Summary of Technical Expert Panel (TEP) Evaluation of Measure

Risk-Standardized Payment Measure: Acute Myocardial Infarction (AMI) Episode-of-Care

November 20, 2012

Prepared by:
Yale New Haven Health Services Corporation/Center for Outcomes Research and Evaluation (YNHHSC/CORE)

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Contents

Background

The Centers for Medicare & Medicaid Services (CMS) has contracted Yale New Haven Health Services Corporation/Center for Outcomes Research and Evaluation (YNHHSC/CORE) for the development of an administrative claims-based, hospital-level, risk-adjusted measure for payment associated with a 30-day episode-of-care following admission for Acute Myocardial Infarction (AMI).

YNHHSC/CORE has obtained expert and stakeholder input on the proposed payment measure. The YNHHSC/CORE measure development team meets regularly and is comprised of experts in healthcare economics, internal medicine, quality outcomes measurements, and measure development. Additionally, YNHHSC/CORE convened a Technical Expert Panel (TEP) of clinicians, healthcare economists, consumers, purchasers, and experts in quality improvement to provide input on key methodological decisions.

This report summarizes the feedback and recommendations provided by the TEP regarding the proposed measure. Details regarding overall approach to measure development, measure rationale, and preliminary technical specifications, will be available for public comment through CMS during a dry-run period expected to occur in 2013. Of note, the measure remains in development and the technical specifications will not be finalized until January 2013.

Measure Development Team

The YNHHSC/CORE measure development team includes clinical, statistical, policy, and project management experts who provide a broad range of perspectives and expertise. The team participates in all discussions and facets of measure development.

The YNHHSC/CORE measure development team is led by Dr. Nancy Kim. Dr. Kim is a health services researcher, Assistant Professor of Medicine at Yale School of Medicine, and academic hospitalist with experience in outcomes research and measure development specifically. See Appendix A for the full list of the YNHHSC/CORE development team.

The Technical Expert Panel (TEP)

In alignment with the CMS Measures Management System (MMS), YNHHSC/CORE released a 30-day public call for nominations and convened a TEP. Potential members were solicited via email per recommendations by the measure development team, stakeholder groups, CMS hospital listservs, and through a posting on CMS's public comment site.

The role of the TEP is to provide feedback on key methodological and clinical decisions made in consultation with the measure development team. The TEP is comprised of individuals with diverse perspectives and backgrounds and includes clinicians, healthcare economists,

consumers, purchasers, and experts in quality improvement. The appointment term for the TEP will be through November 2012.

Specific Responsibilities of TEP Members:

- Reviewing background materials provided by YNHHSC/CORE prior to each TEP meeting
- Participating in all TEP meetings to the extent possible
- Providing input to YNHHSC/CORE on key methodological, clinical, and other technical decisions
- Providing feedback to YNHHSC/CORE on key policy or other non-technical issues
- Reviewing TEP summary report prior to public release
- Assisting in development of proposed reporting framework

TEP Members

Name	Organization	Location
Amanda Kowalski, PhD	Yale University	New Haven, CT
Anne-Marie Audet, MD, MSc,	Commonwealth Fund	New York, NY
David Dunn, MD	AAPC; ZHealth, LLC	Brentwood, TN
David S. P. Hopkins, PhD	Pacific Business Group on Health	San Francisco, CA
Donald Casey, MD, MPH, MBA	NYU Langone Medical Center	New York, NY
Kavita Panel, MD, MS	Brookings Institution	Washington, DC
Lesley Curtis, PhD, MS	Duke University	Durham, NC
Peter Bach, MD, MAPP	Memorial Sloan-Kettering Cancer	New York, NY
Richard Bankowitz, MD, MBA	Premier Inc.	Washington, DC
Steven Schmaltz, PhD, MS,	Joint Commission	Oakbrook Terrace, IL
Terry Golash, MD	Aetna	New York, NY
Vivian Ho, PhD	Rice University	Houston, TX

TEP Meetings

YNHHSC/CORE conducted two TEP meetings (see Appendix B for TEP meeting schedule). The TEP meetings follow a structured format consisting of presentation of key issues encountered in measure development and the YNHHSC/CORE proposed approaches to addressing the issues, followed by open discussion of these issues by the TEP members.

During the two TEP meetings the measure developer reviewed several key aspects of the measure and responded to requests for clarification and additional analyses from the TEP. Specifically, the following items were raised resulting in the decisions below:

- <u>Measure cohort</u>
  Medicare fee-for-service (FFS) patients age 65 and older with a primary discharge diagnosis of AMI (Appendix C)

- Timeframe for assessing payment
  30 days, starting on the date of the index admission
- Transfer patients
  Initial transferring hospital is assigned payments for the transfer patient (Appendix E)
- Stripping and standardizing Medicare Payments
  Omit or standardize geography and policy payment adjustments that are independent of care decisions when calculating the payment outcome
- Payments that extend beyond the 30-day timeframe
  Prorate payments so only portion occurring during the 30-day timeframe is included (Appendix F)
- Risk-adjustment
  Adjust for age, history of PCI or CABG, and comorbidities listed in patients' acute inpatient hospital stays, hospital outpatient care, and physician, radiology, and laboratory services for the 12 months prior to the index admission as well as select conditions indicated by secondary diagnoses codes on index admission
- Model selection
  Generalized linear model with a log-link and inverse Gaussian distribution
- Disparities testing
  Do not adjust for SES or race

Conclusion

TEP feedback was instrumental in refining our approach to measure development. Table 1 and Table 2 describe the key issues discussed during the TEP meetings and the TEP responses. The measure development team and TEP continue to provide clinical and methodological expertise and YNHHSC/CORE will consult with the TEP as the measure is further refined. Specifically, the TEP requested to meet once the public comment period closes to review a summary of the comments as well as results for analyses on: a revised breakdown of post-discharge payments; payments for patients who underwent PCI or CABG; and risk-standardized payment paired with risk-standardized readmission rate.

