2014 Measure Updates and Specifications Report
Hospital-Level 30-Day Risk-Standardized Payment Measure

Acute Myocardial Infarction – Version 3.0

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1. HOW TO USE THIS REPORT

This report describes the Centers for Medicare & Medicaid Services (CMS) hospital-level 30-day risk-standardized payment (RSP) measure following acute myocardial infarction (AMI) that will be publicly reported on *Hospital Compare*. This measure is hereafter referred to as the AMI Payment measure. This report is intended to provide a single source of information about this measure for a wide range of readers.

Within this report we provide an overview of the measure methodology and methodology updates for 2014 public reporting. The appendices provide detailed specifications for the measure, including concise tables of the condition codes used for cohort derivation and risk adjustment as well as a history of annual updates from previous years.

Specifically, the reader can find:

- **Section 2 – Background and Overview of Measure Methodology:**
  - Background on payment methodology
  - Cohort
    - included and excluded hospitalizations
    - consideration of transferred patients
  - Outcome
  - Risk-adjustment variables
  - Data sources
  - Measure calculation
  - Categorizing hospital payments

- **Section 3 - Updates to Measures for 2014 Public Reporting:**
  - Updates to payment calculation
  - Winsorization of outlier payments
  - Updates to exclusion criteria

- **Section 4 - Glossary**

The Appendices contain detailed measure information, including:

- Appendix A: Statistical approach
- Appendix B: Annual updates
- Appendix C: Measure specifications

For additional references, the original (v1.0) and updated (v2.0) measure methodology reports are also available on the claims-based payment measure page of *QualityNet*:

- Hospital-level, Risk-Standardized Payment Associated with a 30-Day Episode of Care for AMI (Version 1.0)
- 2013 Measure Updates and Specifications Report: Hospital-Level, Risk-Standardized Payment Associated with a 30-Day Episode of Care for AMI (Version 2.0)

2. BACKGROUND AND OVERVIEW OF MEASURE METHODOLOGY

2.1 Background on the Payment Measure

In 2012, CMS developed a measure of 30-day episode-of-care payment following hospitalization for AMI. This measure is not intended to be interpreted in isolation but considered in the context of existing quality measures such as CMS's 30-day AMI risk-standardized mortality rate (RSMR).[1] The AMI Payment measure results will be posted on *Hospital Compare* starting in 2014, and CMS updates them annually.

CMS contracted with the Yale-New Haven Health Services Corporation/Center for Outcomes Research & Evaluation (CORE) to update the 30-day AMI Payment measure for 2014 public reporting through a process of measure reevaluation. Measure reevaluation is an annual process to improve measures by responding to stakeholder input on the measures and incorporating advances in the science or changes in coding.

2.2 Overview of Measure Methodology

The 2014 risk-standardized AMI Payment measure uses the methodology described in the initial measure methodology report[2] with slight refinements to the measure as listed in Appendix B and described in the prior measure updates report.[3] Below, we provide an overview of the current methodology.

2.2.1 Cohort

Index Admissions Included in Measure

An index admission is the hospitalization that begins the 30-day episode-of-care payment window. The measure includes index admissions for patients:

- Having a principal discharge diagnosis of AMI[*];
- Enrolled in Medicare fee-for-service (FFS);
- Aged 65 years or over;
- Not transferred from another acute care facility[†]; and,
- Enrolled in Part A and Part B Medicare for the 12 months prior to the date of the index admission.

Index Admissions Excluded from the Measure

The measure excludes index admissions for patients:

- Without at least 30 days post-admission enrollment in FFS Medicare (if alive);

[*] For specific International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) codes used to define the cohort, refer to Table C.1.1. in Appendix C.

[†] The acute episode is included in the measure but payment is attributed to the hospital where the patient was initially admitted rather than the hospital receiving the transferred patient.

- Discharged on the same or next day of admission, not including deaths or transfers out;
- With inconsistent or unknown vital status or other unreliable demographic data (age and gender);
- Enrolled in hospice within one year prior to or on the date of an index admission;
- Transferred to a federal hospital; or
- Discharged against medical advice (AMA)

Transferred Patients

The measure considers multiple contiguous hospitalizations as a single acute episode of care. Admissions to another hospital within one day of discharge are considered transfers, regardless of the discharge disposition code of the previous admission.

Payments for transferred patients are attributed to the hospital that admitted the patient for the index hospitalization. Thus, if a patient is admitted to Hospital A and transferred to Hospital B, the 30-day episode of care is considered to be triggered by admission to Hospital A. The total payment includes payments for Hospital A, Hospital B, and other services provided during the 30-day episode. This attribution is consistent with the AMI RSMR measure.

