

**2014 Measure Updates and Specifications Report**  
**Hospital-Wide All-Cause Unplanned Readmission – Version 3.0**

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**Prepared For:**

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## 1. HOW TO USE THIS REPORT

This report describes the Centers for Medicare & Medicaid Services' (CMS) hospital-wide readmission (HWR) measure used in the Hospital Inpatient Quality Reporting (IQR) program and publicly reported on [\*Hospital Compare\*](#). This report provides a single source of information about this measure for a wide range of readers. Reports describing condition-specific readmission outcomes, condition-specific mortality outcomes, and procedure-based outcome measures can be found on [\*QualityNet\*](#).

This report provides an overview of the measure methodology, methodology updates for 2014 public reporting, and the national results for 2014 public reporting. The appendices detail specifications for the measure, including concise tables of measure specifications and a history of annual updates.

Specifically, the report includes:

- **Section 2 - An overview of the HWR measure:**
  - Background
  - [Cohort](#)
    - included and excluded hospitalizations
    - how transferred patients are handled
    - [specialty cohort](#) assignment
  - Unplanned readmission [outcome](#)
  - Risk-adjustment specifications
  - Data sources
  - Readmission rate calculation
  - Categorization of hospitals' performance score
- **Section 3 - 2014 measure updates:**
  - The most significant updates for 2014 reporting are refinements to the planned readmission algorithm that identify planned readmissions.
- **Section 4 - 2014 measure results:**
  - Results from the models that are used for the Hospital IQR program in 2014.
- **Section 5 - Glossary**

The Appendices contain detailed measure information, including

- [Appendix A](#): Statistical approach to risk-standardized readmission rates (RSRRs);
- [Appendix B](#): Data quality assurance;
- [Appendix C](#): Annual updates to the measure since measure development;
- [Appendix D](#): Measure specifications; and
- [Appendix E](#): Detailed overview of the planned readmission algorithm.

For additional references, the original measure methodology report and the 2013 updates and specifications report are available on the claims-based readmission measure page of [QualityNet](#):

- Hospital-Wide All-Cause Unplanned Readmission Measure: Final Technical Report (2011) <sup>1</sup>
- 2013 Measure Updates and Specifications Report: Hospital-Wide All-Cause Unplanned Readmission Measure<sup>2</sup>

## 2. BACKGROUND AND OVERVIEW OF MEASURE METHODOLOGY

### 2.1 Background on HWR Measure

In July 2009, CMS began publicly reporting hospital 30-day risk-standardized readmission rates (RSRR) for acute myocardial infarction (AMI), heart failure (HF), and pneumonia for the nation's non-federal\* acute care hospitals, including critical access hospitals. To provide a broader assessment of the quality of care at hospitals, CMS developed the Hospital-Wide All-Cause Unplanned Readmission Measure (HWR measure), a claims-based, risk-adjusted hospital-wide readmission measure for public reporting that reflects the quality of care for hospitalized patients in the U.S. CMS added the HWR measure, which it updates annually, to the IQR program and began publicly reporting the measure on *Hospital Compare* in 2013.

CMS contracted with the Yale-New Haven Health Services Corporation/Center for Outcomes Research & Evaluation (CORE) to update the 30-day HWR measure for 2014 public reporting through a process of measure reevaluation. Measures are reevaluated annually to improve them by responding to stakeholder input and incorporating advances in the science or changes in coding.

### 2.2 Overview of Measure Methodology

The 2014 risk-adjusted HWR measure uses specifications from the initial measure methodology report<sup>1</sup> with slight refinements to the measure, as listed in [Appendix C](#) and described in the prior measure updates and specifications report.<sup>2</sup> The National Quality Forum (NQF) endorses the HWR measure. An overview of the methodology is provided in this section.

#### 2.2.1 Cohort

##### Index Admissions Included in Measure

An index admission is the hospitalization to which the readmission outcome is attributed and includes admissions for patients:

- Enrolled in Medicare fee-for-service (FFS)\*;
- Aged 65 or over;
- Discharged from non-federal acute care hospitals;
- Without an in-hospital death;
- Not transferred to another acute care facility; and,
- Enrolled in Part A Medicare for the 12 months prior to the date of the index admission.

See [Table D.2](#), [Table D.4](#), [Table D.5](#), [Table D.6](#), and [Table D.7](#) in [Appendix D](#) for specific diagnosis and procedure Agency for Healthcare Research and Quality (AHRQ) Clinical Classification Software (CCS) categories included in the measure.

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\* Includes Indian Health Services hospitals



### Index Admissions Excluded from the Measure<sup>†</sup>

This measure excludes index admissions for patients:

- Admitted to Prospective Payment System (PPS)-exempt cancer hospitals;
- Without at least 30 days post-discharge enrollment in FFS Medicare;
- Discharged against medical advice (AMA);
- Admitted for primary psychiatric diagnoses;
- Admitted for rehabilitation; or,
- Admitted for medical treatment of cancer.

See [Table D.1](#) and [Table D.3](#) in [Appendix D](#) for specific AHRQ CCS categories excluded from the measure. The number of admissions excluded based on each criterion is shown in [Section 4](#) in [Figure 4.2.1](#).

### Patients Transferred Between Hospitals

The measure considers multiple contiguous admissions to two different hospitals as a single acute episode of care. Admissions to a hospital within one day of discharge from another hospital are considered transfers, whether or not the first institution indicates intent to transfer the patient in the discharge disposition code.

Readmissions for transferred patients are attributed to the hospital that ultimately discharges the patient to a non-acute care setting (e.g., to home or a skilled nursing facility). Thus, if a patient is admitted to Hospital A, transferred to Hospital B, and ultimately discharged from Hospital B to a non-acute care setting, a readmission within 30 days of discharge to any acute care hospital is attributed to Hospital B.

If a patient is readmitted to the same hospital on the same day of discharge for the same diagnosis as the index admission, the measure considers the patient to have had one single continuous admission. However, if the second admission has a diagnosis that differs from the index admission it is considered a readmission.

### Specialty Cohort Assignment

Each admission is assigned to one of five mutually exclusive specialty cohorts: medicine, surgery/gynecology, cardiorespiratory, cardiovascular, and neurology. The cohorts reflect how care for patients is organized within hospitals. To assign admissions to cohorts, admissions are first screened for the presence of an eligible surgical procedure category. Admissions with an eligible surgical procedure category are assigned to the surgical cohort, regardless of the principal discharge diagnosis code of the admission. All remaining admissions are assigned to cohorts based on the CCS condition category of

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<sup>†</sup> As a part of data processing prior to the measure calculation, records are removed for non-short-term acute care facilities such as psychiatric facilities, rehabilitation facilities, or long-term care hospitals. Additional data-cleaning steps include removing claims with stays longer than one year and with overlapping dates and records for providers with invalid provider IDs.

the principal discharge diagnosis. See [Appendix D](#) for more information on the assignment of patients to specialty cohort groups.

## **2.2.2 Outcome**

### All-Cause Unplanned Readmissions

The measure counts all unplanned readmissions and is designed to capture readmissions that arise from acute clinical events requiring urgent rehospitalization within 30 days of discharge. Planned readmissions, which are generally not a signal of quality of care, are not counted. For details about how planned readmissions are defined, refer to [Section 2.2.3](#) and [Appendix E](#).

There are a number of reasons for counting unplanned readmissions for all causes in the CMS readmission measures. First, from a patient perspective, an unplanned readmission for any cause is an adverse event. In addition, making inferences about quality issues and accountability based solely on the documented cause of readmission is difficult. For example, a patient with HF who develops a hospital-acquired infection may ultimately be readmitted for sepsis. In this context, considering the readmission as unrelated to the care the patient received for HF during the index admission would be inappropriate.

### 30-Day Time Frame

The measure assesses unplanned readmissions within a 30-day period from the date of discharge from an index admission. The measure uses a 30-day time frame because outcomes occurring within 30 days of discharge can be influenced by hospital care and early transition to the outpatient setting. The 30-day time frame is a clinically meaningful period for hospitals to collaborate with their communities to reduce readmissions.<sup>1</sup>

### Multiple Readmissions

A readmission is also included as an index admission if it meets all other eligibility criteria. This differs from the publicly reported AMI, HF, pneumonia and hip/knee readmission measures, which do not count readmissions as a new index admission within the same measure. However, if the first readmission after discharge is planned, any subsequent unplanned readmission is not counted as an outcome for that index admission because the unplanned readmission could be related to care provided during the intervening planned readmission rather than during the index admission.

## **2.2.3 Planned Readmission Algorithm**

The planned readmission algorithm is a set of criteria for classifying readmissions as planned among the general Medicare population using Medicare administrative claims data. The algorithm identifies admissions that are typically planned and may occur within 30 days of discharge from the hospital.

The planned readmission algorithm has three fundamental principles:

1. A few specific, limited types of care are always considered planned (transplant surgery, maintenance chemotherapy/radiotherapy/ immunotherapy, 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.

The algorithm was developed in 2011 as part of the HWR measure, and in 2013, CMS applied the algorithm to its other readmission measures. The planned readmission algorithm uses a flowchart and four tables of specific procedure categories and discharge diagnosis categories to classify readmissions as planned ([Appendix E](#)). As [Figure PR1](#) illustrates, readmissions are considered planned if any of the following occurs during the readmission:

1. A procedure is performed that is in one of the procedure categories that are always planned regardless of diagnosis;
2. The principal diagnosis is in one of the diagnosis categories that are always planned; or
3. A procedure is performed that is in one of the potentially planned procedure categories and the principal diagnosis is not in the list of acute discharge diagnoses.

#### **2.2.4 Risk-Adjustment Variables**

The measure adjusts for variables (i.e., age, principal discharge diagnosis, and comorbid diseases) that are clinically relevant and have strong relationships with the outcome. The measure adjusts for the principal diagnosis of the index admission (grouped into condition categories) to account for differences in service mix among hospitals. The principal discharge diagnoses used for risk-adjustment are the same as those used to group admissions into each specialty cohort ([Table D.4](#), [Table D.5](#), [Table D.6](#), and [Table D.7](#)), with the exception of the surgical cohort, which is based on procedure categories. [Table D.8](#) lists the principal discharge diagnoses used for risk-adjustment of the surgical cohort. The measure also adjusts for case mix differences among hospitals based on comorbid conditions of the patient at the time of the index admission. Data about comorbid conditions are obtained from inpatient Medicare administrative claims extending 12 months prior to, and including, the index admission. Only comorbidities that convey information about the patient at that time or in the 12 months prior, and not complications that arise during the course of the hospitalization, are included in the risk adjustment. Refer to [Table D.9](#) for the list of comorbidity risk-adjustment variables common to each specialty cohort and [Table D.10](#) for the list of complications that are excluded from risk adjustment if occurring during the index admission.

