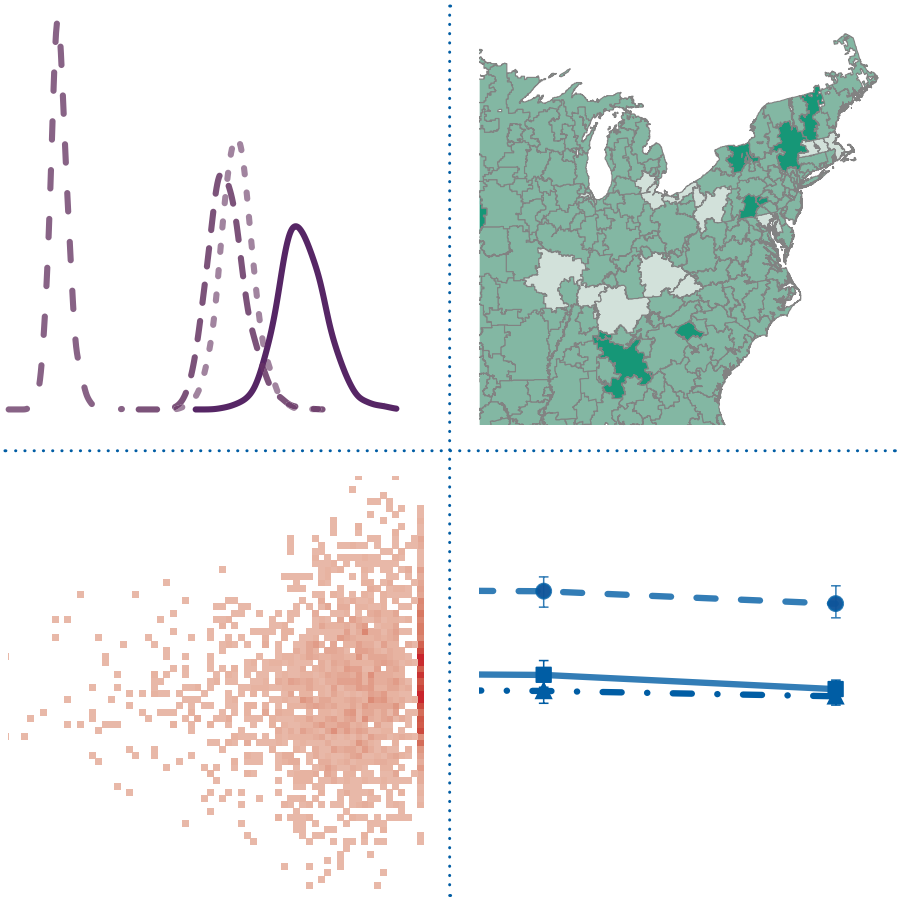
CMS
CENTERS FOR MEDICARE & MEDICAID SERVICES

Medicare Hospital Quality Chartbook

Performance Report on Outcome Measures

SEPTEMBER 2013



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Executive Summary

The 2013 edition of the Centers for Medicare and Medicaid Services (CMS) Hospital Quality Chartbook (the *Chartbook*) is divided into two parts. The first part summarizes national performance on CMS's hospital outcome measures. The second part addresses special measurement topics of national interest and provides surveillance of disparities and utilization of both emergency department (ED) visits and observation stays in the post-discharge period for publicly reported readmission measures. The following publicly reported measures are included in this year's *Chartbook*:

- acute myocardial infarction (AMI) mortality and readmission
- heart failure mortality and readmission
- pneumonia mortality and readmission
- primary elective total hip and/or knee arthroplasty complication and readmission
- hospital-wide readmission

In addition, this year we present results for CMS's newest measures intended for public reporting in 2014:

- ischemic stroke mortality and readmission
- chronic obstructive pulmonary disease (COPD) mortality and readmission

The 2013 *Chartbook* uses July 2009 through June 2012 data for the AMI, heart failure, pneumonia and hip/knee arthroplasty measure analyses (2013 publicly reported data), and January 2009 through December 2011 data for the hospital-wide readmission measure analyses. The stroke and COPD measure analyses use the same data, from January 2009 through December 2011, from this year's "dry run," during which hospitals received their 2013 results for internal review. Planned readmissions are not counted in the outcome of any readmission measures presented in this year's *Chartbook*.

Hospital Quality

AMI mortality rates and unplanned readmission rates for AMI, heart failure, pneumonia, and hip/knee arthroplasty declined between 2009 and 2012. The magnitude of decrease was greatest for AMI and heart failure and least for hip/knee arthroplasty.

Hospitals continue to show variation in unplanned readmission rates after AMI, heart failure, pneumonia, and hip/knee arthroplasty. However, the range of **readmission performance variation has narrowed,** indicating greater consistency in unplanned readmission rates.

COPD mortality and unplanned readmission rates declined from 2009 to 2011.

Disparities

Across all measures, **hospitals serving the fewest Medicaid or minority patients had distributions of performance nearly identical to those of hospitals serving the most Medicaid or minority patients**, indicating that both groups of hospitals can perform well on the measures. For some measures, such as heart failure readmission and hospital-wide readmission, the median outcome rates are higher for hospitals with the highest proportion of Medicaid or minority patients compared with hospitals with the lowest proportion of Medicaid or minority patients, indicating a **continued need for surveillance**.

Observation Stays and ED Visits

We have measured a **small increase in post-discharge observation stays** after hospitalizations for AMI, heart failure, and pneumonia and an increase in ED visits following heart failure hospitalizations. However, the increases are less than and predate the decline in readmission rates.

The relationship between hospital-level use of observation stays in the post-discharge period and risk-standardized readmission rate (RSRR) performance is weak. There is a small correlation between higher use of observation stays and lower RSRRs, but a **wide range of performance at all levels of observation stay use**. This suggests that most hospitals are not systematically improving readmission rates solely through the use of observation stays.

The high degree of variation in hospital-level observation stays in the 30-day post-discharge period and the high use of observation stays at a small proportion of hospitals suggests that the use of hospital-level observation stays should continue to be closely evaluated for ongoing impact on the readmission measures.

What are Risk-Standardized Outcome Rates?

Measuring Key Hospital Outcomes

The hospital outcome measures in this report include CMS's 30-day risk-standardized mortality rates (RSMRs), 30-day risk-standardized readmission rates (RSRRs), and risk-standardized complication rates (RSCRs) for Medicare fee-for-service (FFS) patients aged 65 or older admitted to the hospital for acute myocardial infarction (AMI), heart failure, pneumonia, total hip and/or knee arthroplasty (i.e., joint replacement), stroke, and chronic obstructive pulmonary disease (COPD), as well as all conditions in the hospital-wide readmission measure. The National Quality Forum (NQF) has endorsed all but the stroke measures. The AMI, heart failure, pneumonia, hip/knee, and hospital-wide measures are publicly reported by CMS on the *Hospital Compare* website. The COPD and stroke measures were referenced in the Fiscal Year (FY) 2014 Inpatient Prospective Payment System (IPPS)/Long Term Care Hospital Prospective Payment System (LTCH PPS) Final Rule and will be publicly reported starting next year [1].

Measured Outcomes

The mortality measures assess death from any cause within 30 days of a hospitalization, regardless of whether the patient dies while still in the hospital or after discharge from the hospital. The readmission measures assess unplanned readmissions for any reason within 30 days of discharge from a hospital stay; patients may have been readmitted to the same hospital or to a different hospital. In all measures, planned readmissions are removed from the outcome. Information about the algorithm used to identify planned readmissions can be found in Appendix IV. The complication measure assesses the occurrence of significant medical and/or surgical complications within 7 to 90 days, depending on the complication, following hospitalization for total hip and/or knee arthroplasty.

Risk Adjustment

To ensure accurate assessment of each hospital, the measures use statistical models to adjust for key differences in patient risk factors that are clinically relevant and have strong relationships with the outcome (e.g., age and patient comorbidities). For each patient, risk factors are obtained from Medicare claims extending 12 months prior to and including the index admission. The statistical models adjust for patient differences based on the clinical status of the patient at the time of admission. Accordingly, only comorbidities that convey information about the patient at that time or in the 12 months prior – not complications that arise during the course of the index admission – are included in risk adjustment.

Calculating the Risk-Adjusted Outcome

The mortality, readmission, and complication measures use hierarchical logistic regression to create RSMRs, RSRRs, and RSCRs for each hospital, respectively. These measures are designed to adjust for case mix differences and to account for random variation so that they reflect each hospital's quality of care.

The RSMRs/RSRRs/RSCRs are calculated as the ratio of the number of "predicted" outcomes (deaths, readmissions, or complications) over the number of "expected" outcomes, multiplied by the national mortality/readmission/complication rate. For each hospital, the "numerator" of the ratio is the number of deaths/readmissions/complications within the outcome ascertainment period (30 days for the mortality and readmission measures and 7-90 days for the complication measure, depending upon the complication) predicted on the basis of the hospital's performance with its observed case mix, and the "denominator" is the number of deaths/readmissions/complications expected on the basis of the nation's performance with that specific hospital's case mix. This approach is analogous to a ratio of "observed" to "expected" used in other types of statistical analyses, and 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 a lower-than-expected mortality, readmission, or complication rate and better quality, whereas a higher ratio indicates a higher-than-expected mortality, readmission, or complication rate and worse quality.

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Quality

In Part I of the 2013 CMS Chartbook, we present trends and distributions of hospital-level results and summarize geographic variation in performance on hospital quality outcome measures that are publicly reported as part of the Hospital Inpatient Quality Reporting (IQR) program on *Hospital Compare*. To understand movement in performance within the three-year measurement period, we examine annual trends for each measure. Additionally, we present similar information for the new stroke and chronic obstructive pulmonary disease (COPD) mortality and readmission measures. These data summarize the results shared with hospitals this year as part of a "dry run". A dry run is a private period in which hospitals can see their results and learn about new measures prior to public reporting. The stroke and COPD measures are intended for inclusion in public reporting in 2014. This first part of the Chartbook is intended to portray the state of hospital quality across the nation for a wide variety of conditions by providing information about trends in outcomes and continued variation in quality.

Mortality and complication rates generally remained constant across the three-year measurement period from July 2009 to June 2012, with the exception of a continued decline in acute myocardial infarction (AMI) mortality rates. In the readmission measures, we report declines in unplanned readmission rates across the measurement period for all condition-specific measures.

Overall, variation persists in hospital performance for the mortality and complications measures, suggesting continued opportunities for hospital improvement. A slight narrowing of variation for readmission measures suggests more consistent performance across hospitals on these measures.

Finally, notable geographic variation by hospital referral region (HRR) still remains for both the mortality and readmission measures, with consistent patterns of regional performance across measures. The majority of HRRs perform no differently, however, than the national average.

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AMI, Heart Failure, Pneumonia, Hip/Knee Arthroplasty

Summary

TRENDS | DISTRIBUTIONS | GEOGRAPHIC VARIATION

This section focuses on the acute myocardial infarction (AMI), heart failure, pneumonia mortality and readmission measures, and the hip/knee arthroplasty complication and readmission measures that are publicly reported as part of the Hospital Inpatient Quality Reporting (IQR) program on *Hospital Compare*. The analyses use 2013 publicly reported data: from July 2009 through June 2012 for the AMI, heart failure, and pneumonia measures and the hip/knee readmission measures, and from July 2009 through March 2012 for the hip/knee complication measure.

Hospital-level all-cause risk standardized mortality rates (RSMRs) in the 30 days after hospital admission admission for AMI, heart failure, and pneumonia have been publicly reported since 2007 for AMI and heart failure and since 2008 for pneumonia. Since 2011, Veteran's Health Administration (VA) hospitals were included in public reporting for all three measures. Starting in October 2013, Centers for Medicare & Medicaid Services (CMS) will begin implementing these measures in the Hospital Value-Based Purchasing (HVBP) Program.

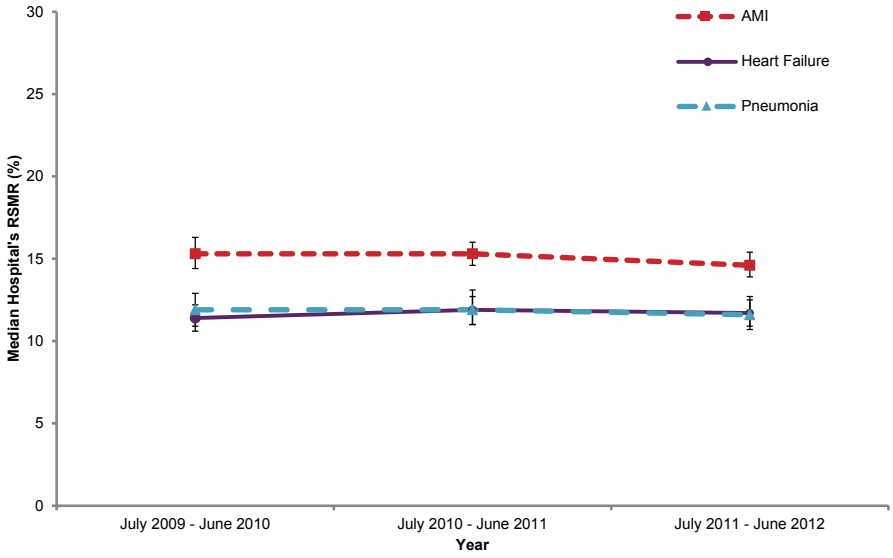
CMS began publicly reporting hospital-level 30-day all-cause risk-standardized readmission rates (RSRRs) after admissions for AMI, heart failure, and pneumonia in 2009. In 2012, CMS adopted the AMI, heart failure, and pneumonia readmission measures into the Hospital Readmissions Reduction Program (HRRP).

Finally, CMS began publicly reporting complications and readmission measures following primary elective hip/knee arthroplasty as part of the Hospital IQR program in 2013. Also known as hip or knee replacements, these procedures are common surgeries performed on more than 600,000 Medicare fee-for-service (FFS) beneficiaries each year. The hip/knee arthroplasty complication measure includes the following complications following a hip or knee replacement: AMI, pneumonia, or sepsis/septicemia during the index hospitalization or within 7 days of admission; surgical site bleeding, pulmonary embolism or death during the index hospitalization or within 30 days of admission; or mechanical complications, periprosthetic joint infection, or wound infection during the index hospitalization or within 90 days of admission.

Results for hospital-wide readmission, another publicly reported measure, are included separately in the following section, starting on page 27.

Are mortality rates changing over time?

FIGURE A.1.1. *Trend in the Median Hospital's One-Year RSMR for AMI, Heart Failure, and Pneumonia, July 2009 – June 2012.*



Hospital-level risk-standardized mortality rates (RSMRs) in the 30 days after hospital admission for acute myocardial infarction (AMI), heart failure, and pneumonia have been publicly reported since 2007 for AMI and heart failure and since 2008 for pneumonia. The measures are reported as combined three-year measures to assess more cases per hospital than a single year of data would provide, thus allowing identification of outliers in hospital performance with greater precision.

Table A.1.1 and Figure A.1.1 show trends in median annual RSMRs between July 2009 and June 2012. The median RSMR for AMI admissions declined by 0.7% from 15.3% in 2009/2010 and 2010/2011 to 14.6% in 2011/2012. This decrease continues a trend seen in previous years [2]. The median RSMR for heart failure admissions increased from 11.4% in 2009/2010 to 11.9% in 2010/2011 and decreased to 11.7% in 2011/2012. The median RSMR for pneumonia admissions was 11.9% in both 2009/2010 and 2010/2011 before decreasing to 11.6% in 2011/2012.

30-day mortality rates after admissions for AMI continued to decline. Trends in 30-day mortality rates after admissions for heart failure and pneumonia showed little change from July 2009 to June 2012.

TABLE A.1.1. *Median Hospital's One-Year RSMR for AMI, Heart Failure, and Pneumonia, July 2009 – June 2012.*

	Median (Range) Hospital's RSMR (%)		
	July 2009 – June 2010	July 2010 – June 2011	July 2011 – June 2012
AMI	15.3 (11.2, 21.4)	15.3 (12.0, 18.9)	14.6 (10.6, 20.3)
Heart Failure	11.4 (7.7, 16.9)	11.9 (7.4, 16.6)	11.7 (7.5, 17.7)
Pneumonia	11.9 (7.2, 18.7)	11.9 (7.0, 20.8)	11.6 (7.2, 19.4)

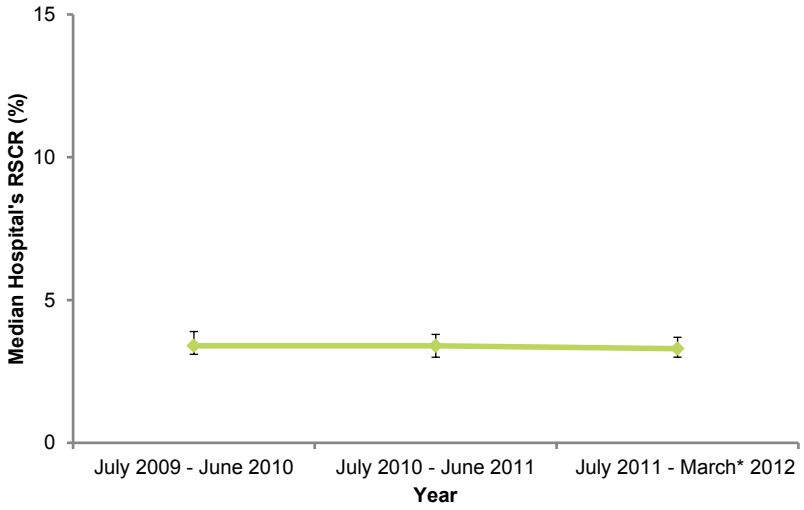
Source Data and Population: Condition-specific Mortality Measure Cohort data – July 2009 – June 2012 (Appendix I).

Notes: 1) Veterans Health Administration (VA) hospitals are included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition in each year are not shown; however, these hospitals are included in the calculations. 3) The bars on the graph represent the interquartile range. 4) For AMI, the total number of hospitals was 1,792 in 09/10, 1,779 in 10/11, and 1,737 in 11/12. 5) For heart failure, the total number of hospitals was 2,986 in 09/10, 2,906 in 10/11, and 2,808 in 11/12. 6) For pneumonia, the total number of hospitals was 3,474 in 09/10, 3,515 in 10/11, and 3,353 in 11/12.

Prepared for CMS by YNHHSC/CORE.

Are the rates of **complications** after elective total hip and knee arthroplasty changing over time?

FIGURE A.1.2. *Trend in the Median Hospital's One-Year RSCR for Hip/Knee Arthroplasty, July 2009-March* 2012.*



Total hip and/or knee arthroplasty, also known as hip and/or knee replacements, are common elective surgeries performed on more than 600,000 Medicare fee-for-service beneficiaries each year [3, 4]. The hip/knee arthroplasty complication measure assesses whether patients undergoing primary elective hip and/or knee arthroplasty experience acute myocardial infarction (AMI), pneumonia, or sepsis/septicemia during the index hospitalization or within 7 days of admission; surgical site bleeding, pulmonary embolism or death during the index hospitalization or within 30 days of admission; or mechanical complications, periprosthetic joint infection or wound infection during the index hospitalization or within 90 days of admission. Patients with hip fractures or undergoing revision procedures are excluded from measurement.

Figure A.1.2 and Table A.1.2 display median hospital-level, risk-standardized complication rates (RSCRs) after hip/knee arthroplasty between July 2009 and March 2012. Median hospital-level RSCRs are below 4% and low overall. However, these rates may be higher than patients expect when they choose to undergo an elective procedure for a non-life threatening condition. The final year of data was cut short and ended in March to allow for complete patient follow up because this measure captures outcomes occurring up to 90 days after admission. The RSCRs for hip/knee arthroplasty complications remain similar over the 33 month period.

Hip/knee arthroplasty complication rates remained steady between July 2009 and March 2012.

TABLE A.1.2. *Median Hospital's One-Year RSCR for Hip/Knee Arthroplasty, July 2009-March* 2012.*

Median (Range) Hospital's RSCR (%)

	July 2009 – June 2010	July 2010 – June 2011	July 2011 – March 2012
Hip/Knee Arthroplasty	3.4 (1.7, 7.3)	3.4 (1.6, 6.7)	3.3 (1.8, 6.1)

Source Data and Population: Hip/Knee Arthroplasty Complication Measure Cohort data – July 2009 – March 2012 (Appendix I).

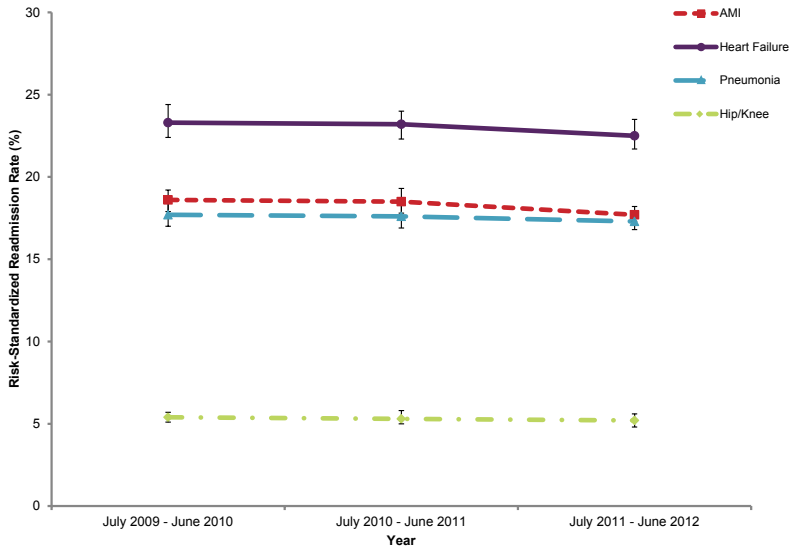
Notes: 1) Veterans Health Administration (VA) hospitals are not included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition in each year are not shown; however, these hospitals are included in the calculations. 3) The bars on the graph represent the interquartile range. 4) For hip/knee arthroplasty complications the total number of hospitals was 2,179 in 09/10, 2,170 in 10/11, and 1,938 in 11/12. 5) Only the final year (July 2011 – March 2012) was cut short to allow for complete patient follow up.

*The final year of data was cut in March to allow for complete patient follow up, since this measure captures outcomes occurring up to 90 days after admission.

Prepared for CMS by YNHHSC/CORE.

Are unplanned readmission rates changing over time?

FIGURE A.1.3. *Trend in the Median Hospital's One-Year RSRR for AMI, Heart Failure, Pneumonia, and Hip/Knee Arthroplasty, July 2009 – June 2012.*



In 2009, CMS began publicly reporting, as part of the Hospital Inpatient Quality Reporting (IQR) program, hospital-level 30-day risk-standardized readmission rates (RSRRs) after admissions for acute myocardial infarction (AMI), heart failure, and pneumonia. RSRRs after admission for hip/knee arthroplasty entered public reporting in 2013 as part of the Hospital IQR program. This year's results for each of these measures exclude planned readmissions from the outcome. Additionally, this is the first time in the *Chartbook* that we report annual AMI, heart failure, and pneumonia RSRRs for admissions which only occurred after the onset of public reporting.

Figure A.1.3 and Table A.1.3 show the median hospital's RSRR each year from July 2009 to June 2012. The RSRRs decreased over the three year period for all measures, particularly between the second and third year (2010/11 and 2011/12), with AMI and heart failure experiencing the largest reductions of nearly 1 percentage point each over the three years. RSRRs after hospitalization for pneumonia decreased by 0.4 percentage points and RSRRs following hip/knee arthroplasty had a decrease of 0.2 percentage points over the three years.

Hospital unplanned readmissions for AMI, heart failure, pneumonia, and hip/knee arthroplasty declined between July 2009 and June 2012. The magnitude of decrease was greatest for AMI and heart failure and least for hip/knee arthroplasty.

TABLE A.1.3. *Median Hospital's One-Year RSRR for AMI, Heart Failure, Pneumonia, and Hip/Knee Arthroplasty, July 2009 – June 2012.*

	Median (Range) Hospital's RSRR (%)		
	July 2009 – June 2010	July 2010 – June 2011	July 2011 – June 2012
AMI	18.6 (15.4, 22.8)	18.5 (15.0, 22.6)	17.7 (15.3, 20.7)
Heart Failure	23.3 (18.2, 31.4)	23.2 (18.4, 30.1)	22.5 (17.5, 30.3)
Pneumonia	17.7 (14.4, 23.6)	17.6 (14.5, 24.6)	17.3 (14.6, 22.0)
Hip/Knee	5.4 (3.7, 8.8)	5.3 (3.6, 8.4)	5.2 (3.4, 8.2)

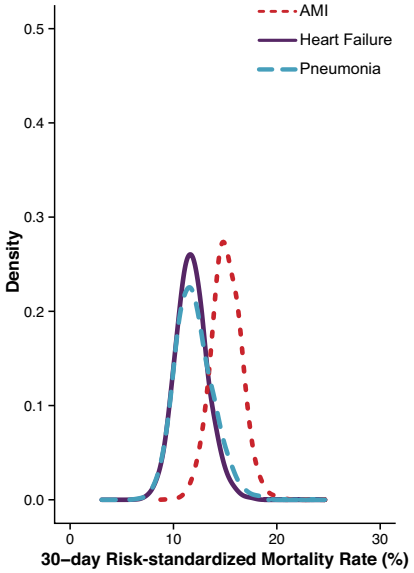
Source Data and Population: Condition-specific Readmission Measure Cohort data – July 2009 – June 2012 (Appendix I).

Notes: 1) Veterans Health Administration (VA) hospitals are included in this analysis, except for in the hip/knee readmission measure. 2) The results of hospitals with fewer than 25 cases of the condition in each year are not shown; however, these hospitals are included in the calculations. 3) The bars on the graph represent the interquartile range. 4) For AMI, the total number of hospitals was 1,627 in 09/10, 1,630 in 10/11, and 1,579 in 11/12. 5) For heart failure, the total number of hospitals was 3,200 in 09/10, 3,109 in 10/11, and 2,938 in 11/12. 6) For pneumonia, the total number of hospitals was 3,560 in 09/10, 3,610 in 10/11, and 3,364 in 11/12. 7) For hip/knee arthroplasty, the total number of hospitals was 2,190 in 09/10, 2,175 in 10/11, and 2,083 in 11/12.