Medicare reduces payments when patients are transferred to another Inpatient Prospective Payment System (IPPS) hospital and have a length of stay at least one day less than the geometric mean length of stay for the diagnosis-related group (DRG). Under this policy, transferring hospitals are paid a per diem rate. For stays at the transferring hospital that are equal to or greater than the geometric mean length of stay for the DRG, transferring hospitals receive a full DRG payment.[4] We assign the per diem rate or the full DRG rate to the transferring hospital where applicable and then add it to the payment for the hospital that received the transfer patient to calculate the payment for the index admission.

2.2.2 **Outcome**

30-Day Time Frame

The measure assesses payments within a 30-day period from the date of index admission. The measure uses a 30-day time frame because payments accrued within 30 days of admission can be influenced by hospital care and the transition to the outpatient setting. Also, the 30-day period provides a standardized observation period for each hospital. Lastly, the 30-day post-admission timeframe is consistent with other CMS measures endorsed by the National Quality Forum (NQF) and publicly reported by CMS, which provides stakeholders with a consistent time period for assessing health care value.

Please see the 2012 Methodology Report[2] for a full description of the calculation of patients' total 30-day payment, by setting.

2.2.3 **Risk-Adjustment Variables**

The measure adjusts for variables (i.e., age, prior PCI/CABG, and comorbidities) that are clinically relevant and have strong relationships with the outcome. For each patient, risk-adjustment variables are obtained from inpatient, outpatient, and physician Medicare administrative claims data extending 12 months prior to, and including, the index admission.

The measure seeks to adjust for case-mix differences among hospitals based on the clinical status of the patient at the time of the index admission. Accordingly, only comorbidities that convey information about the patient at that time or in the 12 months prior to – and not complications that arise during – the course of the hospitalization are included in the risk adjustment. Please refer to Table C.1.3. in Appendix C of this report for the list of potential complications not used for risk-adjustment.

The measure does not adjust for the patients' admission source or their discharge disposition (e.g. skilled nursing facility (SNF)) because these factors are associated with the structure of the healthcare system, not solely patients' clinical comorbidities. Regional differences in the availability of post-acute care providers and practice patterns might exert an undue influence on model results.

The measure also does not adjust for socioeconomic status (SES) because the association between SES and health outcomes can be due, in part, to differences in care received by groups of patients with varying SES. Risk adjusting for SES could also mask important disparities. The intention is for the measure to adjust for patient demographic and clinical characteristics while illuminating important payment differences. Additionally, recent analyses have shown that hospitals caring for high proportions of low SES patients perform similarly on the measure to hospitals caring for low proportions of low SES patients.[5]

Please refer to Table C.1.2. in Appendix C of this report for the list of risk-adjustment variables for the AMI Payment measure.

2.2.4 **Data Sources**

The data sources for these analyses are Medicare administrative claims data, publicly-available CMS final rule and fee schedule data, and enrollment information for patients with hospitalizations that occurred between July 1, 2010 and June 30, 2013. The datasets allow for calculation of associated payments for Medicare patients across multiple care settings, services, and supplies (i.e., inpatient, outpatient, skilled nursing facility, home health, hospice, physician/clinical laboratory/ambulance services, and durable medical equipment, prosthetics/orthotics, and supplies). Medicare administrative claims data for certain Part A and Part B services in the 12 months prior to and during the index admission are used for risk adjustment. Please see the original methodology report[2] for further descriptions of these data sources.

2.2.5 **Measure Calculation**

The measure estimates hospital-level 30-day RSPs using a hierarchical generalized linear model. In brief, the approach simultaneously models data at the patient and hospital levels to account for the variance in patient outcomes within and across hospitals.[6] At the patient level, it uses a generalized linear model with a log link and inverse Gaussian distribution to model the total 30-day payment using age, selected clinical covariates, and a hospital-specific intercept. At the hospital level, it models the hospital-specific intercept as arising from a normal distribution. The hospital-specific intercept represents the underlying 30-day payment at the hospital, after accounting for patient risk. If there were no differences among hospitals, then after adjusting for patient risk, the hospital intercepts should be identical across all hospitals.

The RSP is calculated as the ratio of the "predicted" payment to the "expected" payment at a given hospital, multiplied by the national mean payment. For each hospital, the numerator of the ratio is the 30-day payment predicted on the basis of the hospital's performance with its observed case mix, and the denominator is the payment expected on the basis of the nation's performance with that hospital's case mix. 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 of "predicted" payment to "expected" payment indicates lower-than-expected 30-day payment, and a higher ratio indicates higher-than-expected 30-day payment.