Table 1. Key Issues Discussed during First TEP Meeting and TEP Feedback

Topic	Key Issues Discussed	TEP Feedback/Discussion
Cohort Definition	**YNHHSC/CORE described the data source used for measure development which was the 2008 Chronic Condition Warehouse (CCW) administrative claims data for 100% of AMI patients hospitalized with a primary discharge diagnosis of ICD-9 Codes 410.xx, excluding 410.x2.** **YNHHSC/CORE reviewed the index admission inclusion and exclusion criteria (Appendix D) and noted that if there were multiple AMI discharges during a one-year time period for a single patient, one AMI discharge was randomly selected.**	TEP members asked for clarification about the pros and cons of randomly selecting an index admission. YNHHSC/CORE elected to randomly select an index admission for patients with multiple AMI admissions so as to not always include a more or less expensive admission and to maintain statistical independence of the included admissions. TEP members asked if ICD-9 codes are able to adequately distinguish between different types of AMIs. YNHHSC/CORE discussed the maintenance protocol which tracks changes in ICD-9 coding and how measures respond to these changes. **Summary: TEP was satisfied with the YNHHSC/CORE responses and agreed with the rationale for defining the cohort.**
Transfers	**YNHHSC/CORE explained the proposed transfer methodology of assigning all payments within the 30-day timeframe for a patient transferred to a different hospital to the first admitting hospital. Essentially this means starting the episode with the first hospitalization in a transfer pair. The rationale for this was presented and included:** • **the admitting hospital initiates the care decisions** • **this balances hospitals with and without procedural capability** • **this aligns the measure with CMS's AMI 30-day risk-standardized mortality measure** • **this avoids incentivizing hospitals to transfer sicker patients**	TEP members had a number of questions and proposed alternatives to this transfer attribution strategy. One member asked if it would be possible to create a second category for reporting on index admissions that were part of a transfer pair. Another TEP member raised the possibility that certain hospitals might not transfer a patient to another hospital because they do not want to be held accountable for the second hospital's costs. Another TEP member mentioned the need to examine both the admitting and transferring hospitals. The member requested separate analyses on different transfer scenarios. Additionally, a TEP member raised the point that it is important to be sensitive to the fact that distance between care centers sometimes has a serious impact on the decision to transfer or delay a transfer. Another TEP member agreed with this attribution strategy. This member believed that the performance of the first admitting hospital will have a substantial influence on the cost of care for the patient in the remainder of the 30-day timeframe. **Summary: YNHHSC/CORE will analyze different transfer scenarios and bring the results to the second TEP for further discussion. [Please see summary from TEP #2 for follow-up on this discussion]**
Timeframe	**YNHHSC/CORE introduced the measure timeframe.**	**Summary: The TEP agreed with the chosen timeframe**

Topic	Key Issues Discussed	TEP Feedback/Discussion
	The measure includes payments within the admission to 30 days post-admission time window. This is in alignment with the CMS 30-day risk-standardized AMI mortality measure and also incentivizes hospitals to optimize their post-discharge care.	**and rationale.**
Approach to stripping and standardizing payments	**YNHHSC/CORE explained how the payment outcome is calculated. The goal is to remove payment adjustments that are unrelated to quality of care because the measure profiles hospitals solely based on how their clinical decisions affect payments. Therefore, payment adjustments unrelated to clinical care (such as the wage index adjustment, disproportionate share adjustment, and indirect medical education adjustment) are excluded.** **YNHHSC/CORE also presented a pictorial example of how payments are stripped or standardized, and explained that payments are standardized when it is not possible to remove the geographic adjustments from the payment.**	One TEP member raised the point that in some cases CMS might want to look at the total cost rather than stripping and standardizing. Another member inquired about the process of standardizing and whether a weighted average or straight average was utilized. YNHHSC/CORE responded by stating that a straight average was used because it is a relative measure so each hospital will be charged the same regardless of how the average is calculated. **Summary: The TEP agreed with the method of stripping and standardizing payments given the measure goal.**
Prorating payments	**YNHHSC/CORE reiterated that the measure only includes payments that fall within the 30-day measurement window. Services that extend past the 30-day window are prorated (e.g. if a patient is rehospitalized and only 3 days of the hospitalization fall within the 30-day day time period, the total costs of the hospitalization would be divided by 30 to obtain a daily average amount and this amount would be multiplied by 3 since that is the number of days that fell into the 30-day window).**	**Summary**: **The TEP agreed with the methodology and decision to prorate payments.**
Risk-adjustment	**YNHHSC/CORE explained definition and purpose of CMS condition categories (CC) and hierarchical condition categories (HCCs). YNHHSC/CORE has traditionally not applied the hierarchy embedded in the HCCs for its measures because it has found that using HCCs often distorted the results by cancelling out comorbidities. Therefore, YNHHSC/CORE has initially decided to use CCs without utilizing the associated hierarchy.**	TEP members had additional questions about use of hierarchy with the HCCs versus just CCs. Another TEP member asked if the measure was taking into account conditions that are present on admission, and suggested that it may not be correct to risk adjust away costs for certain complications that take place in the hospital. YNHHSC/CORE responded by stating that this has been taken into account with an algorithm that is used to assess whether or not a condition is a complication related to care. This will be shared with the TEP during the second meeting. Additionally, TEP members noted that in the future the POA flag might be useful in helping YNHHSC/CORE risk adjust for complications. YNHHSC/CORE agreed that this may be useful once the data and coding of POAs are more consistent

Topic	Key Issues Discussed	TEP Feedback/Discussion
		Several members also brought up the issue of disparities and whether or not hospitals would perform worse on the measure based on patient characteristics like race and Medicaid status. YNHHSC agreed to provide these data and analyses to the TEP at the second meeting. **Summary: YNHHSC will address the issues of HCCs and disparities at the next TEP meeting, and also provide the algorithm for assessing complications of care (Appendix G) (please see TEP meeting #2 summary).**
Modeling	**YNHHSC/CORE presented its traditional hierarchical logistical modeling approach to the TEP but stated that this will have to be altered since payment is a continuous outcome**	One TEP member asked about whether a log-normal distribution would be utilized because of the skewed distribution. YNHHSC responded by stating that several different estimators are being investigated. Another TEP member asked if YNHHSC/CORE was going to be able to include suggestions made in the Committee of Presidents of Statistical Societies (COPSS) white paper about how one might alter the application of the hierarchical model. YNHHSC/CORE responded by stating that the team is exploring these alternatives but does not anticipate including these suggestions in the current version of the measure. **Summary: YNHHSC/CORE will present the modeling approach at the next TEP meeting (please see TEP meeting #2 summary).**
Reporting the payment measure	**YNHHSC/CORE stated it was still refining how it plans to report the payment measure, but that it is CMS's intention that the payment measure eventually be aligned with the CMS 30-day risk-standardized AMI mortality measure. Thus, the payment measure is not meant to be taken in isolation.**	**Summary: YNHHSC/CORE will present a final proposed approach for how to report the payment outcome during the second TEP meeting.**

