHRQ to examine harmonization of complementary measures of mortality for patients with AMI and stroke. We have found that the measures are harmonized to the extent possible given that small differences in cohort inclusion and exclusion criteria are warranted on the basis of the use of different outcomes. However, this current measure includes patients with a principal discharge diagnosis of sepsis and a secondary discharge diagnosis of pneumonia that is present on admission. The cohort was also expanded to include patients with a principal discharge diagnosis of aspiration pneumonia. Thus, the current measure cohort is still not harmonized with measure #0231.

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 #0229, NQF #1893 and NQF #3502

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Steward

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Centers for Medicare & Medicaid Services

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

Centers for Medicare & Medicaid Services

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Centers for Medicare & Medicaid Services

Description

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

The measure estimates a hospital-level 30-day, all-cause, risk-standardized mortality rate for patients discharged from the hospital with a principal diagnosis of HF. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. 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.

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

The measure estimates a hospital-level 30-day risk-standardized mortality rate (RSMR), defined as death from any cause within 30 days after the index admission date, for patients discharged from the hospital with either a principal discharge diagnosis of COPD or a principal discharge diagnosis of respiratory failure with a secondary discharge diagnosis of acute exacerbation of COPD. 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.

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

The measure estimates a hospital-level 30-day risk-standardized mortality rate (RSMR), defined as death from any cause within 30 days after the index admission date for patients who are between the ages of 50 and 94.

Please note that in parallel with the hybrid HWM measure, we are submitting a claims-only HWM measure. Note that ultimately the claims and hybrid measures will be harmonized and use the same exact cohort specifications. The intent is that prior to implementation, the two measures will be exactly the same, with the exception of the additional risk adjustment added by the CCDE in the

hybrid measure. This is analogous to the currently endorsed and implemented hybrid hospital-wide readmissions measure (NQF 1789 and NQF 2879e).

Because of the homology between the claims and hybrid HWM measures, there is no reason to suspect that the results of analyses done for the claims-only measure would differ in any significant way from results of analyses for a nationally representative hybrid measure.

Below we highlight the differences between the two measures, including specifications, data used, and testing which reflect limitations of data availability, as well as actual intended differences in the measure (risk adjustment).

Differences in the measure, data, and testing that reflect limitations in data availability

1. Dataset used for development, some testing (see below for differences), and measure results:
    a. The claims-only measure uses nation-wide Medicare FFS claims and the enrollment database.
    b. The hybrid measure uses an electronic health record (EHR) database from 21 hospitals in the Kaiser Permanente network which includes inpatient claims data information.

2. Age of patients in cohort:
    a. The claims-only measure includes Medicare FFS patients, age 65-94.
    b. The hybrid measure includes all patients age 50-94 (see later discussion for justification)

3. External empiric validity testing
    a. Not possible for the hybrid measure, due to limited data availability. We provide results from the claims-only measure within the hybrid testing form.

4. Socioeconomic risk factor analyses
    a. Not possible for the hybrid measure, due to limited data availability. We provide results from the claims-only measure within the hybrid testing form.

5. Exclusion analyses
    a. To be representative of what we expect the impact would be of the measures' exclusions in a nation-wide sample, we provide the results from the claims-only measure.

6. Meaningful differences
    a. To be representative of what we expect the range of performance would be in a nation-wide sample, we provide the distribution results from the claims-only measure.

    Difference between the two measures when fully harmonized, prior to implementation:

1. Risk adjustment:
    a. The claims-only measure uses administrative claims data only for risk adjustment
    b. The hybrid measure adds 10 clinical risk variables, derived from a set of core clinical data elements (CCDE) extracted from the EHR.

Type

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Outcome

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

Outcome

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Outcome

Data Source

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) 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, skilled nursing facility care, some home health agency 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 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): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score.

References:

Fleming C, Fisher ES, Chang CH, Bubolz TA, Malenka DJ. 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 NQF_datadictionary_HFmortality_Fall2020_final_7.22.20.xlsx

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) 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, skilled nursing facility care, some home health agency 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 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): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score.

References:

Fleming C, Fisher ES, Chang CH, Bubolz TA, Malenka DJ. 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 NQF_datadictionary_COPDmortality_Fall2020_final_7.22.20.xlsx

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Claims, Electronic Health Records, Other Clinical-Hybrid Dataset

Constructed using Kaiser Permanente Northern California matched administrative claims and electronic health record (EHR) data, admission dates from October 1, 2015 – December 30, 2016. This data source was used for measure testing. (An earlier Kaiser dataset from that included all admissions for adult patients to any of their member hospitals between January 1, 2009 and June 30, 2015 was used for measure development, as described in the attached methodology report).

The two data sources listed below were used for testing the claims-based measure; the hybrid testing form includes some testing data from the claims-based measure (for example, for the social risk factor and external validation analyses).

HWM claims-only datasets:

Medicare Part A Inpatient Claims Data

The index dataset contains administrative inpatient hospitalization data for Medicare FFS beneficiaries, aged 65-94 on admission. The history dataset includes administrative inpatient hospitalization data on each patient for the 12 months prior to the index admission. This data was used along with the Medicare Enrollment Database (EDB) for testing the claims-based measure.

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. It was also used to determine hospice enrollment.

No data collection instrument provided Attachment Del18b2HOP5HWMHybridDataDictionary01072019.xlsx

Level

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Facility

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

Facility

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Facility

Setting

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Inpatient/Hospital

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

Inpatient/Hospital

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Inpatient/Hospital, Other Home-based primary care and home-based palliative care); Settings include: Home, Boarding home, Domiciliary, Assisted Living Facilities, Rest Home or Custodial Care Services

Numerator Statement

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients 65 and older hospitalized with a principal diagnosis of HF.

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients hospitalized with either a principal diagnosis of COPD or a principal diagnosis of respiratory failure with a secondary diagnosis of acute exacerbation of COPD.

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

The outcome for this measure is 30-day, all-cause mortality. Mortality is defined as death from any cause, either during or after admission, within 30 days of the index admission date.

Numerator Details

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

The measure counts all deaths (including in-hospital deaths) for any cause within 30 days of the date of the index HF admission.

Identifying deaths in the FFS measure

As currently reported, we identify deaths for FFS Medicare patients 65 years and older in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

The measure counts all deaths (including in-hospital deaths) for any cause within 30 days of the date of the index COPD admission.

Identifying deaths in the FFS measure

As currently reported, we identify deaths for FFS Medicare patients 65 years and older in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

The measure outcome is death from any cause within 30 days of the admission date of the index admission. The numerator is a binary variable (1=yes/0=no) that indicates whether the patient died within 30 days of the index admission date.

Denominator Statement

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

This claims-based measure is used for a cohort of patients aged 65 years or older.

The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of HF 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.

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

This claims-based measure is used for a cohort of patients aged 65 years or older.

The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of COPD 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.

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

The cohort includes inpatient admissions for a wide variety of conditions for patients aged between 50 and 94 years old who were discharged from short-term acute care hospitals. If a patient has more than one admission during the measurement year, one admission is randomly

selected for inclusion in the measure. Additional details are provided in S.7 Denominator Details. The age range for this measure differs from that of the claims-only measure due to the limited size of the dataset used for testing. The intent is to harmonize the age range of the hybrid measure with the age range of the claims-only measure, so that both will include admissions for patients age 65-94.

Denominator Details

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria:

1. Principal discharge diagnosis of heart failure
2. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of the index admission and Part A during the index admission, or those who are VA beneficiaries
3. Aged 65 or over
4. Not transferred from another acute care facility

> We have explicitly tested the measure for those aged 65+ years and those aged 65+ years (see Testing Attachment for details).

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria:

1. Principal discharge diagnosis of COPD or a principal discharge diagnosis of respiratory failure with a secondary discharge diagnosis of acute exacerbation of COPD
2. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of the index admission and Part A during the index admission, or those who are VA beneficiaries
3. Aged 65 or over
4. Not transferred from another acute care facility.

> This measure can also be used for an all-payer population aged 40 years and older. We have explicitly tested the measure in both patients aged 40+ years and those aged 65+ years (see Testing Attachment for details).

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

The index cohort includes all inpatient admissions for patients aged 50-94 years old. (Note: The intention is to fully harmonize the cohort definition with the claims-only measure so that both measures will capture admissions for patients age 65-94. We deviated from that definition during development and testing due to the limited dataset available that included the EHR data elements needed to calculate this measure. Note that the risk model already includes age in years, as a risk variable.)

An index admission is the hospitalization to which the mortality outcome is attributed and includes admissions for patients:

1. Not transferred from another acute care facility

Rationale: Admissions to an acute cate hospital within one day of discharge from another acute care hospital are considered transfers. Transferred patients are included in the measure cohort, but it is the initial hospitalization rather than any "transfer-in" hospitalization(s), that is included as the hospitalization to which the mortality outcome is attributed (the index admission).

2. Aged between 50 and 94 years

The hybrid measure is intended for the Medicare FFS population but was tested in a limited dataset due to the EHR data elements included. The use of a small dataset required that we expand the sample by including admissions from patients ages 50 to 94 years. Note that the measure already adjusts for age.

3. Not admitted for primary psychiatric diagnoses

Rationale: Patients admitted for psychiatric treatment are typically cared for in separate psychiatric facilities that are not comparable to short-term acute care hospitals (see data dictionary, HWM Non-Acute Care Inclusion tab).

4. Not admitted for rehabilitation

Rationale: These admissions are not typically to a short-term acute care hospital and are not for acute care (see data dictionary, HWM Non-Acute Care Inclusion tab).

5. Not enrolled in hospice at the time of, or 12 months prior to, their index admission

Rationale: Patients enrolled in hospice in the prior 12 months or at the time of admission are unlikely to have 30-day survival as a primary goal

6. Not enrolled in hospice within two days of admission

Rationale: There is not a single, correct approach regarding patients enrolled in hospice during admission or upon discharge – mortality may or may not represent a quality signal for this group of patients and hospice enrollment is inadequate to differentiate this issue. However, for most patients and/or families who had the discussion and agreed to enroll in hospice within two days of admission, 30-day survival is not likely the primary goal due to their condition and not the quality of care received.

7. Not with a principal diagnosis of cancer and enrolled in hospice during their index admission

Rationale: Patients admitted primarily for cancer who are enrolled in hospice during admission are unlikely to have 30-day survival as a primary goal of care. (see data dictionary, HWM Cancer Inclusion tab).

8. Without any diagnosis of metastatic cancer

Rationale: Although some patients admitted with a diagnosis of metastatic cancer will have 30-day survival as a primary goal of care, for many such patients admitted to the hospital, death may be a clinically reasonable and patient-centered outcome. (see data dictionary, HWM Metastatic Cancer Inclusion tab).

9. Not with a principal discharge diagnosis, or a secondary diagnosis that is present on admission (POA) for a condition which hospitals have limited ability to influence survival

Rationale: Hospitals have little ability to impact mortality for some conditions. This list of conditions (see data dictionary, HWM ICD-10 Inclusion tab) was determined through independent review, by several clinicians, of conditions associated with high mortality. The decisions were also reviewed with our Technical Expert Panel (TEP) and Technical Work Group. Admissions are not included in the cohort if the patient had a principal diagnosis code that is on this list, or a secondary code with POA that is on the list.

In addition, for patients with multiple admissions, the measure selects only one admission, at random, for inclusion. There is no practical statistical modeling approach that can account or adjust for the complex relationship between the number of admissions and risk of mortality in the context of a hospital-wide mortality measure. Random selection ensures that providers are not penalized for a "last" admission during the measurement period; selecting the last admission would not be as accurate a reflection of the risk of death as random selection, as the last admission is inherently associated with a higher mortality risk. Random selection is also used in CMS's condition-specific mortality measures. Note that random selection reduces the number of admissions, but does not exclude any patients from the measure.

The cohort is defined using ICD-10 Clinical Modification codes identified in Medicare Part A Inpatient claims data. The measure aggregates the ICD-10 principal diagnosis and all procedure codes of the index admission into clinically coherent groups of conditions and procedures (condition categories or procedure categories) using the Agency for Healthcare Research and Quality (AHRQ) Clinical Classifications System (CCS). There is a total of 285 mutually exclusive AHRQ condition categories, most of which are single, homogenous diseases such as pneumonia or acute myocardial infarction. Some are aggregates of conditions, such as "other bacterial infections". There is a total of 231 mutually exclusive procedure categories. Using the AHRQ CCS procedure and condition categories, the measure assigns each index hospitalization to one of 15 mutually exclusive divisions. The divisions were created based upon clinical coherence, consistency of mortality risk, adequate patient and hospital case volume for stable results reporting, and input from clinicians, patients, and patient caregivers on usability.

The measure first assigns admissions with qualifying AHRQ procedure categories to one of six surgery divisions by identifying a defining surgical procedure. The defining surgical procedure is identified using the following algorithm: 1) if a patient only has one major surgical procedure then that procedure is the defining surgical procedure; 2) if a patient has more than one major surgical procedure, the first dated procedure performed during the index admission is the defining surgical procedure; 3) if there is more than one major surgical procedure on that earliest date, the procedure with the highest mortality rate is the defining surgical procedure. These divisions include admissions likely cared for by surgical teams.

The surgical divisions are: Surgical Cancer (see note below), Cardiothoracic Surgery, General Surgery, Neurosurgery, Orthopedic Surgery, and Other Surgical Procedures.

For the Surgical Cancer division, any admission that includes a surgical procedure and a principal discharge diagnosis code of cancer is assigned to the Surgical Cancer division. This division and the logic behind it was implemented in response to feedback from our Technical Expert Panel.

The measure then assigns the remaining admissions into one of the nine non-surgical divisions based on the AHRQ diagnostic CCS of the principal discharge diagnosis. The non-surgical divisions are: Cancer, Cardiac, Gastrointestinal, Infectious Disease, Neurology, Orthopedic, Pulmonary, Renal, Other Conditions.

The full list of the specific diagnosis and procedure AHRQ CCS categories used to define the divisions are attached in the Data Dictionary.

Exclusions

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

The mortality measures exclude index admissions for patients:

1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility;
2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data;
3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission;
4. Discharged against medical advice (AMA); or
5. Patients undergoing left ventricular assist device (LVAD) implantation or heart transplantation during an index admission or who have a history of LVAD or heart transplant in the preceding year.

> For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort for each year.

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

> The mortality measures exclude index admissions for patients:

1. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data;
2. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission; or
3. Discharged against medical advice (AMA).

> For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort for each year.

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

> The measure excludes index admissions for patients:

1. With inconsistent or unknown vital status (from claims data) or other unreliable claims data;
2. Discharged against medical advice (AMA);
3. With an admission for spinal cord injury (CCS 227), skull and face fractures (CCS 228), Intracranial Injury (CCS 233), Crushing injury or internal injury (CCS 234), Open wounds of head/neck/trunk (CCS 235), and burns (CCS 240); and
4. With a principal discharge diagnosis within a CCS with fewer than 100 admissions in that division within the measurement year.

Exclusion Details

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

1. The discharge disposition indicator is used to identify patients alive at discharge. Transfers are identified in the claims when a patient with a qualifying admission is discharged from an acute care hospital and admitted to another acute care hospital on the same day or next day. Patient length of stay and condition is identified from the admission claim.

> Rationale: This exclusion prevents inclusion of patients who likely did not have clinically significant HF.

2. Inconsistent vital status or unreliable data are identified if any of the following conditions are met 1) the patient's age is greater than 115 years: 2) if the discharge date for a hospitalization is before the admission date; 3) if the patient has a sex other than 'male' or 'female'.

> Rationale: Reliable and consistent data are necessary for valid calculation of the measure.

3. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice data and the Inpatient standard analytic file (SAF).

> Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care.

4. 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.

5. Patients with LVAD implantation or heart transplantation during an index admission or in the previous 12 months are identified by the corresponding codes for these procedures included in claims data.

> Rationale: Patients undergoing implantation of an LVAD designed to offer intermediate to long-term support (weeks to years) as a bridge to heart transplant or destination therapy represent a clinically distinct, highly-selected group of patients cared for at highly specialized medical centers.

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

1. Inconsistent vital status or unreliable data are identified if any of the following conditions are met 1) the patient's age is greater than 115 years: 2) if the discharge date for a hospitalization is before the admission date; 3) if the patient has a sex other than 'male' or 'female'.

> Rationale: Reliable and consistent data are necessary for valid calculation of the measure.

2. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice data.

> Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care.

3. 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.

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

1. With inconsistent or unknown vital status (from claims data) or other unreliable claims data.

> Rationale: The measure does not include stays for patients where the admission date is after the date of death, or where the date of death occurs before the date of discharge but the patient was discharged alive because these are likely errors in the data.