The "predicted" 30-day payment (the numerator) is calculated using the coefficients estimated by regressing the risk factors (found in Table C.1.2.) and the hospital-specific intercept on the payment outcome. The estimated hospital-specific intercept is added to the sum of the estimated regression coefficients multiplied by the patient characteristics. The results are then summed over all patients attributed to a hospital to get a predicted value. The "expected" 30-day payment (the denominator) is obtained in the same manner, but a common intercept using all hospitals in our sample is added in place of the hospital-specific intercept. The results are then summed over all patients in the hospital to get an expected value. To assess hospital performance for each reporting period, we re-estimate the model coefficients using the years of data in that period.

For each hospital, the ratio of "predicted" 30-day payment over "expected" 30-day payment is then multiplied by the national mean payment to get the RSP. This transforms the ratio of predicted over expected into a payment amount that is compared to the national mean payment. The hierarchical generalized linear regression models are described fully in Appendix A and in the original methodology report.[2]

2.2.6 **Categorizing Hospital Payments**

To categorize hospital payments, CMS estimates each hospital's RSP and the corresponding 95% interval estimate. CMS assigns hospitals to a payment category by comparing each hospital's RSP interval estimate to the national mean payment. Comparative payments for hospitals with 25 or more eligible cases is classified as follows:

- "No different than U.S. national payment" if the 95% interval estimate surrounding the hospital's RSP includes the national mean payment.
- "Higher than U.S. national payment" if the entire 95% interval estimate surrounding the hospital's RSP is higher than the national mean payment.
- "Lower than U.S. national payment" if the entire 95% interval estimate surrounding the hospital's RSP is lower than the national mean payment.

If a hospital has fewer than 25 eligible cases, CMS assigns the hospital to a separate category: "The number of cases is too small (fewer than 25) to reliably tell how well the hospital is performing." If a hospital has fewer than 25 eligible cases, the hospital's RSP and interval estimate will not be publicly reported for the measure.

3. UPDATES TO MEASURE FOR 2014 PUBLIC REPORTING

3.1 Rationale for Measure Updates

Measure reevaluation ensures that the RSP model is continually assessed and remains valid given possible changes in the data over time, and allows for model refinements. As part of measure reevaluation we:

- Validate the performance of the AMI Payment model and its corresponding risk-adjustment variables in three recent one-year datasets (July 2010-June 2011, July 2011-June 2012, and July 2012-June 2013);
- Evaluate and validate model performance in the three-year combined dataset (July 2010-June 2013); and,
- Update the measure SAS pack and documentation.

3.2 Detailed Discussion of Measure Updates

3.2.1 Updates to Payment Calculation

The calculation of the patient-level total 30-day payment has been updated to include the following payments: new technology add-on payment and blood clotting factor add-on payment.

New technology add-on payment
CMS allows inpatient settings to claim the new technology add-on payment as an addition to the standard reimbursement they receive. New technology payments are meant to ensure that Medicare beneficiaries have access to new technologies that have not been accounted for by the DRG reimbursement rate. This payment is identified in administrative claims by an inpatient value code that is specific to new technology.[7]

Blood clotting factor add-on payment
CMS allows inpatient hospital, inpatient rehabilitation facilities and long-term care hospitals to receive additional reimbursement for blood clotting factor for patients with hemophilia. Blood clotting factors typically represent a cost above and beyond the DRG reimbursement. Hospitals indicate this payment in administrative claims with the Healthcare Common Procedure Coding System (HCPCS) codes for blood clotting factors.[7]

The new technology and blood clotting factor add-on payments are related to clinical care decisions and hospital practice patterns. Since the intent of the measure is to highlight variation in payments related to these domains we include these payment adjustments in our calculation of the outcome.

3.2.2 Winsorization of Outlier Payments

As part of the maintenance of this measure, the patient-level total 30-day payments were Winsorized to eliminate extreme values at the upper end of the total payment distribution. This method reassigns any patient-level total 30-day payment that is

greater than a particular percentile (e.g. 99.5th or 99.9th) with the value of that percentile. Winsorizing outlier data can improve model prediction. In addition, by Winsorizing the extreme values of payments, we are able to mitigate the impact of possibly erroneous claims without making corrections or excluding patients.

