APPENDIX

Table A1. Study Modifications to the Centers for Medicare & Medicaid Services (CMS) Condition-Specific Readmission Measure Specifications for Acute Myocardial Infarction, Heart Failure, and Pneumonia

| **CMS Specification\***† | **Study Population Modification** |
| --- | --- |
| Cohort limited to beneficiaries enrolled in Medicare Fee-for-Service (FFS) with at least 30 days of post-discharge enrollment in Medicare FFS. | Study population includes patients with all insurance types and the uninsured. For Medicare patients, we examined all stays with an expected primary or secondary payer of Medicare. This includes stays billed to either Medicare FFS or Medicare Advantage. |
| Cohort limited to patients aged 65 years and older. | Study population included patients aged 65 years and older for Medicare stays and patients aged 18 years or older for all other payers and the uninsured. |
| Cohort limited to beneficiaries enrolled in Part A Medicare (and, for some measures, Part B Medicare) for the 12 months prior to the date of the index admission and enrolled in Part A during the index admission. | Study population included all discharges in the hospital and was not limited on the basis of insurance enrollment. |
| Cohort limited to hospitals participating in the Inpatient Perspective Payment System. | Study population included nonfederal general medical/surgical hospitals that were not critical access hospitals in the four study states. In addition, we required that hospitals have at least one index admission per target condition per year and have at least five visits to each setting (inpatient, observation, ED) for any condition each year. |
| Readmission measure counts only one all-cause unplanned inpatient readmission in 30 days. | Study used a 30-day window but looked for all possible inpatient, observation, and ED unplanned revisits. If there were multiple revisits in the 30-day window, we counted only one visit, which was determined to be the most acute visit (inpatient, then observation, then ED). We only counted those revisits that qualified as unplanned. |

Abbreviations: ED, emergency department; FFS, fee-for-service;

\* QualityNet. Archived resources: readmission measures and measure methodology. QualityNet web page. (Accessed November 7, 2016, at <https://www.qualitynet.org/dcs/ContentServer?cid=1228774371008&pagename=QnetPublic%2FPage%2FQnetTier4&c=Page>.)

† Centers for Medicare & Medicaid Services. 2014 measures updates and specifications report: hospital-level 30-day risk-standardized readmission measures: acute myocardial infarction, heart failure, pneumonia, chronic obstructive pulmonary disease, stroke. March 2014. (<http://www.astellashealthcarereformonestopshop.com/documents/Rdmsn_Updts_AMIPNCOPDSTK_032114.pdf>.)

Table A2. Data Elements Used for Matching

|  |  |
| --- | --- |
| Data Element | Description |
| Age | Patient age at admission grouped into 7 categories |
| Dual Medicare and Medicaid enrollment | Dual Medicare and Medicaid enrollment was used to match Medicare index admissions only. |
| Sex | Patient sex |
| Elixhauser comorbidity index for readmissions21 | The Elixhauser comorbidity index for readmissions was designed to account for the influence of the 29 different Elixhauser comorbidity indicators in studies of readmissions using administrative data with limited clinical information. Each comorbidity indicator was assigned a weight ranging from –3 for obesity to 21 for metastatic cancer. The index was calculated as the sum of the weights for comorbidities listed on an inpatient discharge record. The distribution of the Elixhauser comorbidity index into deciles was determined using all index admissions for AMI, HF, and pneumonia from 2009 and 2010. |
| Hospital’s use of observation visits relative to inpatient admissions | For each hospital meeting inclusion criteria for the study (i.e., nonfederal general medical/surgical hospitals [excluding critical access hospitals] that had at least one index admission per target condition per year and had at least five ED, observation, and inpatient visits for any condition per year), we divided the total number of observation visits for adults (aged 18 years and older) across all conditions by the total number of adult inpatient admissions, and then we multiplied the ratio by 100 to obtain a percentage. The hospital-based percentages of observation visits to inpatient admissions were calculated separately for the two time periods, 2009 and 2010 versus 2013 and 2014. Using the information from 2009 and 2010, the distribution of the percentages of observation stays to inpatient admissions was divided into quartiles. |

Abbreviations: AMI, acute myocardial infarction; ED, emergency department; HF, heart failure.

**Table A3. Characteristics of Index Admissions\* After Matching for Acute Myocardial Infarction (AMI), Heart Failure (HF), and Pneumonia in 2009 and 2010 versus 2013 and 2014, by Expected Payer at the Index Admission**