Table 2. Key Issues Discussed during Second TEP Meeting and TEP Feedback

Topic	Key Issues Discussed	TEP Feedback
When to begin the episode-of-care and how to handle transfer patients	**YNHHSC CORE discussed rationale for starting episode-of-care with first admission for patients who are transferred during their index admission.** **YNHHSC/CORE reminded the TEP that patients who are transferred from an emergency department that does not belong to the hospital admitting the patient are not considered transfer patients in the measure. YNHHSC/CORE stated that patients must be admitted to one hospital and then transferred to another hospital in order to be considered a transfer patient.** **YNHHSC/CORE reviewed the rationale for including transfer patients in the measure, mentioning that 7.8% of AMI hospitalizations include a transfer. YNHHSC/CORE also reviewed the rationale for the attribution strategy, which includes the fact that 169 more hospitals will be reported using this strategy and that roughly $4,800 of payment will be lost for each index admission that includes a transfer patient if payments are excluded from the initial admitting hospital.**	One TEP member inquired about whether transportation costs during the transfer are included in the payment. YNHHSC/CORE responded that these costs were included if the transportation occurred on the day of admission or after. The same TEP member mentioned that sometimes patients are admitted to a place that cannot provide adequate treatment past the first few hours (e.g., non-STEMI patients admitted to non-PCI facilities). YNHHSC/CORE responded that in the cases where people decide to put off a procedure for a few hours or weeks, payment for that procedure will still be included in the 30-day episode-of-care. **Summary: The TEP agreed to include transfer patients in the measure and begin the episode with the first hospitalization.**
The decision to use CCs instead of HCCs	**YNHHSC/CORE reviewed the rationale for using CCs as opposed to HCCs for risk adjustment which included that HCCs were designed to predict payment over one year for all conditions (whereas this measure is condition-specific over 30 days) and that HCCs were constructed so that the highest CC in that hierarchy had a higher payment rate than all the CCs beneath it, which would omit specific conditions which may affect care decisions that could affect payment.**	**Summary: The TEP agreed with the YNHHSC/CORE's rationale to use CCs as opposed to HCCs for the purposes of risk adjustment.**
Unadjusted results	**YNHHSC/CORE reviewed the histogram showing the distribution of AMI episode-of-care unadjusted payments, reporting on hospitals with a minimum of 25 AMI index admissions. YNHHSC/CORE emphasized that there is wide variation in the 30-day episode-of-care payments.** **YNHHSC/CORE then presented a pie chart showing that 74% of the total unadjusted national payments are attributable to the index hospitalization and 26% are for post-discharge care. This chart represents only patients who received post-discharge care (85.5% of patients). The other 14.5% of patients not included died (10%), received no post-discharge care but survived (4%), or were in the hospital for more than 30 days (0.5%).**	One TEP member stated that random events like motor vehicle accidents could bring a patient back to the hospital and skew the payment results. YNHHSC/CORE stated that it is creating a relative measure, and does not believe any hospital is more likely to be disproportionately affected by payments for such readmissions. Another TEP member stated that one graph he would like to see is the distribution of payments for patients who actually had a PCI or had a CABG, versus people who didn't have those interventions and also presenting the count of patients alongside the payments for each care setting. **Summary: YNHHSC/CORE will conduct follow-up**

Topic	Key Issues Discussed	TEP Feedback
		analyses on post-discharge payments (and share the results with the TEP).
Risk-adjustment methodology and model selection results	**YNHHSC/CORE introduced the basic steps to the risk-adjustment methodology. It adjusts for hospital case-mix to allow for fair comparisons across hospitals while illuminating payment differences. Specifically, YNHHSC/CORE adjusts for patient factors at the time of admission which might influence 30-day payments including age, comorbidities, and a history of PCI or CABG. The measure does not adjust for complications of care or procedures during the episode-of-care. It does not adjust for patients' admission source or discharge disposition such as a skilled nursing facility. It does not adjust for socioeconomic status, gender, race, or ethnicity. It does not adjust for hospital characteristics, such as a teaching status. YNHHSC/CORE also adjusts for secondary diagnoses during the index admission, except those that represent complications of care.** **The final model includes clinically relevant variables associated with payment. YNHHSC/CORE begins by excluding clinically irrelevant CCs. It combines specific CCs based on clinical coherence and statistical significance. And then, YNHHSC/CORE uses a modified stepwise regression, or bootstrapping, to select the final variables. Age and relevant procedures are included. In this case specifically, YNHHSC/CORE also includes history of PCI and history of CABG.** **YNHHSC/CORE also spoke about model selection and showed that the payment data were heavily right-skewed. As a result of this, YNHHSC/CORE considered five different models. YNHHSC/CORE chose a generalized linear model with a log-link and inverse Gaussian distribution because of the ease of interpretation and good model performance.**	One TEP member asked if YNHHSC/CORE used POA codes for risk-adjustment. YNHHSC/CORE stated that in 2008, the POA codes were still newly in use but that it will continue to investigate using POA codes in the future. Another TEP member asked why risk adjustment was done on information 12 months prior to the index admission. YNHHSC/CORE stated that it was a Yale-CORE practice pattern to use 12 months, and that this time frame should be adequate for identifying major comorbid conditions. In other settings contractors have used a three month window as opposed to 12 months **Summary: The TEP agreed with the risk-adjustment methodology and the model selection.**
Risk-standardized model results	**YNHHSC/CORE began by explaining that payments are estimated using a hierarchical generalized linear regression model that accounts for the clustering of patients within hospitals. The model calculates the risk-standardized payment as a ratio of a predicted AMI payment (which takes into account the hospital-specific effect) and the expected AMI payment (which considers the average hospital effect).**	One TEP member asked if practices that are different in hospitals, which lead to higher or lower costs, are being washed out or kept by the measure. YNHHSC/CORE responded by stating that these practices are represented by the hospital-specific effect and thus reflected in the ratio. **Summary: The TEP was presented with the risk-standardized model results and no objections were raised.**
Disparities testing results	**YNHHSC/CORE then presented the disparities testing results requested during the first TEP meeting. A box plot showed AMI risk-standardized payment by**	One TEP member asked about whether the patients in the Medicaid cohort are all dual-eligible for Medicare and Medicaid. YNHHSC/CORE stated that, yes, these