2. Discharged against medical advice (AMA)

> Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.

3. With an admission for spinal cord injury (CCS 227), skull and face fractures (CCS 228), Intracranial Injury (CCS 233), Crushing injury or internal injury (CCS 234), Open wounds of head/neck/trunk (CCS 235), and burns (CCS 240).

> Rationale: Even though a hospital likely can influence the outcome of some of these conditions, in many cases death events are not a signal of poor quality of care when patients present with these conditions. These conditions are also infrequent events that are unlikely to be uniformly distributed across hospitals.

4. With a principal discharge diagnosis within a CCS with fewer than 100 admissions in that division within the measurement year.

> Rationale: To calculate a stable and precise risk model, there are a minimum number of admissions that are needed. In addition, a minimum number of admissions and/or outcome events are required to inform grouping admissions into larger categories. These admissions present challenges to both accurate risk prediction and coherent risk grouping and are therefore excluded.

> Note: During measure development we analyzed different volume cut-offs (25, 50 and 100). Using cut-off values below 100 resulted in too many CCS codes in some of the divisions (the CCS category codes are used in risk adjustment) which resulted in non-convergence of those division-level risk models. The total number of patients excluded is very small (13,597 or 0.21% of admissions for a cut off of 100). During measure development we also explored the option of pooling low-volume CCS codes (CCS<100 patients) into one group, however, the heterogeneity in mortality rates for the individual ICD-10 codes in those groups would preclude adequate risk adjustment. The TEP supported excluding these admissions.

Risk Adjustment

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Statistical risk model

118210| 112469| 146637| 141015| 150289

118210| 112469| 146637| 141015| 150289

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

Statistical risk model

112469| 118210| 146637| 150289

112469| 118210| 146637| 150289

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Statistical risk model

146637| 110639| 141015| 110874| 146313

146637| 110639| 141015| 110874| 146313

Stratification

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

N/A

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

N/A

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

N/A

Type Score

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Rate/proportion better quality = lower score

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

Rate/proportion better quality = lower score

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Rate/proportion better quality = lower score

Algorithm

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

The measure estimates hospital-level 30-day all-cause RSMRs following hospitalization for HF 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 mortality 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 mortality 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 RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality.

The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. The estimated hospital-specific intercept is added 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 deaths (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 [https://qualitynet.org/inpatient/measures/mortality/methodology].

References:

1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 118210| 112469| 146637| 141015| 150289

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

The measure estimates hospital-level 30-day all-cause RSMRs following hospitalization for COPD 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 mortality 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 mortality 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 RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality.

The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. The estimated hospital-specific intercept is added 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 deaths (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: https://qualitynet.org/inpatient/measures/mortality/methodology.

References:

1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 112469| 118210| 146637| 150289

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

The measure estimates hospital-level, risk-standardized mortality rates (RSMRs) within 30 days of hospital admission using hierarchical logistical regression models through a Bayesian Markov Chain Monte Carlo (MCMC) procedure. In brief, we used hierarchical logistic regression to model the log-odds of mortality for each of the 15 service-line divisions. Death within 30 days was modeled as a function of patient-level demographic and clinical characteristics and a random hospital-level intercept. This model specification accounts for within-hospital correlation of the observed outcomes and models the assumption that underlying differences in quality among the health care facilities being evaluated lead to systematic differences in outcomes. We estimated a separate hierarchical logistic regression model for each service-line division. In order to obtain the variance and interval estimates, we fit the hierarchical model under the Bayesian framework along with the Markov Chain Monte Carlo (MCMC) technique.

Admissions are assigned to one of 15 mutually exclusive divisions (groups of discharge condition categories and procedure categories). For each division and each hospital with patients in that division, the standardized mortality ratio (SMR) is calculated as the ratio of the number of "predicted" deaths to the number of "expected" deaths at a given hospital. The predicted number of deaths is based on the hospital's performance with its observed case mix and service mix, and is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific effect on the risk of mortality. 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 transformed via an inverse logit function and summed over all patients attributed to a hospital to get a predicted value. The expected number of deaths is based on the nation's performance with that hospital's case mix and service mix and 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 transformed via an inverse logit function and summed over all patients in the hospital to get an expected value. 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 mortality rates or better quality, while a higher ratio indicates higher-than-expected mortality rates or worse quality.

To assess hospital performance for each reporting period, the measure re-estimates the model coefficients using the data in that period.

The division-level SMRs are then pooled for each hospital using an inverse variance-weighted geometric mean to create a hospital-wide composite SMR. (Note that in the case of the hybrid measure, we are presenting data from 9 of the total 15 divisions due to limitations in availability of electronic health records data). The hospital-wide SMR is then multiplied by the national observed mortality rate to produce the RSMR. 146637| 110639| 141015| 110874| 146313

Submission items

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

5.1 Identified measures: 0330 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

0358 : Heart Failure Mortality Rate (IQI 16)

0468 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

1789 : Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

1893 : Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

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. Our measure cohort was heavily vetted by clinical experts, a technical expert panel, and a public comment period. Additionally, the measure, with the specified cohort, has been publicly reported since 2008. 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

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

5.1 Identified measures: 0468 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

0506 : Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

0275 : Chronic Obstructive Pulmonary Disease (COPD) or Asthma in Older Adults Admission Rate (PQI 05)

1891 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following chronic obstructive pulmonary disease (COPD) hospitalization

2888 : Accountable Care Organization Risk-Standardized Acute Hospital Admission Rate for Patients with Multiple Chronic Conditions

3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

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. Our measure cohort was heavily vetted by clinical experts, a technical expert panel, and a public comment period. Additionally, the measure, with the specified cohort, has been publicly reported since 2008. 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

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

5.1 Identified measures:

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: This hybrid HWM measure incorporates patient-level clinical data from the EHR into the risk adjustment model, compared to the claims-only hospital-wide mortality measure. This hybrid HWM measure is intended to complement the existing CMS Hospital-Wide All-Cause Risk-Standardized Readmission Measure (NQF #1789) to allow assessment of trends in hospital performance for both readmission and mortality outcomes, similar to other complementary pairs of readmission and mortality measures for specific conditions and procedures. By measuring mortality outcomes across almost all hospitalized patients, this measure will provide an important additional performance assessment that will complement condition- and procedure-specific or other more narrowly defined mortality measures and allow a greater number of patients and hospitals to be evaluated. This HWM measure captures a similarly broad cohort to the CMS Hospital-Wide All-Cause Risk-Standardized Readmission Measure (NQF #1789), and a broader cohort than those of other CMS condition-specific measures. Because the mortality measure is focused on a different outcome, it differs from the existing CMS Hospital-Wide All-Cause Risk Standardized Readmission Measure (NQF #1789) in a couple of ways. First, this HWM measure includes patients with a principal discharge diagnosis of cancer, whereas those patients are not included in the readmission measure. Cancer patients are appropriate to include as many have survival as their primary goal, however due to cancer treatment plans, readmissions are frequently part of the plan and expected and therefore are not a reasonable signal of quality. Another difference between the two measures is the number of divisions or specialty cohorts the patients are divided into in order to more accurately risk adjust for case-mix and service-mix. The readmission measure divides patients into six categories, or "specialty cohorts", while the mortality measure uses 15. This is because the risk of mortality is much more closely related to patient factors than readmission is related to patient factors. PSI-02 (NQF #0357) is another complementary mortality measure, which captures a different patient population and a different outcome compared with the HWM measure submitted with this application. PSI-02 captures patients 18 years of age or older, or obstetric patients, whereas the HWM measure captures patients between the ages of 65 and 94. PSI-02 captures DRGs with less than 0.5% mortality rate, whereas the HWM measure captures all patients within all CCSs, regardless of mortality rate. HWM captures mortality up to 30 days past admission, where AHRQ PSI-02 only captures in-hospital mortality. IQI 90 (NQF #0530) is another complimentary mortality measure, which is a composite measure of the number of in-hospital deaths for a narrow range of conditions (CHF, stroke, hip fracture, pneumonia, acute myocardial

infarction and GI hemorrhage). The HWM measure presented in this application captures all deaths after 30 days of admission, for all conditions and procedures.

5b.1 If competing, why superior or rationale for additive value: There are no competing NQF-endorsed measures.

Comparison of NQF #0229 and NQF #3504

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Steward

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Centers for Medicare & Medicaid Services

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Centers for Medicare & Medicaid Services

Description

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

The measure estimates a hospital-level 30-day, all-cause, risk-standardized mortality rate for patients discharged from the hospital with a principal diagnosis of HF. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. 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.

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

The measure estimates a hospital-level 30-day hospital-wide risk-standardized mortality rate (RSMR), defined as death from any cause within 30 days after the index admission date, for Medicare fee-for-service (FFS) patients who are between the ages of 65 and 94.

Please note that in parallel with the claims-only HWM measure, we are submitting a hybrid HWM measure. Note that ultimately the claims and hybrid measures will be harmonized and use the same exact cohort specifications. The intent is that prior to implementation, the two measures will be exactly the same, with the exception of the additional risk adjustment added by the CCDE in the hybrid measure. This is analogous to the currently endorsed and implemented hybrid hospital-wide readmissions measure (NQF 1789 and NQF 2879e).

Because of the homology between the claims and hybrid HWM measures, there is no reason to suspect that the results of analyses done for the claims-only measure would differ in any significant way from results of analyses for a nationally representative hybrid measure.

Below we highlight the differences between the two measures, including specifications, data used, and testing which reflect limitations of data availability, as well as actual intended differences in the measure (risk adjustment).

Differences in the measure, data, and testing that reflect limitations in data availability

1. Dataset used for development, some testing (see below for differences), and measure results:
   a. The claims-only measure uses nation-wide Medicare FFS claims and the enrollment database.
   b. The hybrid measure uses an electronic health record (EHR) database from 21 hospitals in the Kaiser Permanente network which includes inpatient claims data information.

2. Age of patients in cohort:
   a. The claims-only measure includes Medicare FFS patients, age 65-94.
   b. The hybrid measure includes all patients age 50-94 (see later discussion for justification)

3. External empiric validity testing
   a. Not possible for the hybrid measure, due to limited data availability. We provide results from the claims-only measure within the hybrid testing form.

4. Socioeconomic risk factor analyses
   a. Not possible for the hybrid measure, due to limited data availability. We provide results from the claims-only measure within the hybrid testing form.

5. Exclusion analyses
   a. To be representative of what we expect the impact would be of the measures' exclusions in a nation-wide sample, we provide the results from the claims-only measure.

6. Meaningful differences
   a. To be representative of what we expect the range of performance would be in a nation-wide sample, we provide the distribution results from the claims-only measure.

   Difference between the two measures when fully harmonized, prior to implementation:

1. Risk adjustment:
   a. The claims-only measure uses administrative claims data only for risk adjustment
   b. The hybrid measure adds 10 clinical risk variables, derived from a set of core clinical data elements (CCDE) extracted from the EHR.

Type

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Outcome

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Outcome

Data Source

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) 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, skilled nursing facility care, some home health agency 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 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): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score.

References:

Fleming C, Fisher ES, Chang CH, Bubolz TA, Malenka DJ. 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
NQF_datadictionary_HFmortality_Fall2020_final_7.22.20.xlsx

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Claims, Enrollment Data, Other Data sources for the Medicare FFS measure:

1. Medicare Part A Inpatient: The index dataset contains administrative inpatient hospitalization data for Medicare FFS beneficiaries, aged 65-94 on admission, hospitalized from July 1, 2016-June 30, 2017. The history dataset includes administrative inpatient hospitalization data on each patient for the 12 months prior to the index admission.

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 as well as vital status. It was also used to determine hospice enrollment.

No data collection instrument provided Attachment
Del18b1HOP5HWMClaimsDataDictionary01072019.xlsx

Level

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Facility

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Facility

Setting

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Inpatient/Hospital

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Inpatient/Hospital

Numerator Statement

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients 65 and older hospitalized with a principal diagnosis of HF.

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

The outcome for this measure is 30-day, all-cause mortality. Mortality is defined as death from any cause, either during or after admission, within 30 days of the index admission date.

Numerator Details

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

The measure counts all deaths (including in-hospital deaths) for any cause within 30 days of the date of the index HF admission.

Identifying deaths in the FFS measure

As currently reported, we identify deaths for FFS Medicare patients 65 years and older in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

The measure outcome is death from any cause within 30 days of the admission date of the index admission, for Medicare FFS patients identified using the Medicare Enrollment Database (EDB). The numerator is a binary variable (1=yes/0=no) that indicates whether the patient died within 30 days of the index admission date.

Denominator Statement

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

This claims-based measure is used for a cohort of patients aged 65 years or older.

The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of HF 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.

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

The cohort includes inpatient admissions for a wide variety of conditions for Medicare FFS patients aged between 65 and 94 years old who were admitted to short-term acute care hospitals. If a patient has more than one admission during the measurement year, one admission is randomly selected for inclusion in the measure. Additional details are provided in S.7 Denominator Details.

Denominator Details

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria:

1. Principal discharge diagnosis of heart failure
2. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of the index admission and Part A during the index admission, or those who are VA beneficiaries
3. Aged 65 or over
4. Not transferred from another acute care facility

> We have explicitly tested the measure for those aged 65+ years and those aged 65+ years (see Testing Attachment for details).

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

An index admission is the hospitalization to which the mortality outcome is attributed and includes admissions for patients:

1. Enrolled in Medicare FFS Part A for at least 12 months prior to the date of admission and during the index admission

   > Rationale: Claims data are consistently available only for Medicare FFS beneficiaries. The 12-month prior enrollment criterion ensures a full year of administrative data is available for risk adjustment.

2. Not transferred from another acute care facility

   > Rationale: Admissions to an acute cate hospital within one day of discharge from another acute care hospital are considered transfers. Transferred patients are included in the measure cohort, but it is the initial hospitalization rather than any "transfer-in" hospitalization(s), that is included as the hospitalization to which the mortality outcome is attributed (the index admission).

3. Aged between 65 and 94 years

   > Rationale: Medicare patients younger than 65 are not included in the measure because they usually qualify for the program due to severe disability and are considered to be clinically distinct from Medicare patients 65 and over. Patients over age 94 are not included to avoid holding hospitals responsible for the survival of the very elderly patients, who may be less likely to have survival as a primary goal.

   > Note that the hybrid measure (submitted for NQF endorsement in parallel with the claims-only measure) differs from the claims-only measure in terms of the age range of included admissions; the hybrid measure includes all inpatient admissions for patients aged 50-94 years old. The intention is to fully harmonize the cohort definitions for the two measures, so that both measures will capture admissions for patients age 65-94. We deviated from that definition during development and testing for the hybrid measure due to the limited dataset available that included

the EHR data elements needed to calculate the hybrid measure. Note that the risk model already includes age in years, as a risk variable.)

4. Not admitted for primary psychiatric diagnoses

   Rationale: Patients admitted for psychiatric treatment are typically cared for in separate psychiatric facilities that are not comparable to short-term acute care hospitals (see data dictionary, HWM Non-Acute Care Inclusion tab).

5. Not admitted for rehabilitation

   Rationale: These admissions are not typically to a short-term acute care hospital and are not for acute care (see data dictionary, HWM Non-Acute Care Inclusion tab).

6. Not enrolled in hospice at the time of, or 12 months prior to, their index admission

   Rationale: Patients enrolled in hospice in the prior 12 months or at the time of admission are unlikely to have 30-day survival as a primary goal.

7. Not enrolled in hospice within two days of admission

   Rationale: There is not a single, correct approach regarding patients enrolled in hospice during admission or upon discharge – mortality may or may not represent a quality signal for this group of patients and hospice enrollment is inadequate to differentiate this issue. However, for most patients and/or families who had the discussion and agreed to enroll in hospice within two days of admission, 30-day survival is not likely the primary goal due to their condition and not the quality of care received.

8. Not with a principal diagnosis of cancer and enrolled in hospice during their index admission

   Rationale: Patients admitted primarily for cancer who are enrolled in hospice during admission are unlikely to have 30-day survival as a primary goal of care. (see data dictionary, HWM Cancer Inclusion tab).

9. Without any diagnosis of metastatic cancer

   Rationale: Although some patients admitted with a diagnosis of metastatic cancer will have 30-day survival as a primary goal of care, for many such patients admitted to the hospital, death may be a clinically reasonable and patient-centered outcome. (see data dictionary, HWM Metastatic Cancer Inclusion tab).

