

# NATIONAL QUALITY FORUM

TO: NQF Members and Public

FR: NQF Staff

RE: Pre-comment review of an addendum to *National Voluntary Consensus Standards: Cardiovascular Endorsement Maintenance 2010: A Consensus Report*

DA: October 6, 2011

In the recent draft report, [National Voluntary Consensus Standards: Cardiovascular Endorsement Maintenance, 2010](#), measures for acute myocardial infarction mortality (0230), heart failure mortality (0229) and heart failure readmission (0330) were presented. Stakeholders have urged expanding these measure from the original specifications for ages 65 years and older to include all patients. On September 12, 2011, the Cardiovascular Endorsement Maintenance Steering Committee reviewed revised specifications that have been tested to apply to all patients, not just those over 65 years. The revised submissions include all payer data testing results and have been evaluated as an addendum to the original report. The three revised measures are recommended for endorsement.

Pursuant to section II.A of the Consensus Development Process v. 1.8, this draft document, along with the accompanying material, is being provided to you at this time for purposes of review and comment only and is not intended to be used for voting purposes. You may post your comments and view the comments of others on the [NQF website](#). **The comment period for the three revised measures report is 15 days.**

**NQF Member comments must be submitted no later than 6:00 pm ET, September 14, 2011.**

**Public comments must be submitted no later than 6:00 pm ET, September 21, 2011.**

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## NATIONAL VOLUNTARY CONSENSUS STANDARDS: CARDIOVASCULAR ENDORSEMENT MAINTENANCE 2010: A CONSENSUS REPORT ADDENDUM

In the draft report, [National Voluntary Consensus Standards: Cardiovascular Endorsement Maintenance, 2010](#), measures for acute myocardial infarction mortality (0230), heart failure mortality (0229) and heart failure readmission (0330) were presented. Stakeholders have urged expanding these measure from the original specifications for ages 65 years and older to include all patients. The measure developers have recently provided the [results of testing on all payer data](#). The Cardiovascular Endorsement Maintenance Steering Committee reviewed the revised specifications and the testing information and recommends the following revised measures for endorsement:

0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization for patients 18 and older

0229 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following heart failure (HF) hospitalization for patients 18 and older

0330 Hospital 30-day, all-cause, risk-standardized readmission rate following heart failure hospitalization for patients 18 and older

<b>0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization for patients 18 and older</b>
<b>For More Information:</b> <a href="#">Complete Measure Submission</a>
<b>Description:</b> The measure estimates a hospital-level risk-standardized mortality rate (RSMR), defined as death from any cause within 30 days after the index admission date, for patients 18 and older discharged from the hospital with a principal diagnosis of AMI. <b>Numerator Statement:</b> This outcome measure does not have a traditional numerator and denominator like a core process measure (e.g., percentage of adult patients with diabetes aged 18-75 years receiving one or more hemoglobin A1c tests per year); thus, we are using this field to define the outcome. The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days of the index admission date for patients 18 and older discharged from the hospital with a principal diagnosis of AMI. <b>Denominator Statement:</b> Note: This outcome measure does not have a traditional numerator and denominator like a core process measure; thus, we are using this field to define the patient cohort. This claims-based measure can be used in either of two patient cohorts: (1) patients aged 65 years or older or (2) patients aged 18 years or older. While the measure can be applied to populations aged 18 years or older, national data are often only available for patients aged 65 years or older. We have explicitly tested the measure in both age groups. The cohorts include admissions for patients discharged from the hospital with a principal diagnosis of AMI (ICD-9-CM codes 410.xx except for 410.x2) and with a complete claims history for the 12 months prior to admission. Patients who are transferred from one acute care facility to another must have a principal discharge diagnosis of AMI at both hospitals. The initial hospital for a transferred patient is designated as the responsible institution for the episode. If a patient has more than one AMI admission in a year, one hospitalization is randomly selected for inclusion in the measure.

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## 0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization for patients 18 and older

**Exclusions:** For all cohorts, the measure excludes admissions for patients:

- who were discharged on the day of admission or the following day and did not die or get transferred (because it is less likely they had a significant AMI).
- who were transferred from another acute care hospital (because the death is attributed to the hospital where the patient was initially admitted).
- with inconsistent or unknown mortality status or other unreliable data (e.g. date of death precedes admission date).
- who were discharged alive and against medical advice (AMA) (because providers did not have the opportunity to deliver full care and prepare the patient for discharge).
- that were not the first hospitalization in the 30 days prior to a patient's death. We use this criterion to prevent attribution of a death to two admissions.

For Medicare FFS patients, the measure additionally excludes admissions for patients:

- enrolled in the Medicare Hospice program any time in the 12 months prior to the index hospitalization including the first day of the index admission (since it is likely these patients are continuing to seek comfort measures only). Although this exclusion currently applies to Medicare FFS patients, it could be expanded to include all payer data if an acceptable method for identifying hospice patients outside of Medicare becomes available.

**Adjustment/Stratification:** Risk adjustment devised specifically for this measure/condition. Our approach to risk adjustment was tailored to and appropriate for a publicly reported outcome measure, as articulated in the American Heart Association (AHA) Scientific Statement, "Standards for Statistical Models Used for Public Reporting of Health Outcomes" (Krumholz et al. 2006).

The measure employs a hierarchical logistic regression model (a form of hierarchical generalized linear model [HGLM]) to create a hospital level 30-day RSMR. This approach to modeling appropriately accounts for the structure of the data (patients clustered within hospitals), the underlying risk due to patients' comorbidities, and sample size at a given hospital when estimating hospital mortality rates. In brief, the approach simultaneously models two levels (patient and hospital) to account for the variance in patient outcomes within and between hospitals (Normand and Shahnian et al. 2007). At the patient level, each model adjusts the log-odds of mortality within 30 days of admission for age, sex, selected clinical covariates and a hospital specific intercept. The second level models the hospital-specific intercepts as arising from a normal distribution. The hospital intercept, or hospital specific effect, represents the hospital contribution to the risk of mortality, after accounting for patient risk and sample size, and can be inferred as a measure of quality. The hospital-specific intercepts are given a distribution in order 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. Candidate and Final Risk-adjustment Variables: The measure was developed using Medicare FFS claims data. Candidate variables were patient-level risk-adjustors that are expected to be predictive of mortality, based on empirical analysis, prior literature, and clinical judgment, including demographic factors (age, sex) and indicators of comorbidity and disease severity. For each patient, covariates were obtained from Medicare claims extending 12 months prior to and including the index admission. The model adjusted for case differences based on the clinical status of the patient at the time of admission. We used condition categories (CCs), which are clinically meaningful groupings of more than 15,000 ICD-9-CM diagnosis codes. We did not risk-adjust for CCs that were possible adverse events of care and that were only recorded in the index admission. In addition, only comorbidities that conveyed information about the patient at that time or in the 12 months prior, and not complications that arose during the course of the hospitalization were included in the risk-adjustment.

The final set of risk-adjustment variables is:

### Demographic

- Age-65 (years above 65, continuous) for 65 and over cohorts; or Age (years, continuous) for 18 and over cohorts.
- Male

### Cardiovascular

- History of PTCA
- History of CABG
- Congestive heart failure
- History of AMI
- Unstable angina
- Anterior myocardial infarction
- Other location of myocardial infarction
- Chronic atherosclerosis
- Cardio-respiratory failure and shock
- Valvular and rheumatic heart disease

### Comorbidity

- Hypertension
- Stroke

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## 0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization for patients 18 and older

- Cerebrovascular disease
- Renal failure
- Chronic Obstructive Pulmonary Disease
- Pneumonia
- Diabetes and DM complications
- Protein-calorie malnutrition
- Dementia and senility
- Hemiplegia, paraplegia, paralysis, functional disability
- Peripheral vascular disease
- Metastatic cancer, acute leukemia and other severe cancers
- Trauma in the last year
- Major psychiatric disorders
- Chronic liver disease

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### References:

Krumholz HM, Brindis RG, Brush JE, et al. 2006. Standards for Statistical Models Used for Public Reporting of Health Outcomes: An American Heart Association Scientific Statement From the Quality of Care and Outcomes Research Interdisciplinary Writing Group: Cosponsored by the Council on Epidemiology and Prevention and the Stroke Council Endorsed by the American College of Cardiology Foundation. *Circulation* 113: 456-462.

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

**Level of Analysis:** Facility/Agency

**Type of Measure:** Outcome

**Data Source:** Administrative claims, Other

Two data sources were used to create the measure:

1. Medicare Part A inpatient and outpatient and Part B outpatient claims: This database contains claims data for fee-for-service inpatient and outpatient services, including Medicare inpatient hospital care, outpatient hospital services, skilled nursing facility care, some home health agency services, and hospice care, as well as inpatient and outpatient claims for the 12 months prior to an index admission.

2. Medicare Enrollment Database (EDB): This database contains Medicare beneficiary demographic, benefit/coverage, and vital status information. This dataset 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 measure was originally developed with claims data from 1998. The models have been maintained and re-evaluated each year since public reporting of the measure began in 2007. For details, see measure methodology and measure maintenance reports posted at <http://qualitynet.org/dcs/ContentServer?c=Page&pagename=QnetPublic%2FPage%2FQnetTier3&cid=1219069855841>.

The measure was subsequently applied to California Patient Discharge Data, a large, linked all-payer database of patient hospital admissions. Records are linked by a unique patient identification number, allowing us to determine patient history from previous hospitalizations. In addition, the unique patient ID number is used to link with state vital statistics records to assess 30-day mortality. To apply the measure to Medicare data, Medicare Part A inpatient and outpatient and Part B outpatient claims are used. To apply the measure to a non-Medicare population, inpatient claims data are used.