| **Characteristic** | **Private,**  **18–64 Years** | | | **Medicare,**  **65+ Years** | | | **Medicaid,**  **18–64 Years** | | | **Uninsured,  18–64 Years** | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **2009 and 2010** | **2013 and 2014** | **P-value** | **2009 and 2010** | **2013 and 2014** | **P-value** | **2009 and 2010** | **2013 and 2014** | **P-value** | **2009 and 2010** | **2013**  **and**  **2014** | **P-value** |
| Index admissions, N |  |  |  |  |  |  |  |  |  |  |  |  |
| Total | 35,056 | 31,171 | <0.001 | 144,113 | 149,380 | <0.001 | 14,575 | 15,566 | <0.001 | 16,263 | 16,716 | <0.001 |
| AMI | 13,002 | 13,324 | <0.001 | 26,566 | 29,452 | <0.001 | 2,290 | 2,714 | <0.001 | 5,353 | 5,820 | <0.001 |
| HF | 8,371 | 7,381 | <0.001 | 63,659 | 65,011 | <0.001 | 5,692 | 6,615 | <0.001 | 5,382 | 5,726 | <0.001 |
| Pneumonia | 13,683 | 10,466 | <0.001 | 53,888 | 54,917 | <0.001 | 6,593 | 6,237 | <0.001 | 5,528 | 5,170 | <0.001 |
| **Variables Used in Matching Procedure** | | | | | | | | | | | | |
| Patient age, years, % of index admissions |  |  |  |  |  |  |  |  |  |  |  |  |
| 18–24 | 1.8 | 1.5 | 0.020 | – | – | – | 3.8 | 3.4 | 0.101 | 2.2 | 2.0 | 0.155 |
| 25–34 | 4.7 | 4.3 | 0.014 | – | – | – | 8.9 | 8.4 | 0.167 | 7.7 | 7.4 | 0.264 |
| 35–44 | 13.5 | 13.2 | 0.266 | – | – | – | 15.9 | 15.8 | 0.761 | 20.3 | 20.2 | 0.836 |
| 45–54 | 32.1 | 32.4 | 0.384 | – | – | – | 33.6 | 33.8 | 0.666 | 38.9 | 39.2 | 0.620 |
| 55–64 | 48.0 | 48.6 | 0.121 | – | – | – | 37.9 | 38.6 | 0.215 | 30.9 | 31.3 | 0.461 |
| 65–74 | – | – | – | 35.8 | 35.9 | 0.432 | – | – | – | – | – | – |
| 75+ | – | – | – | 64.2 | 64.1 | 0.432 | – | – | – | – | – | – |
| Dual Medicare and Medicaid enrollment, % of index admissions | – | – | – | 14.2 | 14.1 | 0.721 | – | – | – | – | – | – |
| Sex, % of index admissions |  |  |  |  |  |  |  |  |  |  |  |  |
| Male | 59.3 | 60.8 | <0.001 | 46.1 | 46.2 | 0.573 | 44.5 | 45.2 | 0.268 | 63.1 | 63.6 | 0.303 |
| Female | 40.7 | 39.2 | <0.001 | 53.9 | 53.8 | 0.573 | 55.5 | 54.8 | 0.268 | 36.9 | 36.4 | 0.303 |
| Comorbidity index, % of index admissions |  |  |  |  |  |  |  |  |  |  |  |  |
| Decile 1 (fewer  comorbidities) | 14.7 | 15.9 | <0.001 | 6.2 | 6.3 | 0.194 | 4.9 | 5.2 | 0.269 | 11.9 | 12.3 | 0.202 |
| Decile 2 | 24.8 | 25.9 | 0.002 | 9.2 | 9.3 | 0.247 | 11.1 | 11.4 | 0.450 | 20.8 | 21.0 | 0.511 |
| Decile 3 | 14.0 | 13.7 | 0.262 | 10.8 | 10.8 | 0.862 | 10.6 | 10.5 | 0.682 | 13.8 | 13.6 | 0.562 |
| Decile 4 | 10.8 | 10.5 | 0.310 | 9.1 | 9.2 | 0.913 | 11.2 | 11.3 | 0.962 | 11.4 | 11.4 | 0.929 |
| Decile 5 | 7.4 | 7.1 | 0.186 | 9.4 | 9.4 | 0.948 | 8.7 | 8.6 | 0.759 | 8.6 | 8.5 | 0.756 |
| Decile 6 | 8.4 | 8.0 | 0.053 | 11.1 | 11.0 | 0.831 | 11.6 | 11.5 | 0.840 | 9.6 | 9.5 | 0.757 |
| Decile 7 | 5.4 | 5.1 | 0.138 | 9.7 | 9.7 | 0.717 | 9.0 | 9.0 | 0.947 | 6.8 | 6.7 | 0.716 |
| Decile 8 | 6.0 | 5.7 | 0.090 | 12.6 | 12.5 | 0.619 | 11.3 | 11.3 | 0.878 | 7.3 | 7.2 | 0.638 |
| Decile 9 | 4.6 | 4.4 | 0.120 | 11.2 | 11.1 | 0.617 | 10.5 | 10.5 | 0.959 | 5.5 | 5.5 | 0.814 |
| Decile 10 (more  comorbidities) | 3.9 | 3.7 | 0.112 | 10.8 | 10.7 | 0.477 | 10.9 | 10.8 | 0.660 | 4.3 | 4.3 | 0.740 |
| Hospital’s ratio of observation visits to inpatient stays, 2009 and 2010, % of index admissions |  |  |  |  |  |  |  |  |  |  |  |  |
| Quartile 1 (fewer  observation visits  relative to inpatient  stays) | 33.1 | 33.3 | 0.531 | 28.4 | 28.4 | 0.876 | 30.6 | 30.9 | 0.610 | 32.7 | 32.9 | 0.771 |
| Quartile 2 | 33.2 | 33.7 | 0.157 | 32.0 | 32.1 | 0.620 | 32.4 | 32.9 | 0.362 | 30.9 | 31.2 | 0.630 |
| Quartile 3 | 21.7 | 21.3 | 0.273 | 22.9 | 22.8 | 0.769 | 19.7 | 19.4 | 0.514 | 20.7 | 20.5 | 0.663 |
| Quartile 4 (more  observation visits  relative to inpatient  stays) | 12.1 | 11.7 | 0.113 | 16.7 | 16.6 | 0.633 | 17.3 | 16.8 | 0.284 | 15.6 | 15.4 | 0.612 |

Abbreviations: AMI, acute myocardial infarction; ED, emergency department. HF, heart failure. Dashes mean not applicable.

\* Includes records that could be matched and were included in the final analysis; results are weighted for matching.

Source:Agency for Healthcare Research and Quality, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, State Inpatient Databases, State Emergency Department Databases, and State Ambulatory Surgery and Services Databases, four States, 2009 and 2010 versus 2013 and 2014, weighted matched records.