Topic	Key Issues Discussed	TEP Feedback
	hospital proportion of Medicaid patients or African-American patients for hospitals with more than 25 AMI index admissions. There seemed to be little difference across all categories of hospitals with different proportions of Medicaid and African-American patients in their risk-standardized payments.	patients are all dual-eligible. Another TEP member noted that these results seemed to be counterintuitive. YNHHSC/CORE noted that although it initially thought payments may be higher for hospitals with higher proportions of African-American or Medicaid patients, that is not what the analyses show. **Summary: The TEP was presented with the disparities testing results and no objections were raised.**
Pairing of payment with AMI mortality	**YNHHSC/CORE presented a scatter plot of 30-day AMI risk-standardized mortality rate versus risk-standardized AMI payment. It noted that the dots do not show any clear organizational pattern.** **YNHHSC/CORE then presented the same scatter plot with an imposed vertical line representing the observed average payments for AMI episode-of-care (approximately $19,000) and a horizontal line which represents the observed average mortality rate for AMI (approximately 16%). This divides the scatter plot into quadrants (combinations of high/low mortality and high/low payment). It noted that these results do not include confidence intervals, but that there definitely seem to be hospitals that have low payment and low mortality and are thus more efficient than others in caring for AMI patients.**	One TEP member suggested adding a Z-axis or doing a separate plot to look at readmissions. However, this TEP member doubted hospitals will appear as both high readmission and low cost since readmissions are expensive. YNHHSC/CORE is very interested in looking at readmissions and will take this suggestion seriously going forward. **Summary: The TEP was presented with the scatterplot showing results of pairing AMI payment with AMI mortality. The TEP was interested in seeing another version of this scatterplot once point estimates for each hospital underwent bootstrapping and confidence intervals were added.**
Face validity survey question	**YNHHSC/CORE then presented the face validity survey question, which will be e-mailed to all TEP members.**	**Summary: The TEP members agreed to the format and use of the face validity survey and raised no objections.**
Next steps	**YNHHSC/CORE asked the TEP members if they had any questions or concerns and summarized the follow-up items.**	One TEP member suggested that all of the TEP members convene again after public comment and before submission to NQF to review any issues that arise and new analyses that are conducted. Given time constraints, YNHHSC/CORE agreed to follow-up over email to make sure that TEP members are all able to see the issues brought up in public comment and also give YNHHSC/CORE further input. **Summary: YNHHSC/CORE will send an email to TEP members or set up another call to review newly conducted analyses and public comments.**

Appendix A. YNHHSC/CORE New Measure Development Team

Name	Title/Affiliation	Contact Information
Harlan Krumholz, MD, SM	Director, YNHHSC/CORE	harlan.krumholz@yale.edu
Susannah Bernheim, MD MHS	Acting Director, Quality Measurement	susannah.bernheim@yale.edu
Nancy Kim, MD, PhD	Measure Lead	nancy.kim@yale.edu
Lesli Ott, MA, MA	Lead Analyst	lesli.ott@yale.edu
Xiao Xu, PhD	Consulting Health Economist	xiao.xu@yale.edu
Kanchana Bhat, MPH	Project Manager	kanchana.bhat@yale.edu
Steven Spivack, MPH	Project Coordinator	steven.spivack@yale.edu
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Mark Volpe, BS	Research Assistant	mark.volpe@yale.edu
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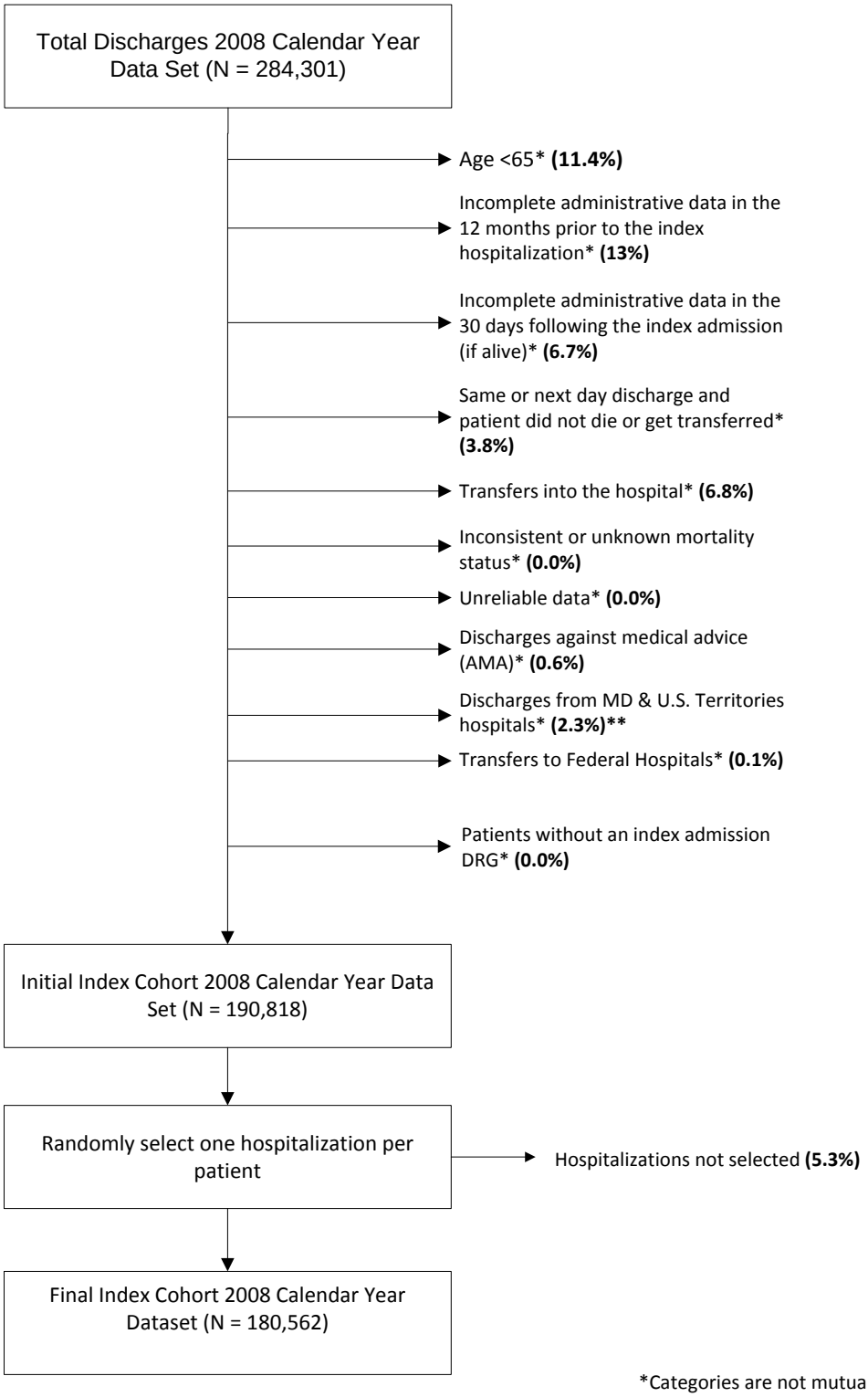
Appendix B. Technical Expert Panel Call Schedule