3.2.3 Update to Exclusion Criteria

The exclusion criteria for the AMI Payment measure have been updated so that patients with a missing DRG code or weight during the index admission are no longer excluded from the cohort. During the development of this measure, patients with a missing DRG code or weight were excluded because the payment for their index admission could not be calculated. However, patients with a missing DRG weight for a readmission were not excluded, nor were patients with analogous missing information from other care settings (i.e., missing resource utilization group (RUG) weight from a SNF stay). In order to maintain consistency, we chose between two options: do not exclude patients with a missing DRG code or weight for their index admission, or exclude all patients with a missing DRG, RUG, or ambulatory payment classification (APC) weights. Because the number of patients with a missing DRG code or weight for their index admission is small and the payment could be calculated using other variables, we decided to eliminate the missing DRG exclusion criterion. In our updated approach, for patients with missing DRG (or other analogous) codes or weights in these settings, the payment was calculated by using the actual payment and removing the wage index and policy adjustments.

3.3 Changes to SAS Analytic Package (SAS Pack)

We revised the measure calculation SAS pack to reflect all changes to the index admission cohorts, new technology and blood clotting factor add-on payments, Winsorization, and model specifications. The new SAS pack and documentation are available upon request by emailing cmsepisodepaymentmeasures@yale.edu. **Do *NOT* submit patient-identifiable information (e.g., Date of Birth, Social Security Number, Health Insurance Claim Number, etc.) to this address.**

4. GLOSSARY

Cohort: The index admissions included in the measure after the inclusion and exclusion criteria have been applied.

Complications: Medical conditions that likely occurred as a consequence of care rendered, rather than as an expected outcome of the patient's condition or a condition that the patient had upon presentation to the hospital.

Comorbidities: Medical conditions that the patient had in addition to their primary disease.

Condition Categories (CCs): Groupings of ICD-9-CM diagnosis codes in clinically relevant categories, from the Hierarchical Condition Categories (HCCs) system. CMS uses the grouping but not the hierarchical logic of the system to create risk factor variables. Description of the CCs can be found at http://www.cms.hhs.gov/Reports/downloads/pope_2000_2.pdf.

Expected payment: The total payment expected on the basis of an average hospital's performance with a specific hospital's case mix.

Hierarchical model: A widely accepted statistical method that enables fair evaluation of relative hospital performance by taking into account patient risk factors as well as the number of patients that a hospital treats. This statistical model accounts for the structure of the data (patients clustered within hospitals) and calculates: (1) how much variation in hospital payment overall is accounted for by patients' individual risk factors (such as age and other medical conditions); and (2) how much variation is accounted for by hospital-specific performance.

Hospital-specific intercept: It is calculated based on the hospital's payment, considering how many patients it served, its patients' risk factors, and its patients' total payments. The hospital-specific intercept will be negative for a lower-than-average payment hospital, positive for a greater-than-average payment hospital, and close to zero for an average payment hospital. The hospital-specific intercept is used in the numerator to calculate the "predicted" payment.

Index admission: Any admission included in the measure calculation that begins the 30-day AMI episode of care.

Interval estimate: Similar to a confidence interval. The interval estimate is a range of probable values for the measure that characterizes the amount of uncertainty associated with the estimate. For example, a 95% interval estimate for the estimated payment ratio indicates that there is 95% statistical confidence that the true value of the payment ratio lies between the lower limit and the upper limit of the interval.

Medicare fee-for-service (FFS): Original Medicare plan. Only beneficiaries in Medicare FFS, not in managed care (Medicare Advantage), are included in the measure.

National mean payment: Sum of payments among all included episodes divided by the number of episodes included in the measure.

Outcome: The result of a broad set of healthcare activities that affect patients' well-being. For the payment measure, the outcome is the sum of payments accrued within 30 days of index admission.

Predicted payment: The total payment within 30 days predicted on the basis of the specific hospital with its observed case mix, also referred to as "adjusted actual" payment.

Risk-adjustment variables: Patient demographics, comorbidities, and relevant prior procedures that are used to adjust for differences in case mix across hospitals.

5. REFERENCES

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6. APPENDICIES

Appendix A. Statistical Approach

To calculate hospital-specific RSPs, we estimate hierarchical generalized linear models using three years of data. This strategy accounts for within-hospital correlation of the observed outcomes and accommodates the assumption that underlying differences in care across hospitals lead to systematic differences in payments. We model the total payment as a function of patient age, select comorbidities, and history of PCI and/or CABG with a hospital-specific random effect.