Prepared for CMS by YNHHSC/CORE.

To what extent do mortality rates vary across hospitals?

FIGURE A.1.4. *Distribution of Hospital RSMRs for AMI, Heart Failure, and Pneumonia, July 2009 – June 2012.*



To examine the variation in risk-standardized mortality rates (RSMRs) after admission for AMI, heart failure, and pneumonia among U.S. hospitals, we report the distribution of RSMRs in Figure A.1.4 and Table A.1.4. Variation in RSMRs reflects differences in performance among U.S. hospitals, with wider distributions suggesting more variation in quality and narrower distributions suggesting less variation in quality.

Hospital RSMRs for AMI, heart failure, and pneumonia are similarly distributed in the density plot shown. While the majority of hospitals had RSMRs close to the median hospital's RSMR, the absolute difference between the 25th and 75th percentiles for all three conditions was still near to or greater than 2 percentage points, suggesting continued opportunity for improvement.

Approximately half of the hospitals have RSMRs 1 percentage point above and below the median hospital following hospitalizations for AMI and heart failure. Mortality rates are more varied for pneumonia: approximately half of the hospitals have risk-standardized mortality rates 1.5 percentage points above and below the median hospital following hospitalizations for pneumonia.

TABLE A.1.4. *Distribution of Hospital RSMRs for AMI, Heart Failure, and Pneumonia, July 2009 – June 2012.*

	Distribution of RSMRs (%)		
	AMI	Heart Failure	Pneumonia
Maximum	21.0	17.9	24.5
90%	16.9	13.8	14.5
75%	16.1	12.7	13.1
Median (50%)	15.1	11.7	11.8
25%	14.2	10.7	10.7
10%	13.3	9.9	9.9
Minimum	9.4	6.4	6.5

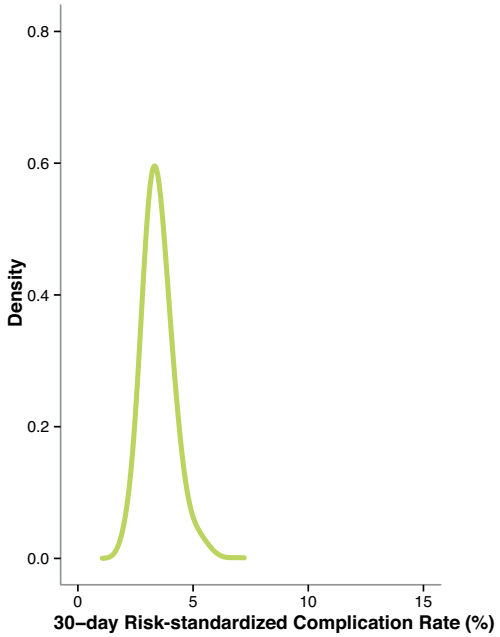
Source Data and Population: Condition-specific Mortality Measure Cohort data – July 2009 – June 2012 (Appendix I).

Notes: 1) Veterans Health Administration (VA) hospitals are included in these analyses. 2) The results of hospitals with fewer than 25 cases of the condition over the three-year period are not shown; however, these hospitals are included in the calculations. 3) The number of hospitals included in the analyses was 2,645 for AMI; 4,017 for heart failure; 4,424 for pneumonia. 4) For more information about figures and density plots, see Appendix III.

Prepared for CMS by YNHHSC/CORE.

To what extent do hip/knee arthroplasty complication rates vary across hospitals?

FIGURE A.1.5. *Distribution of Hospital RSCRs for Hip/Knee Arthroplasty, July 2009-March* 2012.*



To examine the variation in risk-standardized complication rates (RSCRs) following total hip and/or knee arthroplasty among U.S. hospitals, we report the distribution of RSCRs in Figure A.1.5 and Table A.1.5. Variation in RSCRs reflects differences in performance among U.S. hospitals, with wide distributions indicating more variation in quality. While the majority of hospitals had RSCRs close to the median hospital's RSCR, the overall range of RSCRs for hip/knee arthroplasty remains wide: 25% of the hospitals have RSCRs greater than 3.9% and 25% of hospitals have RSCRs lower than 3.0%, suggesting opportunity for improvement for these elective procedures.

Hospitals show variation in RSCRs after elective primary hip/knee arthroplasty.

TABLE A.1.5. *Distribution of Hospital RSCRs for Hip/Knee Arthroplasty, July 2009 – March* 2012.*

	Hip/Knee Arthroplasty
Maximum	7.2
90%	4.3
75%	3.9
Median (50%)	3.4
25%	3.0
10%	2.7
Minimum	1.7

Source Data and Population: Hip/Knee ArthroplastyComplication Measure Cohort data – July 2009-March 2012 (Appendix I).

Notes: 1) Veterans Health Administration (VA) hospitals are not included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition over the three year period are not shown; however, these hospitals are included in the calculation. 3) The number of hospitals included in the analysis was 2,779. 4) For more information about figures and density plots, see Appendix III.

* The final year of data was cut in March to allow for complete patient follow up, since this measure captures outcomes occurring up to 90 days after admission.

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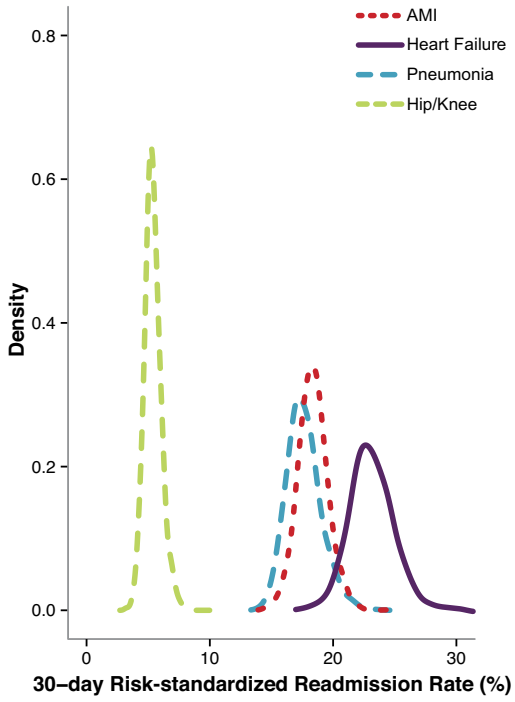
To what extent do unplanned readmission rates vary across hospitals?

FIGURE A.1.6. *Distribution of Hospital RSRRs for AMI, Heart Failure, Pneumonia, and Hip/Knee Arthroplasty, July 2009 – June 2012.*



To examine the variation in risk-standardized readmission rates (RSRRs) after admission for acute myocardial infarction (AMI), heart failure, pneumonia, and total hip/knee arthroplasty among U.S. hospitals, we report the distribution of RSRRs in Figure A.1.6 and Table A.1.6. Variation in RSRRs reflects differences in performance among U.S. hospitals, with wider distributions suggesting more variation in quality and narrower distributions suggesting less variation in quality. The conditions differ in the degree of performance variation, with heart failure showing the widest range of RSRRs and hip/knee arthroplasty showing the narrowest range.

Compared with data presented in the 2012 Chartbook from January 2008 through December 2010, the interquartile range of RSRRs decreased from 2.1 to 1.5 percentage points for AMI, from 2.4 to 2.3 percentage points for heart failure, from 2.3 to 1.7 percentage points for pneumonia, and from 1.0 to 0.9 percentage points for hip/knee arthroplasty. The decrease in variation parallels decreases in national RSRRs shown on page 20. Quality improvement efforts seek to lower the overall rate of readmission and to decrease variation between hospitals. With these results, we are seeing greater consistency in performance among hospitals, simultaneous with the decrease in overall rates described earlier (page 20).

Hospitals continue to show variation in unplanned readmission rates after AMI, heart failure, pneumonia, and hip/knee arthroplasty. However, the range of performance variation has narrowed, indicating greater consistency in unplanned readmission rates.

TABLE A.1.6. *Distribution of Hospital RSRRs for AMI, Heart Failure, Pneumonia, and Hip/Knee Arthroplasty, July 2009 – June 2012.*

Distribution of RSRRs (%)

	AMI	Heart Failure	Pneumonia	Hip/Knee
Maximum	24.3	30.7	24.0	10.0
90%	19.8	25.4	19.5	6.2
75%	19.1	24.2	18.4	5.8
Median (50%)	18.3	23.0	17.5	5.3
25%	17.6	21.9	16.7	4.9
10%	16.9	21.0	15.9	4.6
Minimum	14.4	17.1	13.6	3.2

Source Data and Population: Condition-specific Readmission Measure Cohort data – July 2009-June 2012 (Appendix I).

Notes: 1) Veterans Health Administration (VA) hospitals are included in these analyses, except for the hip/knee analysis. 2) The results of hospitals with fewer than 25 cases of the condition over the three-year period are not shown; however, these hospitals are included in the calculations. 3) The number of hospitals included in the analyses was 2,346 for AMI; 4,128 for heart failure; 4,437 for pneumonia; and 2,811 for hip/knee arthroplasty. 4) For more information about figures and density plots, see Appendix III.

Prepared for CMS by YNHHSC/CORE.

Does overall hospital performance on the AMI, heart failure, and pneumonia mortality measures differ by geographic location?

FIGURE A.1.7. *Classification of HRRs by RSMR for AMI, Heart Failure, and Pneumonia, July 2009 – June 2012.*

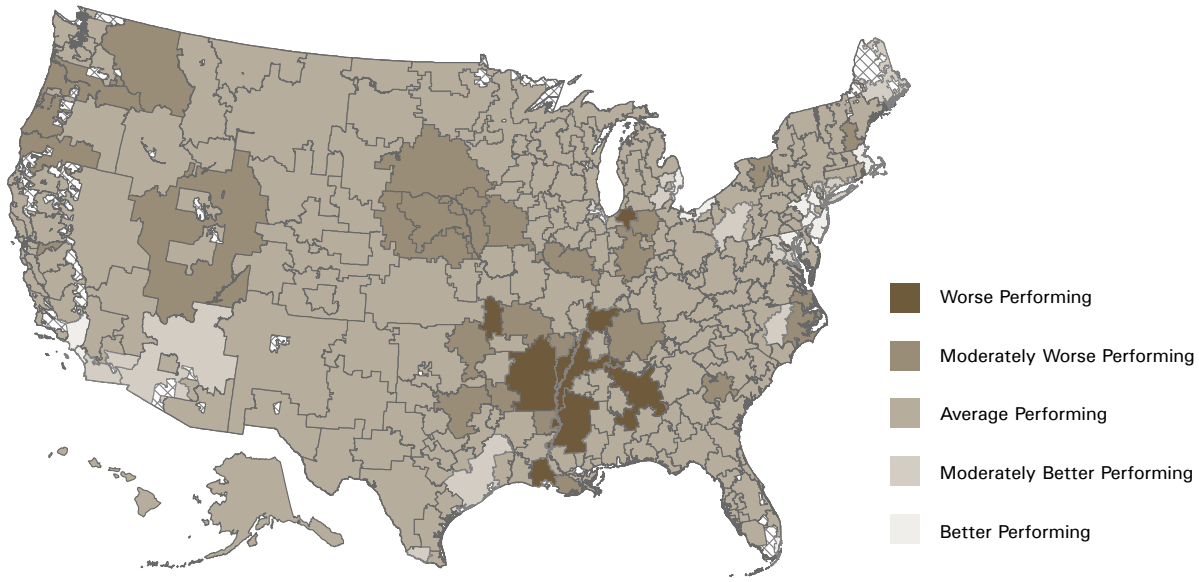


Figure A.1.7 displays geographic variation by Hospital Referral Region (HRR) in overall performance in 30-day risk-standardized mortality rates (RSMRs) after hospitalization for acute myocardial infarction (AMI), heart failure, and pneumonia from July 2009 to June 2012. The darkest areas represent the HRRs that perform worse than the national rate on multiple mortality measures; the lightest areas represent the HRRs that perform better than the national rate on multiple mortality measures. Performance categories were determined for each mortality measure (AMI, heart failure, pneumonia) using a scoring system that gave 3 points for "better than national rate," 2 points for "the same as national rate," and 1 point for "worse than national rate." The scores were added to get a total score for each HRR. For more information on the definition of HRRs and the combined map score calculation methodology, please see Appendix V. There were 8 HRRs (3%) that performed worse than the national rate on two or more of the mortality measures, while 17 HRRs (5%) performed better than the national rate on two or more mortality measures.

TABLE A.1.7. *Worse- and Better-Performing HRRs on the AMI, Heart Failure, and Pneumonia Mortality Measures, July 2009 – June 2012.*

WORSE-PERFORMING HRRs	BETTER-PERFORMING HRRs
Birmingham, AL	Orange County, CA
Little Rock, AR	Los Angeles, CA
South Bend, IN	Miami, FL
Paducah, KY	Blue Island, IL
Lafayette, LA	Chicago, IL
Jackson, MS	Melrose Park, IL
Joplin, MO	Baltimore, MD
Memphis, TN	Boston, MA
	Detroit, MI
	Royal Oak, MI
	Camden, NJ
	Hackensack, NJ
	Morristown, NJ
	Manhattan, NY
	Cleveland, OH
	Allentown, PA
	Philadelphia, PA

Source Data and Population: Condition-specific Mortality Measure Cohort data – July 2009 – June 2012 (Appendix I).

Notes: 1) Veterans Health Administration (VA) hospitals are included in this analysis. 2) AMI, heart failure, and pneumonia mortality measures are included in the map. 3) Details of the definition of HRR and combined map score calculation methodology can be found in (Appendix V).

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Does overall hospital performance on the AMI, heart failure, pneumonia, and hip/knee arthroplasty unplanned readmission measures differ by geographic location?

FIGURE A.1.8. *Classification of HRRs by RSRR for AMI, Heart Failure, Pneumonia and Hip/Knee Arthroplasty, July 2009-June 2012 .*

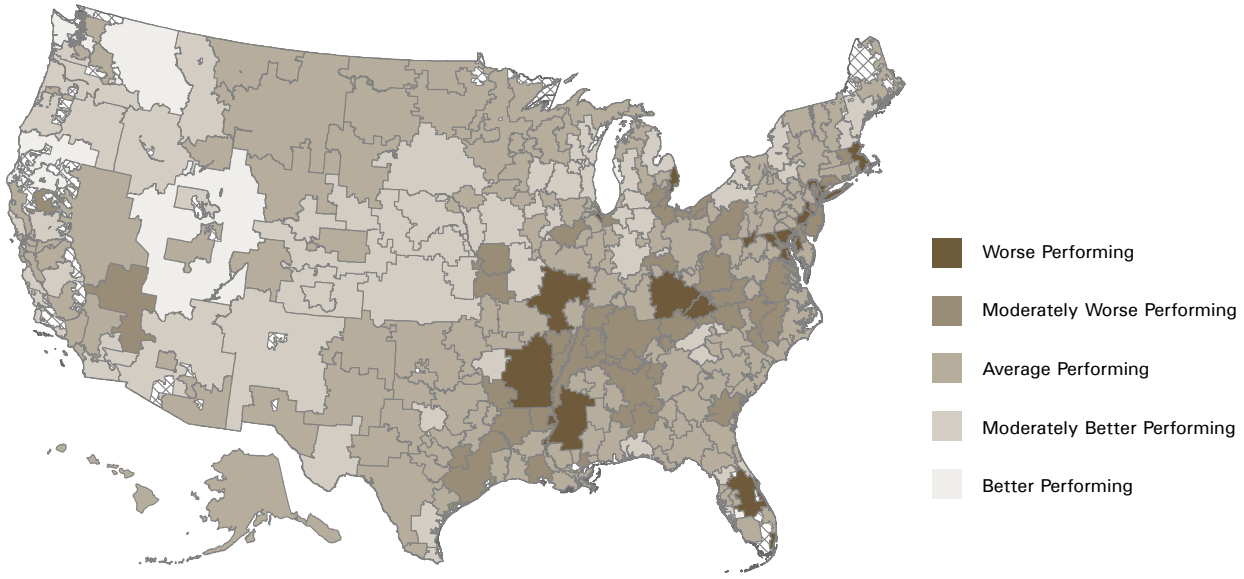

Figure A.1.8 displays geographic variation in the overall performance, divided by Hospital Referral Region (HRR), on readmission measures after hospitalization for acute myocardial infarction (AMI), heart failure, pneumonia, and hip/knee arthroplasty from July 2009 to June 2012. The darkest areas represent the HRRs that perform worse than the national rate on several readmission measures; the lightest areas represent the HRRs that perform better than the national rate on several readmission measures. Performance categories were determined for each readmission measure (AMI, heart failure, pneumonia, and hip/knee arthroplasty) using a scoring system that gave 3 points for "better than national performance," 2 points for "the same as national performance," and 1 point for "worse than national performance." The scores were added to get a total score for each HRR. For more information on definition of HRRs and the combined map score calculation methodology, please see Appendix V. We found 20 HRRs (7%) that performed worse than the national rate on three or more readmission measures, while 7 HRRs (3%) performed better than the national rate on three or more readmission measures.

TABLE A.1.8. *Worse- and Better-Performing HRRs on the AMI, Heart Failure, Pneumonia, and Hip/Knee Arthroplasty Readmission Measures, July 2009 – June 2012.*

WORSE-PERFORMING HRRs	BETTER-PERFORMING HRRs
Little Rock, AR	Redding, CA
Washington, DC	Sarasota, FL
Miami, FL	Muskegon, MI
Orlando, FL	Medford, OR
Blue Island, IL	Salt Lake City, UT
Chicago, IL	Seattle, WA
Lexington, KY	Spokane, WA
Baltimore, MD	
Boston, MA	
Detroit, MI	
Jackson, MS	
St. Louis, MO	
Hackensack, NJ	
Newark, NJ	
Bronx, NY	
East Long Island, NY	
Manhattan, NY	
White Plains, NY	
Philadelphia, PA	
Kingsport, TN	

Source Data and Population: Condition-specific Readmission Measure Cohort data – July 2009 – June 2012 (Appendix I).

Notes: 1) Veterans Health Administration (VA) hospitals are included in the analysis for AMI, heart failure, pneumonia measures. 2) AMI, heart failure, pneumonia, and hip/knee arthroplasty are included on the map. 3) Details of the definition of HRR and combined map score calculation methodology can be found in Appendix V.

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Hospital-Wide Readmission

Summary

TRENDS | DISTRIBUTIONS | GEOGRAPHIC VARIATION

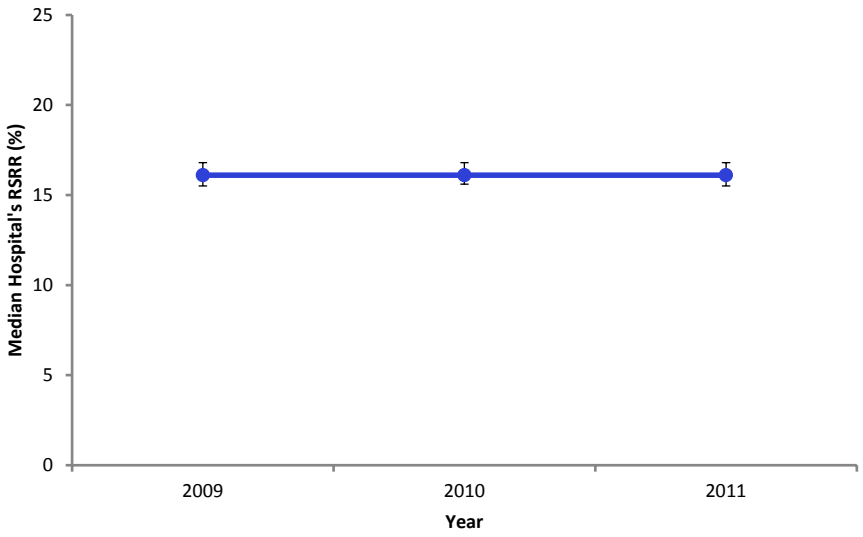
This section focuses on the hospital-level, risk-standardized rate of unplanned hospital-wide readmission within 30 days of discharge. This measure assesses unplanned all-cause 30-day readmission and includes Medicare fee-for-service (FFS) patients for all conditions, rather than focusing on admissions for specific conditions. The measure does not count readmissions that are considered planned. The hospital-wide risk-standardized readmission rate (RSRR) is a summary score derived from the results of five different models, one for each of the following specialty cohorts: medicine, surgery/gynecology, cardiorespiratory, cardiovascular, and neurology [5]. The cohorts reflect how patient care is organized within hospitals.

Combining five models rather than using a single model improves model performance and patient-level discrimination and increases the practical utility of the measure by illuminating differences in performance among specialty areas within hospitals. This attribute of the measure will allow hospitals to target quality improvement efforts better. Studies have shown that hospital readmissions for a wide range of conditions within 30 days are related to quality of inpatient or transitional care and can be reduced through hospital-level interventions [5]. Documented high and variable readmission rates also indicate opportunities for improvement.

CMS began publicly reporting the hospital-wide readmission measure on *Hospital Compare* in 2013 as part of the Hospital Inpatient Quality Reporting (IQR) program. One year of data is used in public reporting of the hospital-wide readmission measure, compared with three years of data in the other publicly reported, condition-specific readmission measures. Since the hospital-wide readmission measure includes most Medicare FFS admissions, it is possible to obtain a sufficient number of eligible admissions that provide a precise estimation of the hospitals' results using only one year of data. In this section, we report data ranging from January 2009 through December 2011 in order to capture annual trends in hospital-wide unplanned readmissions. This data is slightly different than the 2013 publicly reported data, which includes admissions between July 2011 and June 2012, in order to look at readmission trends prior to public reporting.

Is the rate of unplanned readmissions after admission to the hospital for all conditions changing over time?

FIGURE B.1.1. *Trend in the Median Hospital's RSRR for Hospital-Wide Readmission, January 2009 – December 2011.*



CMS started publicly reporting the hospital-wide readmission measure, which assesses unplanned all-cause 30-day readmissions, in 2013 as part of the Hospital Inpatient Quality Reporting (IQR) program. Unlike the other Hospital IQR program outcome measures, the hospital-wide readmission measure uses only one year of admissions and calculates the hospital-wide risk-standardized readmission rate (RSRR). This is a summary score derived from the results of five different models, one for each of the following specialty cohorts: medicine, surgery/gynecology, cardiorespiratory, cardiovascular, and neurology.

Figure B.1.1 and Table B.1.1 display national trends in the median hospital's hospital-wide RSRR within 30 days of discharge for any condition between January 2009 and December 2011. This measurement period is six months earlier than the July 2009 through June 2012 period for the condition-specific readmission measures and the July 2011 through June 2012 period for the hospital-wide measure publicly reported on *Hospital Compare* due to the specific data requirements of this analysis for this measure. Hospital-wide readmission rates did not change between 2009 and 2011, but the publicly reported data that includes July 2011 through June 2012 may show different results.

Hospital-wide unplanned RSRRs remained similar from 2009 through 2011.

TABLE B.1.1. *Median Hospital's One-Year RSRR for Hospital-Wide Readmission, January 2009 – December 2011.*

	Median (Range) Hospital's RSRR (%)		
	2009	2010	2011
Hospital-Wide	16.1 (11.0, 22.6)	16.1 (10.9, 22.6)	16.1 (11.3, 24.0)

Source Data and Population: Hospital-Wide Readmission Measure Cohort data – January 2009 – December 2011 (Appendix I).

Notes: 1) Veterans Health Administration (VA) hospitals are not included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition in each year are not shown; however, these hospitals are included in the calculations. 3) The bars on the graph represent the interquartile range. 4) The total number of hospitals was 4,699 in 2009, 4,685 in 2010, and 4,685 in 2011.

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To what extent do hospital-wide unplanned readmission rates vary across hospitals?

FIGURE B.1.2. *Distribution of Hospital RSRRs for Hospital-Wide Readmission, January 2011 – December 2011.*

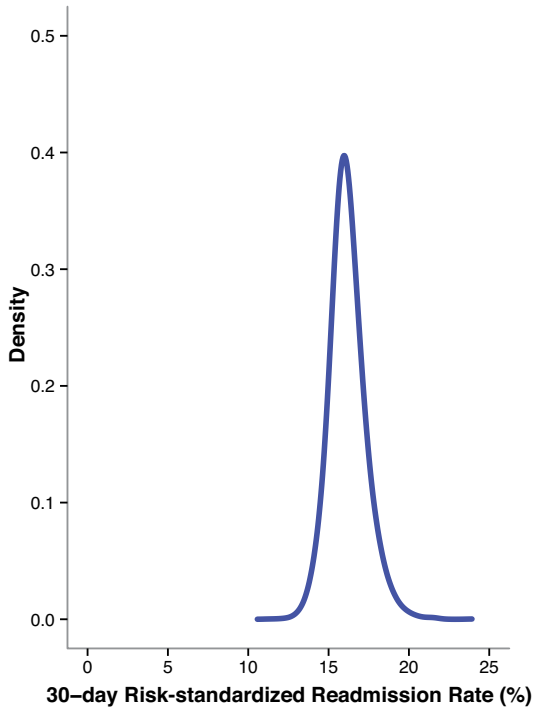

Figure B.1.2 and Table B.1.2 display the distribution of hospital-wide risk-standardized readmission rates (RSRRs) among U.S. hospitals in 2011. Variation in hospital-wide RSRRs reflects differences in performance among U.S. hospitals, with wider distributions suggesting more variation in quality and narrower distributions suggesting less variation in quality.

Hospital-wide RSRRs were distributed over an interquartile range of 1.3 percentage points, identical to the interquartile range reported in the 2012 *Chartbook* [2]. While the majority of hospitals' rates were similar to the median hospital's RSRR, the full range of RSRRs suggests continued opportunity for improvement.

Approximately half of the hospitals have hospital-wide RSRRs within a 1.3 percentage point range around the median hospital rate.