1. August 16, 2012 – 10:00am-12:00pm
2. October 17, 2012 – 3:00pm-5:00pm

Appendix C. AMI ICD-9 Cohort Codes

ICD-9 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

Appendix D. Cohort Definition

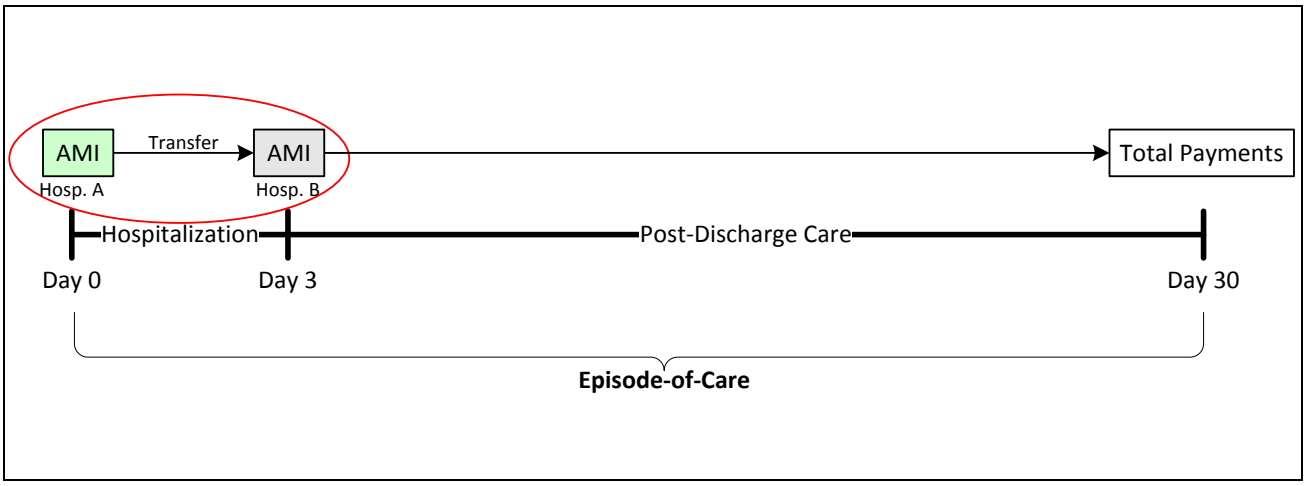


*Categories are not mutually exclusive

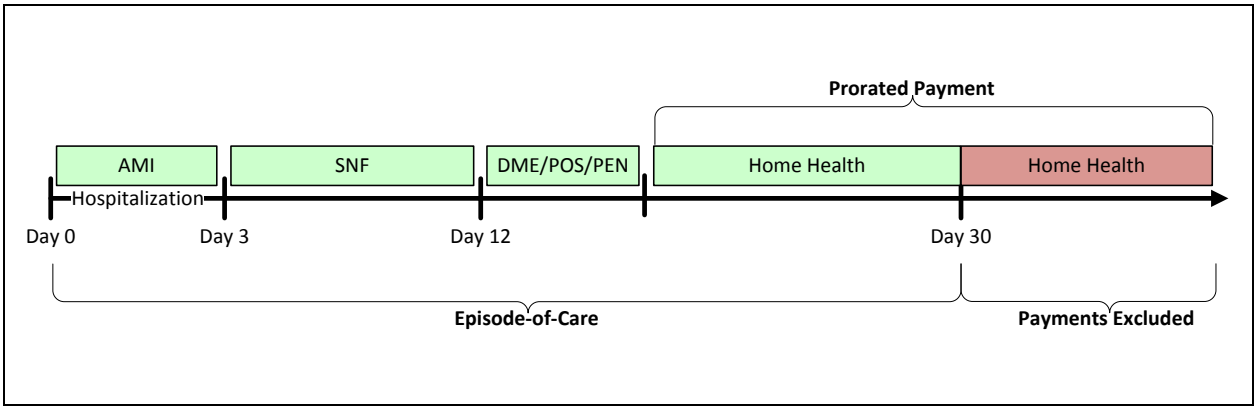
** MD and US Territories hospitals will be included in the final model

Appendix E. Current Model for Transfer Patient Payment Attribution

For inpatient transfer patients, we define the start date of our episode-of-care payments as the date of admission for AMI.