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

The measure also does not adjust for socioeconomic status (SES) because the association between SES and health outcomes can be due, in part, to differences in the quality of healthcare patients with varying SES receive. Risk adjusting for SES could also mask important disparities and minimize incentives to improve outcomes for vulnerable populations. The intent is for the measure to adjust for age and clinical characteristics while illuminating important quality differences. Additionally, recent analyses show that hospitals caring for high proportions of low SES patients perform similarly on the measure to hospitals caring for low proportions of low SES patients.<sup>3</sup>

#### 2.2.5 Data Sources

The data sources for these analyses are Medicare administrative claims data and enrollment information for patients with hospitalizations between July 1, 2012, and June 30, 2013. To make it feasible to implement with Medicare data, the HWR risk-adjustment models use only inpatient claims data for the 12 months prior to the index admission and one month subsequent to the index admission for patients admitted in this time period. The impact of not including outpatient data (Part B) on model performance has been studied for six publicly reported outcome measures (AMI, HF, and pneumonia 30-day risk-standardized mortality and readmission rates) and the results reported in a separate memo to CMS.<sup>4</sup> See the original methodology report for further descriptions of these data sources.<sup>1</sup>

#### 2.2.6 Measure Calculation

The measure estimates hospital-level 30-day all-cause RSRRs using hierarchical logistic regression models. In brief, the approach simultaneously models data at the patient and hospital levels to account for variance in patient outcomes within and between hospitals.<sup>5</sup> At the patient level, it models the log-odds of hospital readmission within 30 days of discharge using age, selected clinical covariates, and a hospital-specific intercept. At the hospital level, it models the hospital-specific intercepts as arising from a normal distribution. The hospital intercept represents the underlying risk of a readmission at the hospital, after accounting for patient risk. The hospital-specific intercepts are given a distribution to account for the clustering (non-independence) of patients within the same hospital.<sup>5</sup> If there were no differences among hospitals, then after adjusting for patient risk, the hospital intercepts should be identical across all hospitals.

Admissions are assigned to one of five mutually exclusive specialty cohort groups consisting of related conditions or procedures. For each specialty cohort group, CMS calculates a standardized readmission ratio (SRR), the ratio of the number of “predicted” readmissions to the number of “expected” readmissions. For each hospital, the numerator of the SRR is the number of readmissions within 30 days predicted based on the hospital’s performance with its observed case mix and service mix. The denominator is the number of readmissions expected based on the nation’s performance with that hospital’s case mix and service mix, an approach analogous to a ratio of “observed” to “expected” used in other types of statistical analyses. Thus, an SRR of less than one indicates a lower-than-expected readmission rate (or better quality), while a ratio of greater than one indicates a higher-than-expected readmission rate (or worse quality).

For each specialty cohort, the number of “predicted” readmissions (the numerator) is calculated using the coefficients estimated by regressing the risk factors (found in [Appendix D](#)) and the hospital-specific intercept on the risk of readmission. The estimated hospital-specific intercept for each cohort is added to the sum of the estimated regression coefficients multiplied by patient characteristics. The results are transformed and summed over all patients attributed to a hospital to get a predicted value. The “expected” number of readmissions (the denominator) is obtained in the same manner, but a common intercept using all hospitals in our sample is added in place of the hospital-specific intercept. The results are transformed and summed over all patients in the hospital to get an expected value. To assess hospital performance for each reporting period, we re-estimate the model coefficients using the data in that period.

The specialty cohort SRRs are then pooled for each hospital using a volume-weighted geometric mean to create a hospital-wide composite SRR. The composite SRR is multiplied by the national observed readmission rate to produce the RSRR. For more details, the statistical modeling approach is described fully in [Appendix A](#) and the original methodology report.<sup>1</sup>

### **2.2.7 Categorizing Hospital Performance**

To categorize hospital performance, CMS estimates each hospital’s RSRR and the corresponding 95% [interval estimate](#). CMS assigns hospitals to a performance category by comparing each hospital’s RSRR interval estimate to the [national observed readmission rate](#). Comparative performance for hospitals with 25 or more eligible cases is classified as follows:

- “No different than U.S. national rate” if the 95% interval estimate surrounding the hospital’s rate includes the national observed readmission rate.
- “Worse than U.S. national rate” if the entire 95% interval estimate surrounding the hospital’s rate is higher than the national observed readmission rate.
- “Better than U.S. national rate” if the entire 95% interval estimate surrounding the hospital’s rate is lower than the national observed readmission rate.

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

[Section 4](#) describes the distribution of hospitals by performance category in the U.S. for this reporting period.

### 3. UPDATES TO MEASURE FOR 2014 PUBLIC REPORTING

#### 3.1 Rationale for Measure Updates

Measure reevaluation ensures that the risk-standardized readmission models are continually assessed and remain valid, given possible changes in the data over time, and allows for model refinements. As this report describes, for 2014 public reporting, we undertook the following measure reevaluation activities<sup>‡</sup>:

- Updated the planned readmission algorithm based on findings from a validation study;
- Updated the AHRQ CCS to the 2013 version;
- Evaluated and validated model performance in the July 2012-June 2013 dataset; and
- Updated the measure SAS analytic package and documentation.

#### 3.2 Detailed Discussion of Measure Updates

##### 3.2.1 Update to Version 3.0 of Planned Readmission Algorithm

The planned readmission algorithm version 3.0 was modified slightly from version 2.1 for 2014 public reporting. Version 3.0 incorporates improvements made following a validation study of the algorithm using data from a medical record review of 634 charts at seven hospitals.

The validation study revealed two potentially planned procedure categories for which accuracy was sufficiently low that they can be removed from the algorithm without inadvertently reinstating many planned readmissions into the outcome: CCS 211 – Therapeutic Radiation and CCS 224 – Cancer Chemotherapy. Version 3.0 removes these procedures from the list of potentially planned procedures ([Table PR3](#)).

Similarly, the validation study identified one diagnosis category most often associated with unplanned readmissions that was misclassifying those readmissions as planned. For this reason, CCS 99 – Hypertension with Complications has been added to the acute diagnosis list ([Table PR4](#)) in version 3.0.

Finally, the validation study identified two condition categories that are not considered acute but that contain ICD-9 codes for acute diagnoses. Version 3.0 adds the acute ICD-9 codes from CCS 149 – Biliary Tract Disease and CCS 152 – Pancreatic Disorders to the acute diagnosis list ([Table PR4](#)) to reduce the misclassification of unplanned readmissions as planned.

These changes improve the accuracy of the algorithm by decreasing the number of readmissions the algorithm mistakenly designated as planned. Full descriptions of the

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<sup>‡</sup> The Condition Category Groups (CC) of ICD-9-CM codes were not updated this year due to the upcoming transition to International Statistical Classification of Diseases and Related Health Problems 10<sup>th</sup> Revision (ICD-10).

rationale for each change are listed in [Table 3.2.1](#). The full list of codes in version 3.0 of the planned readmission algorithm is located in [Appendix E](#).

**Table 3.2.1 – Updates to Planned Readmission Algorithm Version 2.1**

Action	Diagnosis or procedure category	Rationale
Remove from planned procedure list	Therapeutic radiation (CCS 211)	Typically, patients do not require admission for scheduled radiation treatment. Our validation study revealed that when this procedure occurs in the inpatient setting it is usually in the context of an unplanned admission. Removal of this procedure category from the potentially planned procedure list reduces the rate of misclassification of unplanned readmissions as planned.
	Cancer chemotherapy (CCS 224)	Planned admissions for chemotherapy are typically associated with a principal diagnosis of Maintenance Chemotherapy, which is always considered planned. By contrast, readmissions in which the procedure cancer chemotherapy (CCS 224) occurs without the principal diagnosis of Maintenance Chemotherapy are typically unplanned. Removal of this procedure category from the potentially planned procedure list therefore reduces the rate of misclassification of unplanned readmissions as planned.
Add to acute diagnosis list	Hypertension with complications (CCS 99)	Our validation study revealed that this diagnosis category is rarely associated with planned readmissions. The addition of this diagnosis category to the acute diagnosis list reduces the misclassification of unplanned readmissions as planned.
	Acute pancreatitis (ICD-9 577.0)	Clinically there is no situation in which a planned procedure would reasonably be performed for acute pancreatitis. The addition of this ICD-9 code to the acute diagnosis list reduces the misclassification of unplanned readmissions as planned.
	Biliary tract disease (CCS 149) <i>Acute ICD-9 codes only</i>	CCS 149 (biliary tract disease) is a mix of acute and chronic diagnoses. Separating out the acute and non-acute diagnoses will increase the accuracy of the algorithm while still ensuring that planned cholecystectomies and other procedures can be identified.

#### Effect on the Measure

The impact of updating to version 3.0 of the planned readmission algorithm on the HWR measure (July 1, 2011-June 30, 2012) is summarized in [Table 3.2.2](#).

**Table 3.2.2 – Effect of Planned Readmission Algorithm on HWR Measure**

	HWR with Planned Readmission Version 3.0	HWR with Planned Readmission Version 2.1
Number of Admissions	6,918,467	6,918,467
Number of Unplanned Readmissions	1,112,885	1,105,378
Unplanned Readmission Rate	16.1%	16.0%
Number of Planned Readmissions	85,673	93,180
Planned Readmission Rate	1.2%	1.3%
% of Readmissions that are Planned	7.1%	7.8%

### 3.3 Changes to SAS Analytic Package

We revised the measure calculation SAS analytic package to incorporate the new planned readmission algorithm version 3.0. The new SAS analytic package and documentation are available upon request by emailing [cmsreadmissionmeasures@yale.edu](mailto:cmsreadmissionmeasures@yale.edu). **Do NOT submit patient-identifiable information (e.g., date of birth, Social Security number, health insurance claim number, etc.) to this address.**



## 4. RESULTS FOR 2014 PUBLIC REPORTING

### 4.1 Assessment of Updated Models

The HWR measure estimates hospital-specific 30-day all-cause RSRRs using hierarchical logistic regression models. See [Section 2](#) for a summary of the measure methodology and model risk-adjustment variables. Refer to the prior technical report for further details.<sup>2</sup>

We evaluated the performance of the models, provided national results using the data for 2014 reporting, and fitted the updated models to the July 1, 2012-June 30, 2013 dataset. We examined trends in the frequency of patient risk factors and the model variable coefficients and compared the model performance among these datasets.

We assessed logistic regression and hierarchical logistic regression model performance in terms of discriminant ability for each specialty cohort. We computed two summary statistics for assessing model performance: the predictive ability and the area under the receiver operating characteristic (ROC) curve (c-statistic). The c-statistic is an indicator of the model's discriminant ability or ability to correctly classify those who have and have not been readmitted within 30 days of discharge. Potential values range from 0.5, meaning no better than chance, to 1.0, meaning perfect discrimination.