TABLE B.1.2. *Distribution of Hospital RSRRs for Hospital-Wide Readmission, January 2011 – December 2011.*

	Hospital-Wide
Maximum	24.0
90%	17.6
75%	16.8
Median (50%)	16.1
25%	15.5
10%	14.9
Minimum	11.3

Source Data and Population: Hospital-Wide Readmission Measure Cohort data – January 2011-December 2011 (Appendix I).

Notes: 1) Veterans Health Administration (VA) hospitals are not included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition over the one-year period are not shown; however, these hospitals are included in the calculation. 3) The number of hospitals included in the analysis was 4,685. 4) For more information about figures and density plots, see Appendix III.

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Does the rate of unplanned hospital-wide readmission vary across different regions of the U.S.?

FIGURE B.1.3. *Classification of HRRs by RSRR for Hospital-Wide Readmission, January 2011 – December 2011.*

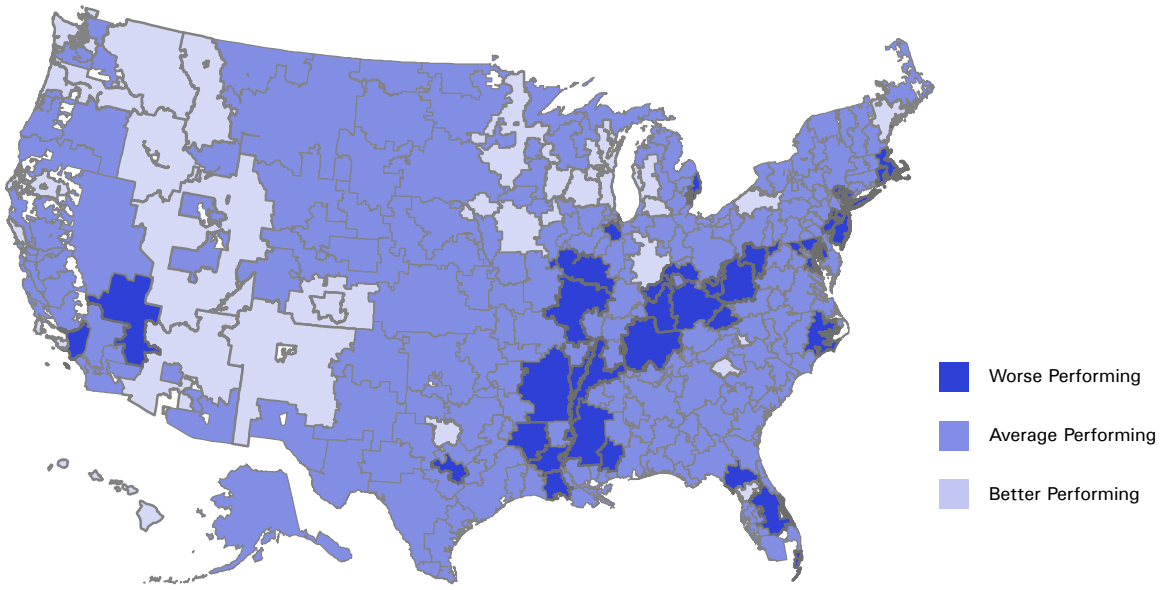

Figure B.1.3 displays geographic variation by Hospital Referral Region (HRR) in unplanned hospital-wide risk-standardized readmission rates (RSRRs) from January 2011 to December 2011 (for more information on definition of HRRs please see Appendix V). The darkest blue areas represent the HRRs that are performing significantly worse than the national readmission rate, while the lightest blue areas represent the HRRs that are performing significantly better than the national readmission rate. The remaining HRRs in medium-blue have hospital-wide RSRRs that are similar to the national rate. We found 42 HRRs (14%) that had worse hospital-wide RSRRs, while 40 HRRs (13%) had better hospital-wide RSRRs. The median RSRR for the worse-performing HRRs was 17%, while the median RSRR for the better-performing HRRs was 15%.

TABLE B.1.3. *Worse- and Better-Performing HRRs on the Hospital-Wide Readmission Measure, January 2011 – December 2011.*

WORSE PERFORMING HRRs		BETTER PERFORMING HRRs	
Little Rock, AR	Camden, NJ	Anchorage, AK	Hickory, NC
Los Angeles, CA	Hackensack, NJ	Phoenix, AZ	Fargo (ND)/ Moorhead (MN)
Washington, DC	New Brunswick, NJ	Redding, CA	Portland, OR
Gainesville, FL	Newark, NJ	Santa Barbara, CA	Erie, PA
Miami, FL	Ridgewood, NJ	Santa Rosa, CA	Greenville, SC
Orlando, FL	Bronx, NY	Colorado Springs, CO	Sioux Falls, SD
Blue Island, IL	East Long Island, NY	Pueblo, CO	Fort Worth, TX
Chicago, IL	Manhattan, NY	Ocala, FL	Salt Lake City, UT
Joliet, IL	White Plains, NY	Honolulu, HI	Seattle, WA
Lexington, KY	Greenville, NC	Boise, ID	Spokane, WA
Louisville, KY	Cincinnati, OH	Indianapolis, IN	Appleton, WI
Alexandria, LA	Philadelphia, PA	Cedar Rapids, IA	Green Bay, WI
Lafayette, LA	Kingsport, TN	Des Moines, IA	La Crosse, WI
Shreveport, LA	Memphis, TN	Sioux City, IA	Madison, WI
Baltimore, MD	Nashville, TN	Portland, ME	Marshfield, WI
Boston, MA	Temple, TX	Grand Rapids, MI	Milwaukee, WI
Dearborn, MI	Charleston, WV	Kalamazoo, MI	Neenah, WI
Detroit, MI	Huntington, WV	Muskegon, MI	
Royal Oak, MI	Morgantown, WV	Petoskey, MI	
Hattiesburg, MS		Minneapolis, MN	
Jackson, MS		Missoula, MT	
St. Louis, MO		Albuquerque, NM	
Las Vegas, NV		Asheville, NC	

Source Data and Population: Hospital-Wide Readmission Measure Cohort data – January – December 2011 (Appendix I).

Notes: 1) Veterans Health Administration (VA) hospitals are not included in this analysis. 2) Hospital-wide readmission measure is shown on the map. 3) The HRR methodology can be found in Appendix V.

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Stroke: Mortality & Readmission

Summary

TRENDS | DISTRIBUTIONS | GEOGRAPHIC VARIATION

This section focuses on the CMS hospital outcome measures intended to assess 30-day mortality and readmission rates following admissions for ischemic stroke. Stroke is a common cause of death and disability among Medicare fee-for-service patients. Ischemic stroke affects nearly 700,000 people each year in the United States [6]. The measures focus on ischemic strokes since they are the most common type of stroke and are different in etiology and prognosis from hemorrhagic stroke [7, 8].

CMS plans to publicly report these measures on *Hospital Compare* beginning in 2014 as part of the Hospital Inpatient Quality Report (IQR) program. The data reported in the 2013 *Chartbook,* from January 2009 through December 2011, summarize the results shared with hospitals this year as part of a "dry run." A dry run is a private period in which hospitals can see their results and learn about new measures prior to public reporting. Mortality and readmission rates for patients with ischemic stroke vary widely by hospital, suggesting that opportunities exist for hospitals to improve the quality of care they provide to stroke patients.

Are rates of mortality and unplanned readmission after stroke changing over time?

FIGURE C.1.1. *Trend in the Median Hospital's RSMR for Stroke, January 2009 – December 2011.*

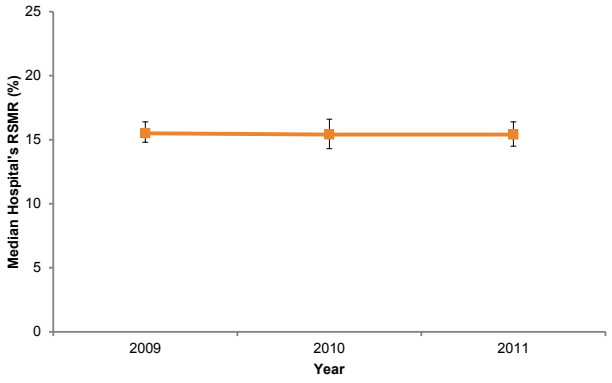
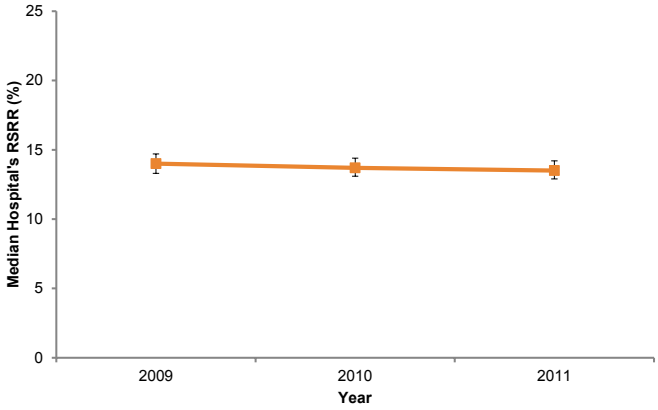


FIGURE C.1.2. *Trend in the Median Hospital's RSRR for Stroke, January 2009 – December 2011.*



There is evidence of variability in the quality of stroke care in the U.S., and research indicates that improvements in care can lead to better quality of life and lower mortality rates [6, 9, 10] after a stroke. CMS developed measures to assess 30-day mortality and readmission rates following admission for ischemic stroke.

Figure C.1.1 displays the median hospital's risk-standardized mortality rate (RSMR) following admission for ischemic stroke each year from 2009 to 2011. Median RSMRs decreased from 15.5% in 2009 to 15.4% in 2010, and remained at 15.4% in 2011 (Table C.1.1).

Figure C.1.2 displays the median hospital's risk-standardized readmission rate (RSRR) following admission for ischemic stroke each year from 2009 to 2011. Median RSRRs declined by 0.5 percentage points across the three-year period (Table C.1.1).

Stroke RSMRs remained similar while RSRRs declined by 0.5 percentage points from 2009 to 2011.

TABLE C.1.1. *Median Hospital's One-Year RSMR and RSRR for Stroke, January 2009 – December 2011.*

Median (Range) Hospital's RSMR/RSRR (%)

	2009	2010	2011
RSMR	15.5 (11.1, 20.9)	15.4 (10.1, 23.2)	15.4 (14.5, 16.4)
RSRR	14.0 (10.9, 19.3)	13.7 (10.9, 18.9)	13.5 (10.6, 17.8)

Source Data and Population: Stroke Measure Cohorts data – January 2009 – December 2011 (Appendix I).

Notes: 1) Veterans Health Administration (VA) hospitals are not included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition in each year are not shown; however, these hospitals are included in the calculations. 3) The bars on the graph represent the interquartile range. 4) For stroke mortality, the total number of hospitals was 1,965 in 2009, 1,914 in 2010, and 1,900 in 2011. 5) For stroke readmission, the total number of hospitals was 1,915 in 2009, 1,879 in 2010, and 1,852 in 2011.

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To what extent do rates of mortality and unplanned readmission following hospitalization for stroke vary across hospitals?

FIGURE C.1.3. *Distribution of Hospital RSMRs for Stroke, January 2009 – December 2011.*

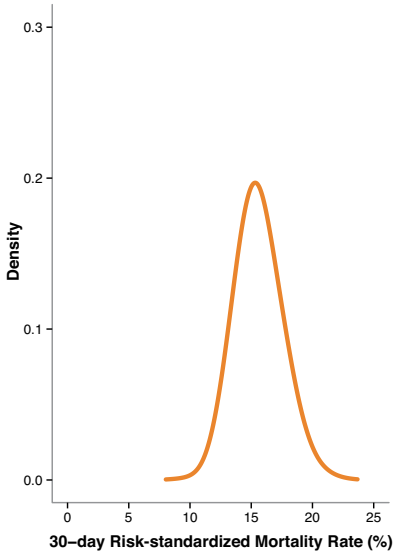
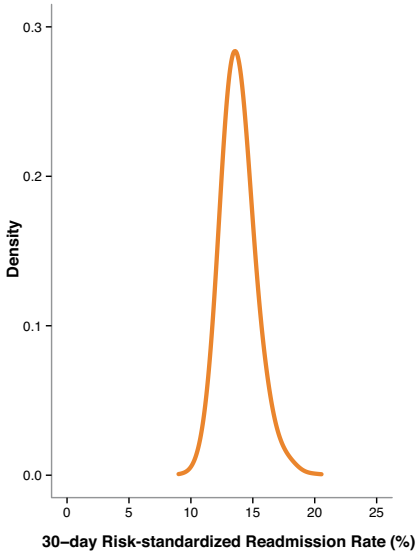


FIGURE C.1.4. *Distribution of Hospital RSRRs for Stroke, January 2009 – December 2011.*



Figures C.1.3 and C.1.4 display distributions of risk-standardized mortality rates (RSMRs) and risk-standardized readmission rates (RSRRs) after admission for acute ischemic stroke among U.S. hospitals. Variation in these rates reflects differences in performance among U.S. hospitals, with wider distributions suggesting more variation in quality.

Hospital RSMRs and RSRRs after admission for stroke were similarly distributed across hospitals in the density plots shown. While the majority of hospitals had RSMRs and RSRRs close to the median hospital's risk-standardized rate, the range of risk-standardized rates was 14.8 percentage points for stroke mortality and 11.5 percentage points for stroke readmission (Table C.1.2). The highest RSMR was nearly three times higher than the lowest RSMR, and the highest RSRR was more than two times the lowest RSRR. The wide range of risk-standardized rates indicates fairly wide performance variation among U.S. hospitals, suggesting significant opportunity for improvement.

Approximately half of hospitals have RSMRs within a 2.5 percentage point range around the median hospital rate. We observed less variation for unplanned readmission, with approximately half of the hospitals having RSRRs within a 1.7 percentage point range around the median hospital rate.

TABLE C.1.2. *Distribution of Hospital RSMRs and RSRRs for Stroke, January 2009 – December 2011.*

	RSMR (%)	RSRR (%)
Maximum	23.3	20.6
90%	18.1	15.7
75%	16.8	14.6
Median (50%)	15.5	13.7
25%	14.3	12.9
10%	13.3	12.2
Minimum	8.5	9.1

Source Data and Population: Stroke Measure Cohort data – January 2009-December 2011 (Appendix I).

Notes: 1) Veterans Health Administration (VA) hospitals are not included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition over the three year period are not shown; however, these hospitals are included in the calculation. 3) For stroke mortality, the number of hospitals included in the analysis was 3,033. 4) For stroke readmission, the number of hospitals included in the analysis was 2,955. 5) For more information about figures and density plots, see Appendix III.

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▶ Does hospital performance on the stroke mortality measure differ by geographic location?

FIGURE C.1.5. *Classification of HRRs by RSMRs for Stroke, January 2009 – December 2011.*

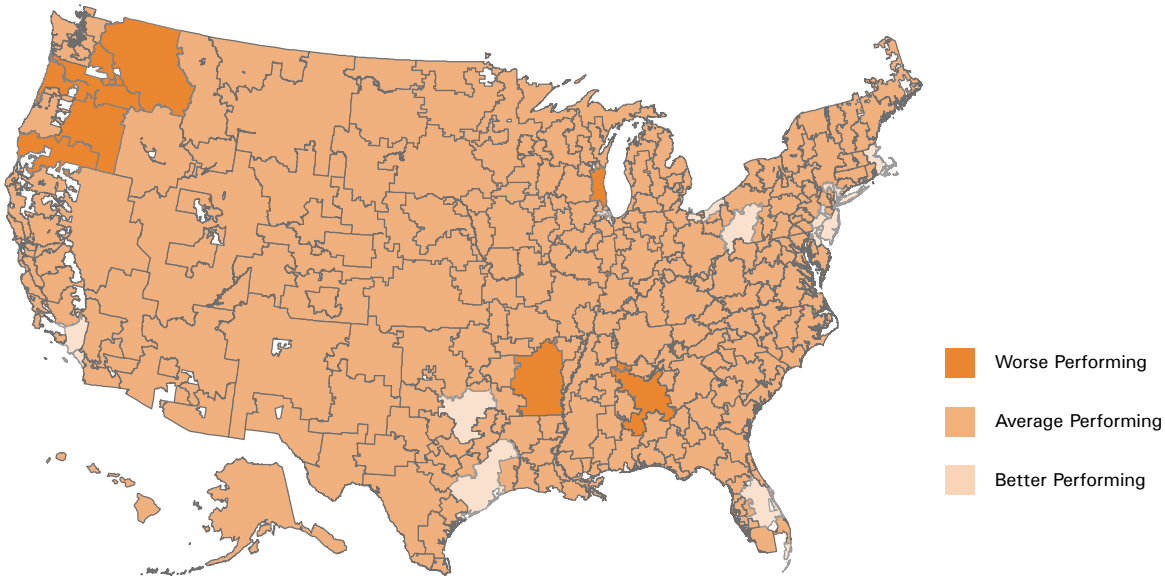

Figure C.1.5 displays geographic variation by Hospital Referral Region (HRR) in risk-standardized mortality rates (RSMRs) after hospitalization for ischemic stroke from January 2009 to December 2011 (for more information on definition of HRRs please see Appendix V). The darkest orange areas represent the HRRs that are performing significantly worse than the national stroke mortality rate, while the lightest orange areas represent the HRRs that are performing significantly better than the national stroke mortality rate. The remaining HRRs in medium-orange have stroke RSMRs that are similar to the national rate. There were 8 HRRs (3%) that performed worse than the national rate on the stroke mortality measure, while 19 (6%) HRRs were better performing on the stroke mortality measure. The median RSMR for the worse-performing HRRs was 16%, while the median RSMR for the better-performing HRRs was 14%.

TABLE C.1.5. *Worse- and Better-Performing HRRs on the Stroke Mortality Measure, January 2009 – December 2011.*

WORSE-PERFORMING HRRs	BETTER-PERFORMING HRRS
Birmingham, AL	Orange County, CA
Little Rock, AR	Los Angeles, CA
Bend, OR	Wilmington, DE
Medford, OR	Miami, FL
Portland, OR	Orlando, FL
Spokane, WA	Blue Island, IL
Yakima, WA	Chicago, IL
Milwaukee, WI	Melrose Park, IL
	Boston, MA
	Camden, NJ
	Hackensack, NJ
	East Long Island, NY
	Manhattan, NY
	White Plains, NY
	Cleveland, OH
	Philadelphia, PA
	Pittsburgh, PA
	Dallas, TX
	Houston, TX

Source Data and Population: Stroke Measure Cohort data – January 2009 – December 2011 (Appendix I).

Notes: 1) Veterans Health Administration (VA) hospitals are not included in this analysis. 2) Stroke mortality measure is shown on the map. 3) The HRR methodology can be found in Appendix V.

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▶ Does hospital performance on the stroke unplanned readmission measure differ by geographic location?

FIGURE C.1.6. *Classification of HRRs by RSRRs for Stroke, January 2009 – December 2011.*

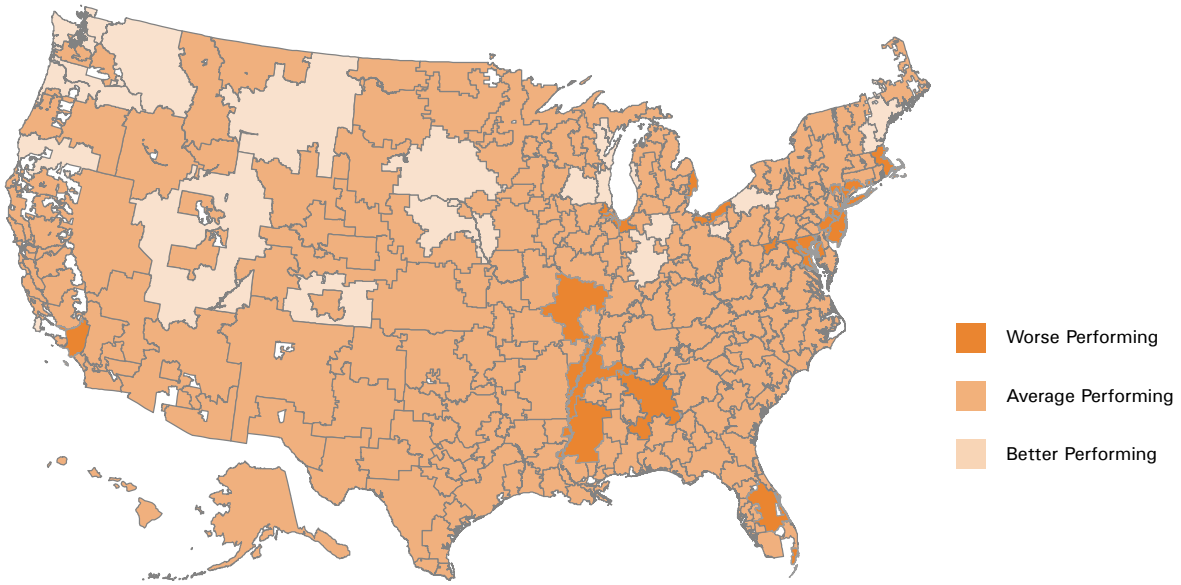

Figure C.1.6 displays geographic variation by Hospital Referral Region (HRR) in risk-standardized unplanned readmission rates (RSRRs) after hospitalization for ischemic stroke from January 2009 to December 2011 (for more information on definition of HRRs please see Appendix V). The darkest orange areas represent the HRRs that are performing significantly worse than the national readmission rate, while the lightest orange areas represent the HRRs that are performing significantly better than the national readmission rate. The remaining HRRs in medium-orange have stroke RSRRs that are similar to the national rate. There were 28 HRRs (9%) that performed worse than the national rate on the stroke unplanned readmission measure, while 21 HRRs (7%) performed better than the national rate on the stroke unplanned readmission measure. The median RSRR for the worse-performing HRRs was 15%, while the median RSRR for the better-performing HRRs was 13%.

TABLE C.1.6. *Worse- and Better-Performing HRRs on the Stroke Readmission Measure, January 2009 – December 2011.*

WORSE-PERFORMING HRRs	BETTER-PERFORMING HRRS
Birmingham, AL	Santa Barbara, CA
Los Angeles, CA	Colorado Springs, CO
New Haven, CT	Fort Wayne, IN
Washington, DC	Indianapolis, IN
Miami, FL	Portland, ME
Orlando, FL	Muskegon, MI
Blue Island, IL	Billings, MT
Chicago, IL	Omaha, NE
Elgin, IL	Manchester, NH
Melrose Park, IL	Canton, OH
Gary, IN	Medford, OR
Munster, IN	Portland, OR
Baltimore, MD	Erie, PA
Takoma Park, MD	Sioux Falls, SD
Boston, MA	Salt Lake City, UT
Detroit, MI	Everett, WA
Jackson, MS	Seattle, WA
St. Louis, MO	Spokane, WA
Camden, NJ	Green Bay, WI
New Brunswick, NJ	Madison, WI
Newark, NJ	Milwaukee, WI
Bronx, NY	
East Long Island, NY	
Manhattan, NY	
White Plains, NY	
Cleveland, OH	
Philadelphia, PA	
Memphis, TN	

Source Data and Population: Stroke Measure Cohort data – January 2009 – December 2011 (Appendix I).

Notes: 1) Veterans Health Administration (VA) hospitals are not included in this analysis. 2) Stroke readmission measure is shown on the map. 3) The HRR methodology can be found in Appendix V.

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COPD: Mortality & Readmission

Summary

TRENDS | DISTRIBUTIONS | GEOGRAPHIC VARIATION

This section focuses on the hospital outcome measures CMS developed to assess 30-day mortality and readmission rates following admissions for acute exacerbation of chronic obstructive pulmonary disease (COPD). COPD affects as many as 26 million individuals in the United States and is a leading cause of death [11]. Between 1998 and 2008, the number of patients hospitalized annually for acute exacerbations of COPD increased by approximately 18 percent [12-14].

CMS plans to publicly report these measures on *Hospital Compare* beginning in 2014 as part of the Hospital Inpatient Quality Reporting (IQR) program. The data reported in the 2013 *Chartbook* from January 2009 through December 2011, summarize the results shared with hospitals this year as part of a "dry run." A dry run is a private period in which hospitals can see their results and learn about new measures prior to public reporting. Additionally, CMS plans to include the COPD readmission measure in the Fiscal Year 2015 Hospital Readmissions Reduction Program (HRRP).

Mortality and readmission rates for patients with COPD vary widely by hospital, suggesting that opportunities exist for hospitals to improve the quality of care provided to COPD patients.

Are the rates of mortality and unplanned readmission after an admission for COPD changing over time?

FIGURE D.1.1. *Trend in the Median Hospital's RSMR for COPD, January 2009 – December 2011.*

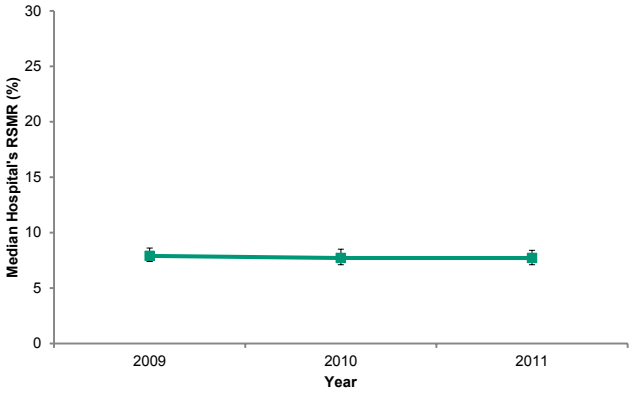
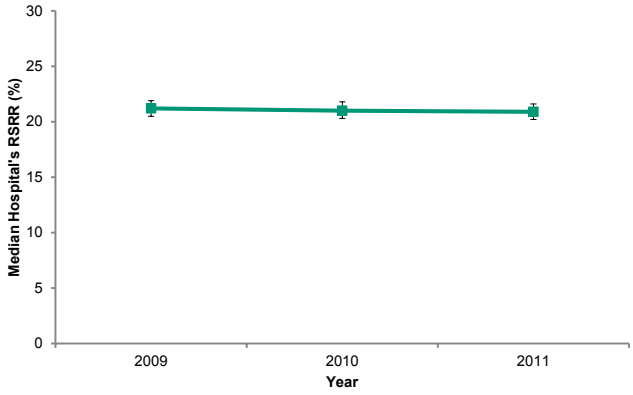


FIGURE D.1.2. *Trend in the Median Hospital's RSRR for COPD, January 2009 – December 2011.*



Evidence shows variation in mortality and readmissions for patients with chronic obstructive pulmonary disease (COPD), suggesting that opportunities exist for improving care [15-21]. CMS developed measures to assess 30-day mortality and readmission rates following admissions for acute exacerbation of COPD.