We use the following strategy to calculate the hospital-specific RSPs. We calculate these payments as the ratio of "predicted" AMI payment to "expected" AMI payment, and multiply by the national mean payment. The predicted AMI payment for each hospital is estimated using its case mix and an estimated hospital-specific intercept. The expected AMI payment for each hospital is estimated given the same case mix but the average intercept among all hospitals in the sample.

Operationally, the expected AMI payment for each hospital is obtained by summing the expected AMI payments for all patients in the hospital. The expected AMI payment for each patient is calculated via the hierarchical model by applying the estimated regression coefficients to the observed patient characteristics and adding the average intercept. The predicted AMI payment for each hospital is calculated by summing the predicted AMI payments for all patients in the hospital. The predicted AMI payment for each patient is calculated through the hierarchical model by applying the estimated regression coefficients to the patient characteristics observed and adding the hospital-specific intercept.

More specifically, we use a hierarchical generalized linear model to account for the clustering of observations within hospitals and adjust for the selected risk factors. The model employs a log link and an inverse Gaussian error distribution with a hospital-specific random effect as follows:

$$h(Y_{ij}) = \alpha_i + \beta \mathbf{Z}_{ij} \quad (1)$$

$$\alpha_i = \mu + \omega_i; \ \ \omega_i \sim N(0, \tau^2) \quad (2)$$

where i indexes hospitals, j indexes patients within hospitals, α_i represents the hospital-specific intercept, $\mathbf{Z}_{ij}$ is defined as the set of risk factors, μ is the average intercept across all hospitals in the sample, and τ^2 is the between-hospital variance component.[8] This model separates within-hospital variation from between-hospital variation. The hierarchical generalized linear models are estimated using the SAS software system (SAS 9.3 GLIMMIX procedure).

Appendix A.1 Hospital Performance Reporting

Using the selected set of risk factors, we fit the hierarchical generalized linear model defined by Equations (1) - (2) and estimate the parameters, $\hat{\mu}$, $\{\alpha_i, \alpha_2, \ldots, \alpha_I\}$, $\hat{\beta}$, and $\hat{\tau}^2$. We calculate a standardized outcome measure, RSP_i, for each hospital by computing the ratio of the predicted AMI payment to the expected AMI payment, and multiplying by the national mean payment, $\bar{y}$. Specifically, we calculate

Predicted $$\hat{y}_{ij}(Z_{ij}) = h^{-1}(\hat{a}_i + \hat{\beta}\mathbf{Z}_{ij}) \quad (3)$$

Expected $$\hat{e}_{ij}(Z_{ij}) = h^{-1}(\hat{\mu} + \hat{\beta}\mathbf{Z}_{ij}) \quad (4)$$

$$\widehat{RSP}_i(Z_{ij}) = \frac{\sum_{j=1}^{n_i} \hat{y}_{ij}(Z)}{\sum_{j=1}^{n_i} \hat{e}_{ij}(Z)} \times \bar{y} \quad (5)$$

Again, i indexes hospitals, j indexes patients within hospitals, and n_i is the number of patients within hospital i. If "predicted" total payment is higher (or lower) than "expected" total payment for a given hospital, then its $\widehat{RSP}_i$ will be higher (or lower) than the national mean payment. For each hospital, we can compute an interval estimate of RSP_i to characterize the level of uncertainty around the point estimate using bootstrapping simulations. The point estimate and interval estimate can be used to characterize and compare hospital performance (e.g., higher than expected, as expected, or lower than expected). See Figure A.1 for our overall analysis steps.

Appendix A.2 Creating Interval Estimates

Because the statistic described in Equation 5 (Appendix A.1), i.e., $\widehat{RSP}_i$, is a complex function of parameter estimates, we use the re-sampling technique – bootstrapping – to derive an interval estimate. Bootstrapping has the advantage of avoiding unnecessary distributional assumptions.

Algorithm:

Let *I* denote the total number of hospitals in the sample. We repeat steps 1-4 below for B times, where *B* is the number of bootstrap samples desired (with b indexes the *b*th bootstrap sample):