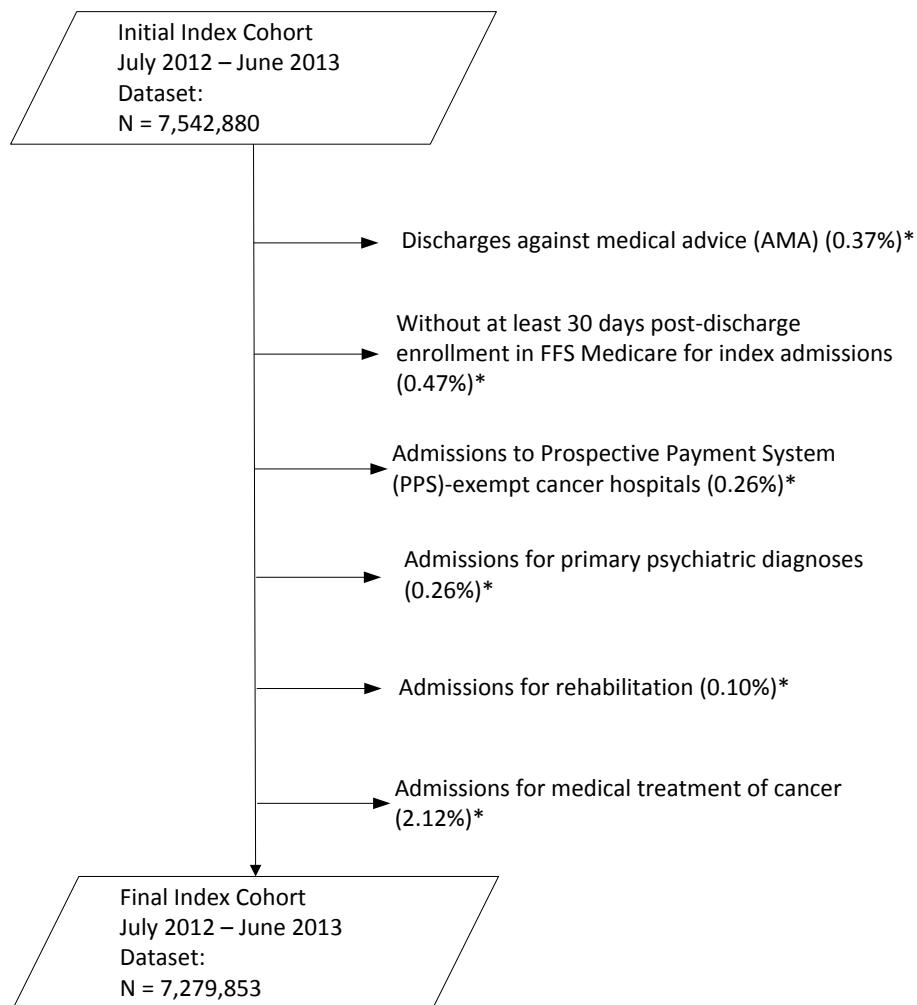
The results of these analyses are presented in [Section 4.2](#).

## 4.2 HWR 2014 Model Results

### 4.2.1 Index Cohort Exclusions

The exclusion criteria for the measure are presented in [Section 2.2.1](#). The percentage of patients meeting each exclusion criterion in the July 2012-June 2013 dataset is presented in [Figure 4.2.1](#).

**Figure 4.2.1 – Index Cohort Sample in the July 2012-June 2013 Dataset**



The index cohort includes Medicare FFS patients aged 65 or older; enrolled in Part A Medicare for the 12 months prior to the date of admission and during the index admission; who were not transferred to another acute care facility; and were alive at discharge.

\* These categories are not mutually exclusive

#### 4.2.2 HWR Specialty Cohort Model Parameters and Performance

Table 4.2.1, Table 4.2.2, Table 4.2.3, Table 4.2.4, and Table 4.2.5 show the specialty cohort-level frequency of risk factors, risk-adjusted odds ratios (ORs) with 95% confidence intervals (CIs), and model coefficients for the July 1, 2012-June 30, 2013 data sample. Table 4.2.6 presents the cohort-level model performance. Table 4.2.7 presents the number of index hospitalizations and observed readmission rates for each specialty cohort.

#### 4.2.3 Distribution of Hospital SRRs and RSRRs

Table 4.2.8 shows the number of hospitals with at least one admission in each specialty cohort, the mean and median national observed readmission rates, and the mean and median standardized readmission ratios (SRR) for each specialty cohort. Table 4.2.9 shows the distribution of hospital-level observed rates and RSRRs. The median hospital RSRR in the dataset was 15.5% (IQR 11.0% - 21.4%). Figure 4.2.2 shows the overall distribution of the hospital RSRRs for the combined dataset.

#### 4.2.4 Distribution of Hospitals by Performance Category

Of 4,794 hospitals in the study cohort, 277 performed “better than the U.S. national rate,” 4,002 performed “no different from the U.S. national rate,” and 372 performed “worse than the U.S. national rate.” 143 were classified as “number of cases too small” (fewer than 25) to reliably tell how well the hospital is performing.

**Table 4.2.1 – Medicine Specialty Cohort Hierarchical Logistic Regression Model Risk Factor Frequencies, Odds Ratios, and Model Coefficients (July 2012-June 2013)**

Risk Variable (CCs)	% of hospitalizations with this risk variable	OR (95% CI)	Model Coefficients
Age – 65	N/A	1.00 (1.00-1.00)	0.002 (0.000)
Metastatic cancer/acute leukemia (CC 7)	4.13	1.30 (1.28-1.32)	0.265 (0.008)
Severe Cancer (CC 8, 9)	6.37	1.30 (1.28-1.31)	0.259 (0.006)
Other cancers (CC 10-12)	9.66	1.07 (1.06-1.09)	0.072 (0.005)
Severe hematological disorders (CC 44)	1.60	1.37 (1.34-1.40)	0.315 (0.011)
Coagulation defects and other specified hematological disorders (CC 46)	7.67	1.08 (1.07-1.09)	0.075 (0.005)
Iron deficiency or other unspecified anemias and blood disease (CC 47)	51.35	1.22 (1.21-1.23)	0.198 (0.004)
End-stage liver disease (CC 25, 26)	3.04	1.32 (1.30-1.34)	0.276 (0.009)
Pancreatic disease (CC 32)	3.06	1.14 (1.12-1.16)	0.128 (0.008)
Dialysis status (CC 130)	2.87	1.32 (1.30-1.35)	0.280 (0.008)
Acute renal failure (CC 131)	26.65	1.14 (1.13-1.14)	0.127 (0.004)
Transplants (CC 128, 174)	0.89	1.23 (1.19-1.26)	0.205 (0.014)
Severe Infection (CC 1, 3-5)	1.77	1.13 (1.10-1.15)	0.119 (0.010)

Risk Variable (CCs)	% of hospitalizations with this risk variable	OR (95% CI)	Model Coefficients
Other infectious disease & pneumonias (CC 6, 111-113)	29.12	1.12 (1.11-1.13)	0.112 (0.004)
Septicemia/shock (CC 2)	8.79	1.04 (1.03-1.05)	0.041 (0.005)
CHF (CC 80)	22.08	1.18 (1.17-1.19)	0.163 (0.004)
Coronary atherosclerosis or angina, cerebrovascular disease (CC 81-84, 89, 98, 99, 103-106)	59.37	1.14 (1.14-1.15)	0.134 (0.004)
Specified arrhythmias (CC 92, 93)	24.55	1.10 (1.09-1.10)	0.092 (0.004)
Cardiorespiratory failure or cardiorespiratory shock (CC 79)	11.48	1.08 (1.07-1.09)	0.079 (0.005)
Coronary obstructive pulmonary disease (COPD) (CC 108)	26.68	1.18 (1.17-1.19)	0.167 (0.004)
Fibrosis of lung or other chronic lung disorders (CC 109)	3.51	1.11 (1.09-1.13)	0.105 (0.008)
Protein-calorie malnutrition (CC 21)	13.31	1.15 (1.14-1.16)	0.136 (0.005)
Disorders of fluid, electrolyte, acid-base (CC 22, 23)	35.18	1.18 (1.18-1.19)	0.169 (0.004)
Rheumatoid arthritis and inflammatory connective tissue disease (CC 38)	5.76	1.12 (1.10-1.13)	0.112 (0.006)
Diabetes mellitus (CC 15-20, 119, 120)	38.23	1.12 (1.11-1.13)	0.111 (0.003)
Decubitus ulcer or chronic skin ulcer (CC 148, 149)	8.21	1.10 (1.09-1.11)	0.097 (0.005)
Hemiplegia, paraplegia, paralysis, functional disability (CC 67-69, 100-102, 177, 178)	6.74	1.08 (1.06-1.09)	0.074 (0.006)
Seizure disorders and convulsions (CC 74)	5.13	1.08 (1.07-1.10)	0.078 (0.007)
Respirator dependence/tracheostomy status (CC 77)	0.57	1.15 (1.11-1.19)	0.138 (0.017)
Drug and alcohol disorders (CC 51, 52)	3.81	1.10 (1.08-1.12)	0.096 (0.008)
Psychiatric comorbidity (CC 54-56, 58, 60)	30.44	1.07 (1.06-1.08)	0.066 (0.003)
Hip fracture/dislocation (CC 158)	2.79	0.91 (0.90-0.93)	-0.090 (0.009)
<b>Condition Specific Indicator (AHRQ CCS)</b>			
Septicemia (except in labor) (CCS 2)	11.84	0.90 (0.88-0.92)	-0.103 (0.011)
Urinary tract infections (CCS 159)	7.68	0.91 (0.89-0.93)	-0.099 (0.011)
Acute and unspecified renal failure (CCS 157)	6.52	1.01 (0.99-1.04)	0.014 (0.011)
Fluid and electrolyte disorders (CCS 55)	4.42	0.93 (0.91-0.95)	-0.071 (0.012)
Gastrointestinal hemorrhage (CCS 153)	4.38	0.84 (0.82-0.86)	-0.172 (0.012)
Skin and subcutaneous tissue infections (CCS 197)	3.89	0.81 (0.79-0.83)	-0.211 (0.013)
Complication of device; implant or graft (CCS 237)	3.26	0.98 (0.95-1.00)	-0.023 (0.013)
Intestinal obstruction without hernia (CCS 145)	2.82	0.89 (0.87-0.92)	-0.112 (0.014)
Diverticulosis and diverticulitis (CCS 146)	2.67	0.82 (0.80-0.85)	-0.192 (0.014)
Aspiration pneumonitis; food/vomitus (CCS 129)	2.61	0.93 (0.91-0.96)	-0.069 (0.013)
Complications of surgical procedures or medical care (CCS 238)	2.59	0.89 (0.87-0.91)	-0.117 (0.014)
Deficiency and other anemia (CCS 59)	2.42	1.06 (1.03-1.09)	0.056 (0.013)
Intestinal infection (CCS 135)	2.37	1.05 (1.02-1.08)	0.048 (0.014)
Syncope (CCS 245)	2.34	0.60 (0.58-0.62)	-0.510 (0.016)