Figure D.1.1 displays the median hospital's risk-standardized mortality rate (RSMR) following admission for acute exacerbation of COPD each year from 2009 to 2011. Median RSMRs decreased from 7.9% in 2009 to 7.7% in 2010, and remained at 7.7% in 2011 (Table D.1.1).

Figure D.1.2 displays the median hospital's risk-standardized readmission rate (RSRR) following admission for acute exacerbation of COPD each year from 2009 to 2011. Median RSRRs decreased by 0.3 percentage points across the three-year period; however, RSRRs remained greater than 20% (Table D.1.1).

TABLE D.1.1. *Median Hospital's One-Year RSMR and RSRR for COPD, January 2009 – December 2011.*

Median (Range) Hospital's RSMR/RSRR (%)

	2009	2010	2011
RSMR	7.9 (5.4, 12.5)	7.7 (4.8, 13.4)	7.7 (5.4, 13.5)
RSRR	21.2 (16.6, 29.8)	21.0 (17.6, 26.4)	20.9 (16.4, 26.3)

Source Data and Population: COPD Measure Cohort data – January 2009 – December 2011 (Appendix I).

Notes: 1) Veterans Health Administration (VA) hospitals are not included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition in each year are not shown; however, these hospitals are included in the calculations. 3) The bars on the graph represent the interquartile range. 4) For COPD mortality, the total number of hospitals was 2,852 in 2009, 2,808 in 2010, and 2,802 in 2011. 5) For COPD readmission, the total number of hospitals was 3,032 in 2009, 2,987 in 2010, and 3,003 in 2011.

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COPD mortality and unplanned readmission rates declined from 2009 to 2011. Unplanned readmission rates were more than twice mortality rates in every year during that period.

To what extent do rates of mortality and unplanned readmission following hospitalization for COPD vary across hospitals?

FIGURE D.1.3. *Distribution of Hospital RSMRs for COPD, January 2009 – December 2011*

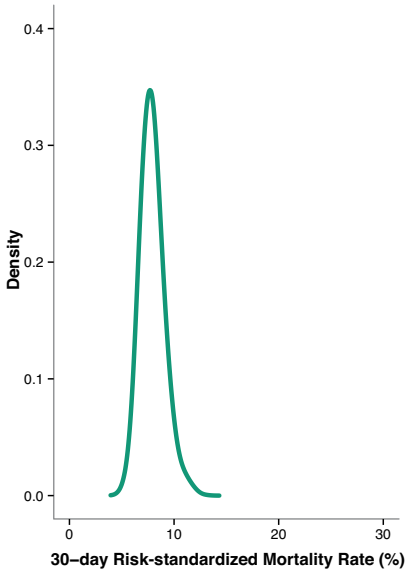
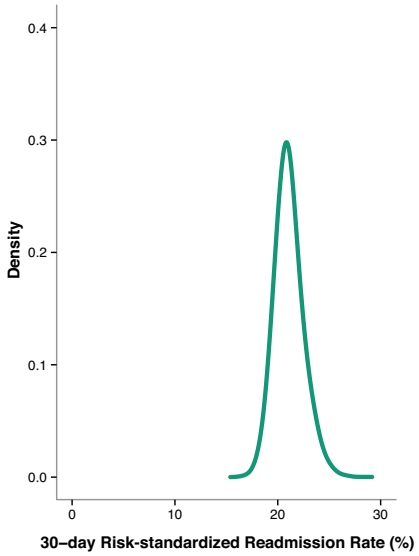


FIGURE D.1.4. *Distribution of Hospital RSRRs for COPD, January 2009 – December 2011.*



Figures D.1.3 and D.1.4 display the distribution of risk-standardized mortality rates (RSMRs) and risk-standardized readmission rates (RSRRs) among U.S. hospitals following hospitalization for exacerbation of chronic obstructive pulmonary disease (COPD). Variation in RSMRs and RSRRs reflects differences in performance among U.S. hospitals, with wider distributions suggesting more variation and narrower distributions suggesting less variation in quality.

Hospital RSMRs and RSRRs were similarly distributed across hospitals in the density plots shown. While the majority of hospitals' rates fell close to the median hospital risk-standardized rates, the highest RSMR was three times higher than the lowest RSMR, and the highest RSRR was nearly two times the lowest RSRR (Table D.1.2). The wide range of risk-standardized rates suggests substantial opportunity exists for improvement.

Approximately half of hospitals have RSMRs after admission for COPD exacerbation within 0.7 percentage points above and below the median hospital, while approximately half of the hospitals have RSRRs within 1 percentage point above and below the median hospital.

TABLE D.1.2. *Distribution of Hospital RSMRs and RSRRs for COPD, January 2009 – December 2011.*

	RSMR (%)	RSRR (%)
Maximum	13.0	29.3
90%	9.4	22.9
75%	8.6	21.9
Median (50%)	7.8	21.0
25%	7.1	20.1
10%	6.6	19.4
Minimum	4.3	16.3

Source Data and Population: COPD Measure Cohort data – January 2009-December 2011 (Appendix I).

Notes: 1) Veterans Health Administration (VA) hospitals are not included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition over the three year period are not shown; however, these hospitals are included in the calculation. 3) For COPD mortality, the number of hospitals included in the analysis was 3,880. 4) For COPD readmission, the number of hospitals included in the analysis was 3,965. 5) For more information about figures and density plots, see Appendix III.

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Does hospital performance on the COPD mortality measure differ by geographic location?

FIGURE D.1.5. *Classification of HRRs by RSMRs for COPD, January 2009 – December 2011.*

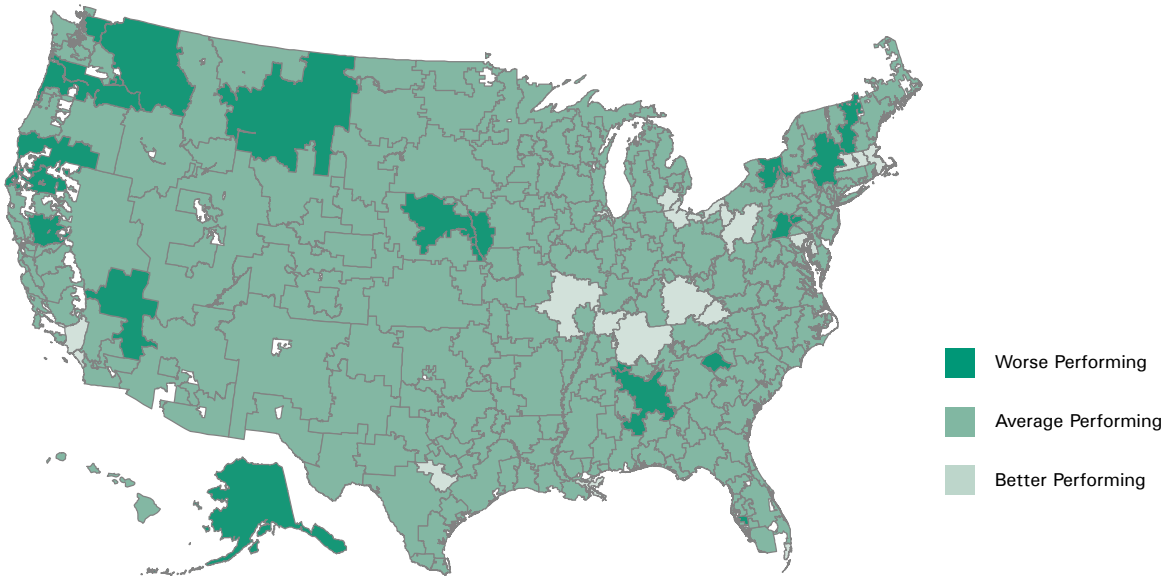

Figure D.1.5 displays geographic variation by Hospital Referral Region (HRR) in chronic obstructive pulmonary disease (COPD) risk-standardized mortality rates (RSMRs) after hospitalization for COPD from January 2009 to December 2011 (for more information on definition of HRRs please see Appendix V). The darkest green areas represent the HRRs that are performing significantly worse than the national mortality rate, while the lightest green areas represent the HRRs that are performing significantly better than the national mortality rate. The remaining HRRs in medium-green have COPD RSMRs that are similar to the national rate. We found 17 HRRs (5%) that performed worse than the national rate on the COPD mortality measure, while 24 HRRs (8%) performed better than the national rate on the COPD mortality measure. The median RSMR for the worse-performing HRRs was 9%, while the median RSMR for the better-performing HRRs was 7%.

TABLE D.1.5. *Worse- and Better-Performing HRRs on the COPD Mortality Measure, January 2009 – December 2011.*

WORSE-PERFORMING HRRs	BETTER-PERFORMING HRRs
Birmingham, AL	Orange County, CA
Anchorage, AK	Los Angeles, CA
Redding, CA	Miami, FL
Sacramento, CA	Chicago, IL
Bradenton, FL	Melrose Park, IL
Billings, MT	Munster, IN
Omaha, NE	Lexington, KY
Las Vegas, NV	Paducah, KY
Lebanon, NH	New Orleans, LA
Albany, NY	Baltimore, MD
Rochester, NY	Boston, MA
Medford, OR	Springfield, MA
Portland, OR	Worcester, MA
Harrisburg, PA	Ann Arbor, MI
Greenville, SC	St. Louis, MO
Everett, WA	Bronx, NY
Spokane, WA	Manhattan, NY
	Cleveland, OH
	Toledo, OH
	Youngstown, OH
	Pittsburgh, PA
	Kingsport, TN
	Nashville, TN
	Austin, TX

Source Data and Population: COPD Measure Cohort data – January 2009 – December 2011 (Appendix I).

Notes: 1) Veterans Health Administration (VA) hospitals are not included in this analysis. 2) COPD mortality measure results are shown on the map. 3) The HRR methodology can be found in Appendix V.

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▶ Does hospital performance on the COPD unplanned readmission measure differ by geographic location?

FIGURE D.1.6. *Classification of HRRs by RSRRs for COPD, January 2009 – December 2011.*

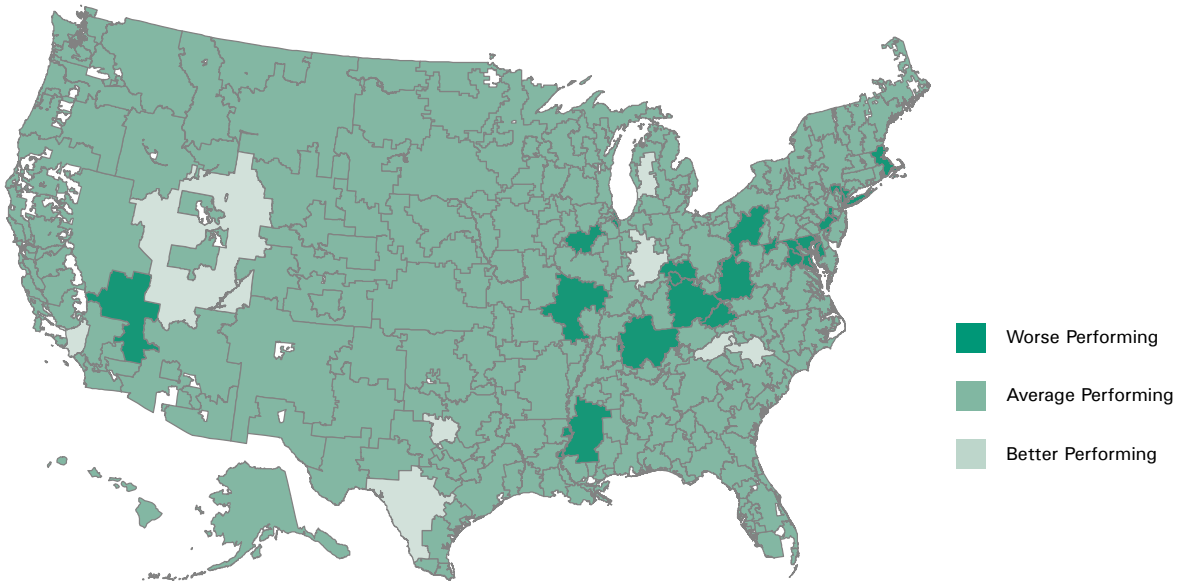

Figure D.1.6 displays geographic variation by Hospital Referral Region (HRR) in chronic obstructive pulmonary disease (COPD) risk-standardized unplanned readmission rates (RSRRs) after hospitalization for chronic obstructive pulmonary disease (COPD) from January 2009 to December 2011 (for more information on definition of HRRs please see Appendix V). The darkest green areas represent the HRRs that are performing significantly worse than the national readmission rate, while the lightest green areas represent the HRRs that are performing significantly better than the national readmission rate. The remaining HRRs in medium-green have RSRRs that are similar to the national rate. There were 23 HRRs (8%) that performed worse than the national rate on the COPD unplanned readmission measure, while 8 HRRs (2%) performed better than the national rate on the COPD unplanned readmission measure. The median RSRR for the worse-performing HRRs was 22%, while the median RSRR for the better-performing HRRs was 20%.

TABLE D.1.6. *Worse- and Better-Performing HRRs on the COPD Readmission Measure, January 2009 – December 2011.*

WORSE-PERFORMING HRRs	BETTER-PERFORMING HRRs
Washington, DC	Los Angeles, CA
Blue Island, IL	Indianapolis, IN
Chicago, IL	Grand Rapids, MI
Peoria, IL	Asheville, NC
Covington, KY	Charlotte, NC
Lexington, KY	Fort Worth, TX
Baltimore, MD	San Antonio, TX
Boston, MA	Salt Lake City, UT
Jackson, MS	
St. Louis, MO	
Las Vegas, NV	
Hackensack, NJ	
Bronx, NY	
East Long Island, NY	
Manhattan, NY	
White Plains, NY	
Cincinnati, OH	
Philadelphia, PA	
Pittsburgh, PA	
Kingsport, TN	
Nashville, TN	
Arlington, VA	
Charleston, WV	

Source Data and Population: COPD Measure Cohort data,– January 2009 – December 2011 (Appendix I).

Notes: 1) Veterans Health Administration (VA) hospitals are not included in this analysis. 2) COPD readmission measure is shown on the map. 3) The HRR methodology can be found in Appendix V.

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Surveillance

In the Surveillance part of the 2013 CMS *Chartbook*, we aim to explore special measurement topics of national interest and respond to stakeholder interests or concerns related to the measures. In this year's *Chartbook* we examine two important topics: 1) potential disparities in hospital performance on the measures and 2) how hospitals' use of observation stays and emergency department (ED) visits may be affecting the measures.

Many stakeholders are concerned that hospitals caring for large numbers of Medicaid or minority patients may not perform well on hospital outcome measures. In this section, we examine Medicaid beneficiaries and African-American patients. Specifically, we show how hospitals with the highest and lowest proportions of Medicaid or minority patients perform on the acute myocardial infarction (AMI), heart failure, pneumonia, hip/knee arthroplasty, hospital-wide, stroke, and chronic obstructive pulmonary disease (COPD) measures.

Overall, we observed that hospitals with high proportions of Medicaid or African-American patients achieved a similar range of performance as compared to hospitals with low proportions of these patients across all measures. Some measures, such as heart failure readmission and hospital-wide readmission, had higher median outcome rates for hospitals with the highest proportion of Medicaid or African-American patients compared to hospitals with the lowest proportion of Medicaid or African-American patients, indicating continued need for surveillance.

Stakeholders are also concerned about the rising rates of observation stays among Medicare fee-for-service beneficiaries. Specifically, policymakers' concerns have focused on the possibility that observation stays are being used as an alternative to short-stay inpatient hospitalization due to hospital payment incentives to decrease readmissions. Currently, we are unclear whether use of observation stays is more beneficial to patients than readmission. On the one hand, observation unit care can be an effective, efficient, and cost-effective alternative to inpatient admission [22, 23]. Conversely, observation care may represent a use of inpatient resources that are intended to be captured by hospital readmission measures. To characterize hospital usage of observation stays, we present trends and distributions of observation stay rates within 30 days of an inpatient hospitalization for AMI, heart failure, and pneumonia. For these same conditions, we also examine the relationship between hospital-level risk-standardized readmission rates (RSRRs) and 30-day observation stay rates.

We found a small increase in post-discharge observation stays after AMI, heart failure, and pneumonia hospitalizations and an increase in ED visits following heart failure hospitalizations. These increases are less than the decline in readmission rates and preceded the decline in readmissions. We observed a weak relationship between post-discharge observation stay use and RSRRs for all three conditions.

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Summary

DISPARITIES | OBSERVATION STAYS & EMERGENCY DEPARTMENT VISITS

This section focuses on the acute myocardial infarction (AMI), heart failure, and pneumonia mortality and readmission measures, and the hip/knee arthroplasty complications and readmission measures that are publicly reported on *Hospital Compare*. The hospital-wide all-cause unplanned readmission measure is presented separately on page 61. Within this section, we explore potential consequences of publicly reporting these measures, specifically examining disparities in care and the use of observation stays after discharge.

In the disparities section, we compare the performance on the measures for hospitals that care for high versus low proportions of Medicaid patients or African-American patients.

In the observation stays section, we analyze the hospital-level trends and distributions of observation stays and emergency department visit rates within 30 days of an inpatient hospitalization for AMI, heart failure, and pneumonia. We also examine the relationship between hospital-level risk-standardized readmission rates and 30-day observation stay rates following an index admission.

How do hospitals caring for high proportions of Medicaid or minority patients perform on the AMI mortality measure?

FIGURE A.2.1. *Distribution of AMI RSMRs for hospitals with the lowest and highest proportion of Medicaid patients, July 2009 – June 2012.*

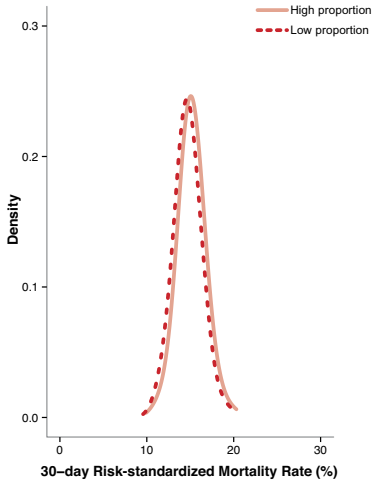
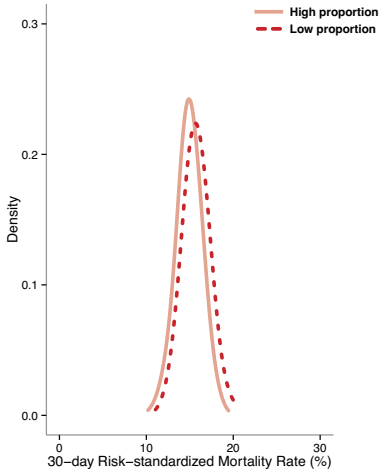


FIGURE A.2.2. *Distribution of AMI RSMRs for hospitals with the lowest and highest proportion of African-American patients, July 2009 – June 2012.*



For the acute myocardial infarction (AMI) mortality measure, we compared the distributions of risk-standardized mortality rates (RSMRs) for hospitals with the lowest overall proportion of Medicaid patients (≤ 8% of a hospital's patients) with RSMR distributions for hospitals with the highest overall proportion of Medicaid patients (≥ 30%). We also compared the distributions of RSMRs for hospitals with the lowest proportion of African-American Medicare fee-for-service (FFS) patients (0%) with RSMR distributions for hospitals with the highest proportion of African-American Medicare FFS patients (≥ 23%). Figures A.2.1 and A.2.2 and Tables A.2.1 and A.2.2 display the distributions.

The distribution of RSMRs is similar for both sets of hospitals. Hospitals with low proportions of Medicaid patients performed slightly better than hospitals with high proportions of Medicaid patients, with a 0.5 percentage point difference in the median hospital's RSMR. In contrast, hospitals with low proportions of African-American patients performed slightly worse than hospitals with high proportions of African-American patients, with a 0.2 percentage point difference in the median hospital's RSMR.

Hospitals serving the fewest Medicaid or minority patients had nearly identical distributions of RSMRs as hospitals serving the most Medicaid or minority patients, indicating that both can perform well on the measure.

TABLE A.2.1. *Distribution of AMI RSMRs by Proportion of Medicaid Patients, July 2009 – June 2012.*

	AMI RSMR (%)	
	Low proportion (≤8%) Medicaid patients; n=256	High proportion (≥30%) Medicaid patients; n=257
Maximum	20.1	20.4
90%	16.6	16.8
75%	15.5	16.0
Median (50%)	14.6	15.1
25%	13.9	14.3
10%	12.8	13.4
Minimum	11.0	10.9

TABLE A.2.2. *Distribution of AMI RSMRs by Proportion of African-American Patients, July 2009 – June 2012.*

	AMI RSMR (%)	
	Low proportion (0%) African-American patients; n=260	High proportion (≥23%) African-American patients; n=259
Maximum	20.1	19.1
90%	17.2	16.9
75%	16.4	16.1
Median (50%)	15.3	15.1
25%	14.4	14.3
10%	13.7	13.2
Minimum	11.6	10.4

Source Data and Population: AMI Mortality Cohort data, July 2009 – June 2012 (Appendix I); 2011 Medicare Part A Inpatient Claims data to calculate proportion of African-American Medicare FFS patients (Appendix II); 2011 American Hospital Association (AHA) data to calculate overall proportion of Medicaid patients (Appendix II).

Notes: 1) Veterans Health Administration (VA) hospitals are not included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition over the three-year period are not shown; however, these hospitals are included in the calculations. 3) The percent of Medicare FFS patients is calculated among all hospital patients.4) The percent of African-American patients is calculated among all Medicare FFS patients. 5) For more information about figures and density plots, see Appendix III.

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How do hospitals caring for high proportions of Medicaid or minority patients perform on the AMI readmission measure?

FIGURE A.2.3. *Distribution of AMI RSRRs for hospitals with the lowest and highest proportion of Medicaid patients, July 2009 – June 2012.*

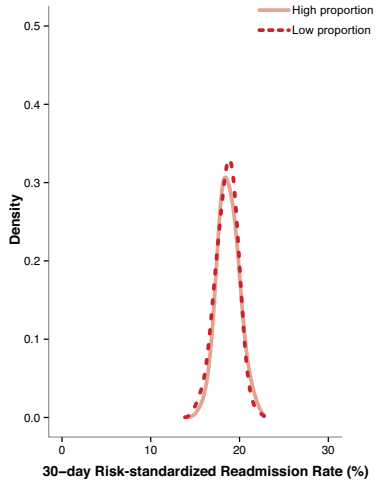
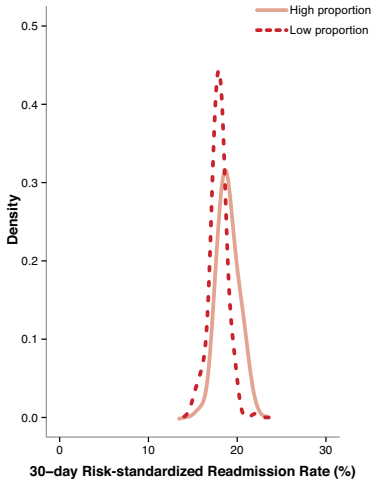


FIGURE A.2.4. *Distribution of AMI RSRRs for hospitals with the lowest and highest proportion of African-American patients, July 2009 – June 2012.*



For the acute myocardial infarction (AMI) readmission measure, we compared the distribution of risk-standardized readmission rates (RSRRs) for hospitals with the lowest overall proportion of Medicaid patients (≤ 8% of a hospital's patients) with RSRR distributions for hospitals with the highest overall proportion of Medicaid patients (≥ 30%). We also compared the distribution of RSRRs for hospitals with the lowest proportion of African-American Medicare fee-for-service (FFS) patients (0%) with RSRR distributions for hospitals with the highest proportion of African-American Medicare FFS patients (≥ 22%). Figures A.2.3 and A.2.4 and Tables A.2.3 and A.2.4 display the distributions.

The distribution of RSRRs is similar for both sets of hospitals. Hospitals with low proportions of Medicaid patients performed slightly better than hospitals with high proportions of Medicaid patients, with a 0.3 percentage point difference in the median hospital's RSRR. Likewise, hospitals with low proportions of African-American patients performed better than hospitals with high proportions of African-American patients, with a 1.0 percentage point difference in the medians.

Hospitals with high proportions of Medicaid patients achieved a similar range of performance as compared to hospitals with low proportions of these patients, indicating that both can perform well. Although similarly wide, the range showed a shift towards poorer performance for hospitals with high proportions of African-American patients compared with those with low proportions of African-American patients.

TABLE A.2.3. *Distribution of AMI RSRRs by Proportion of Medicaid Patients, July 2009 – June 2012.*

	AMI RSMR (%)	
	Low proportion (≤8%) Medicaid patients; n=228	High proportion (≥30%) Medicaid patients; n=227
Maximum	22.0	22.1
90%	19.7	20.3
75%	19.0	19.5
Median (50%)	18.3	18.6
25%	17.4	17.9
10%	16.8	17.3
Minimum	15.2	15.5

TABLE A.2.4. *Distribution of AMI RSRRs by Proportion of African-American Patients, July 2009 – June 2012.*

	AMI RSMR (%)	
	Low proportion (0%) African-American patients; n=228	High proportion (≥22%) African-American patients; n=228
Maximum	22.0	24.3
90%	19.2	20.7
75%	18.4	19.8
Median (50%)	17.9	18.9
25%	17.4	18.2
10%	16.6	17.6
Minimum	14.7	15.5

Source Data and Population: AMI Readmission Cohort data, July 2009 – June 2012 (Appendix I); 2011 Medicare Part A Inpatient Claims data to calculate proportion of African-American Medicare FFS patients (Appendix II); 2011 American Hospital Association (AHA) data to calculate overall proportion of Medicaid patients (Appendix II).