1. Sample *I* hospitals with replacement.

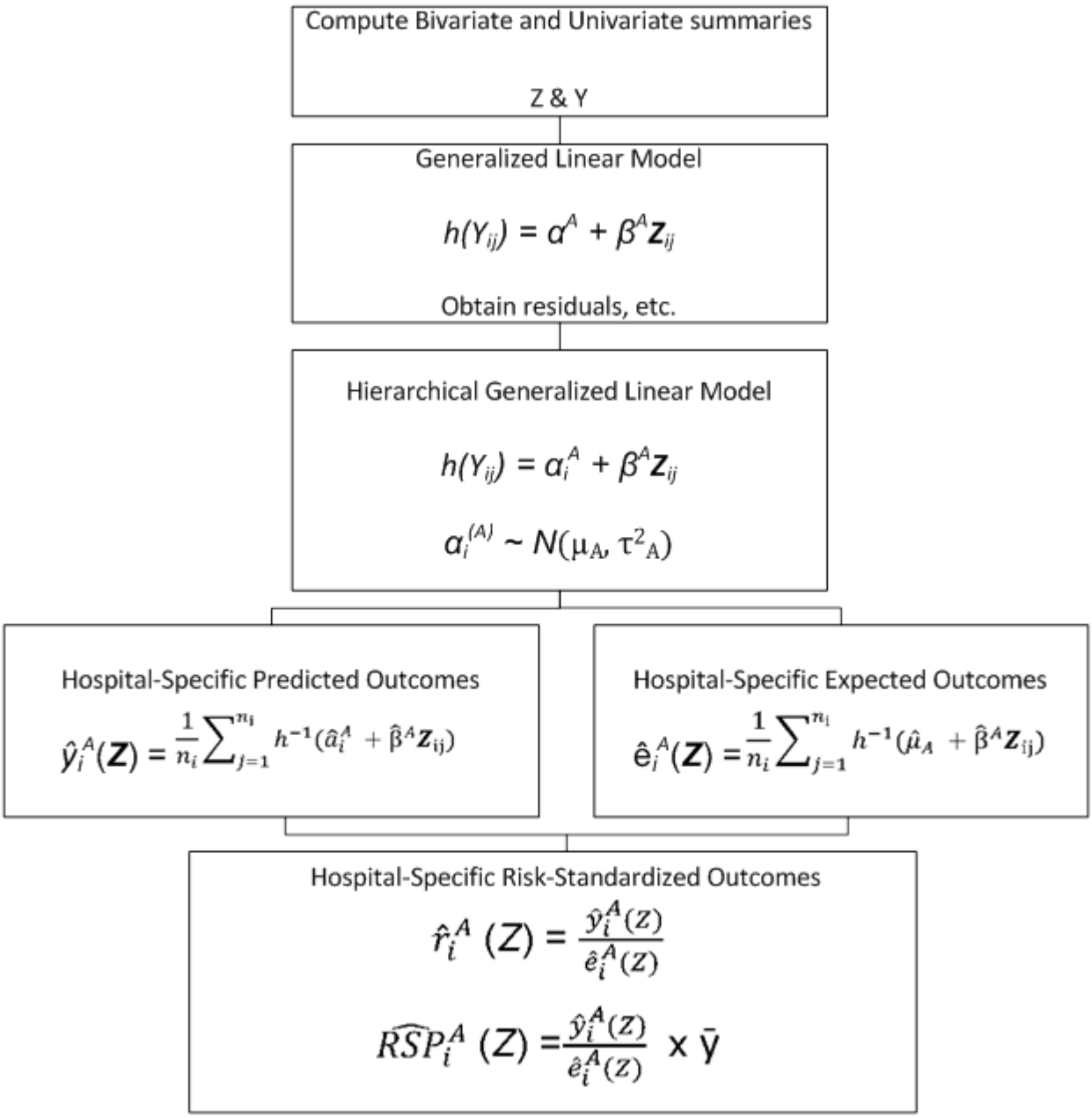
2. Fit the hierarchical generalized linear model using all patients within each sampled hospital. If some hospitals are selected more than once in a bootstrapped sample, we treat them as distinct so that we have *I* random effects to estimate the variance components. At the conclusion of Step 2, we have:
   a. $\hat{\beta}^{(b)}$ (estimated regression coefficients of the risk factors)
   b. The parameters governing the random effects, hospital adjusted outcomes, distribution, $\hat{\mu}^{(b)}$ and $\hat{\tau}^{2(b)}$
   c. The set of hospital-specific intercepts and corresponding variances, $\{\hat{a}_i^{(b)}, \widehat{var}(\alpha_i^{(b)}); i = 1,2,\ldots,I\}$

3. We generate a hospital random effect by sampling from the distribution of the hospital-specific distribution obtained in Step 2c. We approximate the distribution for each random effect by a normal distribution. Thus, we draw $\alpha_i^{(b*)} \sim N(\hat{\alpha}_i^{(b)}, \widehat{var}(\hat{\alpha}_i^{(b)}))$ for the unique set of hospitals sampled in Step 1.