Risk Variable (CCs)	% of hospitalizations with this risk variable	OR (95% CI)	Model Coefficients
Hypertension with complications and secondary hypertension (CCS 99)	2.33	Reference	Reference
Other fractures (CCS 231)	2.19	0.77 (0.75-0.80)	-0.258 (0.015)
Diabetes mellitus with complications (CCS 50)	2.15	0.86 (0.83-0.88)	-0.156 (0.014)
Phlebitis; thrombophlebitis and thromboembolism (CCS 118)	1.67	0.83 (0.80-0.85)	-0.192 (0.016)
Other gastrointestinal disorders (CCS 155)	1.4	0.98 (0.95-1.01)	-0.019 (0.016)
Delirium, dementia, and amnestic and other cognitive disorders (CCS 653)	1.12	0.83 (0.80-0.86)	-0.187 (0.019)
Pancreatic disorders (not diabetes) (CCS 152)	1.08	0.87 (0.84-0.91)	-0.134 (0.019)
Noninfectious gastroenteritis (CCS 154)	1.03	0.81 (0.78-0.84)	-0.216 (0.019)
Biliary tract disease (CCS 149)	1.02	1.03 (1.00-1.07)	0.032 (0.018)
Residual codes; unclassified (CCS 259)	1.02	0.88 (0.85-0.92)	-0.124 (0.018)
Spondylosis; intervertebral disc disorders; other back problems (CCS 205)	1.02	0.85 (0.82-0.89)	-0.157 (0.019)
Other connective tissue disease (CCS 211)	0.98	0.80 (0.77-0.83)	-0.227 (0.020)
Other lower respiratory disease (CCS 133)	0.95	0.91 (0.88-0.94)	-0.094 (0.019)
Influenza (CCS 123)	0.93	0.67 (0.65-0.70)	-0.396 (0.021)
Pleurisy; pneumothorax; pulmonary collapse (CCS 130)	0.89	1.24 (1.19-1.28)	0.212 (0.018)
Esophageal disorders (CCS 138)	0.85	0.82 (0.79-0.86)	-0.196 (0.020)
Other liver diseases (CCS 151)	0.78	1.28 (1.23-1.32)	0.243 (0.019)
Gastritis and duodenitis (CCS 140)	0.73	0.89 (0.86-0.93)	-0.112 (0.021)
Conditions associated with dizziness or vertigo (CCS 93)	0.72	0.41 (0.39-0.44)	-0.881 (0.029)
Abdominal pain (CCS 251)	0.64	0.91 (0.88-0.96)	-0.089 (0.022)
Other injuries and conditions due to external causes (CCS 244)	0.61	0.77 (0.74-0.81)	-0.258 (0.024)
Other disorders of stomach and duodenum (CCS 139)	0.58	1.03 (0.99-1.08)	0.031 (0.021)
Other endocrine disorders (CCS 51)	0.57	0.99 (0.94-1.03)	-0.014 (0.023)
Acute posthemorrhagic anemia (CCS 60)	0.51	0.97 (0.92-1.01)	-0.035 (0.023)
Essential hypertension (CCS 98)	0.51	0.68 (0.65-0.72)	-0.378 (0.028)
Other nutritional; endocrine; and metabolic disorders (CCS 58)	0.51	0.96 (0.92-1.01)	-0.036 (0.023)
Low Frequency Conditions	0.47	0.79 (0.75-0.83)	-0.241 (0.026)
Fracture of upper limb (CCS 229)	0.43	0.92 (0.87-0.97)	-0.084 (0.027)
Superficial injury; contusion (CCS 239)	0.43	0.82 (0.77-0.86)	-0.202 (0.027)
Diseases of white blood cells (CCS 63)	0.42	1.06 (1.01-1.11)	0.056 (0.024)
Poisoning by other medications and drugs (CCS 242)	0.41	0.81 (0.77-0.85)	-0.212 (0.027)
Calculus of urinary tract (CCS 160)	0.4	0.74 (0.69-0.78)	-0.304 (0.031)
Pathological fracture (CCS 207)	0.4	0.96 (0.91-1.01)	-0.041 (0.027)
Malaise and fatigue (CCS 252)	0.39	0.87 (0.83-0.92)	-0.138 (0.027)
Fever of unknown origin (CCS 246)	0.38	0.90 (0.85-0.95)	-0.107 (0.027)

Risk Variable (CCs)	% of hospitalizations with this risk variable	OR (95% CI)	Model Coefficients
Fracture of lower limb (CCS 230)	0.36	0.88 (0.83-0.93)	-0.131 (0.029)
Viral infection (CCS 7)	0.36	0.84 (0.79-0.89)	-0.179 (0.030)
Genitourinary symptoms and ill-defined conditions (CCS 163)	0.35	0.89 (0.85-0.94)	-0.112 (0.028)
Substance-related disorders (CCS 661)	0.35	0.91 (0.86-0.96)	-0.092 (0.028)
Chronic ulcer of skin (CCS 199)	0.34	0.83 (0.78-0.87)	-0.192 (0.029)
Hemorrhoids (CCS 120)	0.34	0.75 (0.71-0.80)	-0.284 (0.030)
Alcohol-related disorders (CCS 660)	0.33	0.86 (0.81-0.91)	-0.151 (0.031)
Nausea and vomiting (CCS 250)	0.3	1.05 (0.99-1.11)	0.048 (0.029)
Crushing injury or internal injury (CCS 234)	0.28	0.85 (0.80-0.91)	-0.157 (0.033)
Fracture of neck or femur (hip) (CCS 226)	0.28	0.74 (0.69-0.79)	-0.305 (0.034)
Other non-traumatic joint disorders (CCS 204)	0.26	0.74 (0.69-0.79)	-0.306 (0.036)
Other upper respiratory disease (CCS 134)	0.26	0.79 (0.74-0.85)	-0.231 (0.033)
Mycoses (CCS 4)	0.25	1.21 (1.14-1.28)	0.190 (0.028)
Regional enteritis and ulcerative colitis (CCS 144)	0.25	1.16 (1.09-1.23)	0.148 (0.031)
Abdominal hernia (CCS 143)	0.24	0.73 (0.68-0.78)	-0.318 (0.037)
Coagulation and hemorrhagic disorders (CCS 62)	0.23	1.30 (1.22-1.38)	0.261 (0.030)
Infective arthritis and osteomyelitis (except that caused by tuberculosis or sexually transmitted disease) (CCS 201)	0.23	0.81 (0.75-0.86)	-0.217 (0.035)
Other upper respiratory infections (CCS 126)	0.23	0.66 (0.62-0.72)	-0.409 (0.039)
Gastroduodenal ulcer (except hemorrhage) (CCS 125)	0.2	0.87 (0.81-0.94)	-0.138 (0.038)
Gout and other crystal arthropathies (CCS 54)	0.19	0.76 (0.70-0.82)	-0.279 (0.040)
Other diseases of kidney and ureters (CCS 161)	0.19	0.90 (0.84-0.97)	-0.101 (0.038)
Other diseases of veins and lymphatics (CCS 121)	0.19	0.86 (0.80-0.92)	-0.155 (0.037)
Headache; including migraine (CCS 84)	0.17	0.63 (0.57-0.69)	-0.460 (0.048)
Osteoarthritis (CCS 203)	0.17	0.68 (0.62-0.75)	-0.382 (0.045)
Other and unspecified benign neoplasm (CCS 47)	0.17	0.91 (0.84-0.99)	-0.092 (0.040)
Anal and rectal conditions (CCS 147)	0.15	1.00 (0.93-1.08)	0.003 (0.039)
Skull and face fractures (CCS 228)	0.14	0.65 (0.59-0.72)	-0.429 (0.052)
Chronic renal failure (CCS 158)	0.13	0.87 (0.80-0.95)	-0.136 (0.042)
Inflammatory conditions of male genital organs (CCS 165)	0.13	0.64 (0.57-0.71)	-0.453 (0.053)
Peritonitis and intestinal abscess (CCS 148)	0.13	1.13 (1.05-1.23)	0.126 (0.040)
Poisoning by psychotropic agents (CCS 241)	0.13	0.75 (0.68-0.82)	-0.292 (0.049)
Screening and history of mental health and substance abuse codes (CCS 663)	0.13	1.22 (1.13-1.32)	0.198 (0.040)
Sprains and strains (CCS 232)	0.13	0.72 (0.65-0.80)	-0.327 (0.050)
Allergic reactions (CCS 253)	0.12	0.85 (0.77-0.93)	-0.166 (0.048)
Gangrene (CCS 248)	0.12	0.85 (0.78-0.93)	-0.161 (0.044)
Hepatitis (CCS 6)	0.12	1.40 (1.29-1.51)	0.334 (0.040)
Hyperplasia of prostate (CCS 164)	0.12	0.98 (0.89-1.07)	-0.021 (0.047)

Risk Variable (CCs)	% of hospitalizations with this risk variable	OR (95% CI)	Model Coefficients
Open wounds of head; neck; and trunk (CCS 235)	0.12	0.71 (0.64-0.78)	-0.348 (0.053)
Diseases of mouth; excluding dental (CCS 137)	0.11	0.79 (0.72-0.87)	-0.236 (0.049)
Other bone disease and musculoskeletal deformities (CCS 212)	0.11	0.80 (0.72-0.88)	-0.227 (0.052)
Thyroid disorders (CCS 48)	0.1	0.97 (0.88-1.07)	-0.028 (0.050)
Nutritional deficiencies (CCS 52)	0.09	1.09 (0.99-1.19)	0.083 (0.048)
Other diseases of bladder and urethra (CCS 162)	0.09	0.91 (0.82-1.01)	-0.095 (0.053)
Open wounds of extremities (CCS 236)	0.08	0.92 (0.82-1.04)	-0.080 (0.060)
Inflammation; infection of eye (except that caused by tuberculosis or sexually transmitted disease) (CCS 75)	0.07	0.72 (0.63-0.83)	-0.322 (0.069)
Meningitis (except that caused by tuberculosis or sexually transmitted disease) (CCS 76)	0.07	0.96 (0.84-1.09)	-0.043 (0.065)
Other infections; including parasitic (CCS 8)	0.07	0.69 (0.60-0.79)	-0.376 (0.070)
Rheumatoid arthritis and related disease (CCS 202)	0.07	0.70 (0.61-0.79)	-0.359 (0.066)
Blindness and vision defects (CCS 89)	0.06	0.55 (0.46-0.64)	-0.607 (0.085)
Lung disease due to external agents (CCS 132)	0.06	0.88 (0.78-0.99)	-0.132 (0.062)
Other inflammatory condition of skin (CCS 198)	0.06	1.19 (1.05-1.33)	0.170 (0.060)
Diabetes mellitus without complication (CCS 49)	0.05	0.88 (0.77-1.01)	-0.129 (0.070)
Disorders of teeth and jaw (CCS 136)	0.05	0.67 (0.57-0.79)	-0.395 (0.081)
Encephalitis (except that caused by tuberculosis or sexually transmitted disease) (CCS 77)	0.05	1.08 (0.94-1.23)	0.074 (0.069)
Bacterial infection; unspecified site (CCS 3)	0.04	0.85 (0.72-1.00)	-0.166 (0.084)
Burns (CCS 240)	0.04	0.91 (0.78-1.07)	-0.093 (0.080)
Nephritis; nephrosis; renal sclerosis (CCS 156)	0.04	1.58 (1.38-1.81)	0.459 (0.068)
Other eye disorders (CCS 91)	0.04	0.66 (0.56-0.79)	-0.410 (0.090)
Poisoning by nonmedicinal substances (CCS 243)	0.04	0.51 (0.41-0.63)	-0.677 (0.108)
Systemic lupus erythematosus and connective tissue disorders (CCS 210)	0.04	1.19 (1.03-1.38)	0.176 (0.075)
Appendicitis and other appendiceal conditions (CCS 142)	0.03	0.88 (0.74-1.06)	-0.122 (0.094)
Other female genital disorders (CCS 175)	0.03	0.93 (0.79-1.10)	-0.069 (0.084)