Fleming C, Fisher ES, Chang CH, Bubolz D, Malenda J. Studying outcomes and hospital utilization in the elderly: The advantages of a merged data base for Medicare and Veterans Affairs Hospitals. *Medical Care*. 1992; 30(5): 377-91.

**Measure Steward:** Centers for Medicare & Medicaid Services, 7500 Security Boulevard, Mail Stop S3-02-01, Baltimore, MD 21244-9045

### STEERING COMMITTEE EVALUATION

**1. Importance to Measure and Report:** original measure Y-19; N-0; [revised measure Y-12 N-0](#)

(1a. Impact; 1b. Performance gap; 1c. Outcome or Evidence)

#### Rationale:

- This is an important indicator, as mortality rates after MI are high.
- There is wide variation in performance among hospitals, and this variation persists after adjustment for patient-level characteristics.
- [The revised measure captures all patients who had an AMI.](#)

**2. Scientific Acceptability of Measure Properties:** C-19; P-1; M-0; N-0; [revised measure C-12; P-0; M-0; N-0](#)

(2a. Precise specifications; 2b. Reliability testing; 2c. Validity testing; 2d. Exclusions justified; 2e. Risk adjustment/stratification; 2f. Meaningful differences; 2g. Comparability; 2h. Disparities)

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<p><b>0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization for patients 18 and older</b></p>
<p><b>Rationale:</b></p> <ul style="list-style-type: none"> <li>• The measure is precise.</li> <li>• Reliability demonstrated in split-half analysis. Validity demonstrated by chart-based audit.</li> <li>• Fully risk adjusted with hierarchical general linear modeling.</li> <li>• Analysis indicates that disparities are small at the hospital level.</li> <li>• <del>Limited to patients great than 65 years.</del></li> <li>• Comprehensive testing analysis.</li> <li>• Model fit is extremely good – c statistic is &gt;0.7 for both populations.</li> <li>• Committee members were impressed that testing demonstrates that there is no need to change the risk variables.</li> <li>• Used linked vital statistics data from California for testing – is this available in all states?</li> <li>• The developers report that data from the National Death index and administrative data are similarly delayed.</li> </ul>
<p><b>3. Usability:</b> C-18; P-2; M-0; N-0; <u>revised measure C-11; P-1; M-0; N-0</u>  <i>(3a. Meaningful/useful for public reporting and quality improvement; 3b. Harmonized; 3c. Distinctive or additive value to existing measures)</i></p> <p><b>Rationale:</b></p> <ul style="list-style-type: none"> <li>• The measure is publicly reported.</li> <li>• The statistical adjustment method is the same one used for heart failure and pneumonia.</li> <li>• AHRQ reports in-hospital mortality, but 30-day mortality is independent of length of stay and cannot be influenced by care decisions like early discharge.</li> </ul> <p>NOTE: Developer indicates it is working on expanding the age range to include all patients in the near future</p> <ul style="list-style-type: none"> <li>• <u>Revised measure broadens the measured population..</u></li> </ul>
<p><b>4. Feasibility:</b> C-20; P-0; M-0; N-0; <u>revised measure C-9; P-3; M-0; N-0</u>  <i>(4a. Clinical data generated during care process; 4b. Electronic sources; 4c. Exclusions—no additional data source; 4d. Susceptibility to inaccuracies/ unintended consequences identified; 4e. Data collection strategy can be implemented)</i></p> <p><b>Rationale:</b></p> <ul style="list-style-type: none"> <li>• Data are byproduct of routine medical record coding.</li> <li>• Data are available electronically, and no additional sources are required.</li> <li>• Measure is already in use.</li> <li>• <u>Testing indicates that Medicare and all payer data can be combined.</u></li> <li>• <u>The developers report that data from the National Death index and administrative data are similarly delayed.</u></li> </ul>
<p><b>Does the Measure Meet Criteria for Endorsement:</b> Y-18; N-0; A-0; <u>revised measure Y-12; N-0</u></p> <p><b>Rationale:</b></p> <ul style="list-style-type: none"> <li>• Risk-adjusted outcome measure.</li> <li>• Well developed and tested.</li> <li>• In use for public reporting.</li> <li>• Complete measure information in submission, including disparities data.</li> <li>• <u>Revised measure captures all patients with good risk model fit.</u></li> </ul>
<p><b>If Applicable, Conditions/Questions for Developer:</b></p> <ul style="list-style-type: none"> <li>• Developer indicated it is working on expanding the measure to apply to all patients, not just those over 65 years. On June 3, 2011 the developer forwarded testing results for the AMI 30 day mortality applied to all payer data. The Committee will review these results in the coming months and perform a full evaluation as an addendum.</li> </ul>
<p><b>RECOMMENDATION: MAINTAIN ENDORSEMENT of REVISED MEASURE for all ages</b></p> <p>On June 3, 2011 NQF and the Steering Committee received initial results of testing this measure on all payer data. The Committee will further evaluate the testing results as an addendum to this recommendation.</p>
<p><b>COMMENTS on original measure:</b></p> <ul style="list-style-type: none"> <li>• All-cause mortality rate does not correlate well with AMI mortality.</li> </ul> <p><b>Committee response:</b></p> <ul style="list-style-type: none"> <li>• All patient care is inter-related. All-cause mortality reflects the reality of caring for patients. It is not possible to</li> </ul>

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**0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization for patients 18 and older**

separate "cardiovascular causes" independent of other conditions affecting a patient.

**0229 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following heart failure (HF) hospitalization for patients 18 and older**

**For More Information:** [Complete Measure Submission](#):

**Description:** The measure estimates a hospital-level risk-standardized mortality rate (RSMR), defined as death from any cause within 30 days after the index admission date, for patients 18 and older discharged from the hospital with a principal diagnosis of HF.

**Numerator Statement:** This outcome measure does not have a traditional numerator and denominator like a core process measure (e.g., percentage of adult patients with diabetes aged 18-75 years receiving one or more hemoglobin A1c tests per year); thus, we are using this field to define the outcome.

The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days of the index admission date for patients 18 and older discharged from the hospital with a principal diagnosis of HF.

**Denominator Statement:** Note: This outcome measure does not have a traditional numerator and denominator like a core process measure; thus, we are using this field to define the patient cohort and to define exclusions to the patient cohort.

This claims-based measure can be used in either of two patient cohorts: (1) patients aged 65 years or older or (2) patients aged 18 years or older. While the measure can be applied to populations aged 18 years or older, nationally data are often only available for patients aged 65 years or older. We have explicitly tested the measure in both age groups.

The cohort includes admissions for patients discharged from the hospital with a principal diagnosis of HF (ICD-9-CM codes 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, and 428.xx) and with a complete claims history for the 12 months prior to admission. Patients who are transferred from one acute care facility to another must have a principal discharge diagnosis of HF at both hospitals. The initial hospital for a transferred patient is designated as the responsible institution for the episode.

If a patient has more than one HF admission in a year, one hospitalization is randomly selected for inclusion in the measure.

**Exclusions:** For all cohorts, the measure excludes admissions for patients:

- who were discharged on the day of admission or the following day and did not die or get transferred (because it is less likely they had a significant HF diagnosis);
- who were transferred from another acute care hospital (because the death is attributed to the hospital where the patient was initially admitted);
- with inconsistent or unknown mortality status or other unreliable data (e.g. date of death precedes admission date);
- who were discharged alive and against medical advice (AMA) (because providers did not have the opportunity to deliver full care and prepare the patient for discharge);
- that were not the first hospitalization in the 30 days prior to a patient's death. We use this criteria to prevent attribution of a death to two admissions.

For Medicare FFS patients, the measure additionally excludes admissions for patients:

- enrolled in the Medicare Hospice program any time in the 12 months prior to the index hospitalization including the first day of the index admission (since it is likely these patients are continuing to seek comfort measures only). Although this exclusion currently applies to Medicare FFS patients, it could be expanded to include all payer data if an acceptable method for identifying hospice patients outside of Medicare becomes available.

**Adjustment/Stratification:** Risk-adjustment devised specifically for this measure/condition. Our approach to risk adjustment was tailored to and appropriate for a publicly reported outcome measure, as articulated in the American Heart Association (AHA) Scientific Statement, "Standards for Statistical Models Used for Public Reporting of Health Outcomes" (Krumholz et al. 2006).

The measure employs a hierarchical logistic regression model (a form of hierarchical generalized linear model [HGLM]) to create a hospital-level 30-day RSMR. This approach to modeling appropriately accounts for the structure of the data (patients clustered within hospitals), the underlying risk due to patients' comorbidities, and sample size at a given hospital when estimating hospital mortality rates. In brief, the approach simultaneously models two levels (patient and hospital) to account for the variance in patient outcomes within and between hospitals (Normand and Shahian et al. 2007). At the patient level, each model adjusts the log-odds of mortality within 30-days of admission for age, sex, selected clinical covariates and a hospital-specific intercept. The second level models the hospital-specific intercepts as arising from a normal distribution. The hospital intercept, or hospital-specific effect, represents the hospital contribution to the risk of mortality, after accounting for patient risk and sample size, and can be inferred as a measure of quality. The hospital-specific intercepts are given a distribution in order 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.