Notes: 1) Veterans Health Administration (VA) hospitals are not included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition over the three-year period are not shown; however, these hospitals are included in the calculations. 3) The percent of African-American patients is calculated among all Medicare FFS patients. 4) The percent of Medicare FFS patients is calculated among all hospital patients. 5) For more information about figures and density plots, see Appendix III.

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How do hospitals caring for high proportions of Medicaid or minority patients perform on the heart failure mortality measure?

FIGURE A.2.5. *Distribution of Heart Failure RSMRs for hospitals with the lowest and highest proportion of Medicaid patients, July 2009 – June 2012.*

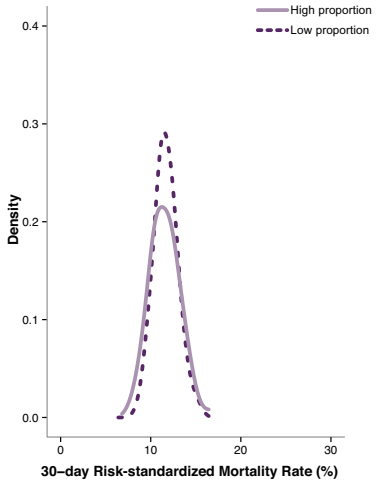
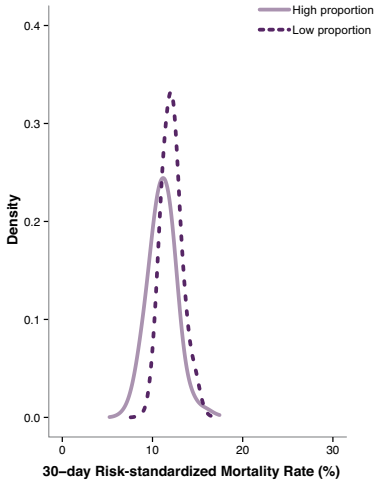


FIGURE A.2.6. *Distribution of Heart Failure RSMRs for hospitals with the lowest and highest proportion of African-American patients, July 2009 – June 2012.*



For the heart failure mortality measure, we compared the distributions of risk-standardized mortality rates (RSMRs) for hospitals with the lowest overall proportion of Medicaid patients (≤ 7% of a hospital's patients) with RSMR distributions for hospitals with the highest overall proportion of Medicaid patients (≥ 29%). We also compared the distribution of RSMRs for hospitals with the lowest proportion of African-American Medicare fee-for-service (FFS) patients (0% African-American patients) with RSMR distributions for hospitals with the highest proportion of African-American Medicare FFS patients (≥ 24%). Figures A.2.5 and A.2.6 and Tables A.2.5 and A.2.6 display the distributions.

The distribution of RSMRs is similar for both sets of hospitals. Hospitals with high proportions of Medicaid patients performed slightly better than hospitals with low proportions of Medicaid patients, with a 0.1 percentage point difference in the median hospital's RSMR. Similarly, hospitals with high proportions of African-American patients performed better than hospitals with low proportions of African-American patients, with a 1.0 percentage point difference between medians. The median hospital with a high proportion of African-American patients did 1 percentage point better than the median hospital with a low proportion of African-American patients.

Hospitals with high proportions of Medicaid or minority patients achieved a similar range of performance as compared to hospitals with low proportions of these patients, indicating both can perform well on the measure.

TABLE A.2.5. *Distribution of Heart Failure RSMRs by Proportion of Medicaid Patients, July 2009 – June 2012.*

	Heart Failure RSMR (%)	
	Low proportion (≤7%) Medicaid patients; n=388	High proportion (≥29%) Medicaid patients; n=388
Maximum	15.6	17.5
90%	13.4	16.9
75%	12.5	13.7
Median (50%)	11.6	11.5
25%	10.8	10.4
10%	10.0	9.5
Minimum	8.3	7.4

TABLE A.2.6. *Distribution of Heart Failure RSMRs by Proportion of African-American Patients, July 2009 – June 2012.*

	Heart Failure RSMR (%)	
	Low proportion (0%) African-American patients; n=546	High proportion (≥24%) African-American patients; n=392
Maximum	17.2	17.3
90%	13.7	13.0
75%	12.8	12.1
Median (50%)	12.1	11.1
25%	11.3	10.0
10%	10.7	9.1
Minimum	8.6	6.4

Source Data and Population: Heart Failure Mortality Cohort data – July 2009 – June 2012 (Appendix I); 2011 Medicare Part A Inpatient Claims data to calculate proportion of African-American Medicare FFS patients (Appendix II); 2011 American Hospital Association (AHA) data to calculate overall proportion of Medicaid patients (Appendix II).

Notes: 1) Veteran Health Administration (VA) hospitals are not included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition over the three-year period are not shown; however, these hospitals are included in the calculations. 3) The percent of Medicaid patients is calculated among all hospital patients. 4) The percent of African-American patients is calculated among all Medicare FFS patients. 5) For more information about figures, see Appendix III.

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How hospitals caring for high proportions of Medicaid or minority patients perform on the heart failure readmission measure?

FIGURE A.2.7. *Distribution of Heart Failure RSRRs for hospitals with the lowest and highest proportion of Medicaid patients, July 2009 – June 2012.*

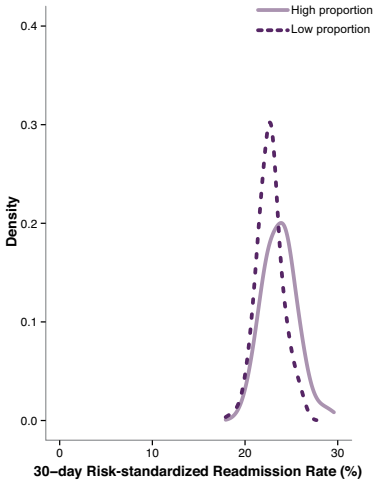
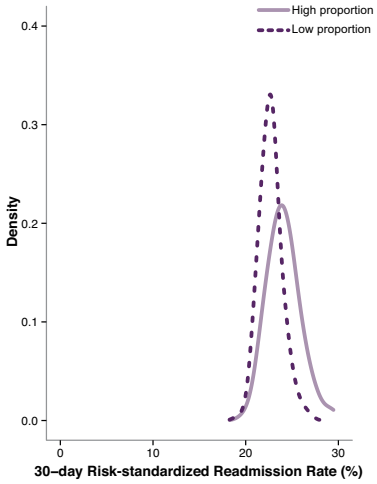


FIGURE A.2.8. *Distribution of Heart Failure RSRRs for hospitals with the lowest and highest proportion of African-American patients, July 2009 – June 2012.*



For the heart failure readmission measure, we compared the distribution of risk-standardized readmission rates (RSRRs) for hospitals with the lowest overall proportion of Medicaid patients (≤7% of a hospital's patients) with RSRR distributions for hospitals with the highest overall proportion of Medicaid patients (≥ 29%). We also compared the distribution of RSRRs for hospitals with the lowest proportion of African-American Medicare fee-for-service (FFS) patients (0%) with RSRR distributions for hospitals with the highest proportion of African-American Medicare FFS patients (≥ 24%). Figures A.2.7 and A.2.8 and Tables A.2.7 and A.2.8 display the distributions.

The distribution of RSRRs is similar for both sets of hospitals. Hospitals with low proportions of Medicaid patients performed slightly better than hospitals with high proportions of Medicaid patients, with a 1.0 percentage point difference in the median hospital's RSRR. Similarly, hospitals with low proportions of African-American patients performed slightly better than hospitals with high proportions of African-American patients, with a 1.2 percentage point difference in medians.

Hospitals with high proportions of Medicaid or minority patients achieved a similar range of RSRRs as compared to hospitals with a low proportions of these patients, indicating both can perform well, but had poorer performance overall.

TABLE A.2.7. *Distribution of Heart Failure RSRRs by Proportion of Medicaid Patients, July 2009 – June 2012.*

	Heart Failure RSRR (%)	
	Low proportion (≤7%) Medicaid patients; n=397	High proportion (≥29%) Medicaid patients; n=398
Maximum	26.5	30.7
90%	24.6	26.1
75%	23.4	24.9
Median (50%)	22.7	23.7
25%	21.7	22.4
10%	21.0	21.4
Minimum	18.1	19.0

TABLE A.2.8. *Distribution of Heart Failure RSRRs by Proportion of African-American Patients, July 2009 – June 2012.*

	Heart Failure RSRR (%)	
	Low proportion (0%) African-American patients; n=585	High proportion (≥24%) African-American patients; n=401
Maximum	28.9	29.8
90%	24.3	26.3
75%	23.4	25.1
Median (50%)	22.7	23.9
25%	21.9	22.9
10%	21.2	21.9
Minimum	18.8	19.5

Source Data and Population: Heart Failure Readmission Cohort data –– July 2009 – June 2012 (Appendix I); 2011 Medicare Part A Inpatient Claims data to calculate proportion of African-American Medicare FFS patients (Appendix II); 2011 American Hospital Association (AHA) data to calculate overall proportion of Medicaid patients (Appendix II).

Notes: 1) Veteran Health Administration (VA) hospitals are not included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition over the three-year period are not shown; however, these hospitals are included in the calculations. 3) The percent of Medicaid patients is calculated among all hospital patients. 4) The percent of African-American patients is calculated among all Medicare FFS patients. 5) For more information about figures, see Appendix III.

Prepared for CMS by YNHHSC/CORE.

How do hospitals caring for high proportions of Medicaid or minority patients perform on the pneumonia mortality measure?

FIGURE A.2.9. *Distribution of Pneumonia RSMRs for hospitals with the lowest and highest proportion of Medicaid patients, July 2009 – June 2012.*

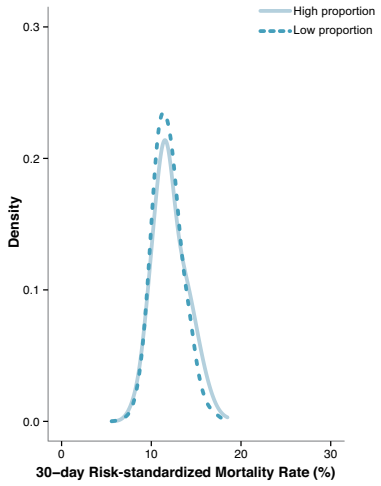
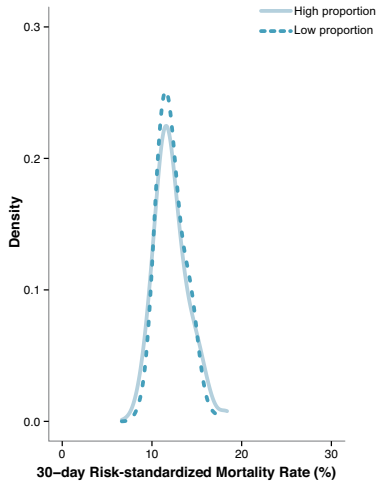


FIGURE A.2.10. *Distribution of Pneumonia RSMRs for hospitals with the lowest and highest proportion of African-American patients, July 2009 – June 2012.*



For the pneumonia mortality measure, we compared the distribution of risk-standardized mortality rates (RSMRs) for hospitals with the lowest overall proportion of Medicaid patients (≤ 6% of a hospital's patients) with RSMR distributions for hospitals with the highest overall proportion of Medicaid patients (≥ 29%). We also compared the distribution of RSMRs for hospitals with the lowest proportion of African-American Medicare fee-for-service (FFS) patients (0%) with RSMRs distributions for hospitals with the highest proportion of African-American Medicare FFS patients (≥ 23%). Figures A.2.9 and A.2.10 and Tables A.2.9 and A.2.10 display the distributions.

The distribution of RSMRs is similar for both sets of hospitals. Hospitals with low proportions of Medicaid patients performed only slightly better than hospitals with high proportions of Medicaid patients, with a 0.1 percentage point difference in the median hospital's RSMR. Hospitals with low proportions of African-American patients performed similarly to hospitals with high proportions of African-American patients.

Hospitals serving the fewest Medicaid or minority patients had a nearly identical distribution of RSMRs as hospitals serving the most Medicaid or minority patients, indicating that both can perform well on the measures.

TABLE A.2.9. *Distribution of Pneumonia RSMRs by Proportion of Medicaid Patients, July 2009 – June 2012.*

	Pneumonia RSMR (%)	
	Low proportion (≤6%) Medicaid patients; n=426	High proportion (≥29%) Medicaid patients; n=427
Maximum	17.4	18.8
90%	14.1	14.8
75%	12.8	13.4
Median (50%)	11.7	11.8
25%	10.7	10.8
10%	9.9	9.9
Minimum	7.0	7.7

TABLE A.2.10. *Distribution of Pneumonia RSMRs by Proportion of African-American Patients, July 2009 – June 2012.*

	Pneumonia RSMR (%)	
	Low proportion (0%) African-American patients; n=824	High proportion (≥23%) African-American patients; n=430
Maximum	18.3	18.8
90%	14.4	14.8
75%	13.2	13.3
Median (50%)	11.9	11.9
25%	11.0	10.9
10%	10.3	9.9
Minimum	8.0	7.3

Source Data and Population: Pneumonia Mortality Cohort data, July 2009 – June 2012 (Appendix I); 2011 American Hospital Association (AHA) data to calculate overall proportion of Medicaid patients (Appendix II); 2011 Medicare Part A Inpatient Claims data to calculate proportion of African-American Medicare FFS patients (Appendix II).

Notes: 1) Veteran Health Administration (VA) hospitals are not included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition over the three-year period are not shown; however, these hospitals are included in the calculations. 3) The percent of Medicaid patients is calculated among all hospital patients. 4) The percent of African-American patients is calculated among all Medicare FFS patients. 5) For more information about figures, see Appendix III.

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How do hospitals caring for high proportions of Medicaid or minority patients perform on the pneumonia readmission measure?

FIGURE A.2.11. *Distribution of Pneumonia RSRRs for hospitals with the lowest and highest proportion of Medicaid patients, July 2009 – June 2012.*

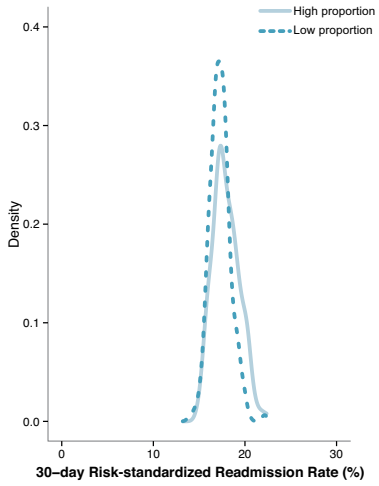
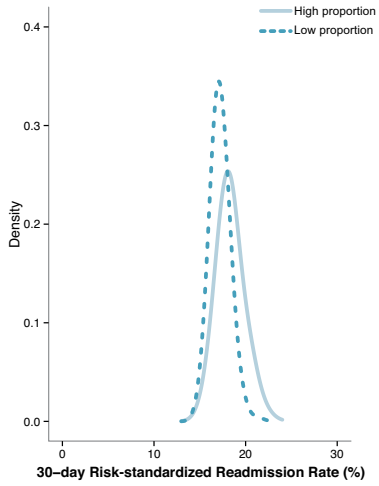


FIGURE A.2.12. *Distribution of Pneumonia RSRRs for hospitals with the lowest and highest proportion of African-American patients, July 2009 – June 2012.*



For the pneumonia readmission measure, we compared the distribution of risk-standardized readmission rates (RSRRs) for hospitals with the lowest overall proportion of Medicaid patients (≤6% of a hospital's patients) with RSRR distributions for hospitals with the highest overall proportion of Medicaid patients (≥ 28%). We also compared the distribution of RSRRs for hospitals with the lowest proportion of African-American Medicare fee-for-service (FFS) patients (0%) with RSRR distributions for hospitals with the highest proportion of African-American Medicare FFS patients (≥ 23%). Figures A.2.11 and A.2.12 and Tables A.2.11 and A.2.12 display the distributions.

The distribution of RSRRs is similar for both sets of hospitals. Hospitals with low proportions of Medicaid patients performed slightly better than hospitals with high proportions of Medicaid patients, with a 0.6 percentage point difference in the median hospital's RSRR. Likewise, hospitals with lowest proportions of African-American patients performed slightly better than hospitals with high proportions of African-American patients, with a 1.0 percentage point difference in medians.

Hospitals with high proportions of Medicaid or minority patients achieved a similar range of RSRRs as compared to hospitals with low proportions of these patients, indicating both can perform well, but had poorer performance overall.

TABLE A.2.11. *Distribution of Pneumonia RSRRs by Proportion of Medicaid Patients, July 2009 – June 2012.*

	Pneumonia RSRR (%)	
	Low proportion (≤6%) Medicaid patients; n=429	High proportion (≥28%) Medicaid patients; n=429
Maximum	22.2	22.7
90%	18.8	20.1
75%	17.9	18.9
Median (50%)	17.2	17.8
25%	16.6	16.9
10%	15.9	16.1
Minimum	13.9	14.8

TABLE A.2.12. *Distribution of Pneumonia RSRRs by Proportion of African-American Patients, July 2009 – June 2012.*

	Pneumonia RSRR (%)	
	Low proportion (0%) African-American patients; n=831	High proportion (≥23%) African-American patients; n=431
Maximum	21.7	23.2
90%	18.5	20.3
75%	17.9	19.1
Median (50%)	17.2	18.2
25%	16.5	17.3
10%	16.0	16.7
Minimum	14.5	15.0

Source Data and Population: Pneumonia Readmission Cohort data – July 2009 – June 2012 (Appendix I); 2011 American Hospital Association (AHA) data to calculate overall proportion of Medicaid patients (Appendix II); 2011 Medicare Part A Inpatient Claims data to calculate proportion of African-American Medicare FFS patients (Appendix II).

Notes: 1) Veteran Health Administration (VA) hospitals are not included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition over the three-year period are not shown; however, these hospitals are included in the calculations. 3) The percent of Medicaid patients is calculated among all hospital patients. 4) The percent of African-American patients is calculated among all Medicare FFS patients. 5) For more information about figures, see Appendix III.

Prepared for CMS by YNHHSC/CORE.

How do hospitals caring for high proportions of Medicaid or minority patients perform on the hip/knee arthroplasty complication measure?

FIGURE A.2.13. *Distribution of Hip/Knee Arthroplasty RSCRs for hospitals with the lowest and highest proportion of Medicaid patients, July 2009-March 2012.*

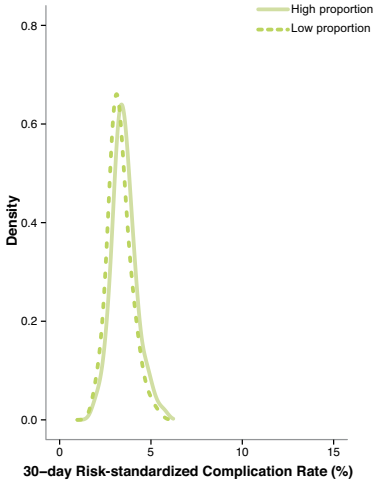
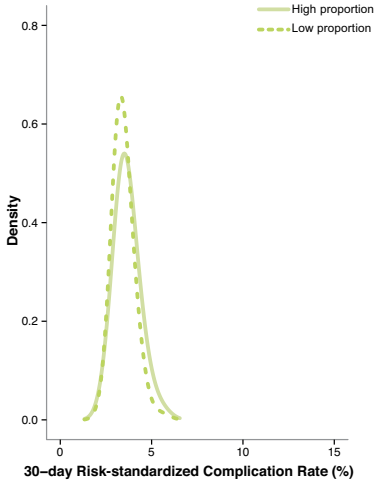


FIGURE A.2.14. *Distribution of Hip/Knee Arthroplasty RSCRs for hospitals with the lowest and highest proportion of African-American patients, July 2009-March 2012.*



For the hip/knee arthroplasty complication measure, we compared the distribution of risk-standardized complication rates (RSCRs) for hospitals with the lowest overall proportion of Medicaid patients (≤ 7% of a hospital's patients) with RSCR distributions for hospitals with the highest overall proportion of Medicaid patients (≥ 29%). We also compared the distribution of RSCRs for hospitals with the lowest proportion of African-American Medicare fee-for-service (FFS) patients (0%) with RSCR distributions for hospitals with the highest proportion of African-American Medicare FFS patients (≥ 20%). Figures A.2.13 and A.2.14 and Tables A.2.13 and A.2.14 display the distributions.

The distribution of RSCRs is similar for both sets of hospitals. Hospitals with low proportions of Medicaid patients performed slightly better than hospitals with high proportions of Medicaid patients, with a 0.3 percentage point difference in the median hospital's RSCR. Similarly, hospitals with low proportions of African-American patients performed slightly better than hospitals with high proportions of African-American patients, with a 0.2 percentage point difference in medians.

Hospitals serving the fewest Medicaid or minority patients had a nearly identical distribution of RSCRs as hospitals serving the most Medicaid or minority patients, indicating that both groups of hospitals can perform well on the measure.

TABLE A.2.13. *Distribution of Hip/Knee Arthroplasty RSCRs by Proportion of Medicaid Patients, July 2009-March 2012.*

	Hip/Knee Arthroplasty RSCR (%)	
	Low proportion (≤7%) Medicaid patients; n=276	High proportion (≥29%) Medicaid patients; n=276
Maximum	5.4	5.7
90%	4.2	4.4
75%	3.7	3.9
Median (50%)	3.2	3.5
25%	2.9	3.1
10%	2.6	2.8
Minimum	1.9	1.9

TABLE A.2.14. *Distribution of Hip/Knee Arthroplasty RSCRs by Proportion of African-American Patients, July 2009-March 2012.*

	Hip/Knee Arthroplasty RSCR (%)	
	Low proportion (0%) African-American patients; n=279	High proportion (≥20%) African-American patients; n=278
Maximum	5.9	6.0
90%	4.2	4.5
75%	3.8	4.0
Median (50%)	3.4	3.6
25%	3.1	3.2
10%	2.9	2.9
Minimum	2.2	2.2

Source Data and Population: Hip/Knee Arthroplasty Complication Cohort data – July 2009 – April 2012 (Appendix I); 2011 American Hospital Association (AHA) data to calculate overall proportion of Medicaid patients (Appendix II), 2011 Medicare Part A Inpatient Claims data to calculate proportion of African-American Medicare FFS patients (Appendix II).

Notes: 1) Veteran Health Administration (VA) hospitals are not included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition over the three-year period are not shown; however, these hospitals are included in the calculations. 3) The percent of Medicaid patients is calculated among all hospital patients. 4) The percent of African-American patients is calculated among all Medicare FFS patients. 5) For more information about figures, see Appendix III.

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How do hospitals caring for high proportions of Medicaid or minority patients perform on the hip/knee arthroplasty readmission measure?

FIGURE A.2.15. *Distribution of Hip/Knee Arthroplasty RSRRs for hospitals with the lowest and highest proportion of Medicaid patients, July 2009 – June 2012.*

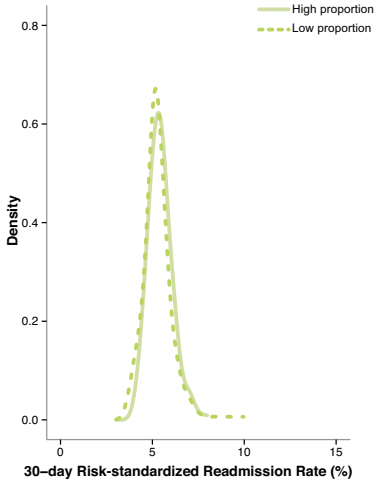
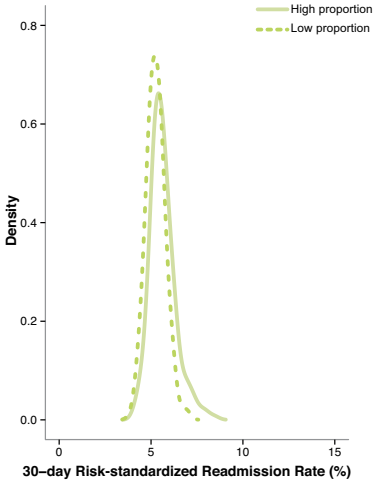


FIGURE A.2.16. *Distribution of Hip/Knee Arthroplasty RSRRs for hospitals with the lowest and highest proportion of African-American patients, July 2009 – June 2012*



For the hip/knee arthroplasty readmission measure, we compared the distribution of risk-standardized readmission rates (RSRRs) for hospitals with the lowest overall proportion of Medicaid patients (≤ 7% of a hospital's patients) with RSRR distributions for hospitals with the highest overall proportion of Medicaid patients (≥ 29%). We also compared the distribution of RSRRs for hospitals with the lowest proportion of African-American Medicare fee-for-service (FFS) patients (0%) with RSRR distributions for hospitals with the highest proportion of African-American Medicare FFS patients (≥ 20%). Figures A.2.15 and A.2.16 and Tables A.2.15 and A.2.16 display the distributions.

The distribution of RSRRs is similar for both sets of hospitals. Hospitals with low proportions of Medicaid patients performed slightly better than hospitals with high proportions of Medicaid patients, with a 0.2 percentage point difference in the median hospital's RSRR. Likewise, hospitals with low proportions of African-American patients performed slightly better than hospitals with high proportions of African-American patients, with a 0.3 percentage point difference in medians.

Hospitals with a high proportion of Medicaid or minority patients achieved a similar range of performance as compared to hospitals with a low proportion of these patients, indicating that both can perform well on the measure.