**Table 4.2.2 – Surgery/Gynecology Specialty Cohort Hierarchical Logistic Regression Model Risk Factor Frequencies, Odds Ratios, and Model Coefficients (July 2012-June 2013)**

Risk variable	% of hospitalizations with this risk variable	OR (95% CI)	Model Coefficients
Age – 65	N/A	1.02 (1.02-1.02)	0.016 (0.000)
Metastatic cancer/acute leukemia (CC 7)	3.77	1.29 (1.26-1.32)	0.252 (0.013)
Severe Cancer (CC 8, 9)	3.52	1.18 (1.15-1.21)	0.164 (0.012)
Other cancers (CC 10-12)	6.19	1.07 (1.05-1.09)	0.068 (0.009)
Severe hematological disorders (CC 44)	0.57	1.32 (1.25-1.39)	0.277 (0.025)
Coagulation defects and other specified hematological disorders (CC 46)	3.33	1.03 (1.00-1.05)	0.025 (0.012)
Iron deficiency or other unspecified anemias and blood disease (CC 47)	45.43	1.29 (1.27-1.30)	0.254 (0.006)
End-stage liver disease (CC 25, 26)	1.04	1.33 (1.28-1.38)	0.284 (0.020)
Pancreatic disease (CC 32)	1.78	1.10 (1.06-1.13)	0.094 (0.016)
Dialysis status (CC 130)	1.05	1.39 (1.35-1.44)	0.333 (0.018)
Acute renal failure (CC 131)	11.53	1.10 (1.09-1.12)	0.099 (0.008)
Transplants (CC 128, 174)	0.43	1.42 (1.34-1.50)	0.351 (0.029)
Severe Infection (CC 1, 3-5)	0.99	1.12 (1.07-1.16)	0.110 (0.020)
Other infectious disease & pneumonias (CC 6, 111-113)	12.56	1.12 (1.11-1.14)	0.117 (0.007)
Septicemia/shock (CC 2)	3.29	0.97 (0.95-1.00)	-0.025 (0.012)
CHF (CC 80)	9.68	1.18 (1.16-1.19)	0.161 (0.008)
Coronary atherosclerosis or angina, cerebrovascular disease (CC 81-84, 89, 98, 99, 103-106)	42.59	1.24 (1.23-1.26)	0.216 (0.006)
Specified arrhythmias (CC 92, 93)	13.18	1.06 (1.05-1.08)	0.062 (0.007)
Cardiorespiratory failure or cardiorespiratory shock (CC 79)	5.04	1.03 (1.01-1.05)	0.025 (0.010)
Coronary obstructive pulmonary disease (COPD) (CC 108)	18.38	1.27 (1.26-1.29)	0.240 (0.006)
Fibrosis of lung or other chronic lung disorders (CC 109)	1.92	1.13 (1.10-1.17)	0.123 (0.015)
Protein-calorie malnutrition (CC 21)	7.10	1.22 (1.20-1.24)	0.200 (0.008)
Disorders of fluid, electrolyte, acid-base (CC 22, 23)	17.38	1.11 (1.09-1.12)	0.102 (0.007)
Rheumatoid arthritis and inflammatory connective tissue disease (CC 38)	4.87	1.18 (1.15-1.20)	0.162 (0.011)
Diabetes mellitus (CC 15-20, 119, 120)	29.09	1.17 (1.16-1.19)	0.160 (0.006)
Decubitus ulcer or chronic skin ulcer (CC 148, 149)	4.45	1.03 (1.00-1.05)	0.026 (0.012)
Hemiplegia, paraplegia, paralysis, functional disability (CC 67-69, 100-102, 177, 178)	3.47	1.09 (1.07-1.12)	0.088 (0.012)
Seizure disorders and convulsions (CC 74)	2.44	1.12 (1.09-1.16)	0.117 (0.014)
Respirator dependence/tracheostomy status (CC 77)	0.20	1.01 (0.94-1.10)	0.014 (0.041)
Drug and alcohol disorders (CC 51, 52)	2.47	1.14 (1.11-1.17)	0.128 (0.014)
Psychiatric comorbidity (CC 54-56, 58, 60)	21.82	1.12 (1.10-1.13)	0.111 (0.006)



Risk variable	% of hospitalizations with this risk variable	OR (95% CI)	Model Coefficients
Hip fracture/dislocation (CC 158)	2.07	0.90 (0.87-0.93)	-0.107 (0.015)
Condition Specific Indicator (AHRQ CCS)			
Osteoarthritis (CCS 203)	20.21	0.24 (0.22-0.27)	-1.412 (0.049)
Fracture of neck of femur (hip) (CCS 226)	9.46	0.49 (0.45-0.54)	-0.703 (0.048)
Spondylosis; intervertebral disc disorders; other back problems (CCS 205)	6.06	0.39 (0.35-0.43)	-0.942 (0.049)
Complication of device; implant or graft (CCS 237)	4.75	0.57 (0.52-0.63)	-0.562 (0.049)
Biliary tract disease (CCS 149)	3.12	0.48 (0.44-0.53)	-0.727 (0.050)
Occlusion or stenosis of precerebral arteries (CCS 110)	2.64	0.32 (0.29-0.36)	-1.136 (0.051)
Abdominal hernia (CCS 143)	2.42	0.49 (0.45-0.54)	-0.706 (0.050)
Heart valve disorders (CCS 96)	2.39	0.71 (0.65-0.79)	-0.339 (0.050)
Coronary atherosclerosis and other heart disease (CCS 101)	2.31	0.62 (0.56-0.69)	-0.473 (0.050)
Fracture of lower limb (CCS 230)	2.16	0.53 (0.48-0.58)	-0.642 (0.050)
Complications of surgical procedures or medical care (CCS 238)	1.81	0.65 (0.59-0.72)	-0.430 (0.050)
Low Frequency Conditions	1.79	0.64 (0.58-0.71)	-0.445 (0.050)
Septicemia (except in labor) (CCS 2)	1.67	0.73 (0.66-0.81)	-0.314 (0.050)
Cancer of colon (CCS 14)	1.63	0.52 (0.47-0.58)	-0.648 (0.051)
Aortic; peripheral; and visceral artery aneurysms (CCS 115)	1.45	0.54 (0.49-0.60)	-0.618 (0.052)
Fracture of upper limb (CCS 229)	1.41	0.40 (0.36-0.44)	-0.926 (0.053)
Intestinal obstruction without hernia (CCS 145)	1.39	0.65 (0.59-0.72)	-0.434 (0.051)
Cardiac dysrhythmias (CCS 106)	1.37	0.55 (0.50-0.61)	-0.592 (0.052)
Peripheral and visceral atherosclerosis (CCS 114)	1.3	0.69 (0.62-0.76)	-0.370 (0.051)
Other and unspecified benign neoplasm (CCS 47)	1.26	0.52 (0.47-0.57)	-0.661 (0.053)
Acute myocardial infarction (CCS 100)	1.18	0.77 (0.69-0.85)	-0.264 (0.051)
Cancer of bronchus; lung (CCS 19)	1.11	0.53 (0.48-0.59)	-0.637 (0.053)
Diabetes mellitus with complications (CCS 50)	1.09	0.59 (0.53-0.65)	-0.534 (0.052)
Secondary malignancies (CCS 42)	0.94	0.70 (0.63-0.77)	-0.364 (0.053)
Diverticulosis and diverticulitis (CCS 146)	0.89	0.62 (0.56-0.69)	-0.473 (0.054)
Prolapse of female genital organs (CCS 170)	0.87	0.19 (0.17-0.22)	-1.649 (0.067)
Pathological fracture (CCS 207)	0.86	0.63 (0.57-0.70)	-0.464 (0.053)
Acute cerebrovascular disease (CCS 109)	0.83	0.77 (0.69-0.85)	-0.267 (0.053)
Cancer of prostate (CCS 29)	0.82	0.33 (0.29-0.37)	-1.117 (0.061)
Other acquired deformities (CCS 209)	0.82	0.39 (0.35-0.44)	-0.936 (0.058)
Other fractures (CCS 231)	0.8	0.60 (0.54-0.67)	-0.510 (0.054)
Other gastrointestinal disorders (CCS 155)	0.79	0.61 (0.55-0.67)	-0.500 (0.053)
Hyperplasia of prostate (CCS 164)	0.77	0.40 (0.36-0.45)	-0.904 (0.057)
Appendicitis and other appendiceal conditions (CCS 142)	0.7	0.44 (0.39-0.49)	-0.829 (0.058)

Risk variable	% of hospitalizations with this risk variable	OR (95% CI)	Model Coefficients
Cancer of breast (CCS 24)	0.68	0.29 (0.25-0.32)	-1.248 (0.062)
Cancer of bladder (CCS 32)	0.67	0.83 (0.75-0.92)	-0.186 (0.054)
Calculus of urinary tract (CCS 160)	0.65	0.46 (0.41-0.52)	-0.769 (0.057)
Other bone disease and musculoskeletal deformities (CCS 212)	0.62	0.40 (0.36-0.45)	-0.916 (0.059)
Cancer of kidney and renal pelvis (CCS 33)	0.61	0.43 (0.38-0.48)	-0.845 (0.059)
Gangrene (CCS 248)	0.58	0.73 (0.65-0.81)	-0.320 (0.054)
Infective arthritis and osteomyelitis (except that caused by tuberculosis or sexually transmitted disease) (CCS 201)	0.55	0.54 (0.48-0.60)	-0.616 (0.056)
Intracranial injury (CCS 233)	0.51	0.81 (0.73-0.91)	-0.208 (0.056)
Other connective tissue disease (CCS 211)	0.51	0.36 (0.32-0.41)	-1.008 (0.063)
Cancer of rectum and anus (CCS 15)	0.44	0.85 (0.76-0.95)	-0.167 (0.057)
Cancer of uterus (CCS 25)	0.41	0.48 (0.42-0.54)	-0.742 (0.064)
Pancreatic disorders (not diabetes) (CCS 152)	0.39	0.56 (0.50-0.63)	-0.584 (0.061)
Other non-traumatic joint disorders (CCS 204)	0.35	0.30 (0.26-0.34)	-1.217 (0.074)
Other hereditary and degenerative nervous system conditions (CCS 81)	0.34	0.70 (0.62-0.79)	-0.358 (0.061)
Anal and rectal conditions (CCS 147)	0.33	0.50 (0.45-0.57)	-0.684 (0.064)
Congestive heart failure; nonhypertensive (CCS 108)	0.32	0.82 (0.73-0.92)	-0.201 (0.057)
Urinary tract infections (CCS 159)	0.32	0.81 (0.72-0.91)	-0.209 (0.058)
Cancer of head and neck (CCS 11)	0.29	0.50 (0.44-0.57)	-0.693 (0.066)
Skin and subcutaneous tissue infections (CCS 197)	0.29	0.51 (0.45-0.57)	-0.679 (0.064)
Aortic and peripheral arterial embolism or thrombosis (CCS 116)	0.28	0.79 (0.71-0.89)	-0.231 (0.060)
Chronic ulcer of skin (CCS 199)	0.28	0.53 (0.47-0.60)	-0.627 (0.062)
Acute and unspecified renal failure (CCS 157)	0.27	0.86 (0.77-0.97)	-0.150 (0.059)
Neoplasms of unspecified nature or uncertain behavior (CCS 44)	0.24	0.57 (0.50-0.65)	-0.557 (0.068)
Other nutritional; endocrine; and metabolic disorders (CCS 58)	0.24	0.41 (0.36-0.48)	-0.882 (0.077)
Pleurisy; pneumothorax; pulmonary collapse (CCS 130)	0.24	0.58 (0.52-0.66)	-0.538 (0.064)
Joint disorders and dislocations; trauma-related (CCS 225)	0.22	0.42 (0.36-0.48)	-0.870 (0.075)
Other diseases of bladder and urethra (CCS 162)	0.22	0.65 (0.58-0.75)	-0.423 (0.066)
Other congenital anomalies (CCS 217)	0.21	0.38 (0.32-0.44)	-0.975 (0.083)
Other nervous system disorders (CCS 95)	0.21	0.58 (0.50-0.66)	-0.550 (0.070)
Cancer of other GI organs; peritoneum (CCS 18)	0.2	0.72 (0.63-0.82)	-0.329 (0.066)
Cancer of ovary (CCS 27)	0.2	0.66 (0.58-0.76)	-0.409 (0.069)
Cancer of pancreas (CCS 17)	0.2	0.90 (0.79-1.02)	-0.106 (0.064)
Other lower respiratory disease (CCS 133)	0.2	0.47 (0.41-0.55)	-0.750 (0.074)