4. Within each unique hospital *i* sampled in Step 1, and for each patient *j* in that hospital, we calculate $\hat{y}_{ij}^{(b)}$, $\hat{e}_{ij}^{(b)}$, and $\widehat{RSP}_i(Z)^{(b)}$ where $\hat{\beta}^{(b)}$ and $\hat{\mu}^{(b)}$ are obtained from Step 2 and $\hat{\alpha}_i^{(b*)}$ is obtained from Step 3.

Ninety-five percent interval estimates (or alternative interval estimates) for the hospital-standardized outcome can be computed by identifying the 2.5th and 97.5th percentiles of the B estimates (or the percentiles corresponding to the alternative desired intervals).[9]

Figure A.1. Analysis Steps



Appendix B. Annual Updates

Prior annual updates for the measure can be found in the annual updates and specifications report available on QualityNet. For convenience, we have listed all prior updates here under the reporting year and corresponding report. In 2013, CMS began assigning version numbers to its measures. The measure specifications in the original methodology reports are considered Version 1.0 for each measure. The measures receive a new version number for each subsequent year of public reporting.

2013 Measure Updates and Specifications Report AMI Payment (Version 2.0)

1. Updated the inclusion and exclusion criteria to include Maryland and US territories hospitals.
   - Rationale: The original measure did not include AMI admissions from hospitals in Maryland or US Territories because CMS reimburses hospitals in Maryland and US Territories using a different mechanism than hospitals in the other 49 states and the District of Columbia. These hospitals are now included in the measure and treated as if they were paid under CMS's Inpatient Prospective Payment System (IPPS).
2. Updated the inclusion and exclusion criteria to exclude hospice patients.
   - Rationale: The original AMI Payment measure did not exclude patients with any hospice assignment due to a desire to include the full breadth of AMI index admissions that met our criteria. This decision was not aligned with CMS's publicly reported 30-day AMI RSMR measure. After discussion with our Technical Expert Panel, we decided to exclude patients with hospice enrollment within one year prior to or on the date of an index admission in order for the AMI payment and RSMR measure cohorts to be aligned as closely as possible. Consistent with CMS's 30-day AMI RSMR measure, we chose to retain patients with hospice assignments after the date of index admission because the hospice assignment may have been related to care received during the index AMI admission.

Appendix C. Measure Specifications

Appendix C.1 AMI Payment

Cohort

Inclusion Criteria for AMI Payment Measure

1. **Principal discharge diagnosis of AMI**
   Rationale: AMI is the condition targeted for measurement.
2. **Enrolled in Medicare FFS**
   Rationale: FFS is the traditional model for Medicare Payment. The calculation of patient-level total payment relies on FFS claims.
3. **Aged 65 or older**
   Rationale: Medicare patients younger than 65 are not included in the measure because they are considered to be clinically different from patients 65 and over as they often qualify for Medicare at a younger age because of disabilities.
4. **Not transferred from another acute care facility**
   Rationale: The acute episode is included in the measure but episode-of-care payments are assigned to the hospital where the patient was initially admitted rather than the hospital receiving the transferred patient.
5. **Enrolled in Part A and Part B Medicare for the 12 months prior to the date of admission**
   Rationale: The 12 month prior enrollment ensures a full year of administrative data for risk adjustment.

Exclusion Criteria for AMI Payment Measure

1. **Admissions for patients with fewer than 30 days of post-admission enrollment in FFS Medicare Parts A and B (if alive)**
   Rationale: This is necessary in order to identify the outcome (payments) in the sample over our analytic period.
2. **Admissions for AMI patients who were admitted and discharged on the same or next day (and did not die or get transferred)**
   Rationale: These patients likely did not suffer a clinically significant AMI.
3. **Admissions with inconsistent or unknown patient vital status, or other unreliable demographic data (age and gender)**
   Rationale: We exclude stays for patients that include inconsistent data (e.g., date of death precedes date of admission, age is greater than 115 or gender is discordant on the index admission claim and the denominator file).
4. **Patients who were admitted from Hospice care, or had Hospice care in the 12 months prior to admission**
   Rationale: This exclusion is made in order to harmonize with the AMI RSMR measure: these patients are likely continuing to seek comfort measures only, so payment may reflect patient preferences rather than hospital practice patterns.
5. **Patients transferred to federal hospitals**
   Rationale: We do not have claims data for these hospitals; therefore, including these patients would systematically underestimate payments.
6. **Admissions where patients are discharged against medical advice (AMA)**
   Rationale: Hospitals had limited opportunity to care for the patient.