**Candidate and Final Risk-adjustment Variables:** The measure was developed using Medicare FFS claims data. Candidate variables were patient-level risk-adjustors that are expected to be predictive of mortality, based on empirical analysis, prior literature, and clinical

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## 0229 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following heart failure (HF) hospitalization for patients 18 and older

judgment, including demographic factors (age, sex) and indicators of comorbidity and disease severity. For each patient, covariates were obtained from Medicare claims extending 12 months prior to and including the index admission. The model adjusted for case differences based on the clinical status of the patient at the time of admission. We used condition categories (CCs), which are clinically meaningful groupings of more than 15,000 ICD-9-CM diagnosis codes. We did not risk-adjust for CCs that were possible adverse events of care and that were only recorded in the index admission. In addition, only comorbidities that conveyed information about the patient at that time or in the 12-months prior, and not complications that arose during the course of the hospitalization were included in the risk-adjustment.

The final set of risk-adjustment variables is:

### Demographic

- Age-65 (years above 65, continuous) for 65 and over cohorts; or Age (years, continuous) for 18 and over cohorts

- Male

### Cardiovascular

- History of PTCA
- History of CABG
- Congestive heart failure
- Acute myocardial infarction
- Unstable angina
- Chronic atherosclerosis
- Cardio-respiratory failure and shock
- Valvular and rheumatic heart disease

### Comorbidity

- Hypertension
- Stroke
- Renal failure
- Pneumonia
- Diabetes and DM complications
- Protein-calorie malnutrition
- Dementia and senility
- Hemiplegia, paraplegia, paralysis, functional disability
- Peripheral vascular disease
- Metastatic cancer, acute leukemia, and other severe cancers
- Trauma in last year
- Major psych disorders
- Chronic liver disease

### References:

Krumholz HM, Brindis RG, Brush JE, et al. 2006. Standards for Statistical Models Used for Public Reporting of Health Outcomes: An American Heart Association Scientific Statement From the Quality of Care and Outcomes Research Interdisciplinary Writing Group: Cosponsored by the Council on Epidemiology and Prevention and the Stroke Council Endorsed by the American College of Cardiology Foundation. *Circulation* 113: 456-462.

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

**Level of Analysis:** Facility/Agency      **Type of Measure:** Outcome

**Data Source:** Administrative claims, Other

Two data sources were used to create the measure:

1. Medicare Part A Inpatient and Outpatient and Part B outpatient claims: This database contains claims data for fee-for service inpatient and outpatient services including: Medicare inpatient hospital care, outpatient hospital services, skilled nursing facility care, some home health agency services, and hospice care, as well as inpatient and outpatient claims for the 12 months prior to an index admission.

2. Medicare Enrollment Database (EDB): This database contains Medicare beneficiary demographic, benefit/coverage, and vital status information. This dataset 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 Fisher et al. 1992).

The measure was originally developed with claims data from a 1998 sample of 222,424 cases from 5,087 hospitals. The models have been maintained and re-evaluated each year since public reporting of the measures began in 2007. For details, see measure methodology and measure maintenance reports posted at

<http://qualitynet.org/dcs/ContentServer?c=Page&pagename=QnetPublic%2FPage%2FQnetTier3&cid=1219069855841>

The measure was subsequently applied to California Patient Discharge Data, a large, linked all-payer database of patient hospital admissions. Records are linked by a unique patient identification number, allowing us to determine patient history from previous

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<b>0229 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following heart failure (HF) hospitalization for patients 18 and older</b>
<p>hospitalizations. In addition, the unique patient ID number is used to link with state vital statistics records to assess 30-day mortality. To apply the measure to Medicare data, Medicare Part A inpatient and outpatient and Part B outpatient claims are used. To apply the measure to a non-Medicare population, inpatient claims data are used.</p> <p>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.</p> <p><b>Measure Steward:</b> Centers for Medicare &amp; Medicaid Services, 7500 Security Boulevard, Mail Stop S3-02-01, Baltimore, MD 21244-9045</p>
<b>STEERING COMMITTEE EVALUATION</b>
<p><b>1. Importance to Measure and Report:</b> <u>Y-19; N-0; revised measure Y-12; N-0</u>  <i>(1a. Impact; 1b. Performance gap; 1c. Outcome or Evidence)</i></p> <p><b>Rationale:</b></p> <ul style="list-style-type: none"> <li>• Most common admission under Medicare; second most costly total bill.</li> <li>• Outcome measure.</li> <li>• Important outcome measure</li> <li>• <b>Including all patients raises Importance criteria further.</b></li> </ul>
<p><b>2. Scientific Acceptability of Measure Properties:</b> <u>C-19; P-1; M-0; N-0; revised measure C-12; P-0; M-0; N-0</u>  <i>(2a. Precise specifications; 2b. Reliability testing; 2c. Validity testing; 2d. Exclusions justified; 2e. Risk adjustment/stratification; 2f. Meaningful differences; 2g. Comparability; 2h. Disparities)</i></p> <p><b>Rationale:</b></p> <ul style="list-style-type: none"> <li>• Data were published in a manuscript last year, looking at long-term trends in cardiovascular quality and outcomes.</li> <li>• Risk adjustment used is administrative data. Methodology was validated against clinical data.</li> <li>• <del>Limited to patients great than 65 years.</del></li> <li>• Comprehensive testing analysis.</li> <li>• Model fit is extremely good – c statistic is &gt;0.7 for both populations.</li> <li>• Committee members were impressed that testing demonstrates that there is no need to change the risk variables.</li> <li>• Used linked vital statistics data from California for testing – is this available in all states?</li> <li>• The developers report that data from the National Death index and administrative data are similarly delayed.</li> <li>• Disparities – developers found that hospitals with large African-American populations have similar distributions of performance</li> <li>• End-of-life concerns – measure includes exclusions for hospice prior to discharge</li> <li>• Measure accounts for risk factors indicating frailty.</li> </ul>
<p><b>3. Usability:</b> <u>C-17; P-2; M-0; N-0; revised measure C-11; P-1; M-0; N-0</u>  <i>(3a. Meaningful/useful for public reporting and quality improvement; 3b. Harmonized; 3c. Distinctive or additive value to existing measures)</i></p> <p><b>Rationale:</b></p> <ul style="list-style-type: none"> <li>• Measure is currently in use.</li> <li>• Public may not view data on website as often as was hoped, but doctors and administrators are using the data for internal quality improvement.</li> <li>• <b>More patients captured in the measure.</b></li> </ul>
<p><b>4. Feasibility:</b> <u>C-19; P-1; M-0; N-0; revised measure C-9; P-3; M-0; N-0</u>  <i>(4a. Clinical data generated during care process; 4b. Electronic sources; 4c. Exclusions – no additional data source; 4d. Susceptibility to inaccuracies/ unintended consequences identified 4e. Data collection strategy can be implemented)</i></p> <p><b>Rationale:</b></p> <ul style="list-style-type: none"> <li>• Measure is in use and publicly reported.</li> <li>• Uses administrative data.</li> <li>• <b>Testing demonstrates all payer data can be used.</b></li> </ul>
<p><b>Does the Measure Meet Criteria for Endorsement?:</b> <u>Y-17; N-1; A-0; revised measure Y-12; No-0</u></p> <p><b>Rationale:</b></p> <ul style="list-style-type: none"> <li>• A detailed, comprehensive submission form demonstrates that the measure meets all the criteria.</li> <li>• Published in the literature.</li> </ul>



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<b>0229 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following heart failure (HF) hospitalization for patients 18 and older</b>
<ul style="list-style-type: none"> <li>In use and publicly reported.</li> <li>Revised measure captures all patients with good risk model fit.</li> </ul>
<p><b>If applicable, Conditions/Questions for Developer:</b> Disparities in race and socioeconomic status have been reported at the patient level. Does CMS plan on stratifying the measure?</p> <p><b>Response:</b> Disparities at the hospital level haven't been seen in facilities with higher percentages of African-American patients.</p>
<p><b>RECOMMENDATION: MAINTAIN ENDORSEMENT of REVISED MEASURE for all ages</b></p> <p>On June 3, 2011, NQF and the Steering Committee were advised that the developer will complete testing of this measure on all payer data. The Committee will evaluate possible revisions to the measure as an addendum.</p>
<p><b>COMMENTS on original measure</b></p> <ul style="list-style-type: none"> <li>Given the advanced age of many HF patients, many in palliative care programs, many deaths cannot be considered a result of substandard care.</li> </ul> <p>Committee response:</p> <ul style="list-style-type: none"> <li>Patients in hospice care are excluded and risk factors account for frailty.</li> </ul>