10. Not with a principal discharge diagnosis, or a secondary diagnosis that is present on admission (POA) for a condition which hospitals have limited ability to influence survival

    Rationale: Hospitals have little ability to impact mortality for some conditions. This list of conditions (see data dictionary, HWM ICD-10 Inclusion tab) was determined through independent review, by several clinicians, of conditions associated with high mortality. The decisions were also reviewed with our Technical Expert Panel (TEP) and Technical Work Group. Admissions are not included in the cohort if the patient had a principal diagnosis code that is on this list, or a secondary code with POA that is on the list.

    In addition, for patients with multiple admissions, the measure selects only one admission, at random, for inclusion. There is no practical statistical modeling approach that can account or adjust for the complex relationship between the number of admissions and risk of mortality in the context of a hospital-wide mortality measure. Random selection ensures that providers are not penalized for a "last" admission during the measurement period; selecting the last admission would not be as accurate a reflection of the risk of death as random selection, as the last admission is inherently associated with a higher mortality risk. Random selection is also used in CMS's

condition-specific mortality measures. Note that random selection reduces the number of admissions, but does not exclude any patients from the measure.

The cohort is defined using ICD-10 Clinical Modification codes identified in Medicare Part A Inpatient claims data. The measure aggregates the ICD-10 principal diagnosis and all procedure codes of the index admission into clinically coherent groups of conditions and procedures (condition categories or procedure categories) using the Agency for Healthcare Research and Quality (AHRQ) Clinical Classifications System (CCS). There is a total of 285 mutually exclusive AHRQ condition categories, most of which are single, homogenous diseases such as pneumonia or acute myocardial infarction. Some are aggregates of conditions, such as "other bacterial infections". There is a total of 231 mutually exclusive procedure categories. Using the AHRQ CCS procedure and condition categories, the measure assigns each index hospitalization to one of 15 mutually exclusive divisions. The divisions were created based upon clinical coherence, consistency of mortality risk, adequate patient and hospital case volume for stable results reporting, and input from clinicians, patients, and patient caregivers on usability.

The measure first assigns admissions with qualifying AHRQ procedure categories to one of six surgery divisions by identifying a defining surgical procedure. The defining surgical procedure is identified using the following algorithm:

1) if a patient only has one major surgical procedure then that procedure is the defining surgical procedure;

2) if a patient has more than one major surgical procedure, the first dated procedure performed during the index admission is the defining surgical procedure;

3) if there is more than one major surgical procedure on that earliest date, the procedure with the highest mortality rate is the defining surgical procedure. These divisions include admissions likely cared for by surgical teams.

The surgical divisions are: Surgical Cancer (see note below), Cardiothoracic Surgery, General Surgery, Neurosurgery, Orthopedic Surgery, and Other Surgical Procedures.

For the Surgical Cancer division, any admission that includes a surgical procedure and a principal discharge diagnosis code of cancer is assigned to the Surgical Cancer division. This division and the logic behind it was implemented in response to feedback from our Technical Expert Panel.

The measure then assigns the remaining admissions into one of the nine non-surgical divisions based on the AHRQ diagnostic CCS of the principal discharge diagnosis. The non-surgical divisions are: Cancer, Cardiac, Gastrointestinal, Infectious Disease, Neurology, Orthopedic, Pulmonary, Renal, Other Conditions.

The full list of the specific diagnosis and procedure AHRQ CCS categories used to define the divisions are attached in the Data Dictionary.

Exclusions

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

The mortality measures exclude index admissions for patients:

1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility;

2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data;

3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission;

4. Discharged against medical advice (AMA); or

5. Patients undergoing left ventricular assist device (LVAD) implantation or heart transplantation during an index admission or who have a history of LVAD or heart transplant in the preceding year.

> For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort for each year.

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

> The measure excludes index admissions for patients:

1. With inconsistent or unknown vital status (from claims data) or other unreliable claims data;

2. Discharged against medical advice (AMA);

3. With an admission for spinal cord injury (CCS 227), skull and face fractures (CCS 228), Intracranial Injury (CCS 233), Crushing injury or internal injury (CCS 234), Open wounds of head/neck/trunk (CCS 235), and burns (CCS 240); and

4. With a principal discharge diagnosis within a CCS with fewer than 100 admissions within the measurement year.

Exclusion Details

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

1. The discharge disposition indicator is used to identify patients alive at discharge. Transfers are identified in the claims when a patient with a qualifying admission is discharged from an acute care hospital and admitted to another acute care hospital on the same day or next day. Patient length of stay and condition is identified from the admission claim.

> Rationale: This exclusion prevents inclusion of patients who likely did not have clinically significant HF.

2. Inconsistent vital status or unreliable data are identified if any of the following conditions are met 1) the patient's age is greater than 115 years: 2) if the discharge date for a hospitalization is before the admission date; 3) if the patient has a sex other than 'male' or 'female'.

> Rationale: Reliable and consistent data are necessary for valid calculation of the measure.

3. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice data and the Inpatient standard analytic file (SAF).

> Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care.

4. 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.

5. Patients with LVAD implantation or heart transplantation during an index admission or in the previous 12 months are identified by the corresponding codes for these procedures included in claims data.

> Rationale: Patients undergoing implantation of an LVAD designed to offer intermediate to long-term support (weeks to years) as a bridge to heart transplant or destination therapy represent a clinically distinct, highly-selected group of patients cared for at highly specialized medical centers.

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

1. With inconsistent or unknown vital status (from claims data) or other unreliable claims data

    Rationale: The measure does not include stays for patients where the admission date is after the date of death in the Medicare Enrollment Database, or where the date of death occurs before the date of discharge but the patient was discharged alive because these are likely errors in the data.

2. Discharged against medical advice (AMA)

    Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.

3. With an admission for spinal cord injury (CCS 227), skull and face fractures (CCS 228), Intracranial Injury (CCS 233), Crushing injury or internal injury (CCS 234), Open wounds of head/neck/trunk (CCS 235), and burns (CCS 240)

    Rationale: Even though a hospital likely can influence the outcome of some of these conditions, in many cases death events are not a signal of poor quality of care when patients present with these conditions. These conditions are also infrequent events that are unlikely to be uniformly distributed across hospitals.

4. With a principal discharge diagnosis within a CCS with fewer than 100 admissions in that division within the measurement year.

    Rationale: To calculate a stable and precise risk model, there are a minimum number of admissions that are needed. In addition, a minimum number of admissions and/or outcome events are required to inform grouping admissions into larger categories. These admissions present challenges to both accurate risk prediction and coherent risk grouping and are therefore excluded.

    Note: During measure development we analyzed different volume cut-offs (25, 50 and 100). Using cut-off values below 100 resulted in too many CCS codes in some of the divisions (the CCS category codes are used in risk adjustment) which resulted in non-convergence of those division-level risk models. The total number of patients excluded is very small (13,597 or 0.21% of admissions for a cut off of 100). During measure development we also explored the option of pooling low-volume CCS codes (CCS<100 patients) into one group, however, the heterogeneity in mortality rates for the individual ICD-10 codes in those groups would preclude adequate risk adjustment. The TEP supported excluding these admissions.

Risk Adjustment

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Statistical risk model

118210| 112469| 146637| 141015| 150289

118210| 112469| 146637| 141015| 150289

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Statistical risk model

146637| 144762| 110639| 141015| 110874| 146313

146637| 144762| 110639| 141015| 110874| 146313

Stratification

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

N/A

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

N/A

Type Score

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Rate/proportion better quality = lower score

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Rate/proportion better quality = lower score

Algorithm

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

The measure estimates hospital-level 30-day all-cause RSMRs following hospitalization for HF 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 mortality 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 mortality 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 RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality.

The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. The estimated hospital-specific intercept is added 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 deaths (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 [https://qualitynet.org/inpatient/measures/mortality/methodology].

References:

1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 118210| 112469| 146637| 141015| 150289

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

The measure estimates hospital-level, risk-standardized mortality rates (RSMRs) within 30 days of hospital admission using hierarchical logistical regression models through a Bayesian Markov Chain Monte Carlo (MCMC) procedure. In brief, we used hierarchical logistic regression to model the log-odds of mortality for each of the 15 service-line divisions. Death within 30 days was modeled as a function of patient-level demographic and clinical characteristics and a random hospital-level intercept. This model specification accounts for within-hospital correlation of the observed outcomes and models the assumption that underlying differences in quality among the health care facilities being evaluated lead to systematic differences in outcomes. We estimated a separate hierarchical logistic regression model for each service-line division. In order to obtain the variance and interval estimates, we fit the hierarchical model under the Bayesian framework along with the Markov Chain Monte Carlo (MCMC) technique.

Admissions are assigned to one of 15 mutually exclusive divisions (groups of discharge condition categories and procedure categories). For each division and each hospital with patients in that division, the standardized mortality ratio (SMR) is calculated as the ratio of the number of "predicted" deaths to the number of "expected" deaths at a given hospital. The predicted number of deaths is based on the hospital's performance with its observed case mix and service mix, and is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific effect on the risk of mortality. 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 transformed via an inverse logit function and summed over all patients attributed to a hospital to get a predicted value. The expected number of deaths is based on the nation's performance with that hospital's case mix and service mix and 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 transformed via an inverse logit function and summed over all patients in the hospital to get an expected value. 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 mortality rates or better quality, while a higher ratio indicates higher-than-expected mortality rates or worse quality.

To assess hospital performance for each reporting period, the measure re-estimates the model coefficients using the data in that period.

The division-level SMRs are then pooled for each hospital using an inverse variance-weighted geometric mean to create a hospital-wide composite SMR. The hospital-wide SMR is then

multiplied by the national observed mortality rate to produce the RSMR. 146637| 144762| 110639| 141015| 110874| 146313

Submission items

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

5.1 Identified measures: 0330 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

0358 : Heart Failure Mortality Rate (IQI 16)

0468 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

1789 : Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

1893 : Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

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. Our measure cohort was heavily vetted by clinical experts, a technical expert panel, and a public comment period. Additionally, the measure, with the specified cohort, has been publicly reported since 2008. 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

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

5.1 Identified measures:

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: This claims-only hospital-wide mortality (HWM) measure is intended to complement the existing CMS Hospital-Wide All-Cause Risk-Standardized Readmission Measure (NQF #1789) to allow assessment of trends in hospital performance for both readmission and mortality outcomes, similar to other complementary pairs of readmission and mortality measures for specific conditions and procedures. By measuring mortality outcomes across almost all hospitalized patients, this measure will provide an important additional performance assessment that will complement condition- and procedure-specific or other more narrowly defined mortality measures and allow a greater number of patients and hospitals to be evaluated. This HWM measure captures a similarly broad cohort to the CMS Hospital-Wide All-Cause Risk-Standardized Readmission Measure (NQF #1789), and a broader cohort than those of other CMS condition-specific measures. Because the mortality measure is focused on a different outcome, it differs from the existing CMS Hospital-Wide All-Cause Risk Standardized Readmission Measure (NQF #1789) in a couple of ways. First, this HWM

measure includes patients with a principal discharge diagnosis of cancer (with some exceptions), whereas those patients are not included in the readmission measure. Cancer patients are appropriate to include in the HWM measure as many have survival as their primary goal; however due to cancer treatment plans, readmissions are frequently part of the plan and expected and therefore, are not a reasonable signal of quality. Another difference between the two measures is the number of divisions or specialty cohorts the patients are divided into, to more accurately risk adjust for case-mix and service-mix. The readmission measure divides patients into five categories, or "specialty cohorts", while the mortality measure uses 15. This is because the risk of mortality is much more closely related to patient factors than readmission is related to patient factors. PSI-02 (NQF #0357) is another complementary mortality measure, which captures a different patient population and a different outcome compared with the HWM measure submitted with this application. PSI-02 captures patients 18 years of age or older, or obstetric patients, whereas the HWM measure captures patients between the ages of 65 and 94. PSI-02 captures DRGs with less than 0.5% mortality rate, whereas the HWM measure captures all patients within all CCSs, regardless of mortality rate. Hospital-wide mortality captures mortality up to 30 days past admission, where AHRQ PSI-02 only captures in-hospital mortality. IQI 90 (NQF #0530) is another complimentary mortality measure, which is a composite measure of the number of in-hospital deaths for a narrow range of conditions (CHF, stroke, hip fracture, pneumonia, acute myocardial infarction and GI hemorrhage). The HWM measure presented in this application captures all deaths after 30 days of admission, for all conditions and procedures.

5b.1 If competing, why superior or rationale for additive value: There are no competing NQF-endorsed measures.

Comparison of NQF #0230, NQF #0229 and NQF #0330

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

Steward

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

Centers for Medicare & Medicaid Services

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Centers for Medicare & Medicaid Services

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

Centers for Medicare & Medicaid Services

Description

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

The measure estimates a hospital-level 30-day risk-standardized mortality rate (RSMR) for patients discharged from the hospital with a principal diagnosis of AMI. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. CMS annually reports the measure for patients who are 65 years or older and are either Medicare fee-for-service (FFS) beneficiaries and hospitalized in non-federal hospitals or are hospitalized in Veterans Health Administration (VA) facilities.

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

The measure estimates a hospital-level 30-day, all-cause, risk-standardized mortality rate for patients discharged from the hospital with a principal diagnosis of HF. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. 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.

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

The measure estimates a hospital-level risk-standardized readmission rate (RSRR) for patients discharged from the hospital with a principal diagnosis of heart failure (HF). 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. The target population is patients age 65 and over. The Centers for Medicare & Medicaid Services (CMS) annually reports the measure for patients who are 65 years or older and are enrolled in fee-for-service (FFS) Medicare and hospitalized in non-federal hospitals or are patients hospitalized in Veterans Health Administration (VA) facilities.

Type

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

Outcome

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Outcome

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

Outcome

Data Source

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) 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, skilled nursing facility care, some home health agency 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 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): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score.

References:

Fleming C, Fisher ES, Chang CH, Bubolz TA, Malenka DJ. 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 NQF_datadictionary_AMImortality_Fall2020_final_7.22.20.xlsx

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) 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, skilled nursing facility care, some home health agency 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 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): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score.

References:

Fleming C, Fisher ES, Chang CH, Bubolz TA, Malenka DJ. 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 NQF_datadictionary_HFmortality_Fall2020_final_7.22.20.xlsx

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) 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, and 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 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 NQF_datadictionary_HFreadmission_Fall2020_final_7.22.20.xlsx

Level

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial
infarction (AMI) hospitalization
Facility

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization
Facility

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization
Facility

Setting

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial
infarction (AMI) hospitalization
Inpatient/Hospital

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization
Inpatient/Hospital

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization
Inpatient/Hospital

Numerator Statement

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial
infarction (AMI) hospitalization

The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients hospitalized with a principal diagnosis of AMI.

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients 65 and older hospitalized with a principal diagnosis of HF.

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

The outcome for this measure is 30-day readmissions. We define readmissions as any inpatient acute care admission, with the exception of certain planned readmissions, within 30 days from the date of discharge from an index admission with a principal discharge diagnosis of HF in patients 65and older. 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.

Additional details are provided in S.5 Numerator Details.

Numerator Details

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial

infarction (AMI) hospitalization

The measure counts all deaths (including in-hospital deaths) for any cause to any acute care hospital within 30 days of the date of the index AMI hospitalization.

Identifying deaths in the FFS measure

As currently reported, we identify deaths for FFS Medicare patients 65 years and older in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

The measure counts all deaths (including in-hospital deaths) for any cause within 30 days of the date of the index HF admission.

Identifying deaths in the FFS measure

As currently reported, we identify deaths for FFS Medicare patients 65 years and older in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

The measure counts readmissions to any acute care hospital for any cause within 30 days of the date of discharge of the index HF 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 (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 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. For the HF readmission measure, CMS used the Planned Readmission Algorithm without modifications.

The planned readmission algorithm and associated code tables are attached in data field S.2b (Data Dictionary or Code Table).

Denominator Statement

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial

infarction (AMI) hospitalization

This claims-based measure is used for patients aged 65 years or older.

The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of AMI 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.

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

This claims-based measure is used for a cohort of patients aged 65 years or older.

The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of HF 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.

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

The cohort includes admissions for patients aged 65years and older discharged from the hospital with a principal discharge diagnosis of HF, 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

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial

infarction (AMI) hospitalization

To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria:

1. Having a principal discharge diagnosis of AMI;
2. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of the index admission and Part A during the index admission, or those who are VA beneficiaries;
3. Aged 65 or over; and
4. Not transferred from another acute care facility.

We have explicitly tested the measure for those aged 65+ years (see Testing Attachment for details).