TABLE A.2.15. *Distribution of Hip/Knee Arthroplasty RSRRs by Proportion of Medicaid Patients, July 2009 – June 2012.*

	Hip/Knee Arthroplasty RSRR (%)	
	Low proportion (≤7%) Medicaid patients; n=278	High proportion (≥29%) Medicaid patients; n=279
Maximum	10.0	8.2
90%	6.1	6.3
75%	5.6	5.8
Median (50%)	5.2	5.4
25%	4.9	5.0
10%	4.4	4.6
Minimum	3.6	4.1

TABLE A.2.16. *Distribution of Hip/Knee RSRRs by Proportion of African-American Patients, July 2009 – June 2012.*

	Hip/Knee Arthroplasty RSRR (%)	
	Low proportion (0%) African-American patients; n=282	High proportion (≥20%) African-American patients; n=281
Maximum	7.0	8.5
90%	5.9	6.4
75%	5.6	6.0
Median (50%)	5.2	5.5
25%	4.9	5.2
10%	4.6	4.9
Minimum	3.9	4.1

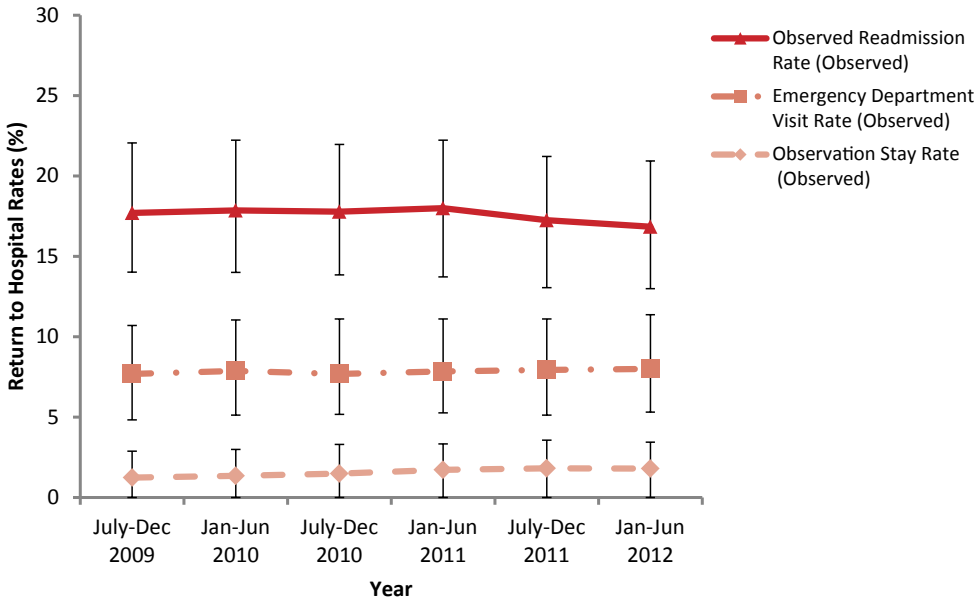
Source Data and Population: Hip/Knee Arthroplasty RSRR Cohort data, July 2009 – June 2012 (Appendix I); 2011 American Hospital Association (AHA) data to calculate overall proportion of Medicaid patients (Appendix II); 2011 Medicare Part A Inpatient Claims data to calculate proportion of African-American Medicare FFS patients (Appendix II).

Notes: 1) Veteran Health Administration (VA) hospitals are not included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition over the three-year period are not shown; however, these hospitals are included in the calculations. 3) The percent of Medicaid patients is calculated among all hospital patients. 4) The percent of African-American patients is calculated among all Medicare FFS patients. 5) For more information about figures, see Appendix III.

Prepared for CMS by YNHHSC/CORE.

Is the trend in hospital-level observation stays and ED visits following AMI hospitalizations continuing to rise?

FIGURE A.2.17. *Trends in the Median Hospital's Readmission Rate, Emergency Department Visit Rate and Observation Stay Rate for AMI, July 2009 – June 2012.*



A concern raised in recent press reports and research studies is whether hospital observation stays in the post-discharge period may replace hospital readmissions, leading hospitals to appear to have lower readmission rates. In Figure A.2.17, we show the trends in the rates of observation stays and emergency department (ED) visits without readmission in the 30 days following index admissions for acute myocardial infarction (AMI) from July 2009 through June 2012. Observation stay usage was low compared with readmissions, but the median hospital's observation stay rate rose over these 36 months from 1.2% to 1.8% (Appendix VI). We measured a decrease of 0.9 percentage points in the median readmission rate during this time period, indicating that replacement by observation stay does not fully explain the decrease in readmissions. The post-discharge ED visit rate (patients with ED visits but no observation stays or readmissions during the 30-day period) remained stable at 8% over the three-year period.

There is a range of post-discharge hospital-level observation service utilization (median three-year rate: 1.9%, interquartile range (IQR): 1.0%-2.8%), with 20.4% of hospitals using no observation stays while 5% of hospitals have a post-discharge observation stay rate following AMI discharge above 4.7%. We calculated the proportion of patients with an observation stay among those who returned to the hospital for either a readmission or an observation stay within 30 days following discharge for AMI. Results showed 9.1% (IQR: 3.2%-15.2%) of the median hospital's combined observation stay/readmission rate was due to observation stays, indicating that select hospitals are disproportionately using observation stays at high rates in the post-discharge period.

We measured a small increase in post-discharge observation stay rates, but the increase is less than and predates the decline in readmission rates. ED visit rates following discharge have remained stable. The high degree of variation in hospital-level observation stay rates in the 30-day post-discharge period and high observation usage at a small proportion of hospitals suggests that observation use should continue to be evaluated closely for ongoing impact on the readmission measures.

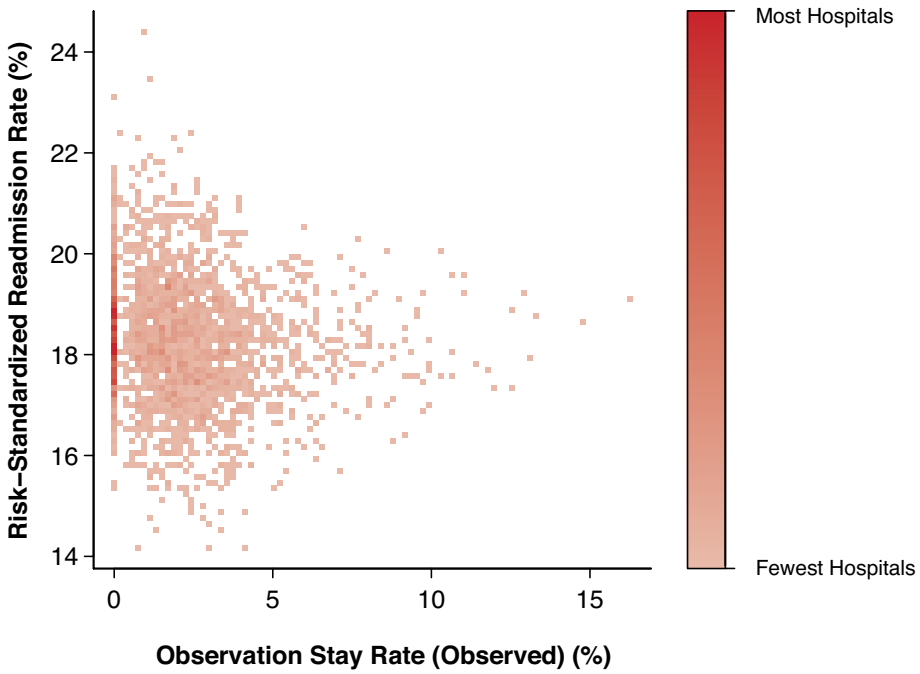
Source Data and Population: AMI Readmission Cohort data, July 2009 – June 2012 (Appendix I).

Notes: 1) Veterans Health Administration (VA) hospitals are not included in this analysis.. 2) The results of hospitals with fewer than 25 cases of the condition in each year are not shown; however, these hospitals are included in the calculations. 3) The bars on the graph represent the interquartile range. 4) For more information about figures, see Appendix III.

Prepared for CMS by YNHHSC/CORE.

Do hospitals with high use of observation stays have lower AMI risk-standardized readmission rates?

FIGURE A.2.18. *Correlation of RSRR and Observation Stay Rate (Observed) for AMI, July 2009 – June 2012.*



Given variation in the use of observation stays in the post-discharge period among hospitals and concerns about observations stays potentially replacing readmissions, we examined the relationship between observation stay use and performance on 30-day risk-standardized readmission rates (RSRRs) and calculated the resulting correlation coefficient.

Figure A.2.18 shows the relationship between observed hospital-level, post-discharge observation stay rates and RSRRs. The color scale indicates the number of hospitals – dark dots represent more hospitals and light dots represent fewer hospitals. There is a weak inverse correlation between observation stay rates and RSRRs for AMI demonstrated in the scatterplot (r=-0.20), suggesting that hospitals with higher observation stay rates have lower RSRRS.

The relationship between hospital-level use of observation stays in the post-discharge period and RSRR performance is weak, with a small correlation between higher use of observation stays and lower RSRRs. A wide range of performance at all levels of observation use, however, suggests that most hospitals are not systematically improving readmission rates solely through the use of observation stays.

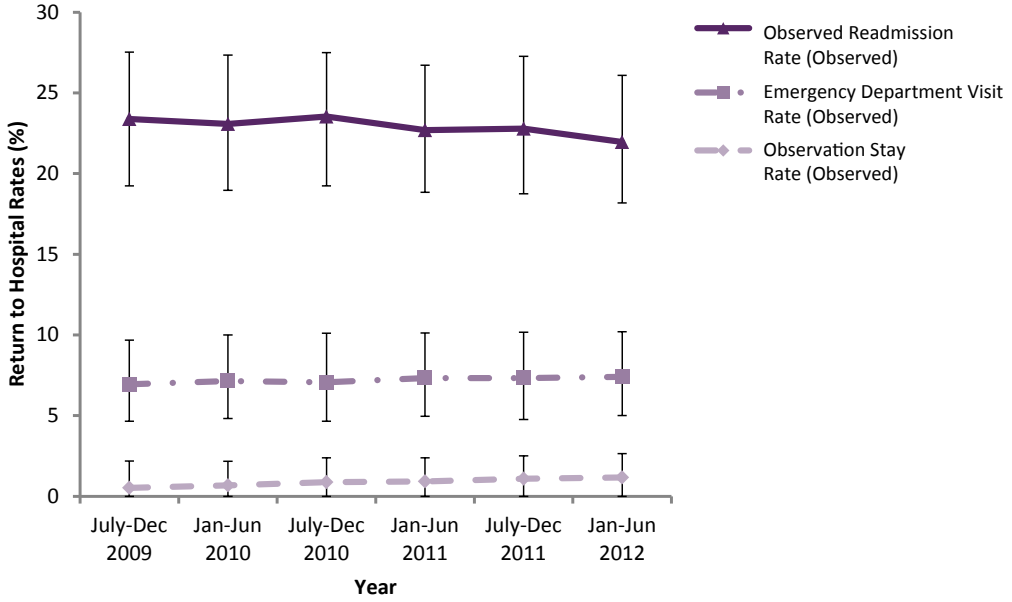
Source Data and Population: AM I Readmission Cohort data, July 2009 – June 2012 (Appendix I).

Notes: 1) Veterans Health Administration (VA) hospitals are not included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition in 3 years are not shown; however, these hospitals are included in the calculations. 3) For more information about figures, see Appendix III.

Prepared for CMS by YNHHSC/CORE.

Is the trend in hospital-level observation stays and ED visits following heart failure hospitalizations continuing to rise?

FIGURE A.2.19. *Trends in Median Hospital's Readmission Rate, Emergency Department Visit Rates and Observation Stay Rates for Heart Failure, July 2009 – June 2012.*



A concern raised in recent press reports and research studies is whether hospital observation stays in the post-discharge period may be replacing hospital readmissions, leading hospitals to appear to have lower readmission rates [22]. In figure A.2.19 we show the trends in the rates of observation stays and emergency department (ED) visits without readmission in the 30 days following index admissions for heart failure from July 2009 through June 2012. Observation stay usage is low compared to readmissions but did rise from 0.5% to 1.2% (Appendix VI). We measured a decrease of 1.4 percentage points in the observed readmission rate during this time period, indicating that replacement by observation use does not fully explain the decrease in readmissions. The median post-discharge ED visit rate (patients with ED visits but no observation stays or readmissions during the 30-day period) rose over the same period from 6.9% to 7.4%.

We measured a range of post-discharge hospital-level observation service utilization (median three-year rate: 1.2%; interquartile range (IQR): 0.7%-1.9%), with 22.6% of hospitals using no observation stays while 5% of hospitals have a post-discharge observation stay rate above 3.5%.We calculated the proportion of patients with an observation stay among those who returned to the hospital for readmission or an observation stay within 30 days following discharge for heart failure; 5.3% (IQR: 1.4%-9.5%) of the median hospital's combined observation stay/readmission rate was due to observation stays, indicating that select hospitals are disproportionately using observation stays at much higher rates in the post-discharge period.

We measured a small increase in post-discharge observation stay and ED visit rates, but the increase is less than and predates the decline in readmission rates. Variation in hospital-level observation stay rates in the 30-day post-discharge period and high observation usage at a small proportion of hospitals suggests that observation use should continue to be evaluated closely for ongoing impact on the readmission measures.

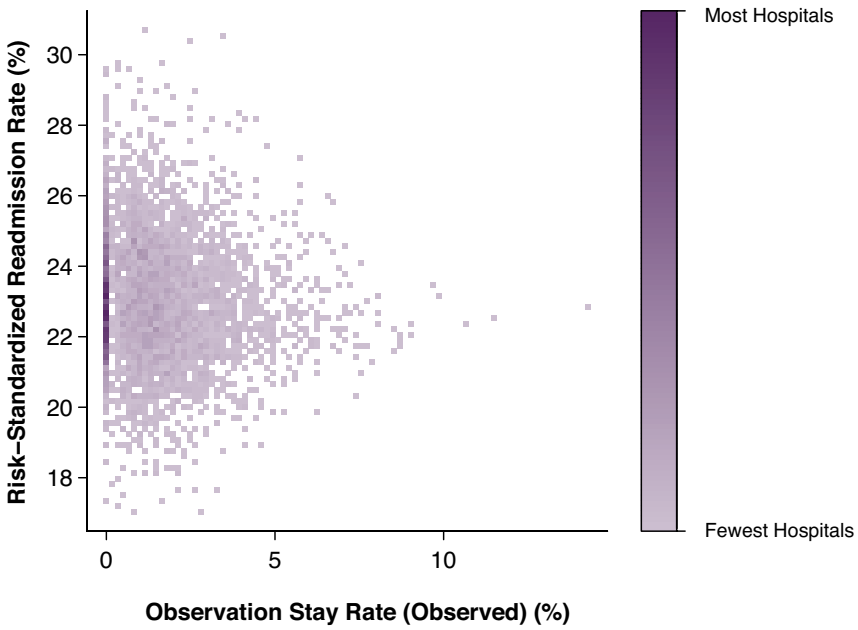
Source Data and Population: Heart Failure Readmission Cohort data, July 2009 – June 2012 (Appendix I).

Notes: 1) Veterans Health Administration (VA) hospitals are not included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition in each year are not shown; however, these hospitals are included in the calculations. 3) The bars on the graph represent the interquartile range. 4) For more information about figures, see Appendix III.

Prepared for CMS by YNHHSC/CORE.

Do hospitals with high use of observation stays have lower heart failure risk-standardized readmission rates?

FIGURE A.2.20. *Correlation of RSRR and Observation Stay Rate (Observed) for Heart Failure, July 2009 – June 2012.*



Given the variation in the use of observation stays in the post-discharge period among hospitals and concerns about observation stays potentially replacing readmissions, we examined the relationship between observation stay use and performance on 30-day risk standardized readmission rates (RSRRs) and calculated the resulting correlation coefficient.

Figure A.2.20 shows the relationship between observed hospital-level, post-discharge observation stay rates and RSRRs. The color scale indicates the number of hospitals – dark dots represent more hospitals and light dots represent fewer hospitals. We measured a weak inverse correlation between observation stay rates and RSRRs for heart failure demonstrated in the scatterplot (r=-0.11), which suggests that hospitals with higher observation stay rates have lower RSRRS. As the majority of hospitals have a very low use of observation stays in the 30-day post-discharge period, the correlation does not seem to have a meaningful impact on reported readmission rates, but it warrants ongoing surveillance.

The relationship between hospital-level use of observation stays in the post-discharge period and RSRR performance is weak with a small correlation between higher use of observation stays and lower RSRRs. A wide range of performance at all levels of observation use, however, suggests that hospitals are not systematically improving readmission rates through the use of observation stays.

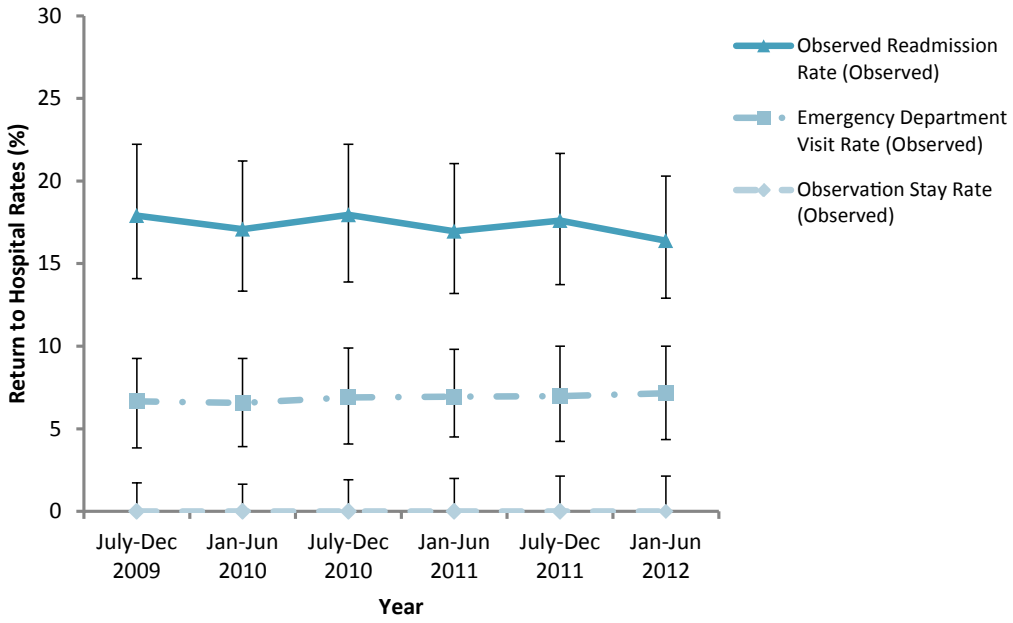
Source Data and Population: Heart Failure Readmission Cohort data, July 2009 – June 2012 (Appendix I).

Notes: 1) Veterans Health Administration (VA) hospitals are not included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition in 3 years are not shown; however, these hospitals are included in the calculations. 3) For more information about figures, see Appendix III.

Prepared for CMS by YNHHSC/CORE.

Is the trend in hospital-level observation stays and ED visits following pneumonia hospitalizations continuing to rise?

FIGURE A.2.21. *Trends in the Median Hospital's Readmission Rate, Emergency Department Visit Rate and Observation Stay Rate for Pneumonia, July 2009 – June 2012.*



A concern raised in recent press reports and research studies is whether hospital observation stays in the post-discharge period may replace hospital readmissions, leading hospitals to appear to have lower readmission rates. In Figure A.2.21 we show the trends in the rates of observation stays and emergency department (ED) visits without readmission in the 30 days following index admissions for pneumonia from July 2009 through June 2012. Consistent with previous studies in a non-Medicare fee-for-service population, while pneumonia may be the condition for which patients are most frequently admitted to the hospital, the use of observation stays after pneumonia admission is not prevalent and observation stay rates are lower for pneumonia than for AMI and heart failure. Over the past three years the median hospital's six-month observation stay rate in the 30-day post-discharge period has remained below 1%. The post-discharge ED visit rate (patients with ED visits but no observation stays or readmissions during the 30-day period) rose from 6.7% to 7.1% over the three-year period.

Similar to heart failure, there is a range of post-discharge hospital-level observation service utilization (median three-year rate: 1.0%, interquartile range (IQR): 0.5%-1.6%), with 28.3% of hospitals using no observation stays while 5% of hospitals have an observation stay rate following discharge for pneumonia above 2.9%. We calculated the proportion of patients with an observation stay among those who returned to the hospital for either a readmission or an observation stay within 30 days following discharge for AMI; 5.0% (IQR: 0.0%-9.4%) of the median hospital's combined observation stay/readmission rate was due to observation stays, indicating that select hospitals are disproportionately using observation stays at high rates in the post-discharge period.

The use of post-discharge observation stays is negligible through 2012 and does not explain decline in readmission rates. ED visit rates increased slightly over the three-year period. The wide variation in hospital-level observation stay rates in the 30-day post-discharge period and high observation stay usage at a small proportion of hospitals suggests that the use of observation stays should continue to be closely evaluated for ongoing impact on the readmission rates.

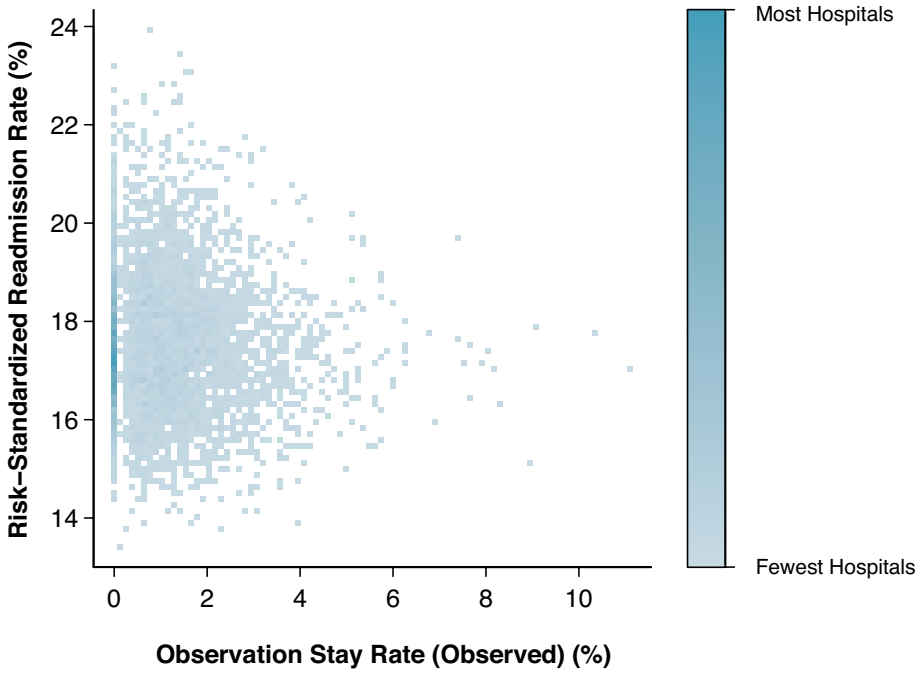
Source Data and Population: Pneumonia Redmission Cohort data, July 2009 – June 2012 (Appendix I).

Notes: 1) Veterans Health Administration (VA) hospitals are not included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition in each year are not shown; however, these hospitals are included in the calculations. 3) The bars on the graph represent the interquartile range. 4) For more information about figures and density plots, see Appendix III.

Prepared for CMS by YNHHSC/CORE.

Do hospitals with high use of observation stays have lower pneumonia risk-standardized readmission rates?

FIGURE A.2.22. *Correlation of Risk-Standardized Readmission Rate (RSRR) and Observation Stay Rate (Observed) for Pneumonia, July 2009 – June 2012..*



Given the variation in the use of post-discharge observation stays among the conditions subject to public reporting of hospital readmissions (acute myocardial infarction (AMI), heart failure, and pneumonia) and concerns about observation stays potentially replacing readmissions, we examined the relationship between observation stay use and performance on 30-day risk standardized readmission rates (RSRRs) and calculated the resulting correlation coefficient.

Figure A.2.22 shows the relationship between observed hospital-level, post-discharge observation stay rates and RSRRs. The color scale indicates the number of hospitals – dark dots represent more hospitals and light dots represent fewer hospitals. Of the three publicly-reported conditions (AMI, heart failure, and pneumonia), pneumonia shows the weakest inverse correlation between higher observation stay rates and lower RSRRs for pneumonia (r=-0.07). As the majority of hospitals have a very low use of observation stays in the 30-day post-discharge period, this does not seem to have a meaningful impact on reported readmission rates.

There does not appear to be a meaningful relationship between hospital-level use of observation stays in the post-discharge period and RSRR performance for pneumonia. There is a small correlation between higher use of observation stays and lower RSRRs, but a wide range of performance at all levels of observation use suggests that hospitals are not systematically improving readmission rates through the use of observation stays.

Source Data and Population: Pneumonia Readmission Cohort data, July 2009 – June 2012 (Appendix I).

Notes: 1) Veterans Health Administration (VA) hospitals are not included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition in 3 years are not shown; however, these hospitals are included in the calculations. 3) For more information about figures, see Appendix III.

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Hospital-Wide Readmission

Summary

DISPARITIES

This section focuses on hospital-level, risk-standardized rates of unplanned hospital-wide readmission within 30 days of discharge that are publicly reported on *Hospital Compare* as part of the Hospital Inpatient Quality Report program. Within this section we address disparities in hospital-level performance. Specifically, we compare how hospitals with low and high proportions of Medicaid patients or African-American patients, respectively, perform on the measure.

How do hospitals caring for high proportions of Medicaid or minority patients perform on the hospital-wide readmission measure?