Appendix F. Current Model for Prorating Payments



Appendix G. Defining Complications of Care

- A team of clinicians carefully reviewed the 189 Condition Categories (CCs) and determined those that could be considered complications of care

- We do not risk adjust for those CCs that are considered complications of care if they appear only as a secondary diagnoses during the index admission and nowhere else in the patient's 12-month history

Table G1. Potential Complications in the Index Admission for AMI Payment Model

CC #	Description	Potential Complication in Index Admission
CC 1	HIV/AIDS	
CC 2	Septicemia/Shock	X
CC 3	Central Nervous System Infection	
CC 4	Tuberculosis	
CC 5	Opportunistic Infections	
CC 6	Other Infectious Diseases	X
CC 7	Metastatic Cancer and Acute Leukemia	
CC 8	Lung, Upper Digestive Tract, and Other Severe Cancers	
CC 9	Lymphatic, Head and Neck, Brain, and Other Major Cancers	
CC 10	Breast, Prostate, Colorectal and Other Cancers and Tumors	
CC 11	Other Respiratory and Heart Neoplasms	
CC 12	Other Digestive and Urinary Neoplasms	
CC 13	Other Neoplasms	
CC 14	Benign Neoplasms of Skin, Breast, Eye	
CC 15	Diabetes with Renal Manifestation	
CC 16	Diabetes with Neurologic or Peripheral Circulatory Manifestation	
CC 17	Diabetes with Acute Complications	X
CC 18	Diabetes with Ophthalmologic Manifestation	
CC 19	Diabetes with No or Unspecified Complications	
CC 20	Type I Diabetes Mellitus	
CC 21	Protein-Calorie Malnutrition	
CC 22	Other Significant Endocrine and Metabolic Disorders	
CC 23	Disorders of Fluid/Electrolyte/Acid-Base	X
CC 24	Other Endocrine/Metabolic/Nutritional Disorders	
CC 25	End-Stage Liver Disease	
CC 26	Cirrhosis of Liver	
CC 27	Chronic Hepatitis	
CC 28	Acute Liver Failure/Disease	X
CC 29	Other Hepatitis and Liver Disease	
CC 30	Gallbladder and Biliary Tract Disorders	
CC 31	Intestinal Obstruction/Perforation	X
CC 32	Pancreatic Disease	
CC 33	Inflammatory Bowel Disease	
CC 34	Peptic Ulcer, Hemorrhage, Other Specified Gastrointestinal Disorders	X
CC 35	Appendicitis	

CC #	Description	Potential Complication in Index Admission
CC 36	Other Gastrointestinal Disorders	
CC 37	Bone/Joint/Muscle Infections/Necrosis	
CC 38	Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	
CC 39	Disorders of the Vertebrae and Spinal Discs	
CC 40	Osteoarthritis of Hip or Knee	
CC 41	Osteoporosis and Other Bone/Cartilage Disorders	
CC 42	Congenital/Developmental Skeletal and Connective Tissue Disorders	
CC 43	Other Musculoskeletal and Connective Tissue Disorders	
CC 44	Severe Hematological Disorders	
CC 45	Disorders of Immunity	
CC 46	Coagulation Defects and Other Specified Hematological Disorders	X
CC 47	Iron Deficiency and Other/Unspecified Anemias and Blood Disease	
CC 48	Delirium and Encephalopathy	X
CC 49	Dementia	
CC 50	Senility, Nonpsychotic Organic Brain Syndromes/Conditions	
CC 51	Drug/Alcohol Psychosis	
CC 52	Drug/Alcohol Dependence	
CC 53	Drug/Alcohol Abuse, Without Dependence	
CC 54	Schizophrenia	
CC 55	Major Depressive, Bipolar, and Paranoid Disorders	
CC 56	Reactive and Unspecified Psychosis	
CC 57	Personality Disorders	
CC 58	Depression	
CC 59	Anxiety Disorders	
CC 60	Other Psychiatric Disorders	
CC 61	Profound Mental Retardation/Developmental Disability	
CC 62	Severe Mental Retardation/Developmental Disability	
CC 63	Moderate Mental Retardation/Developmental Disability	
CC 64	Mild/Unspecified Mental Retardation/Developmental Disability	
CC 65	Other Developmental Disability	
CC 66	Attention Deficit Disorder	
CC 67	Quadriplegia, Other Extensive Paralysis	
CC 68	Paraplegia	
CC 69	Spinal Cord Disorders/Injuries	
CC 70	Muscular Dystrophy	
CC 71	Polyneuropathy	
CC 72	Multiple Sclerosis	
CC 73	Parkinson's and Huntington's Diseases	
CC 74	Seizure Disorders and Convulsions	
CC 75	Coma, Brain Compression/Anoxic Damage	X
CC 76	Mononeuropathy, Other Neurological Conditions/Injuries	
CC 77	Respirator Dependence/Tracheostomy Status	X
CC 78	Respiratory Arrest	X
CC 79	Cardio-Respiratory Failure and Shock	X
CC 80	Congestive Heart Failure	X
CC 81	Acute Myocardial Infarction	X
CC 82	Unstable Angina and Other Acute Ischemic Heart Disease	X
CC 83	Angina Pectoris/Old Myocardial Infarction	

CC #	Description	Potential Complication in Index Admission
CC 84	Coronary Atherosclerosis/Other Chronic Ischemic Heart Disease	
CC 85	Heart Infection/Inflammation, Except Rheumatic	
CC 86	Valvular and Rheumatic Heart Disease	
CC 87	Major Congenital Cardiac/Circulatory Defect	
CC 88	Other Congenital Heart/Circulatory Disease	
CC 89	Hypertensive Heart and Renal Disease or Encephalopathy	
CC 90	Hypertensive Heart Disease	
CC 91	Hypertension	
CC 92	Specified Heart Arrhythmias	X
CC 93	Other Heart Rhythm and Conduction Disorders	X
CC 94	Other and Unspecified Heart Disease	X
CC 95	Cerebral Hemorrhage	X
CC 96	Ischemic or Unspecified Stroke	X
CC 97	Precerebral Arterial Occlusion and Transient Cerebral Ischemia	X
CC 98	Cerebral Atherosclerosis and Aneurysm	
CC 99	Cerebrovascular Disease, Unspecified	
CC 100	Hemiplegia/Hemiparesis	X
CC 101	Diplegia (Upper), Monoplegia, and Other Paralytic Syndromes	X
CC 102	Speech, Language, Cognitive, Perceptual	X
CC 103	Cerebrovascular Disease Late Effects, Unspecified	
CC 104	Vascular Disease with Complications	X
CC 105	Vascular Disease	X
CC 106	Other Circulatory Disease	X
CC 107	Cystic Fibrosis	
CC 108	Chronic Obstructive Pulmonary Disease	
CC 109	Fibrosis of Lung and Other Chronic Lung Disorders	
CC 110	Asthma	
CC 111	Aspiration and Specified Bacterial Pneumonias	X
CC 112	Pneumococcal Pneumonia, Emphysema, Lung Abscess	X
CC 113	Viral and Unspecified Pneumonia, Pleurisy	
CC 114	Pleural Effusion/Pneumothorax	X
CC 115	Other Lung Disorders	
CC 116	Legally Blind	
CC 117	Major Eye Infections/Inflammations	
CC 118	Retinal Detachment	
CC 119	Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	
CC 120	Diabetic and Other Vascular Retinopathies	
CC 121	Retinal Disorders, Except Detachment and Vascular Retinopathies	
CC 122	Glaucoma	
CC 123	Cataract	
CC 124	Other Eye Disorders	
CC 125	Significant Ear, Nose, and Throat Disorders	
CC 126	Hearing Loss	
CC 127	Other Ear, Nose, Throat, and Mouth Disorders	
CC 128	Kidney Transplant Status	
CC 129	End Stage Renal Disease	X
CC 130	Dialysis Status	X
CC 131	Renal Failure	X

CC #	Description	Potential Complication in Index Admission
CC 132	Nephritis	X
CC 133	Urinary Obstruction and Retention	X
CC 134	Incontinence	
CC 135	Urinary Tract Infection	X
CC 136	Other Urinary Tract Disorders	
CC 137	Female Infertility	
CC 138	Pelvic Inflammatory Disease and Other Specified Female Genital Disorders	
CC 139	Other Female Genital Disorders	
CC 140	Male Genital Disorders	
CC 141	Ectopic Pregnancy	
CC 142	Miscarriage/Abortion	
CC 143	Completed Pregnancy With Major Complications	
CC 144	Completed Pregnancy With Complications	
CC 145	Completed Pregnancy Without Complication	
CC 146	Uncompleted Pregnancy With Complications	
CC 147	Uncompleted Pregnancy With No or Minor Complications	
CC 148	Decubitus Ulcer of Skin	X
CC 149	Chronic Ulcer of Skin, Except Decubitus	
CC 150	Extensive Third-Degree Burns	
CC 151	Other Third-Degree and Extensive Burns	
CC 152	Cellulitis, Local Skin Infection	X
CC 153	Other Dermatological Disorders	
CC 154	Severe Head Injury	X
CC 155	Major Head Injury	X
CC 156	Concussion or Unspecified Head Injury	X
CC 157	Vertebral Fractures	
CC 158	Hip Fracture/Dislocation	X
CC 159	Major Fracture, Except of Skull, Vertebrae, or Hip	X
CC 160	Internal Injuries	
CC 161	Traumatic Amputation	
CC 162	Other Injuries	
CC 163	Poisonings and Allergic Reactions	X
CC 164	Major Complications of Medical Care and Trauma	
CC 165	Other Complications of Medical Care	X
CC 166	Major Symptoms, Abnormalities	
CC 167	Minor Symptoms, Signs, Findings	
CC 168	Extremely Low Birth weight Neonates	
CC 169	Very Low Birth weight Neonates	
CC 170	Serious Perinatal Problem Affecting Newborn	
CC 171	Other Perinatal Problems Affecting Newborn	
CC 172	Normal, Single Birth	
CC 173	Major Organ Transplant	
CC 174	Major Organ Transplant Status	X
CC 175	Other Organ Transplant/Replacement	X
CC 176	Artificial Openings for Feeding or Elimination	X
CC 177	Amputation Status, Lower Limb/Amputation	X
CC 178	Amputation Status, Upper Limb	X
CC 179	Post-Surgical States/Aftercare/Elective	X

CC #	Description	Potential Complication in Index Admission
CC 180	Radiation Therapy	
CC 181	Chemotherapy	
CC 182	Rehabilitation	
CC 183	Screening/Observation/Special Exams	
CC 184	History of Disease	
CC 185	Oxygen	
CC 186	CPAP/IPPB/Nebulizers	
CC 187	Patient Lifts, Power Operated Vehicles, Beds	
CC 188	Wheelchairs, Commodes	
CC 189	Walkers	

Appendix H. Candidate and Final Model Variables

Table H1. 2008 AMI Payment Model Candidate Variables

Category	Variable	CC
Demographics	Age (65 – 74)	
	Age (75 – 84)	
	Age (>=85)	
Cardiovascular	History of PCI	
	History of CABG	
	Respiratory Arrest/Cardiorespiratory Failure/Respirator Dependence	CC 77-79
	Congestive Heart Failure	CC 80
	Acute Coronary Syndrome	CC 81, 82
	Angina Pectoris/Old Myocardial Infarction	CC 83
	Coronary Atherosclerosis/Other Chronic Ischemic Heart Disease	CC 84
	Heart Infection/Inflammation, Except Rheumatic	CC 85
	Valvular and Rheumatic Heart Disease	CC 86
	Congenital cardiac/circulatory defect	CC 87, 88
	Hypertension and Hypertension Complications	CC 89-91
Comorbidities	History of Infection	CC 1, 3-5
	Septicemia/Shock	CC 2
	Other Infectious Diseases	CC 6
	Metastatic Cancer and Acute Leukemia and Other Major Cancers	CC 7, 8
	Other Major Cancers	CC 9, 11, 12
	Breast, Prostate, Colorectal, and Other Cancers and Tumors	CC 10
	Other Neoplasms	CC 13
	Benign Neoplasms of Skin, Breast, Eye	CC 14
	Diabetes and Diabetes Complications	CC 15-19, 119-120
	Protein-Calorie Malnutrition	CC 21
	Other Significant Endocrine and Metabolic Disorders	CC 22
	Disorders of Fluid/Electrolyte/Acid-Base	CC 23
	Obesity/Disorders of Thyroid, Cholesterol, Lipids	CC 24
	Liver and Biliary Disease	CC 25-30
	Pancreatic Disease	CC 32
	Inflammatory Bowel Disease	CC 33
	Peptic Ulcer, Hemorrhage, Other Specified Gastrointestinal Disorders	CC 34
	Appendicitis	CC 35
	Other Gastrointestinal Disorders	CC 36
	Bone/Joint/Muscle Infections/Necrosis	CC 37
	Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	CC 38
	Disorders of the Vertebrae and Spinal Discs	CC 39
	Osteoarthritis of Hip or Knee	CC 40
	Osteoporosis and Other Bone/Cartilage Disorders	CC 41
	Congenital/Developmental Skeletal and Connective Tissue Disorders	CC 42
	Other Musculoskeletal and Connective Tissue Disorders	CC 43
	Severe Hematological Disorders	CC 44
	Disorders of Immunity	CC 45
	Coagulation Defects and Other Specified Hematological Disorders	CC 46
	Iron Deficiency and Other/Unspecified Anemias and Blood Disease	CC 47
	Delirium and Encephalopathy	CC 48

Category	Variable	CC
	Dementia	CC 49
	Senility, Nonpsychotic Organic Brain Syndromes/Conditions	CC 50
	Drug/Alcohol Psychosis	CC 51
	Drug/Alcohol Abuse/Dependence	CC 52, 53
	Schizophrenia/Major Depressive/Bipolar Disorders	CC 54, 55
	Reactive and Unspecified Psychosis	CC 56
	Personality Disorders	CC 57
	Depression/Anxiety	CC 58, 59
	Other psychiatric disorders	CC 60
	Mental retardation or developmental disability	CC 61-65
	Plegia, Paralysis, Spinal Cord Disorder and Amputation	CC 67-69, 100, 101, 177, 178
	Muscular Dystrophy	CC 70
	Polyneuropathy	CC 71
	Multiple Sclerosis	CC 72
	Parkinson's and Huntington's Diseases	CC 73
	Seizure Disorders and Convulsions	CC 74
	Coma, Brain Compression/Anoxic Damage	CC 75
	Mononeuropathy, Other Neurological Conditions/Injuries	CC 76
	Arrhythmias	CC 92, 93
	Other and Unspecified Heart Disease	CC 94
	Stroke	CC 95, 96
	Precerebral Arterial Occlusion and Transient Cerebral Ischemia	CC 97
	Cerebrovascular Disease and Aneurysm	CC 98, 99
	Late Effects/Neurologic Deficits	CC 102, 103
	Vascular Disease and Complications	CC 104, 105
	Other Circulatory Disease	CC 106
	Cystic fibrosis	CC 107
	COPD	CC 108
	Fibrosis of lung or other chronic lung disorder	CC 109
	Asthma	CC 110
	History of Pneumonia	CC 111-113
	Pleural Effusion/Pneumothorax	CC 114
	Other Lung Disorders	CC 115
	Legally Blind	CC 116
	Major Eye Infections/Inflammations	CC 117
	Retinal Detachment	CC 118
	Retinal Disorders, Except Detachment and Vascular Retinopathies	CC 121
	Glaucoma	CC 122
	Other Eye Disorders	CC 124
	Significant Ear, Nose, and Throat Disorders	CC 125
	Hearing Loss	CC 126
	Other Ear, Nose, Throat, and Mouth Disorders	CC 127
	Kidney Transplant Status	CC 128
	Dialysis Status	CC 130
	Renal Failure	CC 131
	Nephritis	CC 132
	Urinary Obstruction and Retention	CC 133
	Incontinence	CC 134

Category	Variable	CC
	Urinary Tract Infection	CC 135
	Other urinary tract disorders	CC 136
	Female Genital Disorders	CC 138, 139
	Male genital disorders	CC 140
	Decubitus Ulcer of Skin	CC 148
	Chronic Ulcer of Skin, Except Decubitus	CC 149
	Extensive Third-Degree Burns	CC 150
	Other Third-Degree and Extensive Burns	CC 151
	Cellulitis, Local Skin Infection	CC 152
	Other Dermatological Disorders	CC 153
	Head Injury	CC 154-156
	Vertebral Fractures	CC 157
	Hip Fracture/Dislocation	CC 158
	Major Fracture, Except of Skull, Vertebrae, or Hip	CC 159
	Internal Injuries	CC 160
	Traumatic Amputation	CC 161
	Other Injuries	CC 162
	Poisonings and Allergic Reactions	CC163
	Major Complications of Medical Care and Trauma	CC 164
	Other Complications of Medical Care	CC 165
	Major Symptoms, Abnormalities	CC 166
	Minor Symptoms, Signs, Findings	CC 167
	Major Organ Transplant Status	CC 174
	Other organ transplant/replacement	CC 175

Table H2. 2008 AMI Payment Model Final Variables and Frequencies

Description	2008 Sample (%)
Demographics	
Age (65 – 74)	31.11
Age (75 – 84)	39.23
Age (>=85)	29.66
Cardiovascular	
History of PCI	7.69
History of CABG	6.00
Congestive Heart Failure (CC 80)	31.31
Angina Pectoris/Old Myocardial Infarction (CC 83)	21.18
Heart Infection/Inflammation, Except Rheumatic (CC 85)	1.80
Valvular and Rheumatic Heart Disease (CC 86)	27.24
Congenital cardiac/circulatory defect (CC 87-88)	0.94
Hypertension and Hypertension Complications (CC 89-91)	83.75
Other Comorbidity	
Metastatic Cancer and Acute Leukemia and Other Major Cancers (CC 7-8)	3.98
Diabetes and Diabetes Complications (CC 15-19, 119-120)	41.85
Protein-Calorie Malnutrition (CC 21)	4.97
Other Significant Endocrine and Metabolic Disorders (CC 22)	6.23
Obesity/Disorders of Thyroid, Cholesterol, Lipids (CC 24)	72.28
Other Gastrointestinal Disorders (CC 36)	45.11
Osteoporosis and Other Bone/Cartilage Disorders (CC 41)	14.66
Iron Deficiency and Other/Unspecified Anemias and Blood Disease (CC 47)	38.60
Delirium and Encephalopathy (CC 48)	3.73
Dementia (CC 49)	17.49
Drug/Alcohol Psychosis (CC 51)	1.17
Drug/Alcohol Abuse/Dependence (CC 52-53)	9.89
Schizophrenia/Major Depressive/Bipolar Disorders (CC 54-55)	4.41
Reactive and Unspecified Psychosis (CC 56)	3.05
Depression/Anxiety (CC 58-59)	10.56
Precerebral Arterial Occlusion and Transient Cerebral Ischemia (CC 97)	15.28
Vascular Disease and Complications (CC 104-105)	25.12
Other Lung Disorders (CC 115)	26.95
Legally Blind (CC 116)	0.75
Dialysis Status (CC 130)	2.24
Internal Injuries (CC 160)	0.93