<b>0330 Hospital 30-day, all-cause, risk-standardized readmission rate following heart failure hospitalization for patients 18 and older</b>
<b>For More Information:</b> <a href="#">Complete Measure Submission</a>
<p><b>Description:</b> The measure estimates a hospital 30-day risk-standardized readmission rate (RSRR), defined as readmission for any cause within 30 days after the date of discharge of the index admission for patients 18 and older discharged from the hospital with a principal diagnosis of heart failure (HF).</p> <p><b>Numerator Statement:</b> This outcome measure does not have a traditional numerator and denominator like a core process measure (e.g., percentage of adult patients with diabetes aged 18-75 years receiving one or more hemoglobin A1c tests per year); thus, we are using this field to define the outcome.</p> <p>The outcome for this measure is 30 day all-cause readmission. We define this as readmission for any cause within 30 days from the date of discharge of the index HF admission for patients 18 and older.</p> <p>In addition, if a patient has one or more admissions within 30 days of discharge from the index admission, only one was counted as a readmission.</p> <p><b>Denominator Statement:</b> Note: This outcome measure does not have a traditional numerator and denominator like a core process measure; thus, we are using this field to define the patient cohort and to define the patient cohort.</p> <p>This claims-based measure can be used in either of two patient cohorts: (1) patients aged 65 years or older or (2) patients aged 18 years or older. While the measure can be applied to populations aged 18 years or older, nationally data are often only available for patients aged 65 years or older. We have explicitly tested the measure in both age groups.</p> <p>The cohort includes admissions for patients discharged from the hospital with a principal diagnosis of HF (ICD-9-CM codes 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, and 428.xx) and with a complete claims history for the 12 months prior to admission.</p> <p><b>Exclusions:</b> For all cohorts, the measure excludes admissions for patients:</p> <ul style="list-style-type: none"> <li>with an in-hospital death (because they are not eligible for readmission);</li> <li>without at least 30 days post-discharge enrollment in Medicare FFS (because the 30-day readmission outcome cannot be assessed in this group);</li> <li>transferred to another acute care facility (When a patient is transferred from one acute care hospital to another, these multiple contiguous hospitalizations are considered one episode of care. Readmissions for transferred patients are attributed to the hospital that ultimately discharges the patient to a non-acute care setting.);</li> <li>discharged against medical advice (AMA) (because providers did not have the opportunity to deliver full care and prepare the patient for discharge);</li> <li>admitted with HF within 30 days of discharge from an index admission (Admissions within 30 days of discharge of an index admission will be considered readmissions. No admission is counted as a readmission and an index admission. The next eligible admission after the 30-day time period following an index admission will be considered another index admission.)</li> </ul> <p><b>Adjustment/Stratification:</b> Risk-adjustment devised specifically for this measure/condition. Our approach to risk adjustment was tailored to and appropriate for a publicly reported outcome measure, as articulated in the American Heart Association (AHA) Scientific Statement, "Standards for Statistical Models Used for Public Reporting of Health Outcomes" (Krumholz et al. 2006).</p>

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The measure employs a hierarchical logistic regression model (a form of hierarchical generalized linear model [HGLM]) to create a hospital level 30-day RSRR. This approach to modeling appropriately accounts for the structure of the data (patients clustered within hospitals), the underlying risk due to patients' comorbidities, and sample size at a given hospital when estimating hospital readmission rates. In brief, the approach simultaneously models two levels (patient and hospital) to account for the variance in patient outcomes within and between hospitals (Normand and Shahian et al. 2007). At the patient level, each model adjusts the log-odds of readmission within 30-days of admission for age, sex, selected clinical covariates and a hospital-specific intercept. The second level models the hospital-specific intercepts as arising from a normal distribution. The hospital intercept, or hospital specific effect, represents the hospital contribution to the risk of readmission, after accounting for patient risk and sample size, and can be inferred as a measure of quality. The hospital-specific intercepts are given a distribution in order 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.

**Candidate and Final Risk-adjustment Variables:** The measure was developed using Medicare FFS claims data. Candidate variables were patient-level risk-adjustors that are expected to be predictive of readmission, based on empirical analysis, prior literature, and clinical judgment, including demographic factors (age, sex) and indicators of comorbidity and disease severity. For each patient, covariates were obtained from Medicare claims extending 12 months prior to and including the index admission. The model adjusted for case differences based on the clinical status of the patient at the time of admission. We used condition categories (CCs), which are clinically meaningful groupings of more than 15,000 ICD-9-CM diagnosis codes. In addition, only comorbidities that conveyed information about the patient at that time or in the 12-months prior, and not complications that arose during the course of the hospitalization were included in the risk-adjustment. We did not risk-adjust for CCs that were possible adverse events of care and that were only recorded in the index admission,

The final set of risk-adjustment variables is:

### Demographic

- Age-65 (years above 65, continuous) for 65 and over cohorts; or Age (years, continuous) for 18 and over cohorts.
- Male

### Cardiovascular

- History of CABG
- Cardio-respiratory failure or shock
- Congestive heart failure
- Acute coronary syndrome
- Coronary atherosclerosis or angina
- Valvular or rheumatic heart disease
- Specified arrhythmias
- Other or unspecified heart disease
- Vascular or circulatory disease

### Comorbidity

- Metastatic cancer or acute leukemia
- Cancer
- Diabetes or DM complications
- Protein-calorie malnutrition
- Disorders of fluid, electrolyte, acid-base
- Liver or biliary disease
- Peptic ulcer, hemorrhage, other specified gastrointestinal disorders
- Other gastrointestinal disorders
- Severe hematological disorders
- Iron deficiency or other anemias and blood disease
- Dementia or other specified brain disorders
- Drug/alcohol abuse/dependence/psychosis
- Major psychiatric disorders
- Depression
- Other psychiatric disorders
- Hemiplegia, paraplegia, paralysis, functional disability
- Stroke
- Chronic obstructive pulmonary disease
- Fibrosis of lung or other chronic lung disorders

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- Asthma
- Pneumonia
- End stage renal disease or dialysis
- Renal failure
- Nephritis
- Other urinary tract disorders
- Decubitus ulcer or chronic skin ulcer

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### References:

Krumholz HM, Brindis RG, Brush JE, et al. 2006. Standards for Statistical Models Used for Public Reporting of Health Outcomes: An American Heart Association Scientific Statement From the Quality of Care and Outcomes Research Interdisciplinary Writing Group: Cosponsored by the Council on Epidemiology and Prevention and the Stroke Council Endorsed by the American College of Cardiology Foundation. *Circulation* 113: 456-462.

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

**Level of Analysis:** Facility/Agency **Type of Measure:** Outcome

**Data Source:** Administrative claims, Other. Two data sources were used to create the measure:

1. Medicare Part A Inpatient and Outpatient and Part B outpatient claims: This database contains claims data for fee-for service inpatient and outpatient services including: Medicare inpatient hospital care, outpatient hospital services, skilled nursing facility care, some home health agency services, and hospice care, as well as inpatient and outpatient claims for the 12 months prior to an index admission.
2. Medicare Enrollment Database (EDB): This database contains Medicare beneficiary demographic, benefit/coverage, and vital status information. This dataset 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 Fisher et al. 1992). The measure was originally developed with claims data from a 2004 sample of 283,919 cases from 4,669 hospitals. The models have been maintained and re-evaluated each year since public reporting of the measures began in 2009. For details, see measure methodology and measure maintenance reports posted at [www.qualitynet.org](http://www.qualitynet.org).

The measure was subsequently applied to California Patient Discharge Data, a large, linked all-payer database of patient hospital admissions. Records are linked by a unique patient identification number, allowing us to determine patient history from previous hospitalizations as well as risk of readmission within 30 days.

To apply the measure to Medicare data, Medicare Part A inpatient and outpatient and Part B outpatient claims are used. To apply the measure to a non-Medicare population, inpatient claims data are used.

Fleming C., Fisher ES, Chang CH, Bubolz D, Malenda J. Studying outcomes and hospital utilization in the elderly: The advantages of a merged data base for Medicare and Veterans Affairs Hospitals. *Medical Care*. 1992; 30(5): 377-91.

**Measure Steward:** Centers for Medicare & Medicaid Services, 7500 Security Boulevard, Mail Stop S3-02-01, Baltimore, MD 21244-9045

### STEERING COMMITTEE EVALUATION

**1. Importance to Measure and Report:** Y-19; N-0 **revised measure Y-12; No-0**

(1a. Impact; 1b. Performance gap; 1c. Outcome or Evidence)

#### Rationale:

- Heart failure is the number one cause of hospitalization and readmission among Medicare members.
- **Broader population to include all ages raises Importance further.**

**2. Scientific Acceptability of Measure Properties:** C-18; P-1; M-0; N-0; **revised measure C-12; P-0; M-0; N-0**

(2a. Precise specifications; 2b. Reliability testing; 2c. Validity testing; 2d. Exclusions justified; 2e. Risk adjustment/stratification; 2f. Meaningful differences; 2g. Comparability; 2h. Disparities)

#### Rationale:

- Very well specified.
- Disparities information should be publicly disclosed on Hospital Compare.
- Stratified analyses are done instead of controlling for socioeconomic status.
- **Risk model fit is lower –c-statistic = 0.61 - typical of all readmission measures.**

**3. Usability:** C-18; P-1; M-0; N-0; **revised measure C-11; P-1; M-0; N-0**

(3a. Meaningful/useful for public reporting and quality improvement; 3b. Harmonized; 3c. Distinctive or additive value to existing measures)