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria:

1. Principal discharge diagnosis of heart failure
2. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of the index admission and Part A during the index admission, or those who are VA beneficiaries
3. Aged 65 or over
4. Not transferred from another acute care facility

   We have explicitly tested the measure for those aged 65+ years and those aged 65+ years (see Testing Attachment for details).

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

To be included in the measure cohort used in public reporting, patients must meet the following additional inclusion criteria:

1. Principal discharge diagnosis of HF;
2. 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, 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. Not transferred to another acute care facility.

Exclusions

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial

infarction (AMI) hospitalization

The mortality measures exclude index admissions for patients:

1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility;
2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data;
3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission; or
4. Discharged against medical advice (AMA).

   For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort.

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

The mortality measures exclude index admissions for patients:

1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility;
2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data;

3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission;

4. Discharged against medical advice (AMA); or

5. Patients undergoing left ventricular assist device (LVAD) implantation or heart transplantation during an index admission or who have a history of LVAD or heart transplant in the preceding year.

> For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort for each year.

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

The 30-day HF 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. Admitted within 30 days of a prior index admission for HF; and

4. With a procedure code for LVAD implantation or heart transplantation either during the index admission or in the 12 months prior to the index admission.

Exclusion Details

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

1. The discharge disposition indicator is used to identify patients alive at discharge. Transfers are identified in the claims when a patient with a qualifying admission is discharged from an acute care hospital and admitted to another acute care hospital on the same day or next day. Patient length of stay and condition is identified from the admission claim.

> Rationale: This exclusion prevents inclusion of patients who likely did not have clinically significant AMI.

2. Inconsistent vital status or unreliable data are identified if any of the following conditions are met 1) the patient's age is greater than 115 years; 2) if the discharge date for a hospitalization is before the admission date; and 3) if the patient has a sex other than 'male' or 'female'.

> Rationale: Reliable and consistent data are necessary for valid calculation of the measure.

3. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice data. This exclusion applies when the measure is used in Medicare FFS patients only.

> Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care.

4. 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.

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

1. The discharge disposition indicator is used to identify patients alive at discharge. Transfers are identified in the claims when a patient with a qualifying admission is discharged from an acute care hospital and

admitted to another acute care hospital on the same day or next day. Patient length of stay and condition is identified from the admission claim.

> Rationale: This exclusion prevents inclusion of patients who likely did not have clinically significant HF.

2. Inconsistent vital status or unreliable data are identified if any of the following conditions are met
   1) the patient's age is greater than 115 years:
   2) if the discharge date for a hospitalization is before the admission date;
   3) if the patient has a sex other than 'male' or 'female'.

   > Rationale: Reliable and consistent data are necessary for valid calculation of the measure.

3. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice data and the Inpatient standard analytic file (SAF).

   > Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care.

4. 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.

5. Patients with LVAD implantation or heart transplantation during an index admission or in the previous 12 months are identified by the corresponding codes for these procedures included in claims data.

   > Rationale: Patients undergoing implantation of an LVAD designed to offer intermediate to long-term support (weeks to years) as a bridge to heart transplant or destination therapy represent a clinically distinct, highly-selected group of patients cared for at highly specialized medical centers.

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

The HF 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. 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. HF admissions within 30 days of discharge from a qualifying HF index admission are identified by comparing the discharge date from the index admission with subsequent admission dates.

   > Rationale: Additional HF 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.

4. With a procedure code for LVAD implantation or heart transplantation either during the index admission or in the 12 months prior to the index admission, which are identified by the corresponding codes included in claims data (codes can be found in attached Data Dictionary).

Rationale: Patients with these procedures are a clinically distinct group with a different risk of the readmission outcome.

Risk Adjustment

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

Statistical risk model

118210| 112469| 146637| 150289

118210| 112469| 146637| 150289

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Statistical risk model

118210| 112469| 146637| 141015| 150289

118210| 112469| 146637| 141015| 150289

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

Statistical risk model

117446| 141973| 137977| 112469| 146637| 150289

117446| 141973| 137977| 112469| 146637| 150289

Stratification

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

N/A

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

N/A

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

N/A

Type Score

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

Rate/proportion better quality = lower score

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

Rate/proportion better quality = lower score

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

Rate/proportion better quality = lower score

Algorithm

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial

infarction (AMI) hospitalization

The measure estimates hospital-level 30-day all-cause RSMRs 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 mortality 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 mortality 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 RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality.

The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. The estimated hospital-specific intercept is added 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 deaths (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 [https://qualitynet.org/inpatient/measures/mortality/methodology].

References:

1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226.

2. Krumholz H, Normand S, Galusha D, et al. Risk-Adjustment Models for AMI and HF 30-Day Mortality Methodology. 2005. 118210| 112469| 146637| 150289

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

The measure estimates hospital-level 30-day all-cause RSMRs following hospitalization for HF 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 mortality 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 mortality 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 RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality.

The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. The estimated hospital-specific intercept is added 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 deaths (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 [https://qualitynet.org/inpatient/measures/mortality/methodology].

References:

1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 118210| 112469| 146637| 141015| 150289

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

The measure estimates hospital-level 30-day all-cause RSRRs following hospitalization for HF 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 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" readmissions to the number of "expected" readmissions, multiplied by the national unadjusted readmission rate. For each hospital, the numerator of the ratio ("predicted") 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 ("expected") is the number of readmissions expected on the basis of 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, or better quality, and a higher ratio indicates higher-than-expected readmission, 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 effect 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 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 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 readmission rate. The hierarchical logistic regression models are described fully in the original methodology report (Krumholz et al., 2005).

References:

1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226.
2. Krumholz H, Normand S, Galusha D, et al. Risk-Adjustment Models for HF and HF 30-Day Readmission Methodology. 2005. 117446| 141973| 137977| 112469| 146637| 150289

Submission items

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) 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

0468 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia 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

0229 : Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

1893 : Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

2431 : Hospital-level, risk-standardized payment associated with a 30-day episode-of-care for Acute Myocardial Infarction (AMI)

3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

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. Our measure cohort was heavily vetted by clinical experts, a technical expert panel, and a public comment period. Additionally, the measure, with the specified cohort, has been publicly reported since 2008. 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

0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

5.1 Identified measures: 0330 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

0358 : Heart Failure Mortality Rate (IQI 16)

0468 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

1789 : Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

1893 : Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

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. Our measure cohort was heavily vetted by clinical experts, a technical expert panel, and a public comment period. Additionally, the measure, with the specified cohort, has been publicly reported since 2008. 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

0330 Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization

5.1 Identified measures: 0505 : Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

0229 : Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

1789 : Hospital-Wide All-Cause Unplanned Readmission Measure (HWR)

1891 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following chronic obstructive pulmonary disease (COPD) hospitalization

2879 : Hybrid Hospital-Wide Readmission (HWR) Measure with Claims and Electronic Health Record Data

2880 : Excess days in acute care (EDAC) after hospitalization for heart failure (HF)

2886 : Risk-Standardized Acute Admission Rates for Patients with Heart Failure

2888 : Accountable Care Organization Risk-Standardized Acute Hospital Admission Rate for Patients with Multiple Chronic Conditions

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

Comparison of NQF #0230, NQF #0468 and NQF #0505

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

Steward

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

Centers for Medicare & Medicaid Services

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

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

Description

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

The measure estimates a hospital-level 30-day risk-standardized mortality rate (RSMR) for patients discharged from the hospital with a principal diagnosis of AMI. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. CMS annually reports the measure for patients who are 65 years or older and are either Medicare fee-for-service (FFS) beneficiaries and hospitalized in non-federal hospitals or are hospitalized in Veterans Health Administration (VA) facilities.

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

The measure estimates a hospital-level 30-day risk-standardized mortality rate (RSMR). Mortality is defined as death for any cause within 30 days after the date of admission for the index admission, 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 diagnosis of pneumonia (including aspiration pneumonia) coded as present on admission (POA). CMS annually reports the measure for patients who are 65 years or older and are either Medicare fee-for-service (FFS) beneficiaries and hospitalized in non-federal hospitals or patients hospitalized in Veterans Health Administration (VA) facilities.

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.

Type

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

Outcome

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

Outcome

0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

Outcome

Data Source

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) 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, skilled nursing facility care, some home health agency 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 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): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score.

References:

Fleming C, Fisher ES, Chang CH, Bubolz TA, Malenka DJ. 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 NQF_datadictionary_AMImortality_Fall2020_final_7.22.20.xlsx

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) 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 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): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score.

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 NQF_datadictionary_PNmortality_Fall2020_final_7.22.20.xlsx

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 NQF_datadictionary_AMIreadmission_Fall2020_final_7.22.20.xlsx

Level

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

Facility

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

Facility

0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

Facility

Setting

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

Inpatient/Hospital

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

Inpatient/Hospital

0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

Inpatient/Hospital

Numerator Statement

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients hospitalized with a principal diagnosis of AMI.

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

The outcome for this measure is 30-day all-cause mortality (including in-hospital deaths). We define mortality as death from any cause within 30 days of the index admission datefrom the date of admission for patients hospitalized 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.

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.

Numerator Details

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

The measure counts all deaths (including in-hospital deaths) for any cause to any acute care hospital within 30 days of the date of the index AMI hospitalization.

Identifying deaths in the FFS measure

As currently reported, we identify deaths for FFS Medicare patients 65 years and older in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

The measure counts all deaths (including in-hospital deaths) for any cause within 30 days of the date of admission of the index pneumonia hospitalization.

Identifying deaths in the FFS measure

As currently reported, we identify deaths for FFS Medicare patients 65 years or over in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.

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:

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 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).

Denominator Statement

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

This claims-based measure is used for patients aged 65 years or older.

The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of AMI 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.

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

This claims-based measure is used for a cohort of patients aged 65 years or over older.

The cohort includes admissions for patients aged 65 years and older discharged from the hospital with 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 but no secondary discharge diagnosis of severe sepsis; and with a complete claims history for the 12 months prior to admission. The

measure will be publicly reported by CMS for those patients 65 years or older who are Medicare FFS beneficiaries admitted to non-federal hospitals or patients admitted to VA hospitals.

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.

Denominator Details

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria:

1. Having a principal discharge diagnosis of AMI;
2. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of the index admission and Part A during the index admission, or those who are VA beneficiaries;
3. Aged 65 or over; and
4. Not transferred from another acute care facility.

> We have explicitly tested the measure for those aged 65+ years (see Testing Attachment for details).

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria:

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);
3. Aged 65 or over;
4. Not transferred from another acute care facility; and
5. Enrolled in 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.

> We have explicitly tested the measure for those aged 65 years or over (see Testing Attachment for details).

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:

1. Principal discharge diagnosis of AMI;
2. 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;
3. Aged 65 or over;
4. Discharged alive from a non-federal short-term acute care hospital or VA hospital; and,
5. Not transferred to another acute care facility.

Exclusions

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

The mortality measures exclude index admissions for patients:

1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility;
2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data;
3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission; or
4. Discharged against medical advice (AMA).

For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort.

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

The mortality measure excludes index admissions for patients:

1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility;
2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data;
3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission; or
4. Discharged against medical advice (AMA).

For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort.

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:

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) Admitted within 30 days of a prior index admission for AMI.

Exclusion Details

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

1. The discharge disposition indicator is used to identify patients alive at discharge. Transfers are identified in the claims when a patient with a qualifying admission is discharged from an acute care hospital and admitted to another acute care hospital on the same day or next day. Patient length of stay and condition is identified from the admission claim.

Rationale: This exclusion prevents inclusion of patients who likely did not have clinically significant AMI.

2. Inconsistent vital status or unreliable data are identified if any of the following conditions are met 1) the patient's age is greater than 115 years; 2) if the discharge date for a hospitalization is before the admission date; and 3) if the patient has a sex other than 'male' or 'female'.

Rationale: Reliable and consistent data are necessary for valid calculation of the measure.

3. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice data. This exclusion applies when the measure is used in Medicare FFS patients only.

Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care.

4. 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.

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

1. The discharge disposition indicator is used to identify patients alive at discharge. Transfers are identified in the claims when a patient with a qualifying admission is discharged from an acute care hospital and admitted to another acute care hospital on the same day or next day. Patient length of stay and condition is identified from the admission claim.

Rationale: This exclusion prevents inclusion of patients who likely did not have clinically significant pneumonia.

2. Inconsistent vital status or unreliable data are identified if any of the following conditions are met 1) the patient's age is greater than 115 years; 2) if the discharge date for a hospitalization is before the admission date; or 3) if the patient has a sex other than 'male' or 'female'.

Rationale: Reliable and consistent data are necessary for valid calculation of the measure.

3. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice enrollment data.

Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care.

4. Discharges against medical advice (AMA) are identified using the discharge disposition indicator.

Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.

After all exclusions are applied, the measure randomly selects one index admission per patient per year for inclusion in the cohort so that each episode of care is mutually independent with the similar probability of the outcome. For each patient, the probability of death may increase with each subsequent admission, and therefore, the episodes of care are not mutually independent. Also, for the three-year combined data, when index admissions occur during the transition between measure reporting periods (June and July of each year) and both are randomly selected for inclusion in the measure, the measure includes only the June admission. The July admissions are excluded to avoid assigning a single death to two admissions.

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.

Risk Adjustment

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

Statistical risk model

118210| 112469| 146637| 150289

118210| 112469| 146637| 150289

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

Statistical risk model

107491| 118210| 112469| 146637| 150289

107491| 118210| 112469| 146637| 150289

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

Stratification

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

N/A

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

N/A

0505 Hospital 30-day all-cause risk-standardized readmission rate (RSRR) following acute myocardial infarction (AMI) hospitalization.

N/A

Type Score

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

Rate/proportion better quality = lower score

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

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

Algorithm

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

The measure estimates hospital-level 30-day all-cause RSMRs 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 mortality 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 mortality 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 RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality.

The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. The estimated hospital-specific intercept is added 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 deaths (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 [https://qualitynet.org/inpatient/measures/mortality/methodology].

References:

1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226.

2. Krumholz H, Normand S, Galusha D, et al. Risk-Adjustment Models for AMI and HF 30-Day Mortality Methodology. 2005. 118210| 112469| 146637| 150289

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

The measure estimates hospital-level 30-day all-cause RSMRs 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 mortality 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 mortality 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 RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths

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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality.

The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. 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 deaths (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 mortality rate. The hierarchical logistic regression models are described fully in the original methodology report posted on QualityNet: https://qualitynet.org/inpatient/measures/mortality/methodology.

References:

Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 107491| 118210| 112469| 146637| 150289

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 (https://qualitynet.org/inpatient/measures/readmission/methodology)

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

Submission items

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) 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

0468 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia 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

0229 : Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

1893 : Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

2431 : Hospital-level, risk-standardized payment associated with a 30-day episode-of-care for Acute Myocardial Infarction (AMI)

3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

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. Our measure cohort was heavily vetted by clinical experts, a technical expert panel, and a public comment period. Additionally, the measure, with the specified cohort, has been publicly reported since 2008. 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

0468 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

5.1 Identified measures: 0231 : Pneumonia Mortality Rate (IQI #20)

0506 : Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

0279 : Community Acquired Pneumonia Admission Rate (PQI 11)

1891 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following chronic obstructive pulmonary disease (COPD) hospitalization

1893 : Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

2579 : Hospital-level, risk-standardized payment associated with a 30-day episode of care for pneumonia (PN)

3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

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 (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). Lastly, this measure and the NQF Inpatient Pneumonia Mortality (AHRQ) Measure #0231 are complementary rather than competing measures. Although they both assess mortality for patients admitted to acute care hospitals with a principal discharge diagnosis of pneumonia, the specified outcomes are different. This measure assesses 30-day mortality while #0231 assesses inpatient mortality. Assessment of 30-day and inpatient mortality outcomes have distinct advantages and uses which make them complementary as opposed to competing. For example, the 30-day period provides a broader perspective on hospital care and utilizes standard time period to examine hospital performance to avoid bias by differences in length of stay among hospitals. However, in some settings it may not be feasible to capture post-discharge mortality making the inpatient measure more useable. We have previously consulted with AHRQ to examine harmonization of complementary measures of mortality for patients with AMI and stroke. We have found that the measures are harmonized to the extent

possible given that small differences in cohort inclusion and exclusion criteria are warranted on the basis of the use of different outcomes. However, this current measure includes patients with a principal discharge diagnosis of sepsis and a secondary discharge diagnosis of pneumonia that is present on admission. The cohort was also expanded to include patients with a principal discharge diagnosis of aspiration pneumonia. Thus, the current measure cohort is still not harmonized with measure #0231.