Table C.1.1 – ICD-9-CM Codes for AMI Payment Cohort

ICD-9-CM Code	Description
410.00	AMI (anterolateral wall) – episode-of-care unspecified
410.01	AMI (anterolateral wall) – initial episode-of-care
410.10	AMI (other anterior wall) – episode-of-care unspecified
410.11	AMI (other anterior wall) – initial episode-of-care
410.20	AMI (inferolateral wall) – episode-of-care unspecified
410.21	AMI (inferolateral wall) – initial episode-of-care
410.30	AMI (inferoposterior wall) – episode-of-care unspecified
410.31	AMI (inferoposterior wall) – initial episode-of-care
410.40	AMI (other inferior wall) – episode-of-care unspecified
410.41	AMI (other inferior wall) – initial episode-of-care
410.50	AMI (other lateral wall) – episode-of-care unspecified
410.51	AMI (other lateral wall) – initial episode-of-care
410.60	AMI (true posterior wall) – episode-of-care unspecified
410.61	AMI (true posterior wall) – initial episode-of-care
410.70	AMI (subendocardial) – episode-of-care unspecified
410.71	AMI (subendocardial) – initial episode-of-care
410.80	AMI (other specified site) – episode-of-care unspecified
410.81	AMI (other specified site) – initial episode-of-care
410.90	AMI (unspecified site) – episode-of-care unspecified
410.91	AMI (unspecified site) – initial episode-of-care

Risk Adjustment

Table C.1.2 – Risk-Adjustment Variables for AMI Payment Measure

Code	Description
	Age (65 – 74)
	Age (75 – 84)
	Age (>=85)
	History of PCI
	History of CABG
CC[‡] 80	Congestive Heart Failure
CC 83	Angina Pectoris/Old Myocardial Infarction
CC 85	Heart Infection/Inflammation, Except Rheumatic
CC 86	Valvular and Rheumatic Heart Disease
CC 87-88	Congenital cardiac/circulatory defect

[‡] CC = Condition Category, groupings of ICD-9-CM diagnosis codes developed by CMS.

Code	Description
CC 89-91	Hypertension and Hypertension Complications
CC 7-8	Metastatic Cancer and Acute Leukemia and Other Major Cancers
CC 15-19, 119-120	Diabetes and Diabetes Complications
CC 21	Protein-Calorie Malnutrition
CC 22	Other Significant Endocrine and Metabolic Disorders
CC 24	Obesity/Disorders of Thyroid, Cholesterol, Lipids
CC 36	Other Gastrointestinal Disorders
CC 41	Osteoporosis and Other Bone/Cartilage Disorders
CC 47	Iron Deficiency and Other/Unspecified Anemias and Blood Disease
CC 48	Delirium and Encephalopathy
CC 49	Dementia
CC 51	Drug/Alcohol Psychosis
CC 52-53	Drug/Alcohol Abuse/Dependence
CC 54-55	Severe Mental Illness
CC 56	Reactive and Unspecified Psychosis
CC 58-59	Depression/Anxiety
CC 97	Precerebral Arterial Occlusion and Transient Cerebral Ischemia
CC 104-105	Vascular Disease and Complications
CC 115	Other Lung Disorders
CC 116	Legally Blind
CC 130	Dialysis Status
CC 160	Internal Injuries

Table C.1.3 – Risk-adjustment Variables Considered Complications of Care if Only Occurred on Index Admission [*]

CC Category	Description
CC 17	Diabetes with Acute Complications
CC 48	Delirium and Encephalopathy
CC 80	Congestive Heart Failure
CC 97	Precerebral Arterial Occlusion and Transient Cerebral Ischemia
CC 104	Vascular Disease with Complications
CC 105	Vascular Disease
CC 130	Dialysis Status

[*] The selected CCs are considered complications of care and are not risk adjusted for if they *only* occur during the index admission.

Outcome

Outcome Criteria for AMI Payment Measure

1. **30-day time frame**

   Rationale: First, decisions made at the admitting hospital affect not only hospitalization payments, but payments for care in the immediate post-discharge period. Second, assessing payments for a continuous episode of care may reveal practice variations in the full care of the illness that triggered an index admission. Third, a 30-day preset window provides a standard observation period by which to compare all hospitals. Lastly, when pairing payment measures with quality measures, their measurement periods should be aligned as much as possible. Most publicly reported quality measures are reported for a 30-day period after admission or discharge (e.g. RSMR rate and risk-standardized readmission rate).