#### Rationale:

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<b>0330 Hospital 30-day, all-cause, risk-standardized readmission rate following heart failure hospitalization for patients 18 and older</b>
<ul style="list-style-type: none"> <li>• Has been in use without any major issues for some time.</li> <li>• Captures an important domain of quality that's not captured in the mortality measure or other measures reviewed.</li> <li>• <b>Revised measure captured all patients.</b></li> </ul>
<p><b>4. Feasibility:</b> <u>C-18; P-1; M-0; N-0; revised measure C-11; P-1; M-0; N-0</u>  <i>(4a. Clinical data generated during care process; 4b. Electronic sources; 4c. Exclusions – no additional data source; 4d. Susceptibility to inaccuracies/ unintended consequences identified 4e. Data collection strategy can be implemented)</i></p> <p><b>Rationale:</b></p> <ul style="list-style-type: none"> <li>• Data generated during care process. Uses administrative data.</li> <li>• Data could be obtained from electronic health records or paper.</li> <li>• Isn't particularly susceptible to inaccuracies and is easily implemented.</li> </ul>
<p><b>Does the Measure Meet Criteria for Endorsement?:</b> <u>Y-20; N-0; A-0; revised measure Y-12; N-0</u></p> <p><b>Rationale:</b></p> <ul style="list-style-type: none"> <li>• High readmission rates—20% within 30 days; 50% within 1 years</li> <li>• Significant variation</li> <li>• Addresses all criteria</li> <li>• <b>Broader measure addresses stakeholder's request for improved measure.</b></li> </ul>
<p><b>If applicable, Conditions/Questions for Developer:</b> Strongly recommend that disparities data be reported on Hospital Compare.  <b>Developer Response:</b> Disparities surveillance is on-going and reported on another CMS website. Will consider recommendation to include in Hospital Compare.</p>
<p><b>RECOMMENDATION: MAINTAIN ENDORSEMENT</b></p> <p>On June 3, 2011, NQF and the Steering Committee were advised that the developer will complete testing of this measure on all payer data. The Committee will evaluate possible revisions to the measure as an addendum.</p>
<p><b>COMMENTS on the original measure</b></p>
<p>Several comments were submitted suggesting that the measure does not meet the NQF measure evaluation criteria for endorsement:</p> <ul style="list-style-type: none"> <li>• “Exclusions. We urge the Steering Committee to request an analysis from the measure developer on a list of risk-adjustment variables (Appendix A) that should be considered as candidates for measure exclusions. We recommend the Steering Committee re-examine this measure for scientific acceptability. We are concerned that the criteria included in section 2d: <i>exclusions justified</i> of the Consensus Development Process has not been properly met. Currently, this measure only includes exclusions in five-limited categories: In-hospital death; Without at least 30 days post-discharge enrollment in fee-for-service Medicare; Transferred to another acute care facility; Discharged against medical advice; Admitted with heart failure within 30 days of discharge from an index admission.”</li> <li>• “The measure developer has included a list of risk-adjustment variables (Appendix A) that are applied to claims data. However, these variables are not being applied to ensure that cases that are not truly readmissions are left out of the measures rate. Rather than use these variables in the risk-adjustment methodology, these variables should be considered candidates for additional exclusions. We urge the Steering Committee to ask the developer to provide evidence that these variables are not distorting the measure results. The developer should provide the following: Count of the frequency of these variables; Sensitivity analysis with and without the exclusions; and Variability of exclusions across hospital types (i.e., teaching and non-teaching).”</li> </ul> <p><i>Developer response:</i></p> <p><i>The above comments raise two issues regarding measure exclusions. The first is a request to consider using current risk-adjustment variables (those listed in their Appendix A) instead as exclusions to the measure. We</i></p>

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*feel the measure is a much stronger measure as designed because it includes a greater proportion of a hospitals' heart failure (or AMI) patients while adequately risk-adjusting for differences in hospitals' case-mix. The goal in developing outcomes measures is to create a clinically cohesive cohort that includes as many patients as possible admitted with the given condition (e.g., heart failure). We aim to limit exclusions to factors that preclude fair assessment of care quality for an admission, such as lack of continuous enrollment, which prevents us from assessing patient risk factors, or patients' leaving AMA, since hospitals do not have the opportunity to provide all recommend care for these patients. Greatly expanding our list of exclusions to all the conditions listed in the Appendix would result in a measure that was less useful and meaningful, as it would reflect the care of the small number of a hospital's patients that presented without significant co-morbidities. It also could create incentives for hospitals to code risk-factors in order to exclude patients from the measures. To fairly profile hospitals' performance risk adjustment, it is critical to place hospitals on a level playing field and account for their differences in the patients that present for care. This is accomplished through adequate risk adjustment for patients' clinical presentation rather than exclusion of patients.*

*The second issue raised by the commenter above is the "exclusion" of planned cases and unrelated admissions. In this case the comment is referring to "excluding" readmissions that is, not counting certain admission as readmissions (as opposed to excluding hospitalizations from the cohort assessed for readmissions). The readmission measures are designed as all-cause readmission measures for a number of reasons.*

*First, from the patient perspective, unplanned readmission for any reason is an undesirable outcome of care, even though not all readmissions are related to the index admission or preventable. Second, limiting the outcome to "related readmissions" may limit the focus of efforts to improve care to a narrow set of approaches as opposed to encouraging broader initiatives aimed overall at improving the care within the hospital and transitions from the hospital setting. Moreover, there is no reliable way to exclude quality issues and accountability based on the documented cause of readmission. For example, a patient admitted for heart failure who develops a line infection may ultimately be readmitted for sepsis. It would be inappropriate to treat this readmission as unrelated to the care the patient received during the initial hospitalization. The goal of an all-cause readmission measure is not to reduce readmissions to zero, but to assess hospital performance relative to what is expected given the performance of other hospitals with similar case mixes while minimizing the potential for systematic coding misclassifications (gaming).*

*We do however aim, in the development of readmission measures to identify planned readmissions. Planned readmissions are admissions that include a planned procedure as follow-on care from the index hospitalization. At the time of measure development, clinical experts were asked whether there were common follow-up causes of readmissions for a scheduled procedure that represented a continuation of care after a HF admission. No such related, planned procedures were identified as occurring commonly after the index admissions for HF.*

- "Risk adjustment. We urge the Steering Committee to have additional dialogue with the measure developer on the use of stratification to properly risk adjust the HF readmission measure. We recommend the Steering Committee re-examine this measure for scientific acceptability. We are concerned that the criteria included in section 2e: risk adjustment/stratification of the Consensus Development Process has not properly been met. The NQF criteria in the maintenance report states, "It is preferable to stratify measures by race and socioeconomic status rather than adjusting out differences." However, the measure developer states, "The measure is not stratified."

At a minimum this data must be made publicly available in order for this measure to pass the test of scientific acceptability and remain endorsed under this maintenance review.

- "Disparities. We urge the Steering Committee to have additional dialogue with the measure developer on

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stratification to properly account for the disparities underlying the HF readmission measure. We recommend the Steering Committee re-examine this measure for scientific acceptability. We are concerned that the criteria included in section 2h: disparities of the Consensus Development Process has not been properly met. The NQF criteria in the maintenance report states, “If disparities in care have been identified, measure specifications, scoring and analysis allow for identification of disparities through stratification of results (e.g., by race, ethnicity, socioeconomic status, gender); or rationale/data justifies why stratification is not necessary or not feasible.” However, the measure developer states: “Disparities in race and socio-economic status have been reported at the patient level [for the heart failure readmission measure].”

### *Developer response:*

*Performance on the measure nationally confirms that the measure is fair to hospitals with relatively high proportions of minority and low SES patients. Examination of the current publicly-reported readmission measures demonstrates that hospitals serving high proportions of African-American patients or patients of low SES often perform well on the measures. We have grouped hospitals according to the proportion of their patients who are African-American or the median income level of their patients and compared the performance of these groups on the readmission measures based on discharges for 2007-2009. We have also compared the performance of safety-net and non-safety-net hospitals. In each of these analyses, the primary finding is that the range of performance for hospitals in the group serving the highest proportion of African-American or poorer patients overlaps almost completely with the performance of hospitals with lower percentages of vulnerable populations. In all subgroups of hospitals we find both high and low performers. These analyses support a standard benchmark for hospitals regardless of the racial or SES mix of the patients they serve. Furthermore, stratifying patients in these measures by race and/or socioeconomic status would set a double standard for quality measurement. Therefore, we have neither risk adjusted for race and/or socioeconomic status in order to ensure any disparities present are not masked and we have not stratified the measure to prevent the creation of a double standard of quality performance based upon race and/or socioeconomic status.*

- “I have real concerns about readmission rates as quality measures. One reason is our data from the VA system showed over a 5-year period in patients who were hospitalized for heart failure that there was a progressive rise in readmission rates associated with a progressive decline in mortality rates. (Heidenreich JACC 2010;56:362-68). A likely reason for this may be that systems which have programs in place to see patients early post-discharge and/or employ various forms of remote monitoring, home visits, and contact with trained NPs will recognize clinical deterioration earlier and admit the patient. This measure has the potential to discourage timely readmissions.”

### *Developer response:*

*As noted, a readmission measure could provide an incentive to deny a patient a needed admission, thereby reducing access for patients and ultimately resulting in worse outcomes. The Centers for Medicare and Medicaid Services (CMS) publicly reports both mortality and all-cause readmission measures for AMI, heart failure, and pneumonia, mitigating concerns that hospital actions that affect both readmission and mortality will not be fully captured in performance assessment. Importantly, many hospitals perform well on both the readmission and mortality measures demonstrating that good performance on the mortality measure does not limit performance on the readmission measures. In addition, CMS monitors and maintains their publicly reported measures on an ongoing basis.*

*Furthermore, readmission has several important strengths as an outcome for evaluating hospital quality of*

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*care: 1) It is patient-centered in that patients experience the outcome and incur the disruption, risk, and indirect (and sometimes the direct) costs of the hospitalization and the clinical events that led to it; 2) As an outcome, readmission incorporates many aspects of a patient's care, including actions that are difficult to measure directly. Successful transition from the hospital and an uneventful recovery requires that many aspects of healthcare are successfully delivered; 3) although not all readmissions are preventable, many readmissions could be prevented if care were improved. Research has shown that readmission rates are influenced by the quality of inpatient and outpatient care, and that improvement in care, such as improved discharge processes, can reduce readmission rates; 4) Readmissions are costly and a reduction in these events would not only enhance the patient experience but could also reduce health care spending.*

- “All cause readmission loses its meaning to clinicians and providers as this does not provide information that could lead to performance improvement.”

Committee response: The Committee accepted the developer responses that “adequately addressed the issues in a detailed fashion”.