Risk variable	% of hospitalizations with this risk variable	OR (95% CI)	Model Coefficients
Peri-; endo-; and myocarditis; cardiomyopathy (except that caused by tuberculosis or sexually transmitted disease) (CCS 97)	0.2	0.72 (0.64-0.82)	-0.323 (0.065)
Pneumonia (except that caused by tuberculosis or sexually transmitted disease) (CCS 122)	0.2	0.71 (0.62-0.80)	-0.345 (0.064)
Cancer of stomach (CCS 13)	0.19	0.81 (0.71-0.92)	-0.207 (0.066)
Non-Hodgkin's Lymphoma (CCS 38)	0.19	1.23 (1.08-1.39)	0.205 (0.063)
Other diseases of kidney and ureters (CCS 161)	0.19	0.61 (0.53-0.70)	-0.499 (0.071)
Esophageal disorders (CCS 138)	0.18	0.51 (0.44-0.59)	-0.672 (0.076)
Genitourinary symptoms and ill-defined conditions (CCS 163)	0.18	0.63 (0.55-0.72)	-0.462 (0.069)
Cancer of brain and nervous system (CCS 35)	0.17	0.97 (0.85-1.11)	-0.028 (0.068)
Gastroduodenal ulcer (except hemorrhage) (CCS 139)	0.17	0.82 (0.72-0.94)	-0.194 (0.068)
Other female genital disorders (CCS 175)	0.17	0.50 (0.43-0.58)	-0.691 (0.078)
Thyroid disorders (CCS 48)	0.17	0.23 (0.19-0.29)	-1.456 (0.103)
Gastrointestinal hemorrhage (CCS 153)	0.15	0.78 (0.69-0.89)	-0.243 (0.067)
Sprains and strains (CCS 232)	0.15	0.34 (0.29-0.41)	-1.066 (0.092)
Hypertension with complications and secondary hypertension (CCS 99)	0.14	Reference	Reference
Respiratory failure; insufficiency; arrest (adult) (CCS 131)	0.13	0.69 (0.60-0.80)	-0.368 (0.072)
Cancer of bone and connective tissue (CCS 21)	0.11	0.69 (0.59-0.81)	-0.375 (0.082)
Cancer of thyroid (CCS 36)	0.11	0.29 (0.23-0.35)	-1.254 (0.109)
Chronic obstructive pulmonary disease and bronchiectasis (CCS 127)	0.11	1.02 (0.88-1.17)	0.018 (0.072)
Other and ill-defined cerebrovascular disease (CCS 111)	0.11	0.45 (0.38-0.54)	-0.791 (0.092)
Crushing injury or internal injury (CCS 234)	0.1	0.70 (0.60-0.82)	-0.359 (0.081)
Open wounds of extremities (CCS 236)	0.1	0.47 (0.39-0.56)	-0.764 (0.092)
Other non-epithelial cancer of skin (CCS 23)	0.1	0.38 (0.31-0.45)	-0.981 (0.095)
Cancer of other female genital organs (CCS 28)	0.09	0.65 (0.55-0.77)	-0.428 (0.088)
Other aftercare (CCS 257)	0.09	0.39 (0.32-0.47)	-0.950 (0.095)
Other disorders of stomach and duodenum (CCS 141)	0.09	0.77 (0.66-0.90)	-0.263 (0.080)
Cancer of liver and intrahepatic bile duct (CCS 16)	0.08	0.72 (0.61-0.86)	-0.322 (0.088)
Cancer of other urinary organs (CCS 34)	0.08	0.63 (0.53-0.76)	-0.456 (0.092)
Fluid and electrolyte disorders (CCS 55)	0.08	0.81 (0.69-0.95)	-0.214 (0.082)
Other circulatory disease (CCS 117)	0.08	0.62 (0.53-0.74)	-0.472 (0.087)
Other endocrine disorders (CCS 51)	0.08	0.40 (0.32-0.50)	-0.915 (0.109)
Rheumatoid arthritis and related disease (CCS 202)	0.08	0.38 (0.31-0.47)	-0.967 (0.112)
Skull and face fractures (CCS 228)	0.08	0.37 (0.30-0.46)	-0.985 (0.111)

Risk variable	% of hospitalizations with this risk variable	OR (95% CI)	Model Coefficients
Cardiac and circulatory congenital anomalies (CCS 213)	0.07	0.50 (0.41-0.62)	-0.688 (0.109)
Other liver diseases (CCS 151)	0.07	1.01 (0.85-1.19)	0.005 (0.085)
Other upper respiratory disease (CCS 134)	0.07	0.56 (0.47-0.68)	-0.576 (0.096)
Parkinson's disease (CCS 79)	0.07	0.30 (0.23-0.39)	-1.209 (0.136)
Regional enteritis and ulcerative colitis (CCS 144)	0.07	1.17 (0.99-1.37)	0.153 (0.084)
Spinal cord injury (CCS 227)	0.07	0.69 (0.57-0.84)	-0.367 (0.095)
Aspiration pneumonitis; food/vomitus (CCS 129)	0.06	0.95 (0.81-1.12)	-0.047 (0.083)
Benign neoplasm of uterus (CCS 46)	0.06	0.31 (0.23-0.41)	-1.182 (0.151)
Cancer of esophagus (CCS 12)	0.06	1.00 (0.85-1.19)	0.005 (0.088)
Other injuries and conditions due to external causes (CCS 244)	0.06	0.66 (0.54-0.80)	-0.415 (0.100)
Other male genital disorders (CCS 166)	0.06	0.59 (0.48-0.72)	-0.532 (0.102)

**Table 4.2.3 – Cardiovascular Specialty Cohort Hierarchical Logistic Regression Model Risk Factor Frequencies, Odds Ratios, and Model Coefficients (July 2012-June 2013)**

Risk variable	% of hospitalizations with this risk variable	OR (95% CI)	Model Coefficients
Age – 65	N/A	1.02 (1.02-1.02)	0.016 (0.000)
Metastatic cancer/acute leukemia (CC 7)	1.55	1.43 (1.36-	0.356 (0.024)
Severe Cancer (CC 8, 9)	3.36	1.32 (1.28-	0.277 (0.016)
Other cancers (CC 10-12)	4.96	1.06 (1.03-	0.061 (0.014)
Severe hematological disorders (CC 44)	0.81	1.29 (1.22-	0.255 (0.030)
Coagulation defects and other specified hematological disorders (CC 46)	4.55	1.03 (1.00-1.06)	0.030 (0.014)
Iron deficiency or other unspecified anemias and blood disease (CC 47)	33.23	1.34 (1.32-1.36)	0.293 (0.008)
End-stage liver disease (CC 25, 26)	0.99	1.32 (1.25-	0.278 (0.028)
Pancreatic disease (CC 32)	1.33	1.11 (1.06-	0.105 (0.025)
Dialysis status (CC 130)	2.07	1.56 (1.50-	0.444 (0.018)
Acute renal failure (CC 131)	18.66	1.14 (1.12-	0.134 (0.010)
Transplants (CC 128, 174)	0.41	1.37 (1.26-	0.316 (0.042)
Severe Infection (CC 1, 3-5)	0.79	1.13 (1.06-	0.118 (0.031)
Other infectious disease & pneumonias (CC 6, 111-113)	17.06	1.16 (1.14-1.18)	0.146 (0.009)
Septicemia/shock (CC 2)	3.26	1.00 (0.96-	-0.005 (0.016)
CHF (CC 80)	21.11	1.29 (1.26-	0.252 (0.009)
Coronary atherosclerosis or angina, cerebrovascular disease (CC 81-84, 89, 98, 99, 103-106)	69.43	1.14 (1.12-1.16)	0.132 (0.009)
Specified arrhythmias (CC 92, 93)	27.04	1.08 (1.06-	0.079 (0.008)

Risk variable	% of hospitalizations with this risk variable	OR (95% CI)	Model Coefficients
Cardiorespiratory failure or cardiorespiratory shock (CC 79)	7.94	1.08 (1.05-1.10)	0.074 (0.011)
Coronary obstructive pulmonary disease (COPD) (CC 108)	24.91	1.32 (1.30-1.34)	0.279 (0.008)
Fibrosis of lung or other chronic lung disorders (CC 109)	2.97	1.18 (1.14-1.22)	0.164 (0.017)
Protein-calorie malnutrition (CC 21)	5.01	1.13 (1.10-	0.122 (0.013)
Disorders of fluid, electrolyte, acid-base (CC 22, 23)	21.98	1.15 (1.13-	0.141 (0.009)
Rheumatoid arthritis and inflammatory connective tissue disease (CC 38)	4.70	1.15 (1.11-1.18)	0.136 (0.014)
Diabetes mellitus (CC 15-20, 119, 120)	36.35	1.18 (1.16-	0.163 (0.007)
Decubitus ulcer or chronic skin ulcer (CC 148, 149)	3.80	1.17 (1.14-	0.160 (0.015)
Hemiplegia, paraplegia, paralysis, functional disability (CC 67-69, 100-102, 177, 178)	3.67	1.12 (1.08-1.15)	0.111 (0.015)
Seizure disorders and convulsions (CC 74)	2.85	1.13 (1.09-	0.124 (0.018)
Respirator dependence/tracheostomy status (CC 77)	0.16	1.11 (0.98-1.25)	0.101 (0.063)
Drug and alcohol disorders (CC 51, 52)	2.04	1.23 (1.19-	0.211 (0.020)
Psychiatric comorbidity (CC 54-56, 58, 60)	23.23	1.15 (1.13-	0.138 (0.008)
Hip fracture/dislocation (CC 158)	1.39	0.85 (0.81-	-0.161 (0.025)
Condition Specific Indicator (AHRQ CCS)			
Cardiac dysrhythmias (CCS 106)	35.86	0.84 (0.80-	-0.174 (0.027)
Acute myocardial infarction (CCS 100)	20.33	0.94 (0.89-	-0.064 (0.027)
Coronary atherosclerosis and other heart disease (CCS 101)	14.55	0.64 (0.61-0.68)	-0.444 (0.028)
Nonspecific chest pain (CCS 102)	10.49	0.58 (0.55-	-0.547 (0.029)
Other circulatory disease (CCS 117)	5.82	0.72 (0.68-	-0.323 (0.030)
Peripheral and visceral atherosclerosis (CCS 114)	4.86	0.71 (0.67-	-0.337 (0.031)
Conduction disorders (CCS 105)	3.28	0.63 (0.59-	-0.459 (0.033)
Heart valve disorders (CCS 96)	1.31	0.72 (0.67-	-0.324 (0.038)
Peri-; endo-; and myocarditis; cardiomyopathy (except that caused by tuberculosis or sexually transmitted disease) (CCS 97)	1.25	Reference	Reference
Aortic; peripheral; and visceral artery aneurysms (CCS 115)	0.91	0.83 (0.77-0.91)	-0.181 (0.043)
Aortic and peripheral arterial embolism or thrombosis (CCS 116)	0.61	0.88 (0.80-0.96)	-0.130 (0.048)
Other and ill-defined heart disease (CCS 104)	0.36	0.77	-0.255
Cardiac arrest and ventricular fibrillation (CCS 107)	0.27	0.86	-0.156
Low Frequency Conditions	0.08	0.65 (0.51-	-0.424 (0.124)