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

Comparison of NQF #0230, NQF #0506 and NQF #0730

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization
0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization
0730 Acute Myocardial Infarction (AMI) Mortality Rate

Steward

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) 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

0730 Acute Myocardial Infarction (AMI) Mortality Rate

Agency for Healthcare Research and Quality

Description

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

The measure estimates a hospital-level 30-day risk-standardized mortality rate (RSMR) for patients discharged from the hospital with a principal diagnosis of AMI. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. CMS annually reports the measure for patients who are 65 years or older and are either Medicare fee-for-service (FFS) beneficiaries and hospitalized in non-federal hospitals or are 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.

0730 Acute Myocardial Infarction (AMI) Mortality Rate

In-hospital deaths per 1,000 hospital discharges with acute myocardial infarction (AMI) as a principal diagnosis for patients ages 18 years and older. Excludes cases in hospice care at admission, obstetric discharges, and transfers to another hospital.

Type

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

Outcome

0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

Outcome

0730 Acute Myocardial Infarction (AMI) Mortality Rate

Outcome

Data Source

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) 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, skilled nursing facility care, some home health agency 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 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): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score.

References:

Fleming C, Fisher ES, Chang CH, Bubolz TA, Malenka DJ. 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 NQF_datadictionary_AMImortality_Fall2020_final_7.22.20.xlsx

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 NQF_datadictionary_PNreadmission_Fall2020_final_7.22.20.xlsx

0730 Acute Myocardial Infarction (AMI) Mortality Rate

Claims While the measure is tested and specified using data from the Healthcare Cost and Utilization Project (HCUP) (see section 1.1 and 1.2 of the measure testing form), the measure specifications and software are specified to be used with any ICD-9-CM-coded administrative billing/claims/discharge dataset with Present on Admission (POA) information. Note that in Version 5.0, the AHRQ QI software no longer supports prediction of POA status using an embedded prediction module. Users are expected to provide POA data.

Available at measure-specific web page URL identified in S.1 Attachment IQI_15_Acute_Myocardial_Infarction_Mortality_Rate.xlsx

Level

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

Facility

0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

Facility

0730 Acute Myocardial Infarction (AMI) Mortality Rate

Facility

Setting

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

Inpatient/Hospital

0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

Inpatient/Hospital

0730 Acute Myocardial Infarction (AMI) Mortality Rate

Hospital

Numerator Statement

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients hospitalized with a principal diagnosis of AMI.

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.

0730 Acute Myocardial Infarction (AMI) Mortality Rate

Number of deaths (DISP=20) among cases meeting the inclusion and exclusion rules for the denominator

Numerator Details

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

The measure counts all deaths (including in-hospital deaths) for any cause to any acute care hospital within 30 days of the date of the index AMI hospitalization.

Identifying deaths in the FFS measure

As currently reported, we identify deaths for FFS Medicare patients 65 years and older in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.

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:

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 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).

0730 Acute Myocardial Infarction (AMI) Mortality Rate

N/A

Denominator Statement

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

This claims-based measure is used for patients aged 65 years or older.

The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of AMI 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.

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.

0730 Acute Myocardial Infarction (AMI) Mortality Rate

Discharges, for patients ages 18 years and older, with a principal ICD-10-CM diagnosis code for AMI

Denominator Details

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria:

1. Having a principal discharge diagnosis of AMI;
2. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of the index admission and Part A during the index admission, or those who are VA beneficiaries;
3. Aged 65 or over; and
4. Not transferred from another acute care facility.

We have explicitly tested the measure for those aged 65+ years (see Testing Attachment for details).

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:

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. Not transferred from another acute care facility.

0730 Acute Myocardial Infarction (AMI) Mortality Rate

AMI diagnosis codes: (MRTAMID)

I2101   ST elevation (STEMI) myocardial infarction involving left main coronary artery

I2102   ST elevation (STEMI) myocardial infarction involving left anterior descending coronary artery

I2109   ST elevation (STEMI) myocardial infarction involving other coronary artery of anterior wall

I2111   ST elevation (STEMI) myocardial infarction involving right coronary artery

I2119 ST elevation (STEMI) myocardial infarction involving other coronary artery of inferior wall

I2121 ST elevation (STEMI) myocardial infarction involving left circumflex coronary artery

I2129 ST elevation (STEMI) myocardial infarction involving other sites

I213 ST elevation (STEMI) myocardial infarction of unspecified site

I214 Non-ST elevation (NSTEMI) myocardial infarction

I220 Subsequent ST elevation (STEMI) myocardial infarction of anterior wall

I221 Subsequent ST elevation (STEMI) myocardial infarction of inferior wall

I222 Subsequent non-ST elevation (NSTEMI) myocardial infarction

I228 Subsequent ST elevation (STEMI) myocardial infarction of other sites

I229 Subsequent ST elevation (STEMI) myocardial infarction of unspecified site

Exclusions

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

The mortality measures exclude index admissions for patients:

1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility;
2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data;
3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission; or
4. Discharged against medical advice (AMA).

For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort.

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:

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. Admitted within 30 days of a prior index admission for pneumonia.

0730 Acute Myocardial Infarction (AMI) Mortality Rate

Exclude cases transferring to another short-term hospital (DISP=2); cases in hospice care at admission (PointOFOriginUB04=F); MDC 14 (pregnancy, childbirth, and puerperium); with missing discharge disposition (DISP=missing), gender (SEX=missing), age (AGE=missing), quarter (DQTR=missing), year (YEAR=missing), or principal diagnosis (DX1=missing).

Exclusion Details

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

1. The discharge disposition indicator is used to identify patients alive at discharge. Transfers are identified in the claims when a patient with a qualifying admission is discharged from an acute care hospital and admitted to another acute care hospital on the same day or next day. Patient length of stay and condition is identified from the admission claim.

Rationale: This exclusion prevents inclusion of patients who likely did not have clinically significant AMI.

2. Inconsistent vital status or unreliable data are identified if any of the following conditions are met 1) the patient's age is greater than 115 years; 2) if the discharge date for a hospitalization is before the admission date; and 3) if the patient has a sex other than 'male' or 'female'.

Rationale: Reliable and consistent data are necessary for valid calculation of the measure.

3. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice data. This exclusion applies when the measure is used in Medicare FFS patients only.

Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care.

4. 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.

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.

0730 Acute Myocardial Infarction (AMI) Mortality Rate

N/A

Risk Adjustment

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

Statistical risk model

118210| 112469| 146637| 150289

118210| 112469| 146637| 150289

0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

Statistical risk model

141973| 112469| 146637

141973| 112469| 146637

0730 Acute Myocardial Infarction (AMI) Mortality Rate

No risk adjustment or risk stratification

130177| 132112| 138848| 138827

130177| 132112| 138848| 138827

Stratification

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

N/A

0506 Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

N/A

0730 Acute Myocardial Infarction (AMI) Mortality Rate

Not applicable

Type Score

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) 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

0730 Acute Myocardial Infarction (AMI) Mortality Rate

Rate/proportion better quality = lower score

Algorithm

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

The measure estimates hospital-level 30-day all-cause RSMRs 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 mortality 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 mortality 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 RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality.

The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. The estimated hospital-specific intercept is added 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 deaths (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 [https://qualitynet.org/inpatient/measures/mortality/methodology].

References:

1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226.

2. Krumholz H, Normand S, Galusha D, et al. Risk-Adjustment Models for AMI and HF 30-Day Mortality Methodology. 2005. 118210| 112469| 146637| 150289

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 (https://qualitynet.org/inpatient/measures/readmission/methodology).

References:

Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 141973| 112469| 146637

0730 Acute Myocardial Infarction (AMI) Mortality Rate

The observed rate is the number of discharge records where the patient experienced the QI adverse event divided by the number of discharge records at risk for the event.

Risk adjustment is available for the AHRQ QI ICD-9-CM v6.0 specifications. However, risk adjustment is not currently included in the ICD-10-CM/PCS v6.0 of the AHRQ QI specifications, due

to the transition to ICD-10-CM/PCS (October 1, 2015). At least one full year of data coded in ICD-10-CM/PCS is needed in order to develop robust risk adjustment models. A full year of ICD-10-CM/PCS coded all-payer data will not be available until mid-2017. AHRQ will announce an anticipated date as soon as one is known.

The AHRQ QI v6.0 software (SAS and WinQI) for use with ICD-10-CM/PCS produces observed rates, which may be used to evaluate performance within hospitals. However, caution should be used when comparing observed rates across hospitals because observed rates do not account for differences in patient populations (i.e., case mix). 130177| 132112| 138848| 138827

Submission items

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) 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

0468 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia 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

0229 : Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

1893 : Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

2431 : Hospital-level, risk-standardized payment associated with a 30-day episode-of-care for Acute Myocardial Infarction (AMI)

3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

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. Our measure cohort was heavily vetted by clinical experts, a technical expert panel, and a public comment period. Additionally, the measure, with the specified cohort, has been publicly reported since 2008. 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

0730 Acute Myocardial Infarction (AMI) Mortality Rate

5.1 Identified measures: 0230 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization for patients 18 and older

2473 : Hybrid hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI)

5a.1 Are specs completely harmonized? No

5a.2 If not completely harmonized, identify difference, rationale, impact: The indicators referenced above include 30-day mortality 1) for patients age 18 years and older 2) specified as an e-measure and 3) for patients age 65 and older. Inpatient mortality and 30-day mortality are different concepts, although capturing the same ultimate outcome. Harmonization is not appropriate.

5b.1 If competing, why superior or rationale for additive value: IQI 15 and the Centers for Medicare & Medicaid Services' NQF-endorsed measures concerning AMI mortality (0230 and 2473) use the same ICD-9-CM codes to identify AMI, but they differ in two important respects: (1) whereas the CMS measures concern only Medicare fee-for-service and VA beneficiaries 65 years or older, IQI 15 measures mortality among hospitalizations of patients 18 years or older at non-federal acute care hospitals for all payers; and (2) while the CMS measures evaluate 30-day mortality, IQI 15—because it is based only on UB-04 data elements—is limited to inpatient mortality. The latter difference is a potential disadvantage in that the time at risk is not uniform for all patients and 30-day mortality is typically greater than inpatient mortality, but the former difference is an advantage because IQI 15 encompasses a greater proportion of the entire population at risk. We therefore believe that #0730 complements #0230 by offering an alternative specification for users who are interested in patients of all ages and all payers, just as #2473 offers an alternative e-measure specification for those with electronic health data.

Comparison of NQF #0230, NQF #1893 and NQF #2431

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization
2431 Care Coordination

Steward

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

Centers for Medicare & Medicaid Services

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

Centers for Medicare & Medicaid Services

2431 Care Coordination

Description

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

The measure estimates a hospital-level 30-day risk-standardized mortality rate (RSMR) for patients discharged from the hospital with a principal diagnosis of AMI. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. CMS annually reports the measure for patients who are 65 years or older and are either Medicare fee-for-service (FFS) beneficiaries and hospitalized in non-federal hospitals or are hospitalized in Veterans Health Administration (VA) facilities.

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

The measure estimates a hospital-level 30-day risk-standardized mortality rate (RSMR), defined as death from any cause within 30 days after the index admission date, for patients discharged from the hospital with either a principal discharge diagnosis of COPD or a principal discharge diagnosis of respiratory failure with a secondary discharge diagnosis of acute exacerbation of COPD. 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.

2431 Care Coordination

Inpatient/Hospital

Type

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

Outcome

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

Outcome

2431 Care Coordination

Cardiovascular : Coronary Artery Disease (AMI)

Data Source

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) 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, skilled nursing facility care, some home health agency 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 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): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score.

References:

Fleming C, Fisher ES, Chang CH, Bubolz TA, Malenka DJ. 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 NQF_datadictionary_AMImortality_Fall2020_final_7.22.20.xlsx

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) 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, skilled nursing facility care, some home health agency 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 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): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score.

References:

Fleming C, Fisher ES, Chang CH, Bubolz TA, Malenka DJ. 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 NQF_datadictionary_COPDmortality_Fall2020_final_7.22.20.xlsx

2431 Care Coordination

We do not impute missing data for any of the variables included in the measure. However, if a hospitalization is missing a DRG or DRG weight, we exclude it as an index admission. Inpatient services: Inpatient facility services; Inpatient services: Evaluation and management; Inpatient services: Procedures and surgeries; Inpatient services: Imaging and diagnostic; Inpatient services: Lab services; Inpatient services: Admissions/discharges; Inpatient services: Labor (hours, FTE, etc.); Other inpatient services; Ambulatory services: Outpatient facility services; Ambulatory services: Emergency Department; Ambulatory services: Pharmacy; Ambulatory services: Evaluation and management; Ambulatory services: Procedures and surgeries; Ambulatory services: Imaging and diagnostic; Ambulatory services: Lab services; Ambulatory services: Labor (hours, FTE, etc.); Other ambulatory services; Durable Medical Equipment (DME); Other services not listed

See S.7.8 for a full list of care settings included Data Sources

Medicare Inpatient and Outpatient Administrative Claims: This data source contains claims data for FFS inpatient and outpatient services including: Medicare inpatient hospital care, outpatient hospital services, skilled nursing facility care, some home health agency services, as well as inpatient and outpatient physician claims. The 2020 reporting period for these analyses include Medicare administrative claims and enrollment information for patients with hospitalizations between July 1, 2016 and June 30, 2019. Medicare administrative claims for the 12 months prior to and during the index admission are used for risk adjustment. The period for public reporting of the AMI payment measure aligns with the 30-day AMI mortality and readmission measures for harmonization purposes.

The datasets also contain price-standardized payments for Medicare patients across all Medicare settings, services, and supplies (that is, inpatient, outpatient, SNF, home health agency, hospice, physician/clinical laboratory/ambulance services, and durable medical equipment, prosthetics/orthotics, and supplies). The CMS Standardization Methodology for Allowed Amount for 2009 through 2019 was applied to the claims to calculate the measures. Price-standardized payments for Medicare patients across all Medicare settings, services, and supplies (that is,

inpatient, outpatient, SNF, home health agency, hospice, physician/clinical laboratory/ambulance services, and durable medical equipment, prosthetics/orthotics, and supplies) were calculated using standardized methodology specific to services reimbursed through Medicare parts A and B (for specific values see https://www.resdac.org/articles/cms-price-payment-standardization-overview).

Medicare Enrollment Database (EDB)

This database contains Medicare beneficiary demographic, benefit/coverage, and vital status information. This dataset was used to obtain information on enrollment, date of birth, and post-discharge mortality status. These data have previously been shown to accurately reflect patient vital status (Fleming et al. 1992).

Medicare Fee Schedules

Fee schedules are lists of pre-determined reimbursement amounts for certain services and supplies (e.g. physician services, independent clinical labs, ambulance services, durable medical equipment) and are used by Medicare in the calculation of payment to providers. We used the applicable fee schedules when calculating payments for claims that occurred in each care setting.

Federal Register Final Rules for Medicare Prospective Payment Systems and Payment Policies

Certain data necessary to calculate payments (e.g. annual base payments and conversion factors, DRG weights, wage indexes, and average length of stay) were taken from applicable Federal Register Final Rules.

CMS-published Wage Index Data

Wage index data not published in Federal Register Final Rules (such as the wage index data for Renal Dialysis Facilities) were obtained through the CMS website.

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, E., Chang, C., Bubolz, T., & Malenka, D. (1992). Studying Outcomes and Hospital Utilization in the Elderly: The Advantages of a Merged Data Base for Medicare and Veterans Affairs Hospitals. Medical Care, 30(5), 377-391.

Level

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

Facility

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

Facility

2431 Care Coordination

See S.7.8 for a full list of care settings included

Setting

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

Inpatient/Hospital

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

Inpatient/Hospital

2431 Care Coordination

See S.7.8 for a full list of care settings included To estimate payments for a 30-day episode of care for AMI we included payments for all care settings, services, and supplies, except drugs covered under Part D Medicare claims. We did not include Part D since a large proportion of Medicare beneficiaries are not enrolled in Part D and there is variation in enrollment status across and within states. Including payments for Part D services would thus bias payments upwards for hospitals with high Part D enrollment. By following patients through an episode of care for AMI, CMS and hospitals can gain key insights into the drivers of payments and how practice patterns vary across providers.

We include payments for the following care settings below in the measure:

Inpatient hospital facility and physician

Outpatient hospital facility and physician

Skilled nursing facility and physician

Hospice facility and physician

Home health facility and physician

Inpatient psychiatric facility and physician

Inpatient rehab facility and physician

Long-term care hospital facility

Clinical labs facility and physician

Comprehensive outpatient rehab facility and physician

Outpatient rehab facility and physician

Renal dialysis facility and physician

Community mental health centers facility and physician

DME/POS/PEN

Observation stay facility

Part B drugs

Ambulance and ambulance physician

Emergency department facility and physician

Physician office

Federally qualified health centers facility and physician

Rural health clinics facility and physician

Ambulatory surgical centers facility and physician

We also include physician payments for the following care settings:

Indian health service free-stand facility

Indian health service provider facility

Tribal free-standing facility

Tribal facility

Military treatment facility

Independent clinic

State or local health clinic

Mass immunization center

Walk-in retail health clinic

Urgent care facility

Unassigned

Pharmacy

School

Homeless Shelter

Prison

Group Home

Mobile Unit

Temporary Lodging

Birthing Center

Intermediary Care/Mentally Retarded

Residential Substance Abuse

Psychiatric Residential Facility

Non-Residential Substance Abuse

Other Physician

Other carrier claims with HCPCS codes P9603 or P9604

In order to determine how to assign claims, we examine the place of service code for physician claims and a combination of claim type and facility type codes to determine the facility in which care was provided. Depending on the facility and physician codes we standardize payments differently. Information on how we standardize claims can be found in the methodology report available here: https://qualitynet.cms.gov/files/5d0d398a764be766b01038ea?filename=AMI_Pymnt_Mthdlgy_Rp rt.pdf

Numerator Statement

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients hospitalized with a principal diagnosis of AMI.

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients hospitalized with either a principal diagnosis of COPD or a principal diagnosis of respiratory failure with a secondary diagnosis of acute exacerbation of COPD.

2431 Care Coordination

Numerator Details

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

The measure counts all deaths (including in-hospital deaths) for any cause to any acute care hospital within 30 days of the date of the index AMI hospitalization.

Identifying deaths in the FFS measure

As currently reported, we identify deaths for FFS Medicare patients 65 years and older in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

The measure counts all deaths (including in-hospital deaths) for any cause within 30 days of the date of the index COPD admission.

Identifying deaths in the FFS measure

As currently reported, we identify deaths for FFS Medicare patients 65 years and older in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.

2431 Care Coordination

Denominator Statement

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

This claims-based measure is used for patients aged 65 years or older.

The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of AMI 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.

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

This claims-based measure is used for a cohort of patients aged 65 years or older.

The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of COPD 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.

2431 Care Coordination

This measure estimates hospital-level, risk-standardized payments for a 30-day episode of care for AMI. To this end, we constructed a cohort of AMI patients by examining the principal discharge diagnosis in administrative claims data. Specifically, we included Medicare fee-for-service patients 65 or older with a principal discharge diagnosis of an AMI (defined by ICD-10 codes in attached data dictionary). We then applied several exclusion criteria as detailed in S.9.1.

Once our cohort was finalized we examined all payments for these patients (including co-pays, co-insurance, and deductibles) that occurred within 30 days of the index admission. We included payments for all care settings, except Part D Medicare claims. We standardized payments across providers by removing or averaging geographic differences and removing policy adjustments from the total payment for that service. These payments were then assigned to the initial admitting hospital. As part of our model, we risk adjusted these payments for patient comorbidities listed in outpatient and inpatient claims in the 12 months prior to the index admission as well as the secondary diagnoses included in the index admission. We then used hierarchical generalized linear regression models to calculate a risk-standardized payment for each hospital.

Denominator Details

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria:

1. Having a principal discharge diagnosis of AMI;
2. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of the index admission and Part A during the index admission, or those who are VA beneficiaries;
3. Aged 65 or over; and
4. Not transferred from another acute care facility.

We have explicitly tested the measure for those aged 65+ years (see Testing Attachment for details).

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria:

1. Principal discharge diagnosis of COPD or a principal discharge diagnosis of respiratory failure with a secondary discharge diagnosis of acute exacerbation of COPD
2. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of the index admission and Part A during the index admission, or those who are VA beneficiaries
3. Aged 65 or over
4. Not transferred from another acute care facility.

This measure can also be used for an all-payer population aged 40 years and older. We have explicitly tested the measure in both patients aged 40+ years and those aged 65+ years (see Testing Attachment for details).

2431 Care Coordination

To construct the measure, we use Medicare administrative claims data. These data contain claims for all care settings, supplies, and services as outlined in Section S.7.8. (except Part D). Claim payment data are organized by the setting, supply, or service in which they were rendered. Standard Medicare payment rates were assigned to each service based on claim type, facility type, and place of service codes. These payments are then summed by individual patients. To create a hospital-level measure, we aggregate the payments for all eligible patients at each hospital.

Exclusions

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

The mortality measures exclude index admissions for patients:

1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility;
2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data;
3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission; or
4. Discharged against medical advice (AMA).

For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort.

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

The mortality measures exclude index admissions for patients:

1. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data;
2. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission; or
3. Discharged against medical advice (AMA).

For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort for each year.

2431 Care Coordination

URL

Exclusion Details

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

1. The discharge disposition indicator is used to identify patients alive at discharge. Transfers are identified in the claims when a patient with a qualifying admission is discharged from an acute care hospital and admitted to another acute care hospital on the same day or next day. Patient length of stay and condition is identified from the admission claim.

Rationale: This exclusion prevents inclusion of patients who likely did not have clinically significant AMI.

2. Inconsistent vital status or unreliable data are identified if any of the following conditions are met 1) the patient's age is greater than 115 years; 2) if the discharge date for a hospitalization is before the admission date; and 3) if the patient has a sex other than 'male' or 'female'.

Rationale: Reliable and consistent data are necessary for valid calculation of the measure.

3. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice data. This exclusion applies when the measure is used in Medicare FFS patients only.

Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care.

4. 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.

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

1. Inconsistent vital status or unreliable data are identified if any of the following conditions are met 1) the patient's age is greater than 115 years: 2) if the discharge date for a hospitalization is before the admission date; 3) if the patient has a sex other than 'male' or 'female'.

Rationale: Reliable and consistent data are necessary for valid calculation of the measure.

2. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice data.

Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care.

3. 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.

2431 Care Coordination

https://qualitynet.cms.gov/files/5d0d398a764be766b01038ea?filename=AMI_Pymnt_Mthdlgy_Rprt.pdf

Risk Adjustment

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

Statistical risk model

118210| 112469| 146637| 150289

118210| 112469| 146637| 150289

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

Statistical risk model

112469| 118210| 146637| 150289

112469| 118210| 146637| 150289

2431 Care Coordination

118210| 112469| 135810| 146637| 141015| 146313

118210| 112469| 135810| 146637| 141015| 146313

Stratification

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

N/A

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

N/A

2431 Care Coordination

Type Score

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

Rate/proportion better quality = lower score

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

Rate/proportion better quality = lower score

2431 Care Coordination

This measure examines payments for a 30-day episode of care beginning with an admission for AMI and extending to 30-days post-admission. We determine if a patient has an AMI by examining the principal discharge diagnosis code in the administrative data. If a patient has a principal discharge diagnosis of any other condition, even if this includes a secondary diagnosis of AMI, this admission is not considered as an index admission. Therefore, the concurrency of clinical events is not an issue when determining what triggers the episode of care. Once, an episode is triggered, however, we include payments for all care settings, except Part D Medicare claims. The model risk adjusts for comorbidities listed in outpatient and inpatient claims in the 12 months prior to the index admission as well as the secondary diagnoses included in the index admission that are not considered complications of care. The measure includes payments for all care settings, except Part D, that occur during the 30-day window. If a claim for a complimentary service was filed in the study window, then it would be included in the measure.

Algorithm

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

The measure estimates hospital-level 30-day all-cause RSMRs 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 mortality 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 mortality 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 RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality.

The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. The estimated hospital-specific intercept is added 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 deaths (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 [https://qualitynet.org/inpatient/measures/mortality/methodology].

References:

1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226.

2. Krumholz H, Normand S, Galusha D, et al. Risk-Adjustment Models for AMI and HF 30-Day Mortality Methodology. 2005. 118210| 112469| 146637| 150289

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

The measure estimates hospital-level 30-day all-cause RSMRs following hospitalization for COPD 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 mortality 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 mortality 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 RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality.

The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. The estimated hospital-specific intercept is added 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 deaths (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: https://qualitynet.org/inpatient/measures/mortality/methodology.

References:

1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226. 112469| 118210| 146637| 150289

2431 Care Coordination

118210| 112469| 135810| 146637| 141015| 146313

Submission items

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) 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

0468 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia 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

0229 : Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

1893 : Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

2431 : Hospital-level, risk-standardized payment associated with a 30-day episode-of-care for Acute Myocardial Infarction (AMI)

3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

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. Our measure cohort was heavily vetted by clinical experts, a technical expert panel, and a public comment period. Additionally, the measure, with the specified cohort, has been publicly reported since 2008. 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

1893 Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

5.1 Identified measures: 0468 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia hospitalization

0506 : Hospital 30-day, All-Cause, Risk-Standardized Readmission Rate (RSRR) Following Pneumonia Hospitalization

0275 : Chronic Obstructive Pulmonary Disease (COPD) or Asthma in Older Adults Admission Rate (PQI 05)

1891 : Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following chronic obstructive pulmonary disease (COPD) hospitalization

2888 : Accountable Care Organization Risk-Standardized Acute Hospital Admission Rate for Patients with Multiple Chronic Conditions

3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

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. Our measure cohort was heavily vetted by clinical experts, a technical expert panel, and a public comment period. Additionally, the measure, with the specified cohort, has been publicly reported since 2008. 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

2431 Care Coordination

5.1 Identified measures: As part of the measure methodology we compare payments for a hospital with the expected payment amounts for an average hospital with the same case mix. While we include all hospitals when estimating the risk-adjustment model, we do not report RSPs for hospitals with fewer than 25 AMI admissions, since estimates for hospitals with fewer procedures are less reliable and CMS's past approach to public reporting has been not to report these results.

5a.1 Are specs completely harmonized? Comparative estimates are provided by classifying hospitals as less than average, no different than average, or greater than average payment depending on the span of their confidence interval in comparison with the national average payment amount (i.e., the benchmark). To categorize hospital payments, we estimate each hospital's RSP and the corresponding 95% interval estimate. As with all estimates, there is a degree of uncertainty associated with the RSP. The interval estimate is a range of probable values around the RSP that characterizes the amount of uncertainty associated with the estimate. A 95% interval estimate indicates that there is 95% probability that the true value of the RSP lies between the lower limit and the upper limit of the interval. In an effort to provide fair comparisons, we provide three categories (less than, no different than, or greater than the national average payment amount), which allows for conservative discrimination of hospital RSPs.

5a.2 If not completely harmonized, identify difference, rationale, impact:

5b.1 If competing, why superior or rationale for additive value:

Comparison of NQF #0230, NQF #3502 and NQF #3504

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Steward

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

Centers for Medicare & Medicaid Services

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Centers for Medicare & Medicaid Services

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Centers for Medicare & Medicaid Services

Description

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

The measure estimates a hospital-level 30-day risk-standardized mortality rate (RSMR) for patients discharged from the hospital with a principal diagnosis of AMI. Mortality is defined as death for any cause within 30 days after the date of admission for the index admission. CMS annually reports the measure for patients who are 65 years or older and are either Medicare fee-for-service (FFS) beneficiaries and hospitalized in non-federal hospitals or are hospitalized in Veterans Health Administration (VA) facilities.

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

The measure estimates a hospital-level 30-day risk-standardized mortality rate (RSMR), defined as death from any cause within 30 days after the index admission date for patients who are between the ages of 50 and 94.

Please note that in parallel with the hybrid HWM measure, we are submitting a claims-only HWM measure. Note that ultimately the claims and hybrid measures will be harmonized and use the same exact cohort specifications. The intent is that prior to implementation, the two measures will be exactly the same, with the exception of the additional risk adjustment added by the CCDE in the hybrid measure. This is analogous to the currently endorsed and implemented hybrid hospital-wide readmissions measure (NQF 1789 and NQF 2879e).

Because of the homology between the claims and hybrid HWM measures, there is no reason to suspect that the results of analyses done for the claims-only measure would differ in any significant way from results of analyses for a nationally representative hybrid measure.

Below we highlight the differences between the two measures, including specifications, data used, and testing which reflect limitations of data availability, as well as actual intended differences in the measure (risk adjustment).

Differences in the measure, data, and testing that reflect limitations in data availability

1. Dataset used for development, some testing (see below for differences), and measure results:
a. The claims-only measure uses nation-wide Medicare FFS claims and the enrollment database.
b. The hybrid measure uses an electronic health record (EHR) database from 21 hospitals in the Kaiser Permanente network which includes inpatient claims data information.
2. Age of patients in cohort:
a. The claims-only measure includes Medicare FFS patients, age 65-94.
b. The hybrid measure includes all patients age 50-94 (see later discussion for justification)
3. External empiric validity testing
a. Not possible for the hybrid measure, due to limited data availability. We provide results from the claims-only measure within the hybrid testing form.
4. Socioeconomic risk factor analyses
a. Not possible for the hybrid measure, due to limited data availability. We provide results from the claims-only measure within the hybrid testing form.
5. Exclusion analyses
a. To be representative of what we expect the impact would be of the measures' exclusions in a nation-wide sample, we provide the results from the claims-only measure.

6. Meaningful differences

a. To be representative of what we expect the range of performance would be in a nation-wide sample, we provide the distribution results from the claims-only measure.

Difference between the two measures when fully harmonized, prior to implementation:

1. Risk adjustment:

a. The claims-only measure uses administrative claims data only for risk adjustment

b. The hybrid measure adds 10 clinical risk variables, derived from a set of core clinical data elements (CCDE) extracted from the EHR.

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

The measure estimates a hospital-level 30-day hospital-wide risk-standardized mortality rate (RSMR), defined as death from any cause within 30 days after the index admission date, for Medicare fee-for-service (FFS) patients who are between the ages of 65 and 94.

Please note that in parallel with the claims-only HWM measure, we are submitting a hybrid HWM measure. Note that ultimately the claims and hybrid measures will be harmonized and use the same exact cohort specifications. The intent is that prior to implementation, the two measures will be exactly the same, with the exception of the additional risk adjustment added by the CCDE in the hybrid measure. This is analogous to the currently endorsed and implemented hybrid hospital-wide readmissions measure (NQF 1789 and NQF 2879e).

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1. Dataset used for development, some testing (see below for differences), and measure results:

a. The claims-only measure uses nation-wide Medicare FFS claims and the enrollment database.

b. The hybrid measure uses an electronic health record (EHR) database from 21 hospitals in the Kaiser Permanente network which includes inpatient claims data information.

2. Age of patients in cohort:

a. The claims-only measure includes Medicare FFS patients, age 65-94.

b. The hybrid measure includes all patients age 50-94 (see later discussion for justification)

3. External empiric validity testing

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4. Socioeconomic risk factor analyses

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a. To be representative of what we expect the impact would be of the measures' exclusions in a nation-wide sample, we provide the results from the claims-only measure.

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Difference between the two measures when fully harmonized, prior to implementation:

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a. The claims-only measure uses administrative claims data only for risk adjustment

b. The hybrid measure adds 10 clinical risk variables, derived from a set of core clinical data elements (CCDE) extracted from the EHR.

Type

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

Outcome

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Outcome

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Outcome

Data Source

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) 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, skilled nursing facility care, some home health agency 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 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): The American Community Survey data is collected annually and an aggregated 5-years data were used to calculate the Agency for Healthcare Research and Quality (AHRQ) Socioeconomic Status (SES) composite index score.

References:

Fleming C, Fisher ES, Chang CH, Bubolz TA, Malenka DJ. 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 NQF_datadictionary_AMImortality_Fall2020_final_7.22.20.xlsx

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Claims, Electronic Health Records, Other Clinical-Hybrid Dataset

Constructed using Kaiser Permanente Northern California matched administrative claims and electronic health record (EHR) data, admission dates from October 1, 2015 – December 30, 2016. This data source was used for measure testing. (An earlier Kaiser dataset from that included all admissions for adult patients to any of their member hospitals between January 1, 2009 and June 30, 2015 was used for measure development, as described in the attached methodology report).

The two data sources listed below were used for testing the claims-based measure; the hybrid testing form includes some testing data from the claims-based measure (for example, for the social risk factor and external validation analyses).

HWM claims-only datasets:

Medicare Part A Inpatient Claims Data

The index dataset contains administrative inpatient hospitalization data for Medicare FFS beneficiaries, aged 65-94 on admission. The history dataset includes administrative inpatient hospitalization data on each patient for the 12 months prior to the index admission. This data was used along with the Medicare Enrollment Database (EDB) for testing the claims-based measure.

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. It was also used to determine hospice enrollment.

No data collection instrument provided Attachment Del18b2HOP5HWMHybridDataDictionary01072019.xlsx

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Claims, Enrollment Data, Other Data sources for the Medicare FFS measure:

1. Medicare Part A Inpatient: The index dataset contains administrative inpatient hospitalization data for Medicare FFS beneficiaries, aged 65-94 on admission, hospitalized from July 1, 2016-June 30, 2017. The history dataset includes administrative inpatient hospitalization data on each patient for the 12 months prior to the index admission.

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 as well as vital status. It was also used to determine hospice enrollment.

No data collection instrument provided Attachment Del18b1HOP5HWMClaimsDataDictionary01072019.xlsx

Level

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

Facility

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Facility

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Facility

Setting

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

Inpatient/Hospital

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Inpatient/Hospital, Other Home-based primary care and home-based palliative care); Settings include: Home, Boarding home, Domiciliary, Assisted Living Facilities, Rest Home or Custodial Care Services

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Inpatient/Hospital

Numerator Statement

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days from the date of admission for patients hospitalized with a principal diagnosis of AMI.

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

The outcome for this measure is 30-day, all-cause mortality. Mortality is defined as death from any cause, either during or after admission, within 30 days of the index admission date.

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

The outcome for this measure is 30-day, all-cause mortality. Mortality is defined as death from any cause, either during or after admission, within 30 days of the index admission date.

Numerator Details

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

The measure counts all deaths (including in-hospital deaths) for any cause to any acute care hospital within 30 days of the date of the index AMI hospitalization.

Identifying deaths in the FFS measure

As currently reported, we identify deaths for FFS Medicare patients 65 years and older in the Medicare Enrollment Database (EDB) and for VA patients in the VA data.

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

The measure outcome is death from any cause within 30 days of the admission date of the index admission. The numerator is a binary variable (1=yes/0=no) that indicates whether the patient died within 30 days of the index admission date.

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

The measure outcome is death from any cause within 30 days of the admission date of the index admission, for Medicare FFS patients identified using the Medicare Enrollment Database (EDB). The numerator is a binary variable (1=yes/0=no) that indicates whether the patient died within 30 days of the index admission date.

Denominator Statement

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

This claims-based measure is used for patients aged 65 years or older.

The cohort includes admissions for patients aged 65 years and older discharged from the hospital with a principal discharge diagnosis of AMI 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.

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

The cohort includes inpatient admissions for a wide variety of conditions for patients aged between 50 and 94 years old who were discharged from short-term acute care hospitals. If a patient has more than one admission during the measurement year, one admission is randomly selected for inclusion in the measure. Additional details are provided in S.7 Denominator Details. The age range for this measure differs from that of the claims-only measure due to the limited size of the dataset used for testing. The intent is to harmonize the age range of the hybrid measure with the age range of the claims-only measure, so that both will include admissions for patients age 65-94.

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

The cohort includes inpatient admissions for a wide variety of conditions for Medicare FFS patients aged between 65 and 94 years old who were admitted to short-term acute care hospitals. If a patient has more than one admission during the measurement year, one admission is randomly selected for inclusion in the measure. Additional details are provided in S.7 Denominator Details.

Denominator Details

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

To be included in the measure cohort used in public reporting, patients must meet the following inclusion criteria:

1. Having a principal discharge diagnosis of AMI;
2. Enrolled in Medicare fee-for-service (FFS) Part A and Part B for the 12 months prior to the date of the index admission and Part A during the index admission, or those who are VA beneficiaries;

3. Aged 65 or over; and

4. Not transferred from another acute care facility.

We have explicitly tested the measure for those aged 65+ years (see Testing Attachment for details).

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

The index cohort includes all inpatient admissions for patients aged 50-94 years old. (Note: The intention is to fully harmonize the cohort definition with the claims-only measure so that both measures will capture admissions for patients age 65-94. We deviated from that definition during development and testing due to the limited dataset available that included the EHR data elements needed to calculate this measure. Note that the risk model already includes age in years, as a risk variable.)

An index admission is the hospitalization to which the mortality outcome is attributed and includes admissions for patients:

1. Not transferred from another acute care facility

Rationale: Admissions to an acute cate hospital within one day of discharge from another acute care hospital are considered transfers. Transferred patients are included in the measure cohort, but it is the initial hospitalization rather than any "transfer-in" hospitalization(s), that is included as the hospitalization to which the mortality outcome is attributed (the index admission).

2. Aged between 50 and 94 years

The hybrid measure is intended for the Medicare FFS population but was tested in a limited dataset due to the EHR data elements included. The use of a small dataset required that we expand the sample by including admissions from patients ages 50 to 94 years. Note that the measure already adjusts for age.

3. Not admitted for primary psychiatric diagnoses

Rationale: Patients admitted for psychiatric treatment are typically cared for in separate psychiatric facilities that are not comparable to short-term acute care hospitals (see data dictionary, HWM Non-Acute Care Inclusion tab).

4. Not admitted for rehabilitation

Rationale: These admissions are not typically to a short-term acute care hospital and are not for acute care (see data dictionary, HWM Non-Acute Care Inclusion tab).

5. Not enrolled in hospice at the time of, or 12 months prior to, their index admission

Rationale: Patients enrolled in hospice in the prior 12 months or at the time of admission are unlikely to have 30-day survival as a primary goal

6. Not enrolled in hospice within two days of admission

Rationale: There is not a single, correct approach regarding patients enrolled in hospice during admission or upon discharge – mortality may or may not represent a quality signal for this group of patients and hospice enrollment is inadequate to differentiate this issue. However, for most patients and/or families who had the discussion and agreed to enroll in hospice within two days of admission, 30-day survival is not likely the primary goal due to their condition and not the quality of care received.

7. Not with a principal diagnosis of cancer and enrolled in hospice during their index admission

Rationale: Patients admitted primarily for cancer who are enrolled in hospice during admission are unlikely to have 30-day survival as a primary goal of care. (see data dictionary, HWM Cancer Inclusion tab).

8. Without any diagnosis of metastatic cancer

Rationale: Although some patients admitted with a diagnosis of metastatic cancer will have 30-day survival as a primary goal of care, for many such patients admitted to the hospital, death may be a clinically reasonable and patient-centered outcome. (see data dictionary, HWM Metastatic Cancer Inclusion tab).

9. Not with a principal discharge diagnosis, or a secondary diagnosis that is present on admission (POA) for a condition which hospitals have limited ability to influence survival

Rationale: Hospitals have little ability to impact mortality for some conditions. This list of conditions (see data dictionary, HWM ICD-10 Inclusion tab) was determined through independent review, by several clinicians, of conditions associated with high mortality. The decisions were also reviewed with our Technical Expert Panel (TEP) and Technical Work Group. Admissions are not included in the cohort if the patient had a principal diagnosis code that is on this list, or a secondary code with POA that is on the list.

In addition, for patients with multiple admissions, the measure selects only one admission, at random, for inclusion. There is no practical statistical modeling approach that can account or adjust for the complex relationship between the number of admissions and risk of mortality in the context of a hospital-wide mortality measure. Random selection ensures that providers are not penalized for a "last" admission during the measurement period; selecting the last admission would not be as accurate a reflection of the risk of death as random selection, as the last admission is inherently associated with a higher mortality risk. Random selection is also used in CMS's condition-specific mortality measures. Note that random selection reduces the number of admissions, but does not exclude any patients from the measure.

The cohort is defined using ICD-10 Clinical Modification codes identified in Medicare Part A Inpatient claims data. The measure aggregates the ICD-10 principal diagnosis and all procedure codes of the index admission into clinically coherent groups of conditions and procedures (condition categories or procedure categories) using the Agency for Healthcare Research and Quality (AHRQ) Clinical Classifications System (CCS). There is a total of 285 mutually exclusive AHRQ condition categories, most of which are single, homogenous diseases such as pneumonia or acute myocardial infarction. Some are aggregates of conditions, such as "other bacterial infections". There is a total of 231 mutually exclusive procedure categories. Using the AHRQ CCS procedure and condition categories, the measure assigns each index hospitalization to one of 15 mutually exclusive divisions. The divisions were created based upon clinical coherence, consistency of mortality risk, adequate patient and hospital case volume for stable results reporting, and input from clinicians, patients, and patient caregivers on usability.

The measure first assigns admissions with qualifying AHRQ procedure categories to one of six surgery divisions by identifying a defining surgical procedure. The defining surgical procedure is identified using the following algorithm: 1) if a patient only has one major surgical procedure then that procedure is the defining surgical procedure; 2) if a patient has more than one major surgical procedure, the first dated procedure performed during the index admission is the defining surgical procedure; 3) if there is more than one major surgical procedure on that earliest date, the procedure with the highest mortality rate is the defining surgical procedure. These divisions include admissions likely cared for by surgical teams.

The surgical divisions are: Surgical Cancer (see note below), Cardiothoracic Surgery, General Surgery, Neurosurgery, Orthopedic Surgery, and Other Surgical Procedures.

For the Surgical Cancer division, any admission that includes a surgical procedure and a principal discharge diagnosis code of cancer is assigned to the Surgical Cancer division. This division and the logic behind it was implemented in response to feedback from our Technical Expert Panel.

The measure then assigns the remaining admissions into one of the nine non-surgical divisions based on the AHRQ diagnostic CCS of the principal discharge diagnosis. The non-surgical divisions are: Cancer, Cardiac, Gastrointestinal, Infectious Disease, Neurology, Orthopedic, Pulmonary, Renal, Other Conditions.

The full list of the specific diagnosis and procedure AHRQ CCS categories used to define the divisions are attached in the Data Dictionary.

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

An index admission is the hospitalization to which the mortality outcome is attributed and includes admissions for patients:

1. Enrolled in Medicare FFS Part A for at least 12 months prior to the date of admission and during the index admission

Rationale: Claims data are consistently available only for Medicare FFS beneficiaries. The 12-month prior enrollment criterion ensures a full year of administrative data is available for risk adjustment.

2. Not transferred from another acute care facility

Rationale: Admissions to an acute cate hospital within one day of discharge from another acute care hospital are considered transfers. Transferred patients are included in the measure cohort, but it is the initial hospitalization rather than any "transfer-in" hospitalization(s), that is included as the hospitalization to which the mortality outcome is attributed (the index admission).

3. Aged between 65 and 94 years

Rationale: Medicare patients younger than 65 are not included in the measure because they usually qualify for the program due to severe disability and are considered to be clinically distinct from Medicare patients 65 and over. Patients over age 94 are not included to avoid holding hospitals responsible for the survival of the very elderly patients, who may be less likely to have survival as a primary goal.

Note that the hybrid measure (submitted for NQF endorsement in parallel with the claims-only measure) differs from the claims-only measure in terms of the age range of included admissions; the hybrid measure includes all inpatient admissions for patients aged 50-94 years old. The intention is to fully harmonize the cohort definitions for the two measures, so that both measures will capture admissions for patients age 65-94. We deviated from that definition during development and testing for the hybrid measure due to the limited dataset available that included the EHR data elements needed to calculate the hybrid measure. Note that the risk model already includes age in years, as a risk variable.)

4. Not admitted for primary psychiatric diagnoses

Rationale: Patients admitted for psychiatric treatment are typically cared for in separate psychiatric facilities that are not comparable to short-term acute care hospitals (see data dictionary, HWM Non-Acute Care Inclusion tab).

5. Not admitted for rehabilitation

Rationale: These admissions are not typically to a short-term acute care hospital and are not for acute care (see data dictionary, HWM Non-Acute Care Inclusion tab).

6. Not enrolled in hospice at the time of, or 12 months prior to, their index admission

Rationale: Patients enrolled in hospice in the prior 12 months or at the time of admission are unlikely to have 30-day survival as a primary goal.

7. Not enrolled in hospice within two days of admission

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Rationale: Hospitals have little ability to impact mortality for some conditions. This list of conditions (see data dictionary, HWM ICD-10 Inclusion tab) was determined through independent review, by several clinicians, of conditions associated with high mortality. The decisions were also reviewed with our Technical Expert Panel (TEP) and Technical Work Group. Admissions are not included in the cohort if the patient had a principal diagnosis code that is on this list, or a secondary code with POA that is on the list.

In addition, for patients with multiple admissions, the measure selects only one admission, at random, for inclusion. There is no practical statistical modeling approach that can account or adjust for the complex relationship between the number of admissions and risk of mortality in the context of a hospital-wide mortality measure. Random selection ensures that providers are not penalized for a "last" admission during the measurement period; selecting the last admission would not be as accurate a reflection of the risk of death as random selection, as the last admission is inherently associated with a higher mortality risk. Random selection is also used in CMS's condition-specific mortality measures. Note that random selection reduces the number of admissions, but does not exclude any patients from the measure.

The cohort is defined using ICD-10 Clinical Modification codes identified in Medicare Part A Inpatient claims data. The measure aggregates the ICD-10 principal diagnosis and all procedure codes of the index admission into clinically coherent groups of conditions and procedures (condition categories or procedure categories) using the Agency for Healthcare Research and Quality (AHRQ) Clinical Classifications System (CCS). There is a total of 285 mutually exclusive AHRQ condition categories, most of which are single, homogenous diseases such as pneumonia or

acute myocardial infarction. Some are aggregates of conditions, such as "other bacterial infections". There is a total of 231 mutually exclusive procedure categories. Using the AHRQ CCS procedure and condition categories, the measure assigns each index hospitalization to one of 15 mutually exclusive divisions. The divisions were created based upon clinical coherence, consistency of mortality risk, adequate patient and hospital case volume for stable results reporting, and input from clinicians, patients, and patient caregivers on usability.

The measure first assigns admissions with qualifying AHRQ procedure categories to one of six surgery divisions by identifying a defining surgical procedure. The defining surgical procedure is identified using the following algorithm: 1) if a patient only has one major surgical procedure then that procedure is the defining surgical procedure; 2) if a patient has more than one major surgical procedure, the first dated procedure performed during the index admission is the defining surgical procedure; 3) if there is more than one major surgical procedure on that earliest date, the procedure with the highest mortality rate is the defining surgical procedure. These divisions include admissions likely cared for by surgical teams.

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The full list of the specific diagnosis and procedure AHRQ CCS categories used to define the divisions are attached in the Data Dictionary.

Exclusions

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

The mortality measures exclude index admissions for patients:

1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility;
2. With inconsistent or unknown vital status or other unreliable demographic (age and gender) data;
3. Enrolled in the Medicare hospice program or used VA hospice services any time in the 12 months prior to the index admission, including the first day of the index admission; or
4. Discharged against medical advice (AMA).

For patients with more than one admission for a given condition in a given year, only one index admission for that condition is randomly selected for inclusion in the cohort.

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

The measure excludes index admissions for patients:

1. With inconsistent or unknown vital status (from claims data) or other unreliable claims data;
2. Discharged against medical advice (AMA);

3. With an admission for spinal cord injury (CCS 227), skull and face fractures (CCS 228), Intracranial Injury (CCS 233), Crushing injury or internal injury (CCS 234), Open wounds of head/neck/trunk (CCS 235), and burns (CCS 240); and

4. With a principal discharge diagnosis within a CCS with fewer than 100 admissions in that division within the measurement year.

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

The measure excludes index admissions for patients:

1. With inconsistent or unknown vital status (from claims data) or other unreliable claims data;

2. Discharged against medical advice (AMA);

3. With an admission for spinal cord injury (CCS 227), skull and face fractures (CCS 228), Intracranial Injury (CCS 233), Crushing injury or internal injury (CCS 234), Open wounds of head/neck/trunk (CCS 235), and burns (CCS 240); and

4. With a principal discharge diagnosis within a CCS with fewer than 100 admissions within the measurement year.

Exclusion Details

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

1. The discharge disposition indicator is used to identify patients alive at discharge. Transfers are identified in the claims when a patient with a qualifying admission is discharged from an acute care hospital and admitted to another acute care hospital on the same day or next day. Patient length of stay and condition is identified from the admission claim.

Rationale: This exclusion prevents inclusion of patients who likely did not have clinically significant AMI.

2. Inconsistent vital status or unreliable data are identified if any of the following conditions are met 1) the patient's age is greater than 115 years; 2) if the discharge date for a hospitalization is before the admission date; and 3) if the patient has a sex other than 'male' or 'female'.

Rationale: Reliable and consistent data are necessary for valid calculation of the measure.

3. Hospice enrollment in the 12 months prior to or on the index admission is identified using hospice data. This exclusion applies when the measure is used in Medicare FFS patients only.

Rationale: These patients are likely continuing to seek comfort measures only; thus, mortality is not necessarily an adverse outcome or signal of poor quality care.

4. 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.

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

1. With inconsistent or unknown vital status (from claims data) or other unreliable claims data.

Rationale: The measure does not include stays for patients where the admission date is after the date of death, or where the date of death occurs before the date of discharge but the patient was discharged alive because these are likely errors in the data.

2. Discharged against medical advice (AMA)

Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.

3. With an admission for spinal cord injury (CCS 227), skull and face fractures (CCS 228), Intracranial Injury (CCS 233), Crushing injury or internal injury (CCS 234), Open wounds of head/neck/trunk (CCS 235), and burns (CCS 240).

Rationale: Even though a hospital likely can influence the outcome of some of these conditions, in many cases death events are not a signal of poor quality of care when patients present with these conditions. These conditions are also infrequent events that are unlikely to be uniformly distributed across hospitals.

4. With a principal discharge diagnosis within a CCS with fewer than 100 admissions in that division within the measurement year.

Rationale: To calculate a stable and precise risk model, there are a minimum number of admissions that are needed. In addition, a minimum number of admissions and/or outcome events are required to inform grouping admissions into larger categories. These admissions present challenges to both accurate risk prediction and coherent risk grouping and are therefore excluded.

Note: During measure development we analyzed different volume cut-offs (25, 50 and 100). Using cut-off values below 100 resulted in too many CCS codes in some of the divisions (the CCS category codes are used in risk adjustment) which resulted in non-convergence of those division-level risk models. The total number of patients excluded is very small (13,597 or 0.21% of admissions for a cut off of 100). During measure development we also explored the option of pooling low-volume CCS codes (CCS<100 patients) into one group, however, the heterogeneity in mortality rates for the individual ICD-10 codes in those groups would preclude adequate risk adjustment. The TEP supported excluding these admissions.

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

1. With inconsistent or unknown vital status (from claims data) or other unreliable claims data

Rationale: The measure does not include stays for patients where the admission date is after the date of death in the Medicare Enrollment Database, or where the date of death occurs before the date of discharge but the patient was discharged alive because these are likely errors in the data.

2. Discharged against medical advice (AMA)

Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.

3. With an admission for spinal cord injury (CCS 227), skull and face fractures (CCS 228), Intracranial Injury (CCS 233), Crushing injury or internal injury (CCS 234), Open wounds of head/neck/trunk (CCS 235), and burns (CCS 240)

Rationale: Even though a hospital likely can influence the outcome of some of these conditions, in many cases death events are not a signal of poor quality of care when patients present with these conditions. These conditions are also infrequent events that are unlikely to be uniformly distributed across hospitals.

4. With a principal discharge diagnosis within a CCS with fewer than 100 admissions in that division within the measurement year.

Rationale: To calculate a stable and precise risk model, there are a minimum number of admissions that are needed. In addition, a minimum number of admissions and/or outcome events are required to inform grouping admissions into larger categories. These admissions present challenges to both accurate risk prediction and coherent risk grouping and are therefore excluded.

Note: During measure development we analyzed different volume cut-offs (25, 50 and 100). Using cut-off values below 100 resulted in too many CCS codes in some of the divisions (the CCS category codes are used in risk adjustment) which resulted in non-convergence of those division-level risk models. The total number of patients excluded is very small (13,597 or 0.21% of admissions for a cut off of 100). During measure development we also explored the option of pooling low-volume CCS codes (CCS<100 patients) into one group, however, the heterogeneity in mortality rates for the individual ICD-10 codes in those groups would preclude adequate risk adjustment. The TEP supported excluding these admissions.

Risk Adjustment

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

Statistical risk model

118210| 112469| 146637| 150289

118210| 112469| 146637| 150289

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Statistical risk model

146637| 110639| 141015| 110874| 146313

146637| 110639| 141015| 110874| 146313

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Statistical risk model

146637| 144762| 110639| 141015| 110874| 146313

146637| 144762| 110639| 141015| 110874| 146313

Stratification

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

N/A

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

N/A

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

N/A

Type Score

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

Rate/proportion better quality = lower score

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Rate/proportion better quality = lower score

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

Rate/proportion better quality = lower score

Algorithm

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization

The measure estimates hospital-level 30-day all-cause RSMRs 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 mortality 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 mortality 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 RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the number of deaths 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 mortality rates or better quality, and a higher ratio indicates higher-than-expected mortality rates or worse quality.

The "predicted" number of deaths (the numerator) is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific intercept on the risk of mortality. The estimated hospital-specific intercept is added 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 deaths (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 [https://qualitynet.org/inpatient/measures/mortality/methodology].

References:

1. Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. Stat Sci 22(2): 206-226.

2. Krumholz H, Normand S, Galusha D, et al. Risk-Adjustment Models for AMI and HF 30-Day Mortality Methodology. 2005. 118210| 112469| 146637| 150289

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

The measure estimates hospital-level, risk-standardized mortality rates (RSMRs) within 30 days of hospital admission using hierarchical logistical regression models through a Bayesian Markov Chain Monte Carlo (MCMC) procedure. In brief, we used hierarchical logistic regression to model the log-odds of mortality for each of the 15 service-line divisions. Death within 30 days was modeled as a function of patient-level demographic and clinical characteristics and a random hospital-level intercept. This model specification accounts for within-hospital correlation of the observed outcomes and models the assumption that underlying differences in quality among the health care facilities being evaluated lead to systematic differences in outcomes. We estimated a separate hierarchical logistic regression model for each service-line division. In order to obtain the variance and interval estimates, we fit the hierarchical model under the Bayesian framework along with the Markov Chain Monte Carlo (MCMC) technique.

Admissions are assigned to one of 15 mutually exclusive divisions (groups of discharge condition categories and procedure categories). For each division and each hospital with patients in that division, the standardized mortality ratio (SMR) is calculated as the ratio of the number of "predicted" deaths to the number of "expected" deaths at a given hospital. The predicted number of deaths is based on the hospital's performance with its observed case mix and service mix, and is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific effect on the risk of mortality. 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 transformed via an inverse logit function and summed over all patients attributed to a hospital to get a predicted value. The expected number of deaths is based on the nation's performance with that hospital's case mix and service mix and 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 transformed via an inverse logit function and summed over all patients in the hospital to get an expected value. 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 mortality rates or better quality, while a higher ratio indicates higher-than-expected mortality rates or worse quality.

To assess hospital performance for each reporting period, the measure re-estimates the model coefficients using the data in that period.

The division-level SMRs are then pooled for each hospital using an inverse variance-weighted geometric mean to create a hospital-wide composite SMR. (Note that in the case of the hybrid measure, we are presenting data from 9 of the total 15 divisions due to limitations in availability of electronic health records data). The hospital-wide SMR is then multiplied by the national observed mortality rate to produce the RSMR. 146637| 110639| 141015| 110874| 146313

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

The measure estimates hospital-level, risk-standardized mortality rates (RSMRs) within 30 days of hospital admission using hierarchical logistical regression models through a Bayesian Markov Chain Monte Carlo (MCMC) procedure. In brief, we used hierarchical logistic regression to model the log-odds of mortality for each of the 15 service-line divisions. Death within 30 days was modeled as a function of patient-level demographic and clinical characteristics and a random hospital-level intercept. This model specification accounts for within-hospital correlation of the observed

outcomes and models the assumption that underlying differences in quality among the health care facilities being evaluated lead to systematic differences in outcomes. We estimated a separate hierarchical logistic regression model for each service-line division. In order to obtain the variance and interval estimates, we fit the hierarchical model under the Bayesian framework along with the Markov Chain Monte Carlo (MCMC) technique.

Admissions are assigned to one of 15 mutually exclusive divisions (groups of discharge condition categories and procedure categories). For each division and each hospital with patients in that division, the standardized mortality ratio (SMR) is calculated as the ratio of the number of "predicted" deaths to the number of "expected" deaths at a given hospital. The predicted number of deaths is based on the hospital's performance with its observed case mix and service mix, and is calculated by using the coefficients estimated by regressing the risk factors and the hospital-specific effect on the risk of mortality. 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 transformed via an inverse logit function and summed over all patients attributed to a hospital to get a predicted value. The expected number of deaths is based on the nation's performance with that hospital's case mix and service mix and 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 transformed via an inverse logit function and summed over all patients in the hospital to get an expected value. 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 mortality rates or better quality, while a higher ratio indicates higher-than-expected mortality rates or worse quality.

To assess hospital performance for each reporting period, the measure re-estimates the model coefficients using the data in that period.

The division-level SMRs are then pooled for each hospital using an inverse variance-weighted geometric mean to create a hospital-wide composite SMR. The hospital-wide SMR is then multiplied by the national observed mortality rate to produce the RSMR. 146637| 144762| 110639| 141015| 110874| 146313

Submission items

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) 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

0468 : Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following pneumonia 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

0229 : Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization

1893 : Hospital 30-Day, all-cause, risk-standardized mortality rate (RSMR) following chronic obstructive pulmonary disease (COPD) hospitalization

2431 : Hospital-level, risk-standardized payment associated with a 30-day episode-of-care for Acute Myocardial Infarction (AMI)

3502 : Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

3504 : Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

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. Our measure cohort was heavily vetted by clinical experts, a technical expert panel, and a public comment period. Additionally, the measure, with the specified cohort, has been publicly reported since 2008. 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

3502 Hybrid Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

5.1 Identified measures:

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: This hybrid HWM measure incorporates patient-level clinical data from the EHR into the risk adjustment model, compared to the claims-only hospital-wide mortality measure. This hybrid HWM measure is intended to complement the existing CMS Hospital-Wide All-Cause Risk-Standardized Readmission Measure (NQF #1789) to allow assessment of trends in hospital performance for both readmission and mortality outcomes, similar to other complementary pairs of readmission and mortality measures for specific conditions and procedures. By measuring mortality outcomes across almost all hospitalized patients, this measure will provide an important additional performance assessment that will complement condition- and procedure-specific or other more narrowly defined mortality measures and allow a greater number of patients and hospitals to be evaluated. This HWM measure captures a similarly broad cohort to the CMS Hospital-Wide All-Cause Risk-Standardized Readmission Measure (NQF #1789), and a broader cohort than those of other CMS condition-specific measures. Because the mortality measure is focused on a different outcome, it differs from the existing CMS Hospital-Wide All-Cause Risk Standardized Readmission Measure (NQF #1789) in a couple of ways. First, this HWM measure includes patients with a principal discharge diagnosis of cancer, whereas those patients are not included in the readmission measure. Cancer patients are appropriate to include as many have survival as their primary goal, however due to cancer treatment plans, readmissions are frequently part of the plan and expected and therefore are not a reasonable signal of quality. Another difference between the two measures is the number of divisions or specialty cohorts the patients are divided into in order to more accurately risk adjust for case-mix and service-mix. The readmission measure divides patients into six categories, or "specialty cohorts", while the mortality measure uses 15. This is because the risk of mortality is much more closely related to patient factors than readmission is related to patient factors. PSI-02 (NQF #0357) is another complementary mortality measure, which captures

a different patient population and a different outcome compared with the HWM measure submitted with this application. PSI-02 captures patients 18 years of age or older, or obstetric patients, whereas the HWM measure captures patients between the ages of 65 and 94. PSI-02 captures DRGs with less than 0.5% mortality rate, whereas the HWM measure captures all patients within all CCSs, regardless of mortality rate. HWM captures mortality up to 30 days past admission, where AHRQ PSI-02 only captures in-hospital mortality. IQI 90 (NQF #0530) is another complimentary mortality measure, which is a composite measure of the number of in-hospital deaths for a narrow range of conditions (CHF, stroke, hip fracture, pneumonia, acute myocardial infarction and GI hemorrhage). The HWM measure presented in this application captures all deaths after 30 days of admission, for all conditions and procedures.

5b.1 If competing, why superior or rationale for additive value: There are no competing NQF-endorsed measures.

3504 Claims-Only Hospital-Wide (All-Condition, All-Procedure) Risk-Standardized Mortality Measure

5.1 Identified measures:

5a.1 Are specs completely harmonized? Yes

5a.2 If not completely harmonized, identify difference, rationale, impact: This claims-only hospital-wide mortality (HWM) measure is intended to complement the existing CMS Hospital-Wide All-Cause Risk-Standardized Readmission Measure (NQF #1789) to allow assessment of trends in hospital performance for both readmission and mortality outcomes, similar to other complementary pairs of readmission and mortality measures for specific conditions and procedures. By measuring mortality outcomes across almost all hospitalized patients, this measure will provide an important additional performance assessment that will complement condition- and procedure-specific or other more narrowly defined mortality measures and allow a greater number of patients and hospitals to be evaluated. This HWM measure captures a similarly broad cohort to the CMS Hospital-Wide All-Cause Risk-Standardized Readmission Measure (NQF #1789), and a broader cohort than those of other CMS condition-specific measures. Because the mortality measure is focused on a different outcome, it differs from the existing CMS Hospital-Wide All-Cause Risk Standardized Readmission Measure (NQF #1789) in a couple of ways. First, this HWM measure includes patients with a principal discharge diagnosis of cancer (with some exceptions), whereas those patients are not included in the readmission measure. Cancer patients are appropriate to include in the HWM measure as many have survival as their primary goal; however due to cancer treatment plans, readmissions are frequently part of the plan and expected and therefore, are not a reasonable signal of quality. Another difference between the two measures is the number of divisions or specialty cohorts the patients are divided into, to more accurately risk adjust for case-mix and service-mix. The readmission measure divides patients into five categories, or "specialty cohorts", while the mortality measure uses 15. This is because the risk of mortality is much more closely related to patient factors than readmission is related to patient factors. PSI-02 (NQF #0357) is another complementary mortality measure, which captures a different patient population and a different outcome compared with the HWM measure submitted with this application. PSI-02 captures patients 18 years of age or older, or obstetric patients, whereas the HWM measure captures patients between the ages of 65 and 94. PSI-02 captures DRGs with less than 0.5% mortality rate, whereas the HWM measure captures all patients within all CCSs, regardless of mortality rate. Hospital-wide mortality captures mortality up to 30 days past admission, where AHRQ PSI-02 only captures in-hospital mortality. IQI 90 (NQF #0530) is another complimentary mortality measure, which is a composite measure of the number of in-hospital deaths for a narrow range of conditions (CHF, stroke, hip fracture, pneumonia, acute myocardial

infarction and GI hemorrhage). The HWM measure presented in this application captures all deaths after 30 days of admission, for all conditions and procedures.

5b.1 If competing, why superior or rationale for additive value: There are no competing NQF-endorsed measures.

Appendix F: Pre-Evaluation Comments

Comments received as of January 21, 2021.

Topic	Commenter	Comment
NQF #0229 Hospital 30-Day, All-Cause, Risk-Standardized Mortality Rate (RSMR) Following Heart Failure (HF) Hospitalization	Submitted by American Medical Association	The American Medical Association (AMA) appreciates the opportunity to comment on #229, Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following heart failure (HF) hospitalization. We are disappointed to see the minimum measure score reliability results of 0.34 using a minimum case number of 25 patients. We believe that measures must meet <u>minimum</u> acceptable thresholds of 0.7 for reliability. In addition, the AMA is 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 or was not appropriate to adjust for social risk factors in the same measure used for more than one accountability purpose, which is the case for 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 measure developer relying on the recommendations within this report. We request that the Standing Committee evaluate whether the measure meets the scientific acceptability criteria. 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

Topic	Commenter	Comment
		Program. 2020. https://aspe.hhs.gov/social-risk-factors-and-medicares-value-based-purchasing-programs
NQF #0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization	Submitted by American Medical Association	The American Medical Association (AMA) appreciates the opportunity to comment on #0230, Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization. We are disappointed to see the minimum measure score reliability results of 0.20 using a minimum case number of 25 patients and the intraclass correlation coefficients (ICC) was 0.428. 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 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 or was not appropriate to adjust for social risk factors in the same measure used for more than one accountability purpose, which is the case for 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 measure developer relying on the recommendations within this report. In addition, the AMA questions whether the information provided as a result of this measure is truly useful for accountability purposes and for informing patients on the quality of care provided by hospitals. Specifically, our concern relates to the relatively limited amount of variation across facilities. Only 28 facilities out of the 2,284 facilities were identified as performing Better than the National Rate; and 16 facilities performed Worse than the National Rate. Endorsing a measure that currently

Topic	Commenter	Comment
		only identifies such a small number of outliers does not enable users to distinguish meaning differences in performance and limits a measure's usability.
		We request that the Standing Committee evaluate whether the measure meets the scientific acceptability criteria.
		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. https://aspe.hhs.gov/social-risk-factors-and-medicares-value-based-purchasing-programs

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