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## Appendix A: REVISED SPECIFICATIONS

	0229 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following heart failure (HF) hospitalization for patients 18 and older
Steward	Centers for Medicare & Medicaid Services, 7500 Security Boulevard, Mail Stop S3-02-01, Baltimore, MD 21244-9045
Description	The measure estimates a hospital-level risk-standardized mortality rate (RSMR), defined as death from any cause within 30 days after the index admission date, for patients 18 and older discharged from the hospital with a principal diagnosis of HF.
Type	Outcome
Data Source	administrative data; other  <a href="http://qualitynet.org/dcs/ContentServer?c=Page&amp;pagename=QnetPublic%2FPage%2FQnetTier3&amp;cid=1219069855841">http://qualitynet.org/dcs/ContentServer?c=Page&amp;pagename=QnetPublic%2FPage%2FQnetTier3&amp;cid=1219069855841</a>
Level	Facility/Agency
Setting	Hospital/Acute Care Facility
Numerator Statement	This outcome measure does not have a traditional numerator and denominator like a core process measure (e.g., percentage of adult patients with diabetes aged 18-75 years receiving one or more hemoglobin A1c tests per year); thus, we are using this field to define the outcome.  The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days of the index admission date for patients discharged from the hospital with a principal diagnosis of HF.
Numerator Details	<b>Time Window:</b> Patients who die within 30 days of the index admission date.  Measure includes deaths from any cause within 30 days from admission date of index hospitalization.
Denominator Statement	Note: This outcome measure does not have a traditional numerator and denominator like a core process measure; thus, we are using this field to define the patient cohort and to define exclusions to the patient cohort.  This claims-based measure can be used in either of two patient cohorts: (1) patients aged 65 years or older or (2) patients aged 18 years or older. While the measure can be applied to populations aged 18 years or older, nationally data are often only available for patients aged 65 years or older. We have explicitly tested the measure in both age groups.  The cohort includes admissions for patients discharged from the hospital with a principal diagnosis of HF (ICD-9-CM codes 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, and 428.xx) and with a complete claims history for the 12 months prior to admission. Patients who are transferred from one acute care facility to another must have a principal discharge diagnosis of HF at both hospitals. The initial hospital for a transferred patient is designated as the responsible institution for the episode.  If a patient has more than one HF admission in a year, one hospitalization is randomly selected for inclusion in



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	0229 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following heart failure (HF) hospitalization for patients 18 and older
	the measure.
<b>Denominator Categories</b>	Female; Male The target population is age 18 years or older
<b>Denominator Details</b>	<p><b>Time Window:</b> This measure was developed with 12 months of data. Currently the measure is publicly reported with three years of index hospitalizations.</p> <p>The denominator includes patients aged 18 and older admitted to non-federal acute care hospitals for an HF defined by a principal discharge diagnosis of (ICD-9-CM codes 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, and 428.xx) and with a complete claims history for the 12 months prior to admission.</p> <p>ICD-9-CM codes that define the patient cohort:</p> <p>402.01 Hypertensive heart disease, malignant, with heart failure</p> <p>402.11 Hypertensive heart disease, benign, with heart failure</p> <p>402.91 Hypertensive heart disease, unspecified, with heart failure</p> <p>404.01 Hypertensive heart and chronic kidney disease, malignant, with heart failure and with chronic kidney disease stage I through stage IV, or unspecified</p> <p>404.03 Hypertensive heart and chronic kidney disease, malignant, with heart failure and with chronic kidney disease stage V or end stage renal disease</p> <p>404.11 Hypertensive heart and chronic kidney disease, benign, with heart failure and with chronic kidney disease stage I through stage IV, or unspecified</p> <p>404.13 Hypertensive heart and chronic kidney disease, benign, with heart failure and chronic kidney disease stage V or end stage renal disease</p> <p>404.91 Hypertensive heart and chronic kidney disease, unspecified, with heart failure and with chronic kidney disease stage I through stage IV, or unspecified</p> <p>404.93 Hypertensive heart and chronic kidney disease, unspecified, with heart failure and chronic kidney disease stage V or end stage renal disease</p> <p>428.0 Congestive heart failure, unspecified</p> <p>428.1 Left heart failure</p> <p>428.20 Unspecified systolic heart failure</p> <p>428.21 Acute systolic heart failure</p> <p>428.22 Chronic systolic heart failure</p> <p>428.23 Acute on chronic systolic heart failure</p>

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	<b>0229 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following heart failure (HF) hospitalization for patients 18 and older</b>
	<p>428.30 Unspecified diastolic heart failure</p> <p>428.31 Acute diastolic heart failure</p> <p>428.32 Chronic diastolic heart failure</p> <p>428.33 Acute on chronic diastolic heart failure</p> <p>428.40 Unspecified combined systolic and diastolic heart failure</p> <p>428.41 Acute combined systolic and diastolic heart failure</p> <p>428.42 Chronic combined systolic and diastolic heart failure</p> <p>428.43 Acute on chronic combined systolic and diastolic heart failure</p> <p>428.9 Heart Failure, unspecified</p>
<b>Exclusions</b>	<p>For all cohorts, the measure excludes admissions for patients:</p> <ul style="list-style-type: none"> <li>• who were discharged on the day of admission or the following day and did not die or get transferred (because it is less likely they had a significant HF diagnosis);</li> <li>• who were transferred from another acute care hospital (because the death is attributed to the hospital where the patient was initially admitted);</li> <li>• with inconsistent or unknown mortality status or other unreliable data (e.g. date of death precedes admission date);</li> <li>• who were discharged alive and against medical advice (AMA) (because providers did not have the opportunity to deliver full care and prepare the patient for discharge);</li> <li>• that were not the first hospitalization in the 30 days prior to a patient's death. We use this criteria to prevent attribution of a death to two admissions.</li> </ul> <p>For Medicare FFS patients, the measure additionally excludes admissions for patients:</p> <ul style="list-style-type: none"> <li>• enrolled in the Medicare Hospice program any time in the 12 months prior to the index hospitalization including the first day of the index admission (since it is likely these patients are continuing to seek comfort measures only). Although this exclusion currently applies to Medicare FFS patients, it could be expanded to include all payer data if an acceptable method for identifying hospice patients outside of Medicare becomes available.</li> </ul>
<b>Exclusion Details</b>	See "Denominator Exclusions" section.
<b>Risk Adjustment</b>	<p>Risk-adjustment devised specifically for this measure/condition</p> <p>URL</p>

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	<b>0229 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following heart failure (HF) hospitalization for patients 18 and older</b>
	<a href="http://www.qualitynet.org/dcs/ContentServer?c=Page&amp;pagename=QnetPublic%2FPage%2FQnetTier3&amp;cid=1163010421830">http://www.qualitynet.org/dcs/ContentServer?c=Page&amp;pagename=QnetPublic%2FPage%2FQnetTier3&amp;cid=1163010421830</a>
<b>Stratification</b>	Results of this measure will not be stratified.
<b>Type Score</b>	Rate/proportion    better quality = lower score
<b>Algorithm</b>	<p>The RSMR is calculated as the ratio of the number of "adjusted actual" deaths (also known as "predicted") to the number of "expected" deaths at a given hospital, multiplied by the national unadjusted 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 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</p> <p>The "adjusted actual" deaths (the numerator) is calculated by regressing the risk factors and the hospital-specific intercept on the risk of mortality, multiplying the estimated regression coefficients by the patient characteristics in the hospital, transforming, and then summing over all patients attributed to the hospital to get a value. The expected number of deaths (the denominator) is obtained by regressing the risk factors and a common intercept on the mortality outcome using all hospitals in our sample, multiplying the subsequent estimated regression coefficients by the patient characteristics observed in the hospital, transforming, and then summing over all patients in the hospital to get a value.</p> <p>To assess hospital performance in any reporting period, the model coefficients are re-estimated using the years of data in that period.</p>

	<b>0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization for patients 18 and older</b>
<b>Steward</b>	Centers for Medicare & Medicaid Services (CMS), 7500 Security Boulevard, Mail Stop S3-02-01, Baltimore, MD 21244-9045
<b>Description</b>	The measure estimates a hospital-level risk-standardized mortality rate (RSMR), defined as death from any cause within 30 days after the index admission date, for patients 18 and older discharged from the hospital with a principal diagnosis of AMI.
<b>Type</b>	Outcome
<b>Data Source</b>	Electronic administrative data/claims
	URL Condition <a href="http://qualitynet.org/dcs/ContentServer?c=Page&amp;pagename=QnetPublic%2FPage%2FQnetTier3&amp;cid=12190698">http://qualitynet.org/dcs/ContentServer?c=Page&amp;pagename=QnetPublic%2FPage%2FQnetTier3&amp;cid=12190698</a>

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	<b>0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization for patients 18 and older</b>
	55841
<b>Level</b>	Facility/Agency
<b>Setting</b>	Hospital/Acute Care Facility
<b>Numerator Statement</b>	<p>This outcome measure does not have a traditional numerator and denominator like a core process measure (e.g., percentage of adult patients with diabetes aged 18-75 years receiving one or more hemoglobin A1c tests per year); thus, we are using this field to define the outcome.</p> <p>The outcome for this measure is 30-day all-cause mortality. We define mortality as death from any cause within 30 days of the index admission date for patients 18 and older discharged from the hospital with a principal diagnosis of AMI.</p>
<b>Numerator Details</b>	<p><b>Time Window:</b> Patients who die within 30 days of the index admission date.</p> <p>Measure includes deaths from any cause within 30 days from admission date of index hospitalization.</p>
<b>Denominator Statement</b>	<p>Note: This outcome measure does not have a traditional numerator and denominator like a core process measure; thus, we are using this field to define the patient cohort.</p> <p>This claims-based measure can be used in either of two patient cohorts: (1) patients aged 65 years or older or (2) patients aged 18 years or older. While the measure can be applied to populations aged 18 years or older, national data are often only available for patients aged 65 years or older. We have explicitly tested the measure in both age groups.</p> <p>The cohorts include admissions for patients discharged from the hospital with a principal diagnosis of AMI (ICD-9-CM codes 410.xx except for 410.x2) and with a complete claims history for the 12 months prior to admission. Patients who are transferred from one acute care facility to another must have a principal discharge diagnosis of AMI at both hospitals. The initial hospital for a transferred patient is designated as the responsible institution for the episode.</p> <p>If a patient has more than one AMI admission in a year, one hospitalization is randomly selected for inclusion in the measure.</p>
<b>Denominator Categories</b>	Female; Male The target population is age 18 years or older