**Table 4.2.4 – Cardiorespiratory Specialty Cohort Hierarchical Logistic Regression Model Risk Factor Frequencies, Odds Ratios, and Model Coefficients (July 2012-June 2013)**

Risk variable	% of hospitalizations with this risk variable	OR (95% CI)	Model Coefficients
Age – 65	N/A	1.00 (1.00-	0.000 (0.000)
Metastatic cancer/acute leukemia (CC 7)	2.60	1.21 (1.18-	0.192 (0.015)
Severe Cancer (CC 8, 9)	6.08	1.22 (1.20-	0.202 (0.009)
Other cancers (CC 10-12)	5.97	1.07 (1.05-	0.065 (0.009)
Severe hematological disorders (CC 44)	1.24	1.22 (1.18-	0.200 (0.019)
Coagulation defects and other specified hematological disorders (CC 46)	7.03	1.03 (1.02-1.05)	0.033 (0.008)
Iron deficiency or other unspecified anemias and blood disease (CC 47)	47.46	1.19 (1.18-1.21)	0.177 (0.005)
End-stage liver disease (CC 25, 26)	1.54	1.17 (1.14-	0.160 (0.017)
Pancreatic disease (CC 32)	1.45	1.08 (1.04-	0.074 (0.017)
Dialysis status (CC 130)	2.19	1.28 (1.25-	0.250 (0.014)
Acute renal failure (CC 131)	28.00	1.11 (1.10-	0.109 (0.006)
Transplants (CC 128, 174)	0.49	1.21 (1.14-	0.191 (0.029)
Severe Infection (CC 1, 3-5)	1.63	1.17 (1.13-	0.154 (0.016)
Other infectious disease & pneumonias (CC 6, 111-113)	38.16	1.10 (1.08-1.11)	0.092 (0.005)
Septicemia/shock (CC 2)	6.42	1.01 (0.99-	0.009 (0.009)
CHF (CC 80)	36.21	1.21 (1.19-	0.188 (0.006)
Coronary atherosclerosis or angina, cerebrovascular disease (CC 81-84, 89, 98, 99, 103-106)	65.73	1.16 (1.15-1.17)	0.148 (0.006)
Specified arrhythmias (CC 92, 93)	31.98	1.09 (1.08-	0.089 (0.006)
Cardiorespiratory failure or cardiorespiratory shock (CC 79)	22.45	1.16 (1.14-1.17)	0.145 (0.006)
Coronary obstructive pulmonary disease (COPD) (CC 108)	49.64	1.25 (1.23-1.26)	0.221 (0.005)
Fibrosis of lung or other chronic lung disorders (CC 109)	8.18	1.11 (1.09-1.13)	0.103 (0.008)
Protein-calorie malnutrition (CC 21)	10.50	1.10 (1.09-	0.096 (0.007)
Disorders of fluid, electrolyte, acid-base (CC 22, 23)	34.51	1.15 (1.14-	0.142 (0.006)
Rheumatoid arthritis and inflammatory connective tissue disease (CC 38)	5.45	1.07 (1.05-1.09)	0.064 (0.010)
Diabetes mellitus (CC 15-20, 119, 120)	40.01	1.09 (1.08-	0.085 (0.005)
Decubitus ulcer or chronic skin ulcer (CC 148, 149)	5.67	1.12 (1.10-	0.112 (0.009)
Hemiplegia, paraplegia, paralysis, functional disability (CC 67-69, 100-102, 177, 178)	4.77	1.06 (1.04-1.08)	0.060 (0.010)
Seizure disorders and convulsions (CC 74)	3.79	1.08 (1.06-	0.078 (0.011)
Respirator dependence/tracheostomy status (CC 77)	0.61	1.16 (1.10-	0.145 (0.025)
Drug and alcohol disorders (CC 51, 52)	3.05	1.14 (1.11-	0.128 (0.012)
Psychiatric comorbidity (CC 54-56, 58, 60)	32.65	1.10 (1.09-	0.093 (0.005)
Hip fracture/dislocation (CC 158)	2.30	0.90 (0.88-	-0.100 (0.015)

Risk variable	% of hospitalizations with this risk variable	OR (95% CI)	Model Coefficients
Condition Specific Indicator (AHRQ CCS)			
Congestive heart failure; nonhypertensive (CCS 108)	31.15	1.05 (1.03-1.07)	0.052 (0.009)
Pneumonia (except that caused by tuberculosis or sexually transmitted disease) (CCS 122)	28.68	0.87 (0.85-0.88)	-0.142 (0.009)
Chronic obstructive pulmonary disease and bronchiectasis (CCS 127)	21.51	1.06 (1.04-1.08)	0.056 (0.009)
Respiratory failure; insufficiency; arrest (adult) (CCS 131)	8.20	Reference	Reference
Pulmonary heart disease (CCS 103)	4.41	0.86 (0.83-0.89)	-0.154 (0.014)
Asthma (CCS 128)	4.15	0.92 (0.89-0.95)	-0.086 (0.014)
Acute bronchitis (CCS 125)	1.90	0.73 (0.70-0.76)	-0.320 (0.022)
Low Frequency Conditions	0.00	0.64 (0.25-1.64)	-0.440 (0.484)

**Table 4.2.5 – Neurology Specialty Cohort Hierarchical Logistic Regression Model Risk Factor Frequencies, Odds Ratios, and Model Coefficients (July 2012-June 2013)**

Risk variable	% of hospitalizations with this risk variable	OR (95% CI)	Model Coefficients
Age – 65	N/A	1.00 (1.00-1.01)	0.004 (0.001)
Metastatic cancer/acute leukemia (CC 7)	2.74	1.34 (1.27-1.41)	0.290 (0.026)
Severe Cancer (CC 8, 9)	3.92	1.26 (1.21-1.31)	0.230 (0.021)
Other cancers (CC 10-12)	6.05	1.06 (1.03-1.10)	0.061 (0.018)
Severe hematological disorders (CC 44)	0.71	1.27 (1.16-1.38)	0.238 (0.044)
Coagulation defects and other specified hematological disorders (CC 46)	4.54	1.05 (1.01-1.09)	0.045 (0.019)
Iron deficiency or other unspecified anemias and blood disease (CC 47)	31.21	1.25 (1.22-1.28)	0.223 (0.010)
End-stage liver disease (CC 25, 26)	1.09	1.33 (1.24-1.43)	0.287 (0.036)
Pancreatic disease (CC 32)	1.24	1.15 (1.07-1.23)	0.140 (0.034)
Dialysis status (CC 130)	1.59	1.46 (1.38-1.54)	0.378 (0.028)
Acute renal failure (CC 131)	16.07	1.13 (1.10-1.16)	0.124 (0.014)
Transplants (CC 128, 174)	0.38	1.47 (1.31-1.64)	0.382 (0.057)
Severe Infection (CC 1, 3-5)	1.16	1.07 (0.99-1.15)	0.065 (0.037)
Other infectious disease & pneumonias (CC 6, 111-113)	16.88	1.11 (1.08-1.13)	0.101 (0.013)
Septicemia/shock (CC 2)	3.84	1.01 (0.97-1.05)	0.007 (0.021)
CHF (CC 80)	14.30	1.19 (1.16-1.22)	0.173 (0.014)
Coronary atherosclerosis or angina, cerebrovascular disease (CC 81-84, 89, 98, 99, 103-106)	54.03	1.17 (1.14-1.19)	0.154 (0.010)
Specified arrhythmias (CC 92, 93)	19.72	1.08 (1.05-1.10)	0.075 (0.012)



Risk variable	% of hospitalizations with this risk variable	OR (95% CI)	Model Coefficients
Cardiorespiratory failure or cardiorespiratory shock (CC 79)	6.68	1.03 (0.99-1.06)	0.028 (0.017)
Coronary obstructive pulmonary disease (COPD) (CC 108)	18.38	1.16 (1.14-1.19)	0.150 (0.011)
Fibrosis of lung or other chronic lung disorders (CC 109)	2.03	1.07 (1.01-1.13)	0.064 (0.028)
Protein-calorie malnutrition (CC 21)	7.27	1.16 (1.12-1.19)	0.145 (0.016)
Disorders of fluid, electrolyte, acid-base (CC 22, 23)	23.95	1.14 (1.11-1.17)	0.130 (0.012)
Rheumatoid arthritis and inflammatory connective tissue disease (CC 38)	4.30	1.09 (1.04-1.13)	0.082 (0.021)
Diabetes mellitus (CC 15-20, 119, 120)	34.94	1.16 (1.14-1.18)	0.146 (0.010)
Decubitus ulcer or chronic skin ulcer (CC 148, 149)	3.36	1.07 (1.03-1.12)	0.072 (0.022)
Hemiplegia, paraplegia, paralysis, functional disability (CC 67-69, 100-102, 177, 178)	8.75	1.08 (1.05-1.11)	0.076 (0.015)
Seizure disorders and convulsions (CC 74)	10.11	1.10 (1.07-1.14)	0.099 (0.015)
Respirator dependence/tracheostomy status (CC 75)	0.20	1.09 (0.93-1.27)	0.083 (0.079)
Drug and alcohol disorders (CC 51, 52)	3.28	1.10 (1.05-1.15)	0.095 (0.023)
Psychiatric comorbidity (CC 54-56, 58, 60)	28.21	1.04 (1.02-1.06)	0.035 (0.010)
Hip fracture/dislocation (CC 158)	2.14	0.82 (0.77-0.87)	-0.202 (0.029)
<b>Condition Specific Indicator (AHRQ CCS)</b>			
Acute cerebrovascular disease (CCS 109)	43.93	0.91 (0.89-0.94)	-0.093 (0.013)
Transient cerebral ischemia (CCS 112)	15.63	0.67 (0.65-0.69)	-0.402 (0.017)
Other nervous system disorders (CCS 95)	14.13	Reference	Reference
Intracranial injury (CCS 233)	9.59	1.11 (1.07-1.15)	0.102 (0.018)
Epilepsy; convulsions (CCS 83)	8.28	0.86 (0.83-0.89)	-0.154 (0.019)
Other hereditary and degenerative nervous system conditions (CCS 81)	1.92	1.01 (0.95-1.08)	0.014 (0.032)
Occlusion or stenosis of precerebral arteries (CCS 110)	1.36	0.70 (0.65-0.77)	-0.350 (0.043)
Late effects of cerebrovascular disease (CCS 113)	1.29	0.91 (0.84-0.98)	-0.096 (0.039)
Coma; stupor; and brain damage (CCS 85)	1.11	0.97 (0.90-1.05)	-0.028 (0.041)
Parkinson's disease (CCS 79)	0.98	0.86 (0.79-0.95)	-0.147 (0.048)
Other and ill-defined cerebrovascular disease (CCS 111)	0.97	0.67 (0.60-0.74)	-0.402 (0.054)
Low Frequency Conditions	0.55	1.03 (0.92-1.15)	0.032 (0.057)
Multiple sclerosis (CCS 80)	0.25	1.18 (1.00-1.40)	0.169 (0.084)



**Table 4.2.6 – Model Performance by Specialty Cohort (July 2012-June 2013)**

Specialty Cohort	Predictive Ability, % (lowest decile- highest decile)	c-statistic
Medicine	8.1-32.3	0.65
Surgery/Gynecology	4.0-24.7	0.67
Cardiorespiratory	5.1-29.0	0.66
Cardiovascular	9.9-35.0	0.64
Neurology	7.0-25.2	0.62

**Table 4.2.7 – Index Hospitalizations and Observed Readmission Rates by Specialty Cohort (July 2012-June 2013)**

Specialty Cohort	Index Hospitalizations	Observed Readmission Rate
Medicine	3,027,679	17.1%
Surgery/Gynecology	1,710,132	11.4%
Cardiorespiratory	1,275,067	19.7%
Cardiovascular	813,003	13.9%
Neurology	453,972	13.4%
HWR	7,279,853	15.6%

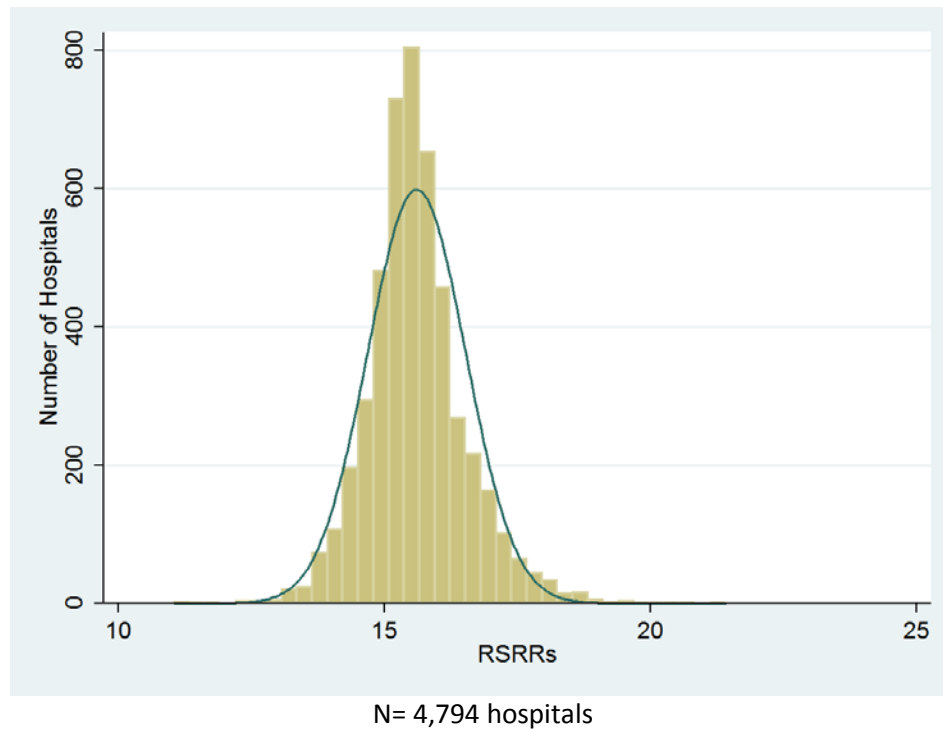
**Table 4.2.8 – Hospital-level observed readmission rates and SRRs (July 2012-June 2013)**

Variable	N	Mean observed readmission rate (SD)	Median observed readmission rate (IQR)	Mean SRR (SD)	Median SRR (IQR)
Medicine	4743	15.5 (5.9)	15.9 (13.2 – 18.3)	1.002 (0.075)	0.996 (0.956 – 1.042)
Surgery/gynecology	4084	10.9 (8.9)	10.5 (7.3 – 13.4)	1.002 (0.075)	0.997 (0.963 – 1.037)
Cardiovascular	4491	14.2 (10.1)	13.6 (10.0 – 17.2)	1.001 (0.052)	0.998 (0.977 – 1.023)
Cardiorespiratory	4610	18.0 (6.9)	18.4 (14.8 – 21.5)	1.002 (0.072)	0.996 (0.957 – 1.040)
Neurology	4470	12.4 (10.6)	12.2 (7.1 – 15.9)	1.001 (0.050)	0.996 (0.978 – 1.020)
HWR	4794	14.7 (4.6)	15.0 (12.5 – 17.3)	1.000 (0.059)	0.996 (0.966 – 1.029)

**Table 4.2.9 – Distribution of hospital-level observed readmission rates and RSRRs (July 2012-June 2013)**

Composite readmission rate	Mean	SD	Min	10th Percentile	Lower Quartile	Median	Upper Quartile	90th Percentile	Max
Observed	14.7	4.6	0.0	9.5	12.5	15.0	17.3	19.5	66.7
RSRR	15.6	0.9	11.0	14.6	15.2	15.5	16.0	16.8	21.4

**Figure 4.2.2 - Distribution of Hospital 30-Day HWR RSRRs (July 2012-June 2013)**



## 5. GLOSSARY

**Case Mix:** The particular illness severity and age characteristics of patients with index admissions at a given hospital.

**Cohort:** The index admissions used to calculate the measure after inclusion and exclusion criteria have been applied.

**Complications:** Medical conditions that likely occurred as a consequence of care rendered during hospitalization.

**Comorbidities:** Medical conditions that the patient had in addition to his/her primary reason for admission to the hospital.

**Condition Categories (CCs):** Groupings of ICD-9-CM diagnosis codes in clinically relevant categories, from the Hierarchical Condition Categories (HCCs) system. CMS uses the grouping but not the hierarchical logic of the system to create risk factor variables. Description of the CCs can be found at [http://www.cms.hhs.gov/Reports/downloads/pope\\_2000\\_2.pdf](http://www.cms.hhs.gov/Reports/downloads/pope_2000_2.pdf).

**Discharge Condition Category:** A group of related discharge diagnosis ICD-9 codes (principal diagnoses), as grouped by the Agency for Healthcare Research and Quality (AHRQ) Clinical Classification Software (CCS).

**Expected readmissions:** The number of readmissions expected based on average hospital performance with a given hospital's case mix.

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

**Hospital-specific intercept:** A measure of the hospital quality of care calculated based on the hospital's actual readmission rate relative to hospitals with similar patients, considering how many patients it served, its patients' risk factors, and how many died or were readmitted. The hospital-specific effect will be negative for a better-than-average hospital, positive for a worse-than-average hospital, and close to zero for an average hospital. The hospital-specific effect is used in the numerator to calculate "predicted" readmissions.

**Index admission:** Any admission included in the measure calculation as the initial admission for an episode of care to which the outcome is attributed.

**Interval estimate:** Similar to a CI, the interval estimate is a range of probable values for the estimate that characterizes the amount of associated uncertainty. For example, a 95% interval estimate for a readmission rate indicates that CMS is 95% confident that the true value of the rate lies between the lower limit and the upper limit of the interval.

**Medicare fee-for-service (FFS):** Original Medicare plan in which providers receive a fee or payment for each individual service provided directly from Medicare. All services rendered are unbundled and paid for separately. Only beneficiaries in Medicare FFS, not in managed care (Medicare Advantage), are included in the measure.

**National observed readmission rate:** All included hospitalizations with the outcome divided by all included hospitalizations.

**Outcome:** The result of a broad set of healthcare activities that affect patients' well-being. For this readmission measure, the outcome is readmission within 30 days of discharge.

**Planned readmissions:** A readmission within 30 days of discharge from an acute care hospital that is a scheduled part of the patient's plan of care. Planned readmissions are not counted as outcomes in this measure.

**Predicted readmissions:** The number of readmissions within 30 days predicted based on the hospital's performance with its observed case mix.

**Procedure Category:** A group of related procedure codes, as grouped by the Agency for Healthcare Research and Quality (AHRQ) Clinical Classification Software (CCS).

**Risk-adjustment variables:** Patient demographics and comorbidities used to standardize rates for differences in case mix across hospitals.

**Service Mix:** The particular conditions and procedures of the patients with index admissions at a given hospital.

**Specialty Cohort:** A group of index admissions for patients with related condition categories or procedure categories that are likely treated by similar care teams. This measure includes five cohorts, each with its own risk model.

**Unplanned readmissions:** Acute clinical events a patient experiences that require urgent rehospitalization. Unplanned readmissions are counted as outcomes in the measure.

## 6. REFERENCES

1. Horwitz L, Partovian C, Lin Z, et al. Hospital-Wide All-Cause Unplanned Readmission Measure: Final Technical Report. 2011;  
[https://www.qualitynet.org/dcs/BlobServer?blobkey=id&blobnocache=true&blobwhere=1228889825199&blobheader=multipart%2Foctet-stream&blobheadername1=Content-Disposition&blobheadervalue1=attachment%3Bfilename%3DDryRun\\_HWR\\_TechReport\\_081012.pdf&blobcol=urldata&blobtable=MungoBlobs](https://www.qualitynet.org/dcs/BlobServer?blobkey=id&blobnocache=true&blobwhere=1228889825199&blobheader=multipart%2Foctet-stream&blobheadername1=Content-Disposition&blobheadervalue1=attachment%3Bfilename%3DDryRun_HWR_TechReport_081012.pdf&blobcol=urldata&blobtable=MungoBlobs). Accessed 30 April 2014.
2. Horwitz L, Grady J, Lin Z, et al. 2013 Measure Updates and Specifications Report: Hospital-Wide All-Cause Unplanned Readmission Measure (Version 2.0). 2013;  
[https://www.qualitynet.org/dcs/BlobServer?blobkey=id&blobnocache=true&blobwhere=1228890067794&blobheader=multipart%2Foctet-stream&blobheadername1=Content-Disposition&blobheadervalue1=attachment%3Bfilename%3DUpdated\\_HWRMSrUpdtRprt\\_080113.pdf&blobcol=urldata&blobtable=MungoBlobs](https://www.qualitynet.org/dcs/BlobServer?blobkey=id&blobnocache=true&blobwