NATIONAL
QUALITY FORUM

Measure Information

This document contains the information submitted by measure developers/stewards, but is organized according to NQF's measure evaluation criteria and process. The item numbers refer to those in the submission form but may be in a slightly different order here. In general, the item numbers also reference the related criteria (e.g., item 1b.1 relates to sub criterion 1b).

Brief Measure Information

NQF #: 2473e
Corresponding Measures:
De.2. Measure Title: Hybrid hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI)
Co.1.1. Measure Steward: Centers for Medicare & Medicaid Services (CMS)
De.3. Brief Description of Measure: This measure estimates a hospital-level 30-day, all-cause, risk-standardized mortality rate (RSMR) for patients discharged from the hospital with a principal discharge diagnosis of acute myocardial infarction (AMI). The outcome is all-cause 30-day mortality, defined as death from any cause within 30 days of the index admission date, including in-hospital death, for AMI patients. The target population is Medicare Fee-for-Service beneficiaries who are 65 years or older.

This Hybrid AMI mortality measure was developed de novo. This measure is harmonized with the Centers for Medicare and Medicaid Services' (CMS's) current publicly reported claims-only measure, hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) (NQF #2473). The measure is referred to as a hybrid because it is CMS's intention to calculate the measure using two data sources: Medicare fee-for-service (FFS) administrative claims and clinical electronic health record (EHR) data.

1b.1. Developer Rationale: The goal of this measure is to improve patient outcomes by providing patients, physicians, and hospitals with information about hospital-level, risk-standardized mortality rates following hospitalization for AMI. Measurement of patient outcomes allows for a broad view of quality of care that encompasses more than what can be captured by individual process-of-care measures. Complex and critical aspects of care, such as communication between providers, prevention of and response to complications, patient safety, and coordinated transitions to the outpatient environment, all contribute to patient outcomes but are difficult to measure by individual process measures. The goal of outcomes measurement is to risk-adjust for patients' conditions at the time of hospital admission and then evaluate patient outcomes. This measure was developed to identify institutions whose performance is better or worse than what would be expected based on their patient case mix, and therefore promote hospital quality improvement and better inform consumers about care quality.

Additionally, AMI mortality is a priority area for outcomes measure development as it is a costly and common condition. Hospital mortality is an outcome that is likely attributable to care processes and is an important outcome for patients. Measuring and reporting mortality rates will inform health care providers about opportunities to improve care, strengthen incentives for quality improvement, and ultimately improve the quality of care received by Medicare patients. The measure will also provide patients with information that could guide their choices. Furthermore, the measure will increase transparency for consumers and has the potential to lower health care costs associated with mortality.

This Hybrid AMI mortality measure incorporates clinical data elements pulled from the EHR in risk adjustment of the mortality model. Some benefits of including the clinical data elements are:
1. Inclusion of patient-level clinical data related to severity of illness is responsive to providers who continue to express preference for using patient-level clinical data, and provides an opportunity to incorporate clinical data into outcome measures.
2. Hospitals will increasingly use EHR data to assess severity of illness and patients' risk of poor outcomes. This provides an opportunity to align the measure with clinical decision support systems that many providers utilize to alert care teams about patients at increased risk of poor outcomes in real time during the inpatient stay.
3. Collecting a simple core set of clinical data elements that perform well as risk-adjustment variables (for illness severity) across conditions can greatly reduce the cost and effort of future measure development, improve harmonization, and create opportunity

for longitudinal assessment of patient status and quality of care across settings.
4. These core clinical data elements will provide measure developers with a standard set of reliable data that can be used as a starting place when building risk-adjustment models for quality measures using clinical data.

S.4. **Numerator Statement:** The outcome is all-cause 30-day mortality, defined as death from any cause within 30 days of the index admission date, including in-hospital death, for patients with a principal discharge diagnosis of AMI.
S.6. **Denominator Statement:** The cohort includes inpatient admissions for Medicare FFS patients 65 years and older who were discharged from non-federal, short-term, acute care hospitals with a principal discharge diagnosis of AMI.

Additional details are provided in S.7 Denominator Details.
S.8. **Denominator Exclusions:** The mortality measure excludes index hospitalizations that meet any of the following exclusion criteria:

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 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).

After exclusions #1-4 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 same probability of the outcome. Additional admissions within that year are excluded. For each patient, the probability of death increases with each subsequent admission and therefore the episodes of care are not mutually independent. 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. July admissions are excluded to avoid assigning a single death to two admissions.

De.1. **Measure Type:** Outcome
S.17. **Data Source:** Claims, Electronic Health Data, Electronic Health Records, Other, Registry Data
S.20. **Level of Analysis:** Facility

IF Endorsement Maintenance – Original Endorsement Date: Sep 08, 2014 **Most Recent Endorsement Date:** Sep 08, 2014

IF this measure is included in a composite, NQF Composite#/title:

IF this measure is paired/grouped, NQF#/title:

De.4. IF PAIRED/GROUPED, what is the reason this measure must be reported with other measures to appropriately interpret results? N/A

1. Evidence, Performance Gap, Priority – Importance to Measure and Report

Extent to which the specific measure focus is evidence-based, important to making significant gains in healthcare quality, and improving health outcomes for a specific high-priority (high-impact) aspect of healthcare where there is variation in or overall less-than-optimal performance. ***Measures must be judged to meet all sub criteria to pass this criterion and be evaluated against the remaining criteria.***

1a. Evidence to Support the Measure Focus – See attached Evidence Submission Form
Del18eHOY4HybridAMIMortalityEndorsementMaintenanceEvidenceAttachment03262018.docx
1a.1 <u>For Maintenance of Endorsement:</u> **Is there new evidence about the measure since the last update/submission?**
Do not remove any existing information. If there have been any changes to evidence, the Committee will consider the new evidence. Please use the most current version of the evidence attachment (v7.1). Please use red font to indicate updated evidence.
No

1b. Performance Gap
Demonstration of quality problems and opportunity for improvement, i.e., data demonstrating:
- considerable variation, or overall less-than-optimal performance, in the quality of care across providers; and/or

- Disparities in care across population groups.

1b.1. Briefly explain the rationale for this measure *(e.g., how the measure will improve the quality of care, the benefits or improvements in quality envisioned by use of this measure)*
If a COMPOSITE (e.g., combination of component measure scores, all-or-none, any-or-none), SKIP this question and answer the composite questions.

The goal of this measure is to improve patient outcomes by providing patients, physicians, and hospitals with information about hospital-level, risk-standardized mortality rates following hospitalization for AMI. Measurement of patient outcomes allows for a broad view of quality of care that encompasses more than what can be captured by individual process-of-care measures. Complex and critical aspects of care, such as communication between providers, prevention of and response to complications, patient safety, and coordinated transitions to the outpatient environment, all contribute to patient outcomes but are difficult to measure by individual process measures. The goal of outcomes measurement is to risk-adjust for patients' conditions at the time of hospital admission and then evaluate patient outcomes. This measure was developed to identify institutions whose performance is better or worse than what would be expected based on their patient case mix, and therefore promote hospital quality improvement and better inform consumers about care quality.

Additionally, AMI mortality is a priority area for outcomes measure development as it is a costly and common condition. Hospital mortality is an outcome that is likely attributable to care processes and is an important outcome for patients. Measuring and reporting mortality rates will inform health care providers about opportunities to improve care, strengthen incentives for quality improvement, and ultimately improve the quality of care received by Medicare patients. The measure will also provide patients with information that could guide their choices. Furthermore, the measure will increase transparency for consumers and has the potential to lower health care costs associated with mortality.

This Hybrid AMI mortality measure incorporates clinical data elements pulled from the EHR in risk adjustment of the mortality model. Some benefits of including the clinical data elements are:
1. Inclusion of patient-level clinical data related to severity of illness is responsive to providers who continue to express preference for using patient-level clinical data, and provides an opportunity to incorporate clinical data into outcome measures.
2. Hospitals will increasingly use EHR data to assess severity of illness and patients' risk of poor outcomes. This provides an opportunity to align the measure with clinical decision support systems that many providers utilize to alert care teams about patients at increased risk of poor outcomes in real time during the inpatient stay.
3. Collecting a simple core set of clinical data elements that perform well as risk-adjustment variables (for illness severity) across conditions can greatly reduce the cost and effort of future measure development, improve harmonization, and create opportunity for longitudinal assessment of patient status and quality of care across settings.
4. These core clinical data elements will provide measure developers with a standard set of reliable data that can be used as a starting place when building risk-adjustment models for quality measures using clinical data.

1b.2. Provide performance scores on the measure as specified (current and over time) at the specified level of analysis. *(This is required for maintenance of endorsement. Include mean, std dev, min, max, interquartile range, scores by decile. Describe the data source including number of measured entities; number of patients; dates of data; if a sample, characteristics of the entities include.) This information also will be used to address the sub-criterion on improvement (4b1) under Usability and Use.*
We analyzed variation in RSMRs among the hospitals in the development dataset – i.e., hospitals participating in the ACTION Registry(R)–GWTG(TM) (AR-G), for clinical data, merged with CMS Medicare claims and enrollment data – for the 30-day mortality outcome.

The development cohort includes AMI discharges for patients aged 65 and older from January 1 - December 31, 2009 who were discharged from hospitals participating in the AR-G and who were enrolled in Medicare. It includes 20,540 admissions from 280 hospitals. AMI RSMRs vary among hospitals, with a mean of 10.8%, a standard deviation of 0.006, and a range of 9.6% to 13.1%. The interquartile range is 10.3% to 11.1%. The set of hospitals included is likely to have a narrow range of performance due to their participation in the AR-G registry. The mean score by decile is as follows:

Decile of RSMR	Mean RSMR
1	0.100
2	0.103
3	0.105
4	0.107

5	0.107
6	0.108
7	0.109
8	0.110
9	0.112
10	0.118

1b.3. If no or limited performance data on the measure as specified is reported in 1b2, then provide a summary of data from the literature that indicates opportunity for improvement or overall less than optimal performance on the specific focus of measurement.

CMS currently publicly reports a claims-based measure of AMI mortality. The results for this measure, as reported in the 2017 update to the Hospital Compare website, are based on RSMRs calculated for AMI admissions among Medicare fee-for-service patients aged 65 and older from July 2013 – June 2016. It includes 487,646 admissions from 4,310 hospitals. For the most recently reported three years of data (July 2013 - June 2016), the mean hospital RSMR was 13.7%, with a range of 9.7% to 18.0%. The interquartile range was 13.2% to 14.1%.

Trends indicate a decrease in both the Publicly Reported National Rate and Median Hospital Rate using the claims-based measure of AMI mortality.

Year //	Publicly Reported National Rate	// Median Hospital Rate //	Range
2012 //	--- //	15.7% //	10.0-21.5
2013 //	15.2% //	15.1% //	9.4-21.0
2014 //	14.9% //	14.8% //	9.4-20.2
2015 //	14.2% //	14.1% //	9.9-15.7
2016 //	14.1% //	14.0% //	9.4-20.0
2017 //	13.6% //	13.5% //	9.7-18.0

Furthermore, recent work has identified specific strategies utilized by hospitals that achieve low AMI mortality rates (Bradley et al., 2012; Curry et al., 2011). This work demonstrates the relationship between hospital organizational factors and performance on the AMI mortality measures and supports the ability of hospitals to impact these rates.

References:
Bradley EH, Curry LA, Spatz ES, Herrin J, Cherlin EJ, Curtis JP, Thompson JW, Ting HH, Wang Y, Krumholz HM. Hospital strategies for reducing risk-standardized mortality rates in acute myocardial infarction. Ann Intern Med. 2012 May 1;156(9):618-26.

Curry LA, Spatz E, Cherlin E, Thompson JW, Berg D, Ting HH, Decker C, Krumholz HM, Bradley EH. What distinguishes top-performing hospitals in acute myocardial infarction mortality rates? A qualitative study. Ann Intern Med. 2011 Mar 15;154(6):384-90.

1b.4. Provide disparities data from the measure as specified (current and over time) by population group, e.g., by race/ethnicity, gender, age, insurance status, socioeconomic status, and/or disability. *(This is required for maintenance of endorsement. Describe the data source including number of measured entities; number of patients; dates of data; if a sample, characteristics of the entities included.) For measures that show high levels of performance, i.e., "topped out", disparities data may demonstrate an opportunity for improvement/gap in care for certain sub-populations. This information also will be used to address the sub-criterion on improvement (4b1) under Usability and Use.*
We analyzed whether disparities in performance on this measure exist at the hospital level.

To identify potential disparities related to race, we examined the relationship between RSMR and hospital proportion of African-American patients among all hospitals included in the merged AR-G-CMS dataset used for measure development. We used the 2009 Medicare Provider Analysis and Review (MEDPAR) file to calculate the percentage of African-American patients treated at each hospital, using all patients admitted to each hospital. We classified hospitals into quintiles based on their proportion of African-American patients, with the lowest and highest quintile consisting of hospitals with lowest and highest proportions of African-American patients, respectively.

Analyses demonstrated that median RSMRs and the distributions of RSMRs were consistent across quintiles. Specifically, the median

RSMR for hospitals in the lowest quintile was 10.8%, and the median RSMR for hospitals in the highest quintile was 10.8%. This analysis suggests that many hospitals with a high proportion of African-American patients can and do perform well on the measure.

To identify potential disparities related to socioeconomic status (SES), we examined the relationship between RSMR and hospital proportion of dual eligible patients. We used the 2009 MEDPAR file to calculate the percentage of dual eligible patients treated at each hospital. We used Medicaid eligibility status identified in the Medicare Enrollment Database as a proxy for SES. This approach is consistent with prior research as well as National Quality Forum (NQF) recommendations (http://www.qualityforum.org/Publications/2011/07/National_Voluntary_Consensus_Standards_for_Patient_Outcomes_2009.aspx). Hospitals were categorized into quintiles based on their proportion of dual eligible patients, with the lowest and highest quintile consisting of hospitals with lowest and highest proportions of dual eligible patients, respectively. Analyses showed that median RSMRs were consistent across quintiles of hospitals based on the hospital proportion of dual eligible patients. Specifically, the median RSMR for hospitals in the lowest quintile was 10.8%, and the median RSMR for hospitals in the highest quintile was 10.9%. The distributions were also consistent across quintiles. These results indicate that hospitals with high proportions of dual eligible patients can and do perform as well on the measure as hospitals with lower proportions of dual eligible patients.

1b.5. **If no or limited data on disparities from the measure as specified is reported in 1b.4, then provide a summary of data from the literature that addresses disparities in care on the specific focus of measurement. Include citations. Not necessary if performance data provided in 1b.4**
N/A

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2. Reliability and Validity—Scientific Acceptability of Measure Properties

Extent to which the measure, <u>as specified</u>, produces consistent (reliable) and credible (valid) results about the quality of care when implemented. ***Measures must be judged to meet the sub criteria for both reliability and validity to pass this criterion and be evaluated against the remaining criteria.***

2a.1. Specifications The measure is well defined and precisely specified so it can be implemented consistently within and across organizations and allows for comparability. eMeasures should be specified in the Health Quality Measures Format (HQMF) and the Quality Data Model (QDM).

De.5. **Subject/Topic Area** *(check all the areas that apply):*
Cardiovascular : Coronary Artery Disease (AMI)

De.6. **Non-Condition Specific***(check all the areas that apply):*
Care Coordination, Safety, Safety : Complications

De.7. **Target Population Category** *(Check all the populations for which the measure is specified and tested if any):*
Elderly, Populations at Risk

S.1. **Measure-specific Web Page** *(Provide a URL link to a web page specific for this measure that contains current detailed specifications including code lists, risk model details, and supplemental materials. Do not enter a URL linking to a home page or to general information.)*
https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/Downloads/Core-Clinical-Data-Elements-and-Hybrid-Measures.zip

S.2a. **If this is an eMeasure**, HQMF specifications must be attached. Attach the zipped output from the eMeasure authoring tool (MAT) - if the MAT was not used, contact staff. (Use the specification fields in this online form for the plain-language description of the specifications)
This is an eMeasure **Attachment:** CCDE_AMI_Mortality_2016_Final_Specifications-636510023794915089.zip

S.2b. **Data Dictionary, Code Table, or Value Sets** *(and risk model codes and coefficients when applicable) must be attached. (Excel or csv file in the suggested format preferred - if not, contact staff)*
Attachment **Attachment:** HOY4_Hybrid_AMI_Mortality_Data_Dictionary_v1.0.xls

S.2c. Is this an instrument-based measure (i.e., data collected via instruments, surveys, tools, questionnaires, scales, etc.)? Attach copy of instrument if available.
No, this is not an instrument-based measure **Attachment:**

S.2d. Is this an instrument-based measure (i.e., data collected via instruments, surveys, tools, questionnaires, scales, etc.)? Attach copy of instrument if available.
Not an instrument-based measure

S.3.1. **For maintenance of endorsement:** Are there changes to the specifications since the last updates/submission. If yes, update the specifications for S1-2 and S4-22 and explain reasons for the changes in S3.2.
No

S.3.2. **For maintenance of endorsement,** please briefly describe any important changes to the measure specifications since last measure update and explain the reasons.
N/A

S.4. **Numerator Statement** *(Brief, narrative description of the measure focus or what is being measured about the target population, i.e., cases from the target population with the target process, condition, event, or outcome) DO NOT include the rationale for the measure.*
IF an OUTCOME MEASURE, state the outcome being measured. Calculation of the risk-adjusted outcome should be described in the calculation algorithm (S.14).
The outcome is all-cause 30-day mortality, defined as death from any cause within 30 days of the index admission date, including in-hospital death, for patients with a principal discharge diagnosis of AMI.

S.5. **Numerator Details** *(All information required to identify and calculate the cases from the target population with the target process, condition, event, or outcome such as definitions, time period for data collection, specific data collection items/responses, code/value sets – Note: lists of individual codes with descriptors that exceed 1 page should be provided in an Excel or csv file in required format at S.2b)*
IF an OUTCOME MEASURE, describe how the observed outcome is identified/counted. Calculation of the risk-adjusted outcome should be described in the calculation algorithm (S.14).
The measure outcome is death from any cause within 30 days of the admission date of the index admission. As currently specified, we identify deaths for Medicare FFS patients 65 years and older in the Medicare Enrollment Database (EDB).

S.6. **Denominator Statement** *(Brief, narrative description of the target population being measured)*
The cohort includes inpatient admissions for Medicare FFS patients 65 years and older who were discharged from non-federal, short-term, acute care hospitals with a principal discharge diagnosis of AMI.

Additional details are provided in S.7 Denominator Details.

S.7. **Denominator Details** *(All information required to identify and calculate the target population/denominator such as definitions, time period for data collection, specific data collection items/responses, code/value sets – Note: lists of individual codes with descriptors that exceed 1 page should be provided in an Excel or csv file in required format at S.2b.)*
IF an OUTCOME MEASURE, describe how the target population is identified. Calculation of the risk-adjusted outcome should be described in the calculation algorithm (S.14).
To be included in the measure cohort, patients must meet the following inclusion criteria:
1. Had a principal discharge diagnosis of AMI;
2. Enrolled in Medicare FFS Part A and Part B for the first 12 months prior to the date of admission, and enrolled in Part A during the index admission;
3. Aged 65 or over; and
4. Not transferred from another acute care facility.

ICD-9 and ICD-10 cohort codes are included in the attached Data Dictionary.

S.8. **Denominator Exclusions** *(Brief narrative description of exclusions from the target population)*

The mortality measure excludes index hospitalizations that meet any of the following exclusion criteria:

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 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).

After exclusions #1-4 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 same probability of the outcome. Additional admissions within that year are excluded. For each patient, the probability of death increases with each subsequent admission and therefore the episodes of care are not mutually independent. 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. July admissions are excluded to avoid assigning a single death to two admissions.

S.9. Denominator Exclusion Details *(All information required to identify and calculate exclusions from the denominator such as definitions, time period for data collection, specific data collection items/responses, code/value sets – Note: lists of individual codes with descriptors that exceed 1 page should be provided in an Excel or csv file in required format at S.2b.)*
1. Discharged alive on the day of admission or the following day who were not transferred to another acute care facility
Rationale: It is unlikely that these patients had clinically significant AMI. This is determined from the claim

2. Inconsistent or unknown vital status or other unreliable demographic data
Rationale: We do not include stays for patients where the age is greater than 115 (indicated in the claim), where the gender is neither male nor female (indicated in the claim), where the admission date in the claim 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 as indicated in the claim.

3. Enrolled in the Medicare hospice program any time in the 12 months prior to the index admission, including the first day of the index admission
Rationale: These patients are likely continuing to seek comfort measures only, so mortality is not necessarily an adverse outcome or signal of poor quality care. This is indicated in the claim.

4. Discharged against medical advice
Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge. This is determined from the discharge disposition in the claim.

S.10. Stratification Information *(Provide all information required to stratify the measure results, if necessary, including the stratification variables, definitions, specific data collection items/responses, code/value sets, and the risk-model covariates and coefficients for the clinically-adjusted version of the measure when appropriate – Note: lists of individual codes with descriptors that exceed 1 page should be provided in an Excel or csv file in required format with at S.2b.)*
N/A

S.11. Risk Adjustment Type (Select type. Provide specifications for risk stratification in measure testing attachment)
Statistical risk model
If other:

S.12. Type of score:
Rate/proportion
If other:

S.13. Interpretation of Score *(Classifies interpretation of score according to whether better quality is associated with a higher score, a lower score, a score falling within a defined interval, or a passing score)*
Better quality = Lower score

S.14. Calculation Algorithm/Measure Logic (*Diagram or describe the calculation of the measure score as an ordered sequence of*

steps including identifying the target population; exclusions; cases meeting the target process, condition, event, or outcome; time period for data, aggregating data; risk adjustment; etc.)

The measure estimates hospital-level 30-day all-cause RSMRs following 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 discharge using age, sex, selected clinical covariates, and a hospital-specific intercept. 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. If there were no differences among hospitals, then after adjusting for patient risk, the hospital effects should be identical across all hospitals.

This measure uses risk variables from electronic health records (EHR). The model adjusts for case-mix differences based on the clinical status of patients at the time of admission. Clinical risk-adjustment variables are the first values collected during the inpatient episode of care, including values collected in the emergency department or outpatient department in the 24 hours prior to inpatient admission.

Risk adjustment variables:
Age (years, continuous) for patients aged 65 or over
Heart rate
Systolic blood pressure
Creatinine
Troponin level

The RSMR is calculated as the ratio of the number of "predicted" to the number of "expected" deaths, multiplied by the national unadjusted mortality rate. For each hospital, the numerator of the ratio ("predicted") 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 ("expected") is the number of deaths 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 mortality or better quality and a higher ratio indicates higher-than-expected mortality 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 the 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 for the claims-only AMI mortality measure (Krumholz et al., 2005).

Reference:
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.

S.15. Sampling *(If measure is based on a sample, provide instructions for obtaining the sample and guidance on minimum sample size.)*
<u>IF an instrument-based</u> performance measure (e.g., PRO-PM), identify whether (and how) proxy responses are allowed.
N/A

S.16. Survey/Patient-reported data *(If measure is based on a survey or instrument, provide instructions for data collection and guidance on minimum response rate.)*

Specify calculation of response rates to be reported with performance measure results.
N/A

S.17. Data Source *(Check ONLY the sources for which the measure is SPECIFIED AND TESTED).*
If other, please describe in S.18.
 Claims, Electronic Health Data, Electronic Health Records, Other, Registry Data

S.18. Data Source or Collection Instrument *(Identify the specific data source/data collection instrument (e.g. name of database, clinical registry, collection instrument, etc., and describe how data are collected.)*
IF instrument-based, identify the specific instrument(s) and standard methods, modes, and languages of administration.
Although Get With The Guidelines (GWTG) – ACTION Registry (AR-G) data was used in the development of measure specification, this measure is not intended to be used as a registry measure. All data elements derived from the EHR have been tested for feasibility at multiple hospital sites, as shown in the Measure Testing Form section 2b1.3.

Data sources for the Medicare FFS measure:
1. Medicare Part A inpatient claims: This data source contains claims data for FFF inpatient and outpatient services and Medicare inpatient hospital care.
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.
3. Patients' electronic health records: The clinical data elements used in the risk models for this measure will be derived from patients EHRs. The measure was tested using data from EHRs.

S.19. Data Source or Collection Instrument *(available at measure-specific Web page URL identified in S.1 OR in attached appendix at A.1)*
No data collection instrument provided

S.20. Level of Analysis *(Check ONLY the levels of analysis for which the measure is SPECIFIED AND TESTED)*
 Facility

S.21. Care Setting *(Check ONLY the settings for which the measure is SPECIFIED AND TESTED)*
 Inpatient/Hospital
If other:

S.22. COMPOSITE Performance Measure - Additional Specifications *(Use this section as needed for aggregation and weighting rules, or calculation of individual performance measures if not individually endorsed.)*
N/A

2. Validity – See attached Measure Testing Submission Form
HOY4_Hybrid_AMI_Mortality_Data_Dictionary_v1.0-636507676664095439.xls,NQF_Testing_Attachment_7.1_v3.0-636601670362197578.docx

2.1 For maintenance of endorsement
Reliability testing: If testing of reliability of the measure score was not presented in prior submission(s), has reliability testing of the measure score been conducted? If yes, please provide results in the Testing attachment. Please use the most current version of the testing attachment (v7.1). Include information on all testing conducted (prior testing as well as any new testing); use red font to indicate updated testing.
Yes

2.2 For maintenance of endorsement
Has additional empirical validity testing of the measure score been conducted? If yes, please provide results in the Testing attachment. Please use the most current version of the testing attachment (v7.1). Include information on all testing conducted (prior testing as well as any new testing); use red font to indicate updated testing.
Yes

2.3 For maintenance of endorsement

Risk adjustment: For outcome, resource use, cost, and some process measures, risk-adjustment that includes social risk factors is not prohibited at present. Please update sections 1.8, 2a2, 2b1,2b4.3 and 2b5 in the Testing attachment and S.140 and S.11 in the online submission form. NOTE: These sections must be updated even if social risk factors are not included in the risk-adjustment strategy. You MUST use the most current version of the Testing Attachment (v7.1) -- older versions of the form will not have all required questions.

Yes - Updated information is included

3. Feasibility

Extent to which the specifications including measure logic, require data that are readily available or could be captured without undue burden and can be implemented for performance measurement.

3a. Byproduct of Care Processes

   For clinical measures, the required data elements are routinely generated and used during care delivery (e.g., blood pressure, lab test, diagnosis, medication order).

3a.1. Data Elements Generated as Byproduct of Care Processes.

Generated or collected by and used by healthcare personnel during the provision of care (e.g., blood pressure, lab value, diagnosis, depression score), Coded by someone other than person obtaining original information (e.g., DRG, ICD-9 codes on claims)

If other:

3b. Electronic Sources

   The required data elements are available in electronic health records or other electronic sources. If the required data are not in electronic health records or existing electronic sources, a credible, near-term path to electronic collection is specified.

3b.1. To what extent are the specified data elements available electronically in defined fields (*i.e., data elements that are needed to compute the performance measure score are in defined, computer-readable fields*) Update this field for **maintenance of endorsement**.

ALL data elements are in defined fields in a combination of electronic sources

3b.2. If ALL the data elements needed to compute the performance measure score are not from electronic sources, specify a credible, near-term path to electronic capture, OR provide a rationale for using other than electronic sources. For **maintenance of endorsement**, if this measure is not an eMeasure (eCQM), please describe any efforts to develop an eMeasure (eCQM).

All data elements needed to compute performance measure score are captured electronically.

3b.3. If this is an eMeasure, provide a summary of the feasibility assessment in an attached file or make available at a measure-specific URL. Please also complete and attach the NQF Feasibility Score Card.

Attachment: nqf_ecqm_feasibility_scorecard_v1.0.xlsx

3c. Data Collection Strategy

   Demonstration that the data collection strategy (e.g., source, timing, frequency, sampling, patient confidentiality, costs associated with fees/licensing of proprietary measures) can be implemented (e.g., already in operational use, or testing demonstrates that it is ready to put into operational use). For eMeasures, a feasibility assessment addresses the data elements and measure logic and demonstrates the eMeasure can be implemented or feasibility concerns can be adequately addressed.

3c.1. Required for maintenance of endorsement. Describe difficulties (as a result of testing and/or operational use of the measure) regarding data collection, availability of data, missing data, timing and frequency of data collection, sampling, patient confidentiality, time and cost of data collection, other feasibility/implementation issues.

IF instrument-based, consider implications for both individuals providing data (patients, service recipients, respondents) and those whose performance is being measured.

During testing the measure specifications in five hospitals with various EHR systems, few difficulties were found. As shown in the NQF Testing Form, capture rate was high, and data element validity, or agreement between EHR data and chart data was high. We found that some initial time was required for a hospital to map the data elements in the measure specifications to their own EHR system. However, once these data elements are mapped, a hospital could submit many of these data elements for other hybrid

measures, once implemented.

3c.2. Describe any fees, licensing, or other requirements to use any aspect of the measure as specified *(e.g., value/code set, risk model, programming code, algorithm).*
There are no fees for use of this measure.

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4. Usability and Use

Extent to which potential audiences (e.g., consumers, purchasers, providers, policy makers) are using or could use performance results for both accountability and performance improvement to achieve the goal of high-quality, efficient healthcare for individuals or populations.

4a. Accountability and Transparency
Performance results are used in at least one accountability application within three years after initial endorsement and are publicly reported within six years after initial endorsement (or the data on performance results are available). If not in use at the time of initial endorsement, then a credible plan for implementation within the specified timeframes is provided.

4.1. Current <u>and</u> Planned Use
NQF-endorsed measures are expected to be used in at least one accountability application within 3 years and publicly reported within 6 years of initial endorsement in addition to performance improvement.

Specific Plan for Use	Current Use (for current use provide URL)

4a1.1 For each CURRENT use, checked above (update for <u>maintenance of endorsement</u>), provide:
- Name of program and sponsor
- Purpose
- Geographic area and number and percentage of accountable entities and patients included
- Level of measurement and setting

N/A

4a1.2. If not currently publicly reported OR used in at least one other accountability application (e.g., payment program, certification, licensing) what are the reasons? (*e.g., Do policies or actions of the developer/steward or accountable entities restrict access to performance results or impede implementation?*)
This measure was proposed and finalized into the Center for Medicare and Medicaid Services Innovation (CMMI) Advancing Care Coordination Through Episode Payment Models (EPM) five-year bundled payment model in January 2017 (82 FR 180). However, in December 2017, CMMI finalized the cancellation of the bundled payment model that included the hybrid AMI mortality measure (82 FR 57066).

This measure was also signaled in the FY 2016 Hospital Inpatient Quality Reporting (HIQR) final rule in August 2015 (80 FR 49698).

4a1.3. If not currently publicly reported OR used in at least one other accountability application, provide a credible plan for implementation within the expected timeframes -- any accountability application within 3 years and publicly reported within 6 years of initial endorsement. (*Credible plan includes the specific program, purpose, intended audience, and timeline for implementing the measure within the specified timeframes. A plan for accountability applications addresses mechanisms for data aggregation and reporting.*)
This measure is final and ready to be implemented. This measure builds upon the work of the hybrid hospital-wide readmission (HWR) measure (NQF# 0230) currently implemented in the HIQR program as a voluntary measure for reporting. Although, the implementation plan for the hybrid AMI mortality measure has not yet been determined, hospitals will submit data in 2018 for the hybrid HWR measure. This hybrid AMI mortality measure, which uses nearly identical EHR-derived data elements, can be implemented by CMS in future regulation sand is suitable for the HIQR program, the Hospital Value Based Payment (HVBP) program, or a future EPM under a CMMI program.

4a2.1.1. Describe how performance results, data, and assistance with interpretation have been provided to those being measured or other users during development or implementation.
How many and which types of measured entities and/or others were included? If only a sample of measured entities were included, describe the full population and how the sample was selected.
N/A

4a2.1.2. Describe the process(es) involved, including when/how often results were provided, what data were provided, what educational/explanatory efforts were made, etc.
N/A

4a2.2.1. Summarize the feedback on measure performance and implementation from the measured entities and others described in 4d.1.
Describe how feedback was obtained.
N/A

4a2.2.2. Summarize the feedback obtained from those being measured.
N/A

4a2.2.3. Summarize the feedback obtained from other users
N/A

4a2.3. Describe how the feedback described in 4a2.2.1 has been considered when developing or revising the measure specifications or implementation, including whether the measure was modified and why or why not.
N/A

Improvement
Progress toward achieving the goal of high-quality, efficient healthcare for individuals or populations is demonstrated. If not in use for performance improvement at the time of initial endorsement, then a credible rationale describes how the performance results could be used to further the goal of high-quality, efficient healthcare for individuals or populations.

4b1. Refer to data provided in 1b but do not repeat here. Discuss any progress on improvement (trends in performance results, number and percentage of people receiving high-quality healthcare; Geographic area and number and percentage of accountable entities and patients included.)
If no improvement was demonstrated, what are the reasons? If not in use for performance improvement at the time of initial endorsement, provide a credible rationale that describes how the performance results could be used to further the goal of high-quality, efficient healthcare for individuals or populations.
Although this measure is not in public reporting, the harmonized claims-only AMI mortality measure has been in the HIQR program for many years, and has shown a slight decrease over time in AMI mortality. T Because it includes clinical information gathered and used in the course of patient care, the hybrid AMI mortality measure has improved credibility and face validity among stakeholders. It also aligns with CMS's goal to incorporate electronic clinical data into quality measures wherever possible.

4b2. Unintended Consequences
   The benefits of the performance measure in facilitating progress toward achieving high-quality, efficient healthcare for individuals or populations outweigh evidence of unintended negative consequences to individuals or populations (if such evidence exists).

4b2.1. Please explain any unexpected findings (positive or negative) during implementation of this measure including unintended impacts on patients.
We did not identify any unintended consequences during measure development, model testing, or testing the risk variables in hospital settings.

4b2.2. Please explain any unexpected benefits from implementation of this measure.
N/A; measure not currently implemented.

5. Comparison to Related or Competing Measures

If a measure meets the above criteria <u>and</u> there are endorsed or new related measures (either the same measure focus or the same target population) or competing measures (both the same measure focus and the same target population), the measures are compared to address harmonization and/or selection of the best measure.

5. Relation to Other NQF-endorsed Measures
Are there related measures (conceptually, either same measure focus or target population) or competing measures (conceptually both the same measure focus and same target population)? If yes, list the NQF # and title of all related and/or competing measures.
Yes

5.1a. List of related or competing measures (selected from NQF-endorsed measures)

5.1b. If related or competing measures are not NQF endorsed please indicate measure title and steward.
N/A

5a. Harmonization of Related Measures
The measure specifications are harmonized with related measures;
OR
The differences in specifications are justified

5a.1. If this measure conceptually addresses EITHER the same measure focus OR the same target population as NQF-endorsed measure(s):
Are the measure specifications harmonized to the extent possible?
Yes

5a.2. If the measure specifications are not completely harmonized, identify the differences, rationale, and impact on interpretability and data collection burden.
The measure specifications are, by design, not completely harmonized in that the current measure uses clinical data elements collected from EHR for risk adjustment, and the measures listed above use claims data for risk adjustment. Additionally, the outcome in measure #0730 is inpatient mortality rather than 30-day mortality. Inpatient mortality rates can be influenced by hospital length of stay, so 30-day measures that establish a standard follow-up period are more appropriate for profiling a diverse group of hospitals (Drye et al., 2012). The measures listed above have target populations aged 18+, whereas the current measure's target population is age 65+. The exclusion criteria of the current measure are largely similar to those of measure #0230. Reference: Drye EE, Normand SL, Wang Y, Ross JS, Schreiner GC, Han L, Rapp M, Krumholz HM. Comparison of hospital risk-standardized mortality rates calculated by using in-hospital and 30-day models: an observational study with implications for hospital profiling. Ann Intern Med. 2012 Jan 3;156(1 Pt 1):19-26.

5b. Competing Measures
The measure is superior to competing measures (e.g., is a more valid or efficient way to measure);
OR
Multiple measures are justified.

5b.1. If this measure conceptually addresses both the same measure focus and the same target population as NQF-endorsed measure(s):
Describe why this measure is superior to competing measures (e.g., a more valid or efficient way to measure quality); OR provide a rationale for the additive value of endorsing an additional measure. (Provide analyses when possible.)
The use of clinical data elements that are measured in patients during the course of diagnosis and treatment have greater face validity among providers and produced a model with better discrimination (higher c-statistic) compared with the model risk-adjusted with claims data only. However, the hybrid measure has not yet been implemented and we recommend continues endorsement of both measures until such a time as CMS implements the hybrid measure.

Appendix

A.1 Supplemental materials may be provided in an appendix. All supplemental materials (such as data collection instrument or methodology reports) should be organized in one file with a table of contents or bookmarks. If material pertains to a specific submission form number, that should be indicated. Requested information should be provided in the submission form and required attachments. There is no guarantee that supplemental materials will be reviewed.
Available at measure-specific web page URL identified in S.1 **Attachment:**

Contact Information

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Co.3 Measure Developer if different from Measure Steward: Yale New Haven Health Services Corporation/Center for Outcomes Research and Evaluation (YNHHSC/CORE)
Co.4 Point of Contact: Karen, Dorsey, karen.dorsey@yale.edu, 203-764-5700-

Additional Information

Ad.1 Workgroup/Expert Panel involved in measure development
Provide a list of sponsoring organizations and workgroup/panel members' names and organizations. Describe the members' role in measure development.
The following experts provided insight and guidance during measure development.

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Additionally, researchers at Abt Associates and their subcontractors eSpecified and tested the eMeasure in collaboration with the CORE team.

Measure Developer/Steward Updates and Ongoing Maintenance
Ad.2 Year the measure was first released: 2016
Ad.3 Month and Year of most recent revision: 09, 2016
Ad.4 What is your frequency for review/update of this measure? Annual
Ad.5 When is the next scheduled review/update for this measure? 04, 2018

Ad.6 Copyright statement: N/A
Ad.7 Disclaimers: N/A

Ad.8 Additional Information/Comments: N/A