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	0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization for patients 18 and older
Denominator Details	<p><b>Time Window:</b> This measure was developed with 12 months of data. Currently the measure is publicly reported with three years of index hospitalizations.</p> <p>The denominator includes patients aged 18 and older admitted to non-federal acute care hospitals for an AMI defined by a principal discharge diagnosis of ICD-9-CM code 410.xx, excluding those with 410.x2 (AMI, subsequent episode of care), and with a complete claims history for the 12 months prior to admission.</p> <p>ICD-9-CM codes that define the patient cohort:</p> <ul style="list-style-type: none"> <li>410.00 AMI (anterolateral wall) – episode of care unspecified</li> <li>410.01 AMI (anterolateral wall) – initial episode of care</li> <li>410.10 AMI (other anterior wall) – episode of care unspecified</li> <li>410.11 AMI (other anterior wall) – initial episode of care</li> <li>410.20 AMI (inferolateral wall) – episode of care unspecified</li> <li>410.21 AMI (inferolateral wall) – initial episode of care</li> <li>410.30 AMI (inferoposterior wall) – episode of care unspecified</li> <li>410.31 AMI (inferoposterior wall) – initial episode of care</li> <li>410.40 AMI (other inferior wall) – episode of care unspecified</li> <li>410.41 AMI (other inferior wall) – initial episode of care</li> <li>410.50 AMI (other lateral wall) – episode of care unspecified</li> <li>410.51 AMI (other lateral wall) – initial episode of care</li> <li>410.60 AMI (true posterior wall) – episode of care unspecified</li> <li>410.61 AMI (true posterior wall) – initial episode of care</li> <li>410.70 AMI (subendocardial) – episode of care unspecified</li> <li>410.71 AMI (subendocardial) – initial episode of care</li> <li>410.80 AMI (other specified site) – episode of care unspecified</li> <li>410.81 AMI (other specified site) – initial episode of care</li> </ul>

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	<b>0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization for patients 18 and older</b>
	<p>410.90 AMI (unspecified site) – episode of care unspecified</p> <p>410.91 AMI (unspecified site) – initial episode of care</p> <p>Note: We do not include 410.x2 (AMI, subsequent episode of care)</p>
<b>Exclusions</b>	<p>For all cohorts, the measure excludes admissions for patients:</p> <ul style="list-style-type: none"> <li>• who were discharged on the day of admission or the following day and did not die or get transferred (because it is less likely they had a significant AMI).</li> <li>• who were transferred from another acute care hospital (because the death is attributed to the hospital where the patient was initially admitted).</li> <li>• with inconsistent or unknown mortality status or other unreliable data (e.g. date of death precedes admission date).</li> <li>• who were discharged alive and against medical advice (AMA) (because providers did not have the opportunity to deliver full care and prepare the patient for discharge).</li> <li>• that were not the first hospitalization in the 30 days prior to a patient's death. We use this criterion to prevent attribution of a death to two admissions.</li> </ul> <p>For Medicare FFS patients, the measure additionally excludes admissions for patients:</p> <ul style="list-style-type: none"> <li>• enrolled in the Medicare Hospice program any time in the 12 months prior to the index hospitalization including the first day of the index admission (since it is likely these patients are continuing to seek comfort measures only). Although this exclusion currently applies to Medicare FFS patients, it could be expanded to include all payer data if an acceptable method for identifying hospice patients outside of Medicare becomes available.</li> </ul>
<b>Exclusion Details</b>	See "Denominator Exclusions" section.
<b>Risk Adjustment</b>	<p>Risk-adjustment devised specifically for this measure/condition.</p> <p>URL  <a href="http://www.qualitynet.org/dcs/ContentServer?c=Page&amp;pagename=QnetPublic%2FPPage%2FQnetTier3&amp;cid=1163010421830">http://www.qualitynet.org/dcs/ContentServer?c=Page&amp;pagename=QnetPublic%2FPPage%2FQnetTier3&amp;cid=1163010421830</a></p>
<b>Stratification</b>	Results of this measure will not be stratified.
<b>Type Score</b>	Rate/proportion    better quality = lower score
<b>Algorithm</b>	The RSMR is calculated as the ratio of the number of "adjusted actual" deaths (also known as "predicted") to the number of "expected" deaths at a given hospital, multiplied by the national unadjusted mortality rate. For each hospital, the "numerator" of the ratio is the number of deaths within 30 days predicted on the basis of the

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	<b>0230 Hospital 30-day, all-cause, risk-standardized mortality rate (RSMR) following acute myocardial infarction (AMI) hospitalization for patients 18 and older</b>
	<p>hospital's performance with its observed case mix, and the "denominator" 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.</p> <p>The "adjusted actual" deaths (the numerator) is calculated by regressing the risk factors and the hospital-specific intercept on the risk of mortality, multiplying the estimated regression coefficients by the patient characteristics in the hospital, transforming, and then summing over all patients attributed to the hospital to get a value. The expected number of deaths (the denominator) is obtained by regressing the risk factors and a common intercept on the mortality outcome using all hospitals in our sample, multiplying the subsequent estimated regression coefficients by the patient characteristics observed in the hospital, transforming, and then summing over all patients in the hospital to get a value.</p> <p>To assess hospital performance in any reporting period, the model coefficients are re-estimated using the years of data in that period.</p>

	<b>0330 Hospital 30-day, all-cause, risk-standardized readmission rate following heart failure hospitalization</b>
<b>Steward</b>	Centers for Medicare & Medicaid Services, 7500 Security Boulevard, Mail Stop S3-02-01, Baltimore, MD 21244-9045
<b>Description</b>	The measure estimates a hospital 30-day risk-standardized readmission rate (RSRR), defined as readmission for any cause within 30 days after the date of discharge of the index admission for patients discharged from the hospital with a principal diagnosis of heart failure (HF).
<b>Type</b>	Outcome
<b>Data Source</b>	Electronic administrative data/claims  URL <a href="http://qualitynet.org/dcs/ContentServer?c=Page&amp;pagename=OnetPublic%2FPage%2FQnetTier3&amp;cid=1219069855841">http://qualitynet.org/dcs/ContentServer?c=Page&amp;pagename=OnetPublic%2FPage%2FQnetTier3&amp;cid=1219069855841</a>
<b>Level</b>	Facility/Agency
<b>Setting</b>	Hospital/Acute Care Facility
<b>Numerator</b>	This outcome measure does not have a traditional numerator and denominator like a core process measure (e.g., percentage of adult patients with diabetes aged 18-75 years receiving one or more hemoglobin A1c tests per

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0330 Hospital 30-day, all-cause, risk-standardized readmission rate following heart failure hospitalization	
<b>Statement</b>	<p>year); thus, we are using this field to define the outcome.</p> <p>The outcome for this measure is 30 day all-cause readmission. We define this as readmission for any cause within 30 days from the date of discharge of the index HF admission for patients 18 and older.</p> <p>In addition, if a patient has one or more admissions within 30 days of discharge from the index admission, only one was counted as a readmission.</p>
<b>Numerator Details</b>	<p><b>Time Window:</b> Defined as readmission for any cause within 30 days from the date of discharge of the index admission.</p> <p>Measure includes readmissions to any acute care hospital for any cause within 30 days of the index HF admission discharge date.</p>
<b>Denominator Statement</b>	<p>Note: This outcome measure does not have a traditional numerator and denominator like a core process measure; thus, we are using this field to define the patient cohort and to define the patient cohort.</p> <p>This claims-based measure can be used in either of two patient cohorts: (1) patients aged 65 years or older or (2) patients aged 18 years or older. While the measure can be applied to populations aged 18 years or older, nationally data are often only available for patients aged 65 years or older. We have explicitly tested the measure in both age groups.</p> <p>The cohort includes admissions for patients discharged from the hospital with a principal diagnosis of HF (ICD-9-CM codes 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, and 428.xx) and with a complete claims history for the 12 months prior to admission.</p>
<b>Denominator Categories</b>	Female; Male The target population is age 18 years or older
<b>Denominator Details</b>	<p><b>Time Window:</b> This measure was developed with 12 months of data. Currently the measure is publicly reported with three years of index hospitalizations.</p> <p>The denominator includes patients aged 18 and older admitted to non-federal acute care hospitals for HF defined by a principal discharge diagnosis of the following (ICD-9-CM codes 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, and 428.xx) and with a complete claims history for the 12 months prior to admission.</p>