FIGURE B.2.1. *Distribution of Hospital-Wide RSRRs for hospitals with the lowest and highest proportion of Medicaid patients, January – December 2011.*

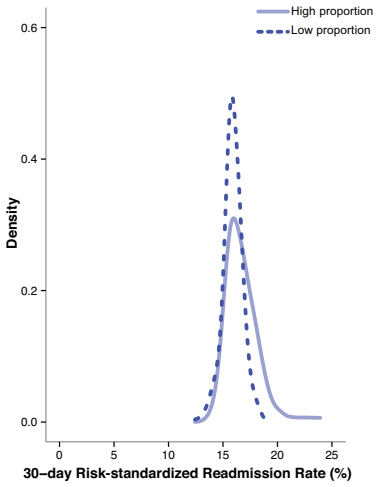
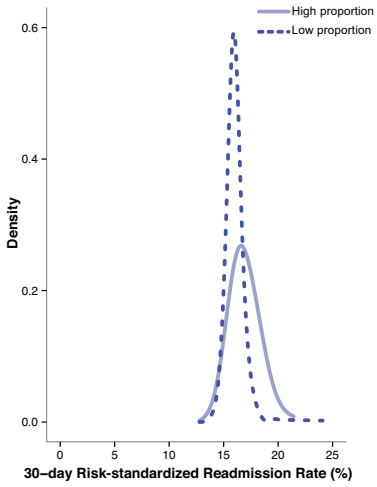


FIGURE B.2.2. *Distribution of Hospital-Wide RSRRs for hospitals with the lowest and highest proportion of African-American patients, January – December 2011.*



For the hospital-wide readmission measure, we compared the distribution of 30-day risk-standardized readmission rates (RSRRs) for hospitals with the lowest overall proportion of Medicaid patients (≤ 5% of a hospital's patients) with RSRR distributions for hospitals with the highest overall proportion of Medicaid patients (≥ 28%). We also compared the distribution of RSRRs for hospitals with the lowest proportion of African-American Medicare fee-for-service (FFS) patients (0%) with RSRR distributions for hospitals with the highest proportion of African-American Medicare FFS patients (≥ 23%). Figures B.2.1 and B.2.2 and Tables B.2.1 and B.2.2 display the distributions.

The distribution of RSRRs is similar for both sets of hospitals. Hospitals with low proportion of Medicaid patients performed slightly better than hospitals with high proportions of Medicaid patients, with a 0.5 percentage point difference in the median hospitals' RSRR. Likewise, hospitals with low proportions of African-American patients performed slightly better than hospitals with high proportions of African-American patients, with a 0.8 percentage point difference in the median hospital's RSRR.

Hospitals with high proportions of Medicaid or minority patients achieved a similar range of RSRRs compared with hospitals with low proportions but the range was shifted toward poorer performance for hospitals with high proportions of Medicaid or minority patients.

TABLE B.2.1. *Distribution of Hospital-Wide RSRRs by Proportion of Medicaid Patients, January 2011 – December 2011.*

	Hospital-Wide RSRR (%)	
	Low proportion (≤5%) Medicaid patients; n=462	High proportion (≥28%) Medicaid patients; n=461
Maximum	24.0	21.6
90%	17.0	18.3
75%	16.4	17.5
Median (50%)	15.9	16.4
25%	15.4	15.7
10%	14.8	15.2
Minimum	11.3	13.8

TABLE B.2.2. *Distribution of Hospital-Wide RSRRs by Proportion of African-American Patients, January 2011 – December 2011.*

	Hospital-Wide RSRR (%)	
	Low proportion (0%) African-American patients; n=962	High proportion (≥23%) African-American patients; n=469
Maximum	20.7	24.0
90%	16.9	18.6
75%	16.4	17.8
Median (50%)	16.0	16.8
25%	15.6	16.0
10%	15.2	15.5
Minimum	13.8	14.2

Source Data and Population: Hospital-Wide Readmission Measure Cohort data, January – December 2011 (Appendix I); 2011 American Hospital Association (AHA) data to calculate overall proportion of Medicaid patients (Appendix II); 2011 Medicare Part A Inpatient Claims data to calculate proportion of African-American Medicare FFS patients (Appendix II).

1) Veteran Health Administration (VA) hospitals are not included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition over the one-year period are not shown; however, these hospitals are included in the calculations. 3) The percent of Medicaid patients is calculated among all hospital patients. 4) The percent of African-American patients is calculated among all Medicare FFS patients. 5) Deciles with 0% African-American patients were combined. 6) For more information about figures, see Appendix III.

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Stroke: Mortality & Readmission

Summary

DISPARITIES

This section focuses on the stroke mortality and readmission measures. CMS plans to publicly report these measures on *Hospital Compare* beginning in 2014 as part of the Hospital Inpatient Quality Reporting program. Within this section we address disparities in hospital-level performance. Specifically, we compare how hospitals with low and high proportions of Medicaid patients or African-American patients, respectively, perform on the measures.

How do hospitals caring for high proportions of Medicaid or minority patients perform on the stroke mortality measure?

FIGURE C.2.1. *Distribution of Stroke RSMRs for hospitals with the lowest and highest proportion of Medicaid patients, January 2009 – December 2011.*

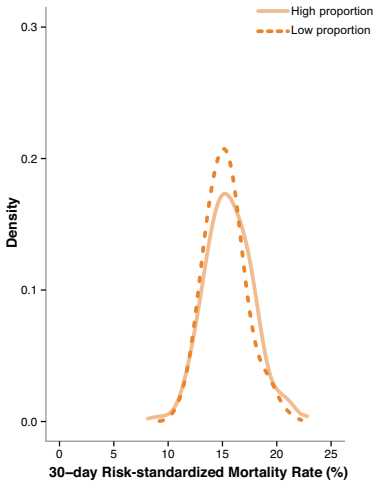
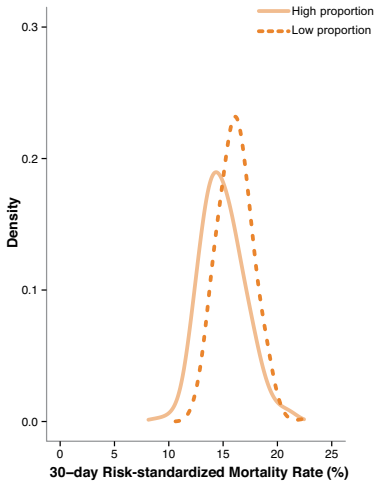


FIGURE C.2.2. *Distribution of Stroke RSMRs for hospitals with the lowest and highest proportion of African-American patients, January 2009 – December 2011.*



For the stroke mortality measure, we compared the distribution of risk-standardized mortality rates (RSMRs) for hospitals with the lowest overall proportion of Medicaid patients (≤ 8% of a hospital's patients) with RSMR distributions for hospitals with the highest overall proportion of Medicaid patients (≥30%). We also compared the distribution of RSMRs for hospitals with the lowest proportion of African-American Medicare fee-for-service (FFS) patients (0%) with RSMR distributions for hospitals with the highest proportion of African-American Medicare FFS patients (≥24%). Figures C.2.1 and C.2.2 and Tables C.2.1 and C.2.2 display the distributions.

The distribution of RSMRs is similar for both sets of hospitals. Hospitals with low proportions of Medicaid patients performed slightly better than hospitals with high proportions of Medicaid patients, with a 0.3 percentage point difference in the median hospital's RSMR. Hospitals with low proportions of African-American patients performed worse than hospitals with high proportions of African-American patients, with a 1.4 percentage point difference in medians.

The hospitals with high proportions of Medicaid patients achieved a similar range of performance as compared with hospitals with low proportions of these patients. Hospitals with high proportions of African-American patients had better performance overall than hospitals with low proportions of African-American patients.

TABLE C.2.1. *Distribution of Stroke RSMRs by Proportion of Medicaid Patients, January 2009 – December 2011.*

	Stroke RSMR (%)	
	Low proportion (≤8%) Medicaid patients; n=300	High proportion (≥30%) Medicaid patients; n=300
Maximum	21.1	21.9
90%	17.7	18.1
75%	16.3	17.0
Median (50%)	15.2	15.5
25%	14.0	14.2
10%	13.1	13.0
Minimum	10.9	8.5

TABLE C.2.2. *Distribution of Stroke RSMRs by Proportion of African-American Patients, January 2009 – December 2011.*

	Stroke RSMR (%)	
	Low proportion (0%) African-American patients; n=303	High proportion (≥24%) African-American patients; n=303
Maximum	22.6	21.4
90%	18.3	17.7
75%	17.2	16.2
Median (50%)	16.2	14.8
25%	15.1	13.6
10%	14.1	12.6
Minimum	12.4	8.7

Source Data and Population: Stroke Measure Cohort data, January 2009 – December 2011 (Appendix I); 2011 American Hospital Association (AHA) data to calculate overall proportion of Medicaid patients (Appendix II); 2011 Medicare Part A Inpatient Claims data to calculate proportion of African-American Medicare FFS patients (Appendix II).

Notes: 1) Veteran Health Administration (VA) hospitals are not included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition over the three-year period are not shown; however, these hospitals are included in the calculations. 3) The percent of Medicaid patients is calculated among all hospital patients. 4) The percent of African-American patients is calculated among all Medicare FFS patients. 5) For more information about figures, see Appendix III.

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How do hospitals caring for high proportions of Medicaid or minority patients perform on the stroke readmission measure?

FIGURE C.2.3. *Distribution of Stroke RSRRs for hospitals with the lowest and highest proportion of Medicaid patients, January 2009 – December 2011.*

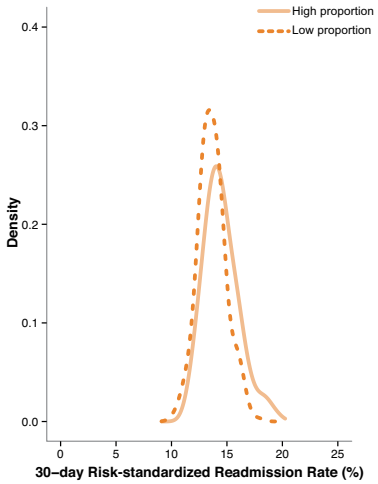
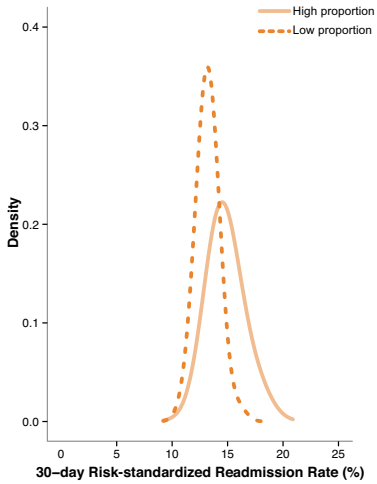


FIGURE C.2.4. *Distribution of Stroke RSRRs for hospitals with the lowest and highest proportion of African-American patients, January 2009 – December 2011.*



For the stroke readmission measure, we compared the distribution of risk-standardized readmission rates (RSRRs) for hospitals with the lowest overall proportion of Medicaid patients (≤ 8% of a hospital's patients) with RSRR distributions for hospitals with the highest overall proportion of Medicaid patients (≥ 30%). We also compared the distribution of RSRRs for hospitals with the lowest proportion of African-American Medicare fee-for-service (FFS) patients (0%) with RSRR distributions for hospitals with the highest proportion of African-American Medicare FFS patients (≥24%). Figures C.2.3 and C.2.4 and Tables C.2.3 and C.2.4 display the distributions.

The distribution of RSRRs is similar for both sets of hospitals. Hospitals with low proportions of Medicaid patients performed slightly better than hospitals with high proportions of Medicaid patients, with a 0.6 percentage point difference in the median hospital's RSRR. Similarly, hospitals with low proportions of African-American patients performed better than hospitals with high proportions of African-American patients, with a 1.5 percentage point difference in medians.

Hospitals with high proportions of Medicaid patients achieved a similar range of RSRRs as compared to hospitals with low proportions of these patients, indicating that both groups can perform well on the measure but the range was shifted towards poorer performance for hospitals with high proportions of African-American patients.

TABLE C.2.3. *Distribution of Stroke RSRRs by Proportion of Medicaid Patients, January 2009 – December 2011.*

	Stroke RSRR (%)	
	Low proportion (≤8%) Medicaid patients; n=293	High proportion (≥30%) Medicaid patients; n=293
Maximum	17.9	19.5
90%	15.3	16.4
75%	14.4	15.3
Median (50%)	13.6	14.2
25%	12.9	13.4
10%	12.2	12.6
Minimum	10.2	11.5

TABLE C.2.4. *Distribution of Stroke RSRRs by Proportion of African-American Patients, January 2009-December 2011.*

	Stroke RSRR (%)	
	Low proportion (0%) African-American patients; n=294	High proportion (≥24%) African-American patients; n=294
Maximum	16.5	19.7
90%	14.3	16.9
75%	13.8	15.8
Median (50%)	13.2	14.7
25%	12.6	13.8
10%	12.0	13.1
Minimum	10.6	10.4

Source Data and Population: Stroke Measure Cohort data, January 2009 – December 2011 (Appendix I); 2011 American Hospital Association (AHA) data to calculate overall proportion of Medicaid patients (Appendix II); 2011 Medicare Part A Inpatient Claims data to calculate proportion of African-American Medicare FFS patients (Appendix II).

Notes: 1) Veteran Health Administration (VA) hospitals are not included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition over the three-year period are not shown; however, these hospitals are included in the calculations. 3) The percent of Medicaid patients is calculated among all hospital patients. 4) The percent of African-American patients is calculated among all Medicare FFS patients. 5) For more information about figures, see Appendix III.

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COPD: Mortality & Readmission

Summary

DISPARITIES

This section focuses on the chronic obstructive pulmonary disease (COPD) mortality and readmission measures. CMS plans to publicly report these measures on *Hospital Compare* beginning in 2014 as part of the Hospital Inpatient Quality Reporting program. Additionally CMS plans to include the COPD readmission measure in the Fiscal Year 2015 Hospital Readmissions Reduction Program. Within this section we address disparities in hospital-level performance. Specifically, we compare how hospitals with low and high proportions of Medicaid patients or African-American patients, respectively, perform on the measures.

How do hospitals caring for high proportions of Medicaid or minority patients perform on the COPD mortality measure?

FIGURE D.2.1. *Distribution of COPD RSMRs for hospitals with the lowest and highest proportion of Medicaid patients, January 2009 – December 2011.*

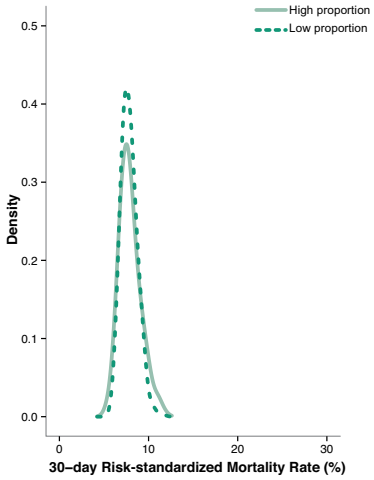
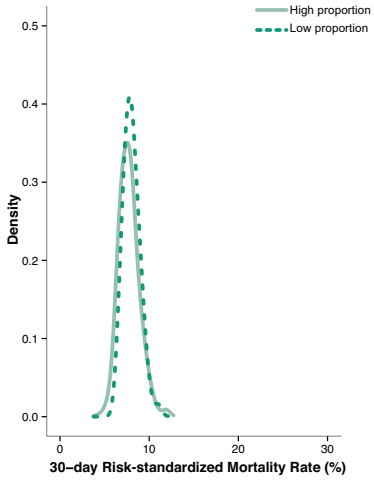


FIGURE D.2.2. *Distribution of COPD RSMRs for hospitals with the lowest and highest proportion of African-American patients, January 2009 – December 2011.*



For the chronic obstructive pulmonary disease (COPD) mortality measure, we compared the distribution of 30-day risk-standardized mortality rates (RSMRs) for hospitals with the lowest overall proportion of Medicaid patients (≤ 7% of a hospital's patients) with RSMR distributions for hospitals with the highest overall proportion of Medicaid patients (≥29%). Similarly, we compared the distribution of RSMRs for hospitals with the lowest proportion of African-American Medicare fee-for-service (FFS) patients (0%) with RSMR distributions for hospitals with the highest proportion of African-American Medicare FFS patients (≥ 23%). Figures D.2.1 and D.2.2 and Tables D.2.1 and D.2.2 display the distributions.

The distribution of RSMRs is similar for both sets of hospitals. Hospitals with low proportions of Medicaid patients had similar performance to hospitals with high proportions of Medicaid patients, with no difference in the median hospital RSMR. Hospitals with high proportions of African-American patients performed slightly better than hospitals with low proportions of African-American patients, with a 0.2 percentage point difference in the median hospital's RSMR.

Hospitals with high proportions of Medicaid or minority patients achieved a similar range of performance as compared to hospitals with low proportions of these patients, indicating that both can perform well on these measures.

TABLE D.2.1. *Distribution of COPD RSMRs by Proportion of Medicaid Patients, January 2009 – December 2011.*

	COPD RSMR (%)	
	Low proportion (≤7%) Medicaid patients; n=382	High proportion (≥29%) Medicaid patients; n=382
Maximum	11.6	12.0
90%	9.1	9.6
75%	8.4	8.6
Median (50%)	7.7	7.7
25%	7.2	7.0
10%	6.8	6.5
Minimum	6.0	5.2

TABLE D.2.2. *Distribution of COPD RSMRs by Proportion of African-American Patients, January 2009-December 2011.*

	COPD RSMR (%)	
	Low proportion (0%) African-American patients; n=517	High proportion (≥23%) African-American patients; n=386
Maximum	12.8	12.0
90%	9.2	9.2
75%	8.6	8.3
Median (50%)	7.9	7.7
25%	7.3	6.9
10%	6.9	6.5
Minimum	6.0	4.3

Source Data and Population: COPD Measure Cohort data, January 2009 – December 2011 (Appendix I); 2011 American Hospital Association (AHA) data to calculate overall proportion of Medicaid patients (Appendix II); 2011 Medicare Part A Inpatient Claims data to calculate proportion of African-American Medicare FFS patients (Appendix II).

Notes: 1) Veteran Health Administration (VA) hospitals are not included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition over the three-year period are not shown; however, these hospitals are included in the calculations. 3) The percent of Medicaid patients is calculated among all hospital patients. 4) The percent of African-American patients is calculated among all Medicare FFS patients. 5) For more information about figures, see Appendix III.

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How do hospitals caring for high proportions of Medicaid or minority patients perform on the COPD readmission measure?

FIGURE D.2.3. *Distribution of COPD RSRRs for hospitals with the lowest and highest proportion of Medicaid patients, January 2009 – December 2011.*

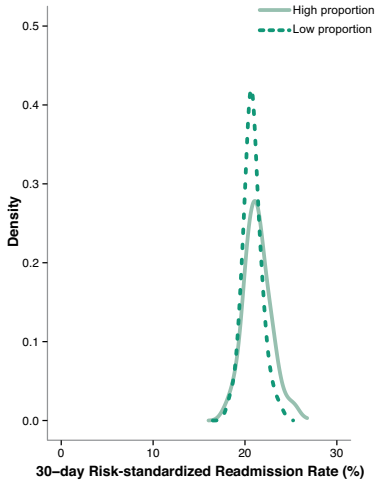
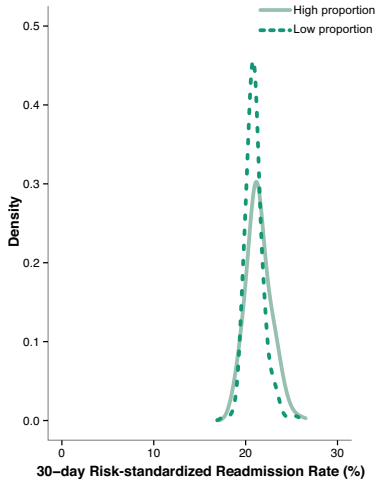


FIGURE D.2.4. *Distribution of COPD RSRRs for hospitals with the lowest and highest proportion of African-American patients, January 2009 – December 2011.*



For the chronic obstructive pulmonary disease (COPD) readmission measure, we compared the distribution of risk-standardized readmission rates (RSRRs) for hospitals with the lowest overall proportion of Medicaid patients (≤ 7% of a hospital's patients) with RSRR distributions for hospitals with the highest overall proportion of Medicaid patients (≥ 29%). We also compared the distribution of RSRRs for hospitals with the lowest proportion of African-American Medicare fee-for-service (FFS) patients (0%) with RSRR distributions for hospitals with the highest proportion of African-American Medicare FFS patients (≥ 24%). Figures D.2.3 and D.2.4 and Tables D.2.3 and D.2.4 display the distributions.

The distribution of RSRRs is similar for both sets of hospitals. Hospitals with low proportions of Medicaid patients performed slightly better than hospitals with high proportions of Medicaid patients, with a 0.6 percentage point difference in the median hospital's RSRR. Similarly, hospitals with low proportions of African-American patients performed slightly better than hospitals with high proportions of African-American patients, with a 0.4 percentage point difference in the median hospital RSRR.

Hospitals with high proportions of Medicaid or minority patients achieved a similar range of performance as compared to hospitals with low proportions of these patients, indicating that both can perform well on the measure.

TABLE D.2.3. *Distribution of COPD RSRRs by Proportion of Medicaid Patients, January 2009 – December 2011.*

	COPD RSRR (%)	
	Low proportion (≤7%) Medicaid patients; n=391	High proportion (≥29%) Medicaid patients; n=390
Maximum	24.3	26.8
90%	22.1	23.2
75%	21.4	22.2
Median (50%)	20.7	21.3
25%	20.2	20.4
10%	19.6	19.7
Minimum	17.8	17.6

TABLE D.2.4. *Distribution of COPD RSRRs by Proportion of African-American Patients, January 2009-December 2011.*

	COPD RSRR (%)	
	Low proportion (0%) African-American patients; n=555	High proportion (≥24%) African-American patients; n=394
Maximum	26.0	26.3
90%	22.2	23.3
75%	21.4	22.2
Median (50%)	20.9	21.3
25%	20.3	20.5
10%	19.8	19.7
Minimum	17.5	18.3

Source Data and Population: COPD Measure Cohort data, January 2009 – December 2011 (Appendix I); 2011 American Hospital Association data to calculate overall proportion of Medicaid patients (Appendix II); 2011 Medicare Part A Inpatient Claims data to calculate proportion of African-American Medicare FFS patients (Appendix II).

Notes: 1) Veteran Health Administration (VA) hospitals are not included in this analysis. 2) The results of hospitals with fewer than 25 cases of the condition over the three-year period are not shown; however, these hospitals are included in the calculations. 3) The percent of Medicaid patients is calculated among all hospital patients. 4) The percent of African-American patients is calculated among all Medicare FFS patients. 5) For more information about figures, see Appendix III.

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Appendices

A. AMI, Heart Failure, and Pneumonia Mortality and Readmission

Cohort Definition

The acute myocardial infarction (AMI), heart failure, and pneumonia mortality and readmission measures include admissions for Medicare fee-for-service (FFS) and Veterans Health Administration (VA) hospital beneficiaries aged 65 years and older who were discharged from non-federal acute care hospitals or VA hospitals with a principal discharge diagnosis of AMI, heart failure, or pneumonia. Medicare FFS beneficiaries with an index admission to a non-federal hospital are included if they have been enrolled in Part A and Part B Medicare for the 12 months prior to and including the date of the index admission to ensure a full year of administrative data for risk adjustment. (This requirement is dropped for patients with an index admission to a VA hospital.) An index admission is the hospitalization considered for the mortality or readmission outcome. For the mortality measures only, for patients with more than one admission in a given year for a given condition, only one index admission for that condition is randomly selected for inclusion in the cohort.

The measures were developed using Medicare FFS administrative data but are designed for and have been tested for use in all-payer claims datasets.

International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) Codes Defining AMI, Heart Failure, and Pneumonia

The specific ICD-9-CM codes meeting the inclusion criteria for AMI, heart failure, and pneumonia are as follows:

For the AMI measure: 410.00, 410.01, 410.10, 410.11, 410.20, 410.21, 410.30, 410.31, 410.40, 410.41, 410.50, 410.51, 410.60, 410.61, 410.70, 410.71, 410.80, 410.81, 410.90, and 410.91

For the heart failure measure: 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20, 428.21, 428.22, 428.23, 428.30, 428.31, 428.32, 428.33, 428.40, 428.41, 428.42, 428.43, and 428.9

For the pneumonia measure: 480.0, 480.1, 480.2, 480.3, 480.8, 480.9, 481, 482.0, 482.1, 482.2, 482.30, 482.31, 482.32, 482.39, 482.40, 482.41, 482.42, 482.49, 482.81, 482.82, 482.83, 482.84, 482.89, 482.9, 483.0, 483.1, 483.8, 485, 486, 487.0, and 488.11

Exclusion Criteria

Mortality Measures

The AMI, heart failure, and pneumonia mortality measures exclude index admissions for patients:

- Discharged alive on the day of admission or the following day who were not transferred because it is unlikely they had a clinically significant diagnosis of AMI, heart failure, or pneumonia;
- Who were transferred from another acute care hospital or VA hospital (the acute episode is included in the measure but the death is attributed to the hospital where the patient was initially admitted rather than the hospital receiving the transferred patient);
- With inconsistent or unknown vital status or other unreliable data (for example, date of death precedes date of admission);
- Who were enrolled in the Medicare or VA Hospice programs any time in the 12 months prior to the index admission, including the first day of the index admission, as these patients were likely continuing to seek comfort measures only;
- Who were discharged against medical advice (AMA) because providers did not have the opportunity to deliver full care and prepare the patient for discharge; or

- Whose admission was not the first admission in the 30 days prior to a patient's death. This exclusion criterion is applied after one admission per patient per year is randomly selected; thus, it is only applicable to the three-year combined data. Also, the exclusion only happens when two randomly-selected admissions occur during the transition months (June and July for data used in this report) and the patient subsequently dies. For example: a patient is admitted on June 18, 2010, readmitted on July 2, 2010, and dies on July 15, 2010. If both of these admissions are randomly selected for inclusion (one for the July 2009 – June 2010 time period and the other for the July 2010 – June 2011 time period), the July 2, 2010 admission will be excluded to avoid assigning the death to two admissions (one between July 2009 and June 2010, and one between July 2010 and June 2011) [24].

For patients with more than one admission in a given year for a given condition, only one index admission for that condition is randomly selected for inclusion in the cohort.

Readmission Measures

The AMI, heart failure, and pneumonia readmission measures exclude index admissions for patients:

- With an in-hospital death;
- Without at least 30 days post-discharge enrollment in FFS Medicare because the 30-day readmission outcome cannot be assessed in this group. This exclusion applies only to patients who have index admissions in non-VA hospitals;
- Who were transferred to another acute care facility, because the measure evaluates hospitalizations for patients discharged to non-acute care settings; or
- Who were discharged against medical advice (AMA), because providers did not have the opportunity to deliver full care and prepare the patient for discharge.