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0330 Hospital 30-day, all-cause, risk-standardized readmission rate following heart failure hospitalization
<p>ICD-9-CM codes that define the patient cohort:</p> <p>402.01 Hypertensive heart disease, malignant, with heart failure</p> <p>402.11 Hypertensive heart disease, benign, with heart failure</p> <p>402.91 Hypertensive heart disease, unspecified, with heart failure</p> <p>404.01 Hypertensive heart and chronic kidney disease, malignant, with heart failure and with chronic kidney disease stage I through stage IV, or unspecified</p> <p>404.03 Hypertensive heart and chronic kidney disease, malignant, with heart failure and with chronic kidney disease stage V or end stage renal disease</p> <p>404.11 Hypertensive heart and chronic kidney disease, benign, with heart failure and with chronic kidney disease stage I through stage IV, or unspecified</p> <p>404.13 Hypertensive heart and chronic kidney disease, benign, with heart failure and chronic kidney disease stage V or end stage renal disease</p> <p>404.91 Hypertensive heart and chronic kidney disease, unspecified, with heart failure and with chronic kidney disease stage I through stage IV, or unspecified</p> <p>404.93 Hypertensive heart and chronic kidney disease, unspecified, with heart failure and chronic kidney disease stage V or end stage renal disease</p> <p>428.0 Congestive heart failure, unspecified</p> <p>428.1 Left heart failure</p> <p>428.20 Unspecified systolic heart failure</p> <p>428.21 Acute systolic heart failure</p> <p>428.22 Chronic systolic heart failure</p> <p>428.23 Acute on chronic systolic heart failure</p> <p>428.30 Unspecified diastolic heart failure</p> <p>428.31 Acute diastolic heart failure</p> <p>428.32 Chronic diastolic heart failure</p> <p>428.33 Acute on chronic diastolic heart failure</p> <p>428.40 Unspecified combined systolic and diastolic heart failure</p> <p>428.41 Acute combined systolic and diastolic heart failure</p> <p>428.42 Chronic combined systolic and diastolic heart failure</p>

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	<b>0330 Hospital 30-day, all-cause, risk-standardized readmission rate following heart failure hospitalization</b>
	<p>428.43 Acute on chronic combined systolic and diastolic heart failure</p> <p>428.9 Heart Failure, unspecified</p>
<b>Exclusions</b>	<p>For all cohorts, the measure excludes admissions for patients:</p> <ul style="list-style-type: none"> <li>• with an in-hospital death (because they are not eligible for readmission);</li> <li>• without at least 30 days post-discharge enrollment in Medicare FFS (because the 30-day readmission outcome cannot be assessed in this group);</li> <li>• transferred to another acute care facility (When a patient is transferred from one acute care hospital to another, these multiple contiguous hospitalizations are considered one episode of care. Readmissions for transferred patients are attributed to the hospital that ultimately discharges the patient to a non-acute care setting.);</li> <li>• discharged against medical advice (AMA) (because providers did not have the opportunity to deliver full care and prepare the patient for discharge);</li> <li>• admitted with HF within 30 days of discharge from an index admission (Admissions within 30 days of discharge of an index admission will be considered readmissions. No admission is counted as a readmission and an index admission. The next eligible admission after the 30-day time period following an index admission will be considered another index admission.)</li> </ul>
<b>Exclusion Details</b>	See "Denominator Exclusions" section.
<b>Risk Adjustment</b>	<p>Risk-adjustment devised specifically for this measure/condition.</p> <p>Our approach to risk adjustment was tailored to and appropriate for a publicly reported outcome measure, as articulated in the American Heart Association (AHA) Scientific Statement, "Standards for Statistical Models Used for Public Reporting of Health Outcomes" (Krumholz et al. 2006).</p> <p>The measure employs a hierarchical logistic regression model (a form of hierarchical generalized linear model [HGLM]) to create a hospital level 30-day RSRR. This approach to modeling appropriately accounts for the structure of the data (patients clustered within hospitals), the underlying risk due to patients' comorbidities, and sample size at a given hospital when estimating hospital readmission rates. In brief, the approach simultaneously models two levels (patient and hospital) to account for the variance in patient outcomes within and between hospitals (Normand and Shahian et al. 2007). At the patient level, each model adjusts the log-odds of readmission within 30-days of admission for age, sex, selected clinical covariates and a hospital-specific</p>

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0330 Hospital 30-day, all-cause, risk-standardized readmission rate following heart failure hospitalization
<p>intercept. The second level models the hospital-specific intercepts as arising from a normal distribution. The hospital intercept, or hospital specific effect, represents the hospital contribution to the risk of readmission, after accounting for patient risk and sample size, and can be inferred as a measure of quality. The hospital-specific intercepts are given a distribution in order 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.</p> <p>Candidate and Final Risk-adjustment Variables: The measure was developed using Medicare FFS claims data. Candidate variables were patient-level risk-adjustors that are expected to be predictive of readmission, based on empirical analysis, prior literature, and clinical judgment, including demographic factors (age, sex) and indicators of comorbidity and disease severity. For each patient, covariates were obtained from Medicare claims extending 12 months prior to and including the index admission. The model adjusted for case differences based on the clinical status of the patient at the time of admission. We used condition categories (CCs), which are clinically meaningful groupings of more than 15,000 ICD-9-CM diagnosis codes. In addition, only comorbidities that conveyed information about the patient at that time or in the 12-months prior, and not complications that arose during the course of the hospitalization were included in the risk-adjustment. We did not risk-adjust for CCs that were possible adverse events of care and that were only recorded in the index admission,</p> <p>The final set of risk-adjustment variables is:</p> <p>Demographic</p> <ul style="list-style-type: none"> <li>• Age-65 (years above 65, continuous) for 65 and over cohorts; or Age (years, continuous) for 18 and over cohorts.</li> <li>• Male</li> </ul> <p>Cardiovascular</p> <ul style="list-style-type: none"> <li>• History of CABG</li> <li>• Cardio-respiratory failure or shock</li> <li>• Congestive heart failure</li> <li>• Acute coronary syndrome</li> <li>• Coronary atherosclerosis or angina</li> <li>• Valvular or rheumatic heart disease</li> <li>• Specified arrhythmias</li> <li>• Other or unspecified heart disease</li> <li>• Vascular or circulatory disease</li> </ul>

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0330 Hospital 30-day, all-cause, risk-standardized readmission rate following heart failure hospitalization	
	<p>Comorbidity</p> <ul style="list-style-type: none"> <li>• Metastatic cancer or acute leukemia</li> <li>• Cancer</li> <li>• Diabetes or DM complications</li> <li>• Protein-calorie malnutrition</li> <li>• Disorders of fluid, electrolyte, acid-base</li> <li>• Liver or biliary disease</li> <li>• Peptic ulcer, hemorrhage, other specified gastrointestinal disorders</li> <li>• Other gastrointestinal disorders</li> <li>• Severe hematological disorders</li> <li>• Iron deficiency or other anemias and blood disease</li> <li>• Dementia or other specified brain disorders</li> <li>• Drug/alcohol abuse/dependence/psychosis</li> <li>• Major psychiatric disorders</li> <li>• Depression</li> <li>• Other psychiatric disorders</li> <li>• Hemiplegia, paraplegia, paralysis, functional disability</li> <li>• Stroke</li> <li>• Chronic obstructive pulmonary disease</li> <li>• Fibrosis of lung or other chronic lung disorders</li> <li>• Asthma</li> <li>• Pneumonia</li> <li>• End stage renal disease or dialysis</li> <li>• Renal failure</li> </ul>

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	<b>0330 Hospital 30-day, all-cause, risk-standardized readmission rate following heart failure hospitalization</b>
	<ul style="list-style-type: none"> <li>• Nephritis</li> <li>• Other urinary tract disorders</li> <li>• Decubitus ulcer or chronic skin ulcer</li> <li>--</li> </ul> <p>References:</p> <p>Krumholz HM, Brindis RG, Brush JE, et al. 2006. Standards for Statistical Models Used for Public Reporting of Health Outcomes: An American Heart Association Scientific Statement From the Quality of Care and Outcomes Research Interdisciplinary Writing Group: Cosponsored by the Council on Epidemiology and Prevention and the Stroke Council Endorsed by the American College of Cardiology Foundation. <i>Circulation</i> 113: 456-462.</p> <p>Normand S-LT, Shahian DM. 2007. Statistical and Clinical Aspects of Hospital Outcomes Profiling. <i>Stat Sci</i> 22 (2): 206-226.</p> <p><a href="http://qualitynet.org/dcs/ContentServer?c=Page&amp;pagename=QnetPublic%2FPage%2FQnetTier3&amp;cid=1219069855841">http://qualitynet.org/dcs/ContentServer?c=Page&amp;pagename=QnetPublic%2FPage%2FQnetTier3&amp;cid=1219069855841</a></p>
<b>Stratification</b>	Results of this measure will not be stratified.
<b>Type Score</b>	Rate/proportion    better quality = lower score
<b>Algorithm</b>	<p>The RSRR is calculated as the ratio of the number of “adjusted-actual” readmissions (also referred to as “predicted”) to the number of “expected” readmissions at a given hospital, multiplied by the national unadjusted 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 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.</p> <p>The “adjusted actual” readmissions (the numerator) is calculated by regressing the risk factors and the hospital-specific intercept on the risk of readmission, multiplying the estimated regression coefficients by the patient characteristics in the hospital, transforming, and then summing over all patients attributed to the hospital to get a value. The expected number of readmissions (the denominator) is obtained by regressing the risk factors and a common intercept on the readmission outcome using all hospitals in our sample, multiplying the subsequent estimated regression coefficients by the patient characteristics observed in the hospital, transforming, and then summing over all patients in the hospital to get a value.</p> <p>To assess hospital performance in any reporting period, the model coefficients are re-estimated using the years of data in that period.</p>