Readmissions within 30 days of discharge from an index admission will not be considered index admissions. Thus, no hospitalization will be counted as both a readmission and an index admission within the same measure. However, because the cohorts for the readmission measures are determined independently of each other, a readmission in one measure may qualify as an index admission in other CMS readmission measures.

An additional exclusion criterion for the AMI cohort is that patients admitted and then discharged on the same day are not included as an index admission because it is unlikely that these are clinically significant AMIs [25]

B. Hip and Knee Arthroplasty Complication and Readmission

Cohort Definition

The hip/knee complication and readmission measures include admissions for Medicare fee-for-service (FFS) patients aged 65 years and older who were discharged from non-federal acute care hospitals after elective primary total hip arthroplasty and/or total knee arthroplasty, defined by ICD-9 codes 81.51 and 81.54, respectively. Beneficiaries are included if they have been enrolled in Medicare FFS for the 12 months prior to and including the date of the index admission to ensure a full year of administrative data for risk adjustment.

Exclusion Criteria

Complication Measure

In order to identify elective primary arthroplasties, the hip/knee arthroplasty complication measure excludes index admissions for patients:

- With a femur, hip, or pelvic fracture coded in the principal discharge diagnosis field for the index admission

- Undergoing partial hip arthroplasty procedures (with a concurrent hip/knee arthroplasty);
- Undergoing revision procedures (with a concurrent hip/knee arthroplasty);
- Undergoing resurfacing procedures (with a concurrent hip/knee arthroplasty);
- With a mechanical complication coded in the principal discharge diagnosis field;
- With a malignant neoplasm of the pelvis, sacrum, coccyx, lower limbs, or bone/bone marrow or a disseminated malignant neoplasm coded in the principal discharge diagnosis field; or
- With a procedure code for removal of implanted devices/prostheses.

After excluding the above admission, the measure also excludes admissions for patients:

- Who were transferred into the index hospital;
- Who leave the hospital against medical advice (AMA); or
- With more than two THA/TKA procedure codes during the index hospitalization.

After applying the exclusion criteria above, we randomly select one index admission for patients with multiple index admissions in a calendar year. We therefore exclude the other eligible index admission in that year.

For ICD-9 codes defining the measure exclusions and other methodological details, please refer to the Measure Update and Specifications Report [3].

Readmission Measure

The hip/knee arthroplasty readmission measure excludes index admissions for patients:

- With a femur, hip or pelvic facture coded in the principal discharge diagnosis field;
- Undergoing partial hip arthroplasty procedures (with a concurrent hip/knee arthroplasty);
- Undergoing revision procedures (with a concurrent hip/knee arthroplasty);
- Undergoing resurfacing procedures (with a concurrent hip/knee arthroplasty);
- With a mechanical complication coded in the principal discharge diagnosis field;
- With a malignant neoplasm of the pelvis, sacrum, coccyx, lower limbs, or bone/bone marrow or a disseminated malignant neoplasm coded in the principal discharge diagnosis field; or
- With a procedure code for removal of implanted devices/prostheses.

After excluding the above admissions, the measure also excludes admissions for patients:

- Without at least 30 days post-discharge enrollment in Medicare FFS;
- Who were transferred in to the index hospital;
- Who were admitted for the index procedure and subsequently transferred to another acute care facility;
- Who were discharged against medical advice (AMA), because providers did not have the opportunity to deliver full care and prepare the patient for discharge; or
- With an in-hospital death.

Readmissions within 30 days of discharge from an index admission will not be considered index admissions. Thus, no hospitalization will be counted as both a readmission and an index admission within the same measure. Because the cohorts for the readmission measures are determined independently of each other, however, a readmission in this measure may qualify as an index admission in other CMS measures.

For ICD-9 codes defining the measure exclusions and other methodological details, please refer to the Measure Update and Specifications Report [4].

C. Hospital-Wide Readmission

Cohort Definition

The cohort includes hospitalizations for Medicare FFS beneficiaries aged 65 years and older who were hospitalized at a non-federal short-stay acute care hospital or critical access hospital who were not discharged to another acute care hospital and who were alive upon discharge. Beneficiaries are included if they have been enrolled in Part A Medicare for the 12 months prior to and including the date of the index admission to allow for adequate risk adjustment.

Exclusion Criteria

The hospital-wide readmission measure excludes admissions for patients:

- Who were admitted to Prospective Payment System-exempt cancer hospitals, because these hospitals care for a unique population of patients that cannot reasonably be compared to the patients admitted to other hospitals;
- Without at least 30 days post-discharge enrollment in Medicare FFS, because the 30-day readmission outcome cannot be assessed in this group;
- Who were not enrolled in Part A Medicare for the 12 months prior to and including the date of the index admission, which ensures a full year of administrative data for risk adjustment;
- Who were discharged against medical advice (AMA), because providers did not have the opportunity to deliver full care and prepare the patient for discharge;
- Who were admitted for primary psychiatric diagnoses, because these patients are typically cared for in separate psychiatric or rehabilitation centers that are not comparable to acute care hospitals;
- Who were admitted for rehabilitation, because these patients are not typically admitted to an acute care hospital and are not for acute care; or
- Who were admitted for medical treatment of cancer, because these admissions have a very different readmission profile than the rest of the Medicare FFS population, and outcomes for these admissions do not correlate well with outcomes for other admissions [26].

D. Stroke Mortality and Readmission

Cohort Definition

The stroke mortality and readmission measures include admissions for Medicare fee-for-service FFS patients aged 65 years and older at the time of index admission and for whom there were a complete 12 months of FFS enrollment to allow for adequate risk adjustment. The cohort of index admissions in the measure is restricted to admissions for patients with a principal discharge diagnosis of ischemic stroke.

ICD-9-CM Codes Defining Acute Ischemic Stroke

The specific ICD-9-CM codes meeting the inclusion criteria for acute ischemic stroke are as follows: 433.01, 433.11, 433.21, 433.31, 433.81, 433.91, 434.01, 434.11, and 434.91

Exclusion Criteria

Mortality Measure

The stroke mortality measure excludes admissions for patients:

- With a principal diagnosis of stroke during the index hospitalization who arrived in transfer from another acute care facility;

- With inconsistent or unknown mortality status or other unreliable data;
- Enrolled in the Medicare Hospice program any time in the 12 months prior to the index hospitalization, including the first date of the index admission; or
- Who are discharged alive and against medical advice (AMA) [8].

Readmission Measure

The stroke readmission measure excludes admissions for patients:

- With in-hospital deaths;
- With a principal diagnosis of stroke during the index hospitalization and subsequently transferred to another acute care facility;
- Who are discharged AMA; or
- Without at least 30-days post-discharge enrollment in Medicare FFS.

Additional admissions for patients within 30 days of discharge from an index stroke admission are considered potential readmissions and not counted as new index admissions [7].

E. COPD Mortality and Readmission

Cohort Definition

The chronic obstructive pulmonary disease (COPD) mortality and readmission measures include admissions of Medicare fee-for-service (FFS) patients aged 65 years or older at the time of index admission and for whom there was a complete 12 months of FFS enrollment to allow for adequate risk adjustment. The cohort of index admissions included in the measure includes admissions for patients with a principal discharge diagnosis of COPD and those with a principal discharge diagnosis of respiratory failure who had a secondary diagnosis of an acute exacerbation of COPD.

ICD-9-CM Codes Defining COPD Measure Cohort

The specific ICD-9-CM codes meeting the inclusion criteria for the COPD measure cohort are as follows: 491.21, 491.22, 491.8, 491.9, 492.8, 493.20, 493.21, 493.22, 496, 518.81*, 518.82*, 518.84*, 799.1*

*Principal diagnosis when combined with a secondary diagnosis of acute exacerbation of COPD (491.21, 491.22, 493.21, 493.22)

Exclusion Criteria

Mortality Measure

The COPD mortality measure excludes admissions for patients:

- Who arrived in transfer from another acute care facility;
- With inconsistent or unknown mortality status or other unreliable data;
- Enrolled in Medicare Hospice in the 12 months prior to and including the date of the index admission; or
- Who were discharged against medical advice (AMA) [27].

Readmission Measure

The COPD readmission measure excludes admissions for patients:

- With in-hospital deaths;
- Who were transferred to another acute care facility;
- Who are discharged against medical advice (AMA); or
- Without at least 30-days post-discharge enrollment in Medicare FFS.

Additional admissions for COPD within 30 days of discharge from an index COPD admission are considered as potential readmissions and are not counted as new index admissions [28].

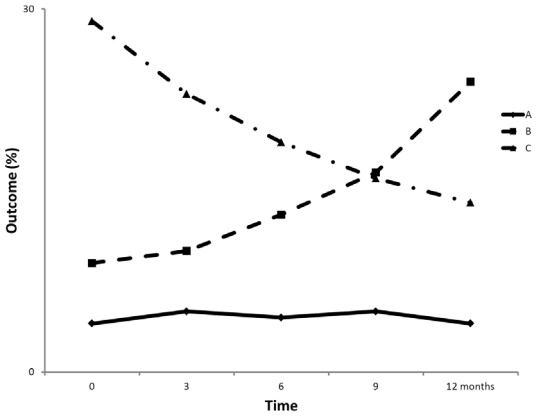
F. Inclusion of Veterans Administration Hospital Patients in Cohorts

Currently, Veterans Health Administration (VA) hospital patients are only included in the publicly reported mortality and readmission measures for acute myocardial infarction (AMI), heart failure, and pneumonia. All Chartbook analyses on the publicly reported measures for AMI, heart failure, and pneumonia include VA patients, with the exception of those analyses examining race and socioeconomic status because this information is not available for VA patients. VA patients are not included in any of the analyses reported for the complication and readmission measures for patients undergoing primary elective total hip and/or knee arthroplasty, the hospital-wide readmission measure, the stroke mortality and readmission measures, or the COPD mortality and readmission measures.

1) American Hospital Association (AHA) Annual Survey Database Fiscal Year 2011. This data was used to determine the overall proportion of Medicaid beneficiaries at each hospital.

2) Medicare Part A Inpatient Claims 2011. This data was used to determine the proportion of African-American Medicare fee-for-service patients at each hospital.

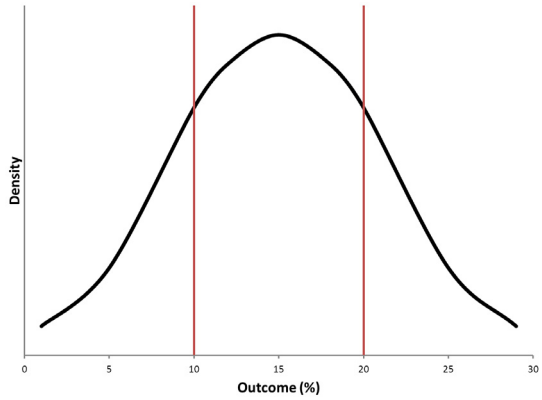
APPENDIX III FIGURE 1. *Example Line Graph*



Line Graphs

A line graph visually represents the relationship between independent and dependent variables. In the *Chartbook*, line graphs are typically used to show how an outcome (mortality/readmission) rate has changed over time. A line graph can illustrate whether the outcome rate is increasing, decreasing, or remaining the same over a given time period. On the example figure above, line A illustrates an outcome that is not changing over time. Line B shows an outcome that starts at a low rate but steadily increases over time. Line C shows an outcome that starts at a high rate but steadily decreases over time.

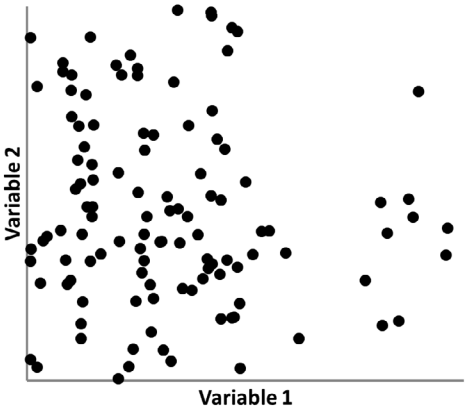
APPENDIX III FIGURE 2. *Example Density Graph*



Density Plots

A density plot shows the estimate of an unobservable underlying probability density function. In Chartbook, we present and interpret the density plots in a similar fashion to histograms. In the example above, the horizontal axis (x-axis) shows the outcome rate and the vertical axis (y-axis) shows the density. If you calculate the area under the curve and between the two lines shown on the figure above, you could estimate the proportion of hospitals that have outcome rates between 10% and 20%. For the outcome shown above, the majority of hospitals had a risk-standardized outcome rate between 5% and 25%.

APPENDIX III FIGURE 3. *Example Scatterplot*



Scatterplots

In a scatterplot, data is displayed as a collection of individual dots. The horizontal position of the dot is determined by the variable along the horizontal axis (x-axis) and the vertical position of the dot is determined by the variable along the vertical axis (y-axis). Scatterplots provide a range of information, but their most useful function is illustrating how the variable on the horizontal axis (x-axis) relates to the variable on the vertical axis (y-axis) across all units of observation. In large datasets, such as the ones used in the *Chartbook*, many dots will be close together and will create areas on the scatterplot where individual dots are indistinguishable, making it difficult to see a relationship between the two variables. The figure above shows that the observations for Variable 2 vary widely, while fewer observations for Variable 1 have high values.

To more broadly identify planned readmissions, CMS contracted with CORE to develop a planned readmission "algorithm" (a set of criteria) for classifying readmissions as planned using Medicare fee-for-service claims [29]. The algorithm identifies admissions that are typically planned and may occur within 30 days of discharge from the hospital.

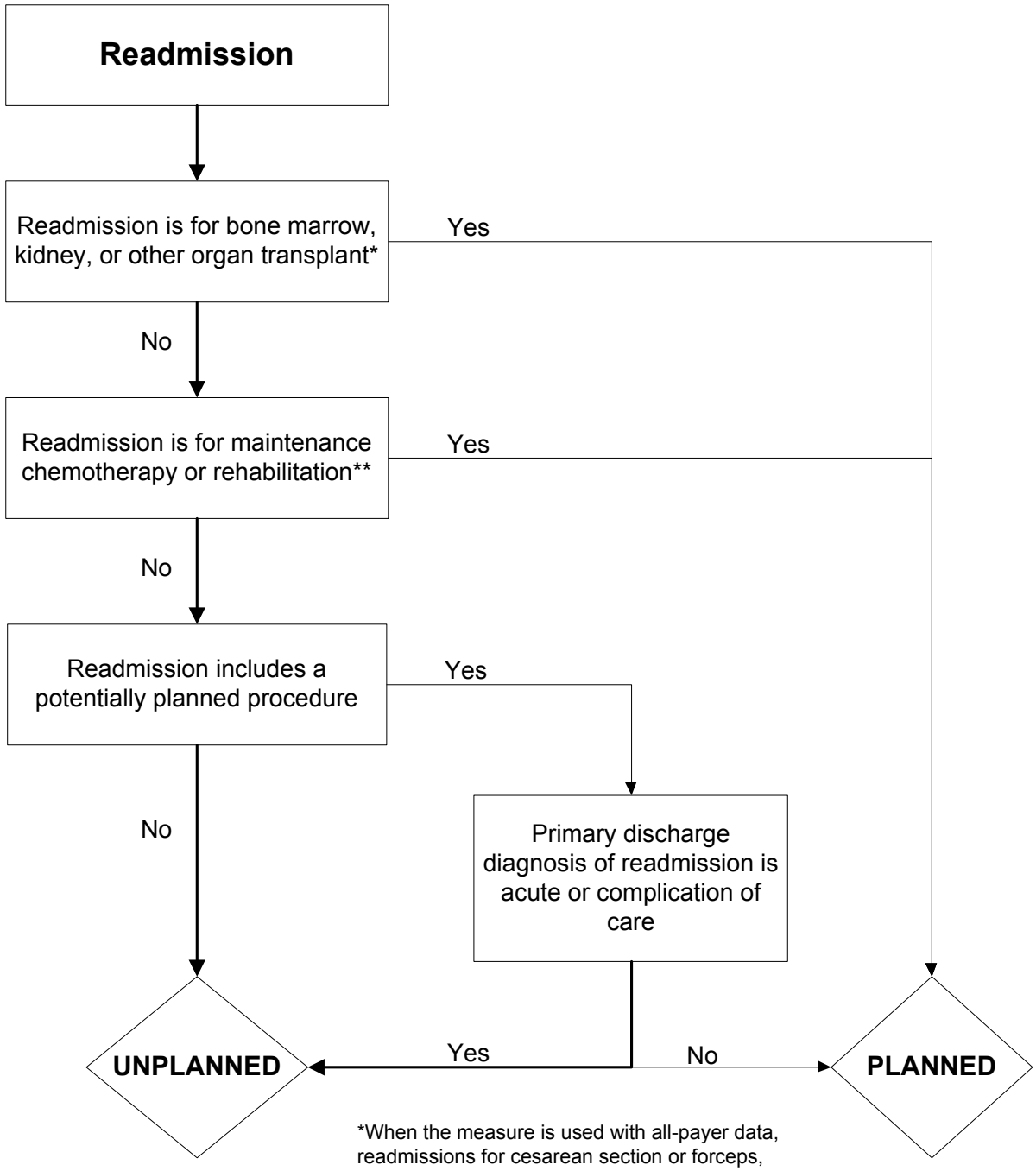
We based the planned readmission algorithm on three principles:

1. A few specific, limited types of care are always considered planned (obstetrical delivery, transplant surgery, maintenance chemotherapy, and rehabilitation);
2. Otherwise, a planned readmission is defined as a non-acute readmission for a scheduled procedure; and
3. Admissions for acute illness or for complications of care are never planned.

In brief, the planned readmission algorithm uses a flow chart (Appendix IV Figure 1) and four tables of specific procedure categories and discharge diagnosis categories to classify readmissions as planned. The algorithm first checks if the readmission had a primary discharge diagnosis that is ALWAYS considered planned, or if the readmission had a procedure for which readmissions are always considered planned. If the readmission does not qualify as always planned, the algorithm then checks if the readmission had a procedure that is considered potentially planned. If not, the readmission is considered unplanned. If the readmission does have a potentially planned procedure, however, the algorithm will do the final check for primary discharge diagnoses that are considered acute. If the potentially planned readmission has an acute primary discharge diagnosis, the readmission is considered unplanned. If the potentially planned readmission does not have an acute primary discharge diagnosis, however, the readmission is considered planned.

The planned readmission algorithm was developed in a hospital-wide cohort of patients and has had extensive public input. Clinicians in our internal working group reviewed the full list of Agency for Healthcare Research and Quality Procedure Clinical Classification Software codes and identified procedure categories that are commonly planned. The initial detailed list of planned readmissions and acute diagnoses was posted as part of two public comment periods for the hospital-wide readmission measure. Subsequently, the algorithm was reviewed by 27 surgical subspecialists nominated by their specialty societies and by hospitals participating in a national dry run (confidential reporting) of two CMS readmission measures (the hospital-wide and total hip or knee arthroplasty readmission measures). In addition, the algorithm has been posted for public comment during National Quality Forum reviews of multiple CMS readmission measures. CMS has revised the algorithm in response to these reviews and is currently using Version 2.1, adapted as appropriate for condition-specific and procedure-specific patient cohorts, in all of its measures.

APPENDIX IV FIGURE 1. *Planned Readmission Algorithm Version 2.1 – Flowchart*



Definition

The geographic distribution of risk-standardized mortality rates (RSMRs) and risk-standardized readmission rates (RSRRs) was reported using the Hospital Referral Region (HRR) for each hospital based on the definition of HRRs produced by the Dartmouth Atlas of Health Care project [30]. HRRs are categorizations of regional market areas for tertiary medical care defined by at least one hospital that performs both major cardiovascular procedures and neurosurgery.

HRR-level risk-standardized mortality/readmission/complication rates were calculated as a weighted average of hospital risk-standardized rate with each HRR, with the inverse of the variance of hospital risk-standardized rate as the weight. The variance of each hospital risk-standardized rate is estimated using the bootstrap simulation results. To further categorize at the HRR level, we ran a linear mixed-effect model using the HRR risk-standardized rate as the dependent variable, and HRR as the unit for the random intercept with no other covariates. If the random effect estimate of the HRR is less than or greater than zero and the corresponding t-test p-value is less than 0.05, then we categorize the HRR as "better" or "worse" performing depending on the directionality of the estimate; otherwise we categorize the HRR as "average performing."

Combined Geographic Variation Maps (pages 24 and 25) Score Calculation and Supplemental Data

Utilizing the above HRR measure methodology and to provide summary information regarding HRR-level performance variation across measures, we created combined maps for the acute myocardial infarction (AMI), heart failure, and pneumonia mortality measures and, separately, for the AMI, heart failure, pneumonia and hip/knee arthroplasty readmission measures. For each measure that a HRR was classified as "worse" it received a score of "1," "average" received a score of "2," and "better" a score of "3."

For each HRR, we summarize the scores it received for each measure. For example, if an HRR was "better performing" on AMI and heart failure mortality, and "average performing" on pneumonia mortality, the HRR received a combined score of 8 (3+3+2). Based on the combined score, we categorized HRRs as "well performing," "moderately well performing," "average performing," "moderately poor performing," and "poor performing" (Appendix V Table 1.).

APPENDIX V TABLE 1. *HHR Combined Score Classification*

HRR classification – based on combined score	Mortality (HF/AMI/PN*) combined score (minimum = 3)	Readmission (HF/AMI/PN/HK*) combined score (minimum = 4)
Poor performing	3 or 4	4 or 5
Moderately poor performing	5	6 or 7
Average performing	6	8
Moderately well performing	7	9 or 10
Well performing	8 or 9	11 or 12

*HF = heart failure; PN = pneumonia; HK = hip/knee arthroplasty

Hospital Referral Region (HHR) Scores

Appendix V Tables 2 and 3 show all possible combinations to get each HRR combined score for mortality and readmission, respectively. The numerical pattern must be present to achieve the combined score; however, any measure may be assigned any score contained in the pattern. For example, to achieve a combined score of 4 in the mortality measures calculation, at least one measure must have a score of 2 and two measures must have a score of 1.

Measure 1 or Measure 2 may have a score of 2, however, rather than Measure 3.

APPENDIX V TABLE 2. *Possible Score Combinations for AMI, Heart Failure and Pneumonia Mortality*

Combined Score	Measure 1	Measure 2	Measure 3	Number of HRRs with combination
3	1	1	1	2
4	1	1	2	6
5	1	1	3	0
	1	2	2	27
6	1	2	3	0
	2	2	2	234
7	1	3	3	0
	2	2	3	20
8	2	3	3	9
9	3	3	3	8

APPENDIX V TABLE 3. *Possible Score Combinations for AMI, Heart Failure, Pneumonia and Hip/Knee Readmission*

Combined Score	Measure 1	Measure 2	Measure 3	Measure 4	Number of HRRs with combination
4	1	1	1	1	8
5	1	1	1	2	12
6	1	1	2	2	12
	1	1	1	3	0
7	1	2	2	2	38
	1	1	2	3	0
8	2	2	2	2	165
	1	2	2	3	1
	1	1	3	3	0
9	1	2	3	3	1
	2	2	2	3	50
10	1	3	3	3	0
	2	2	3	3	12
11	2	3	3	3	6
12	3	3	3	3	1

Return-to-Hospital Visits

Median and range of Readmission, ED Visits, and Observation stay rates for Acute Myocardial Infarction (AMI), Heart Failure, and Pneumonia.

APPENDIX VI TABLE 1. *Return-to-Hospital Rates for AMI*

This table corresponds to Figure A.2.17 (page 54) in the main text.

Median (Range) of Return-to-Hospital Rates for AMI (%)

	July-Dec 2009	Jan-Jun 2010	July-Dec 2010	Jan-Jun 2011	July-Dec 2011	Jan-Jun 2012
Readmission	17.7	17.9	17.8	18.0	17.2	16.8
	(0-61.3)	(0-41.5)	(0-48.1)	(0-52.0)	(0-40.0)	(0-40.6)
ED Visits	7.7	7.9	7.7	7.8	7.9	8.0
	(0-24.2)	(0-26.4)	(0-29.4)	(0-27.0)	(0-28.6)	(0-29.0)
Observation Stays	1.2	1.4	1.5	1.7	1.8	1.8
	(0-12)	(0-17.2)	(0-13.9)	(0-15.4)	(0-16.1)	(0-17.8)

APPENDIX VI TABLE 2. *Return to Hospital Rates for Heart Failure*

This table corresponds to Figure A.2.19 (page 56) in the main text.

Median (Range) of Return-to-Hospital Rates for Heart Failure (%)

	July-Dec 2009	Jan-Jun 2010	July-Dec 2010	Jan-Jun 2011	July-Dec 2011	Jan-Jun 2012
Readmission	23.4	23.1	23.5	22.7	22.8	22.0
	(0-56.6)	(0-53.6)	(3.2-52.0)	(2.1-60.6)	(0-53.8)	(0-48.1)
ED Visits	6.9	7.1	7.1	7.3	7.3	7.4
	(0-26.7)	(0-36.4)	(0-30.8)	(0-29.2)	(0-32.1)	(0-28.6)
Observation Stays	0.5	0.7	0.9	0.9	1.1	1.2
	(0-15.2)	(0-13.3)	(0-11.8)	(0-15.2)	(0-17.2)	(0-15.6)

APPENDIX VI TABLE 3. *Return to Hospital Rates for Pneumonia*

This table corresponds to Figure A.2.21 (page 58) in the main text.

Median (Range) of Return-to-Hospital Rates for Pneumonia (%)

	July-Dec 2009	Jan-Jun 2010	July-Dec 2010	Jan-Jun 2011	July-Dec 2011	Jan-Jun 2012
Readmission	17.9	17.1	17.9	16.9	17.6	16.4
	(0-53.8)	(0-42.9)	(0-50.0)	(0-44.8)	(0-45.5)	(0-41.9)
ED Visits	6.7	6.6	6.9	6.9	7.0	7.1
	(0-30.0)	(0-30.8)	(0-34.6)	(0-33.3)	(0-28.0)	(0-28.0)
Observation Stays	0.0	0.0	0.0	0.0	0.0	0.0
	(0-13.8)	(0-19.2)	(0-16.7)	(0-11.5)	(0-12.3)	(0-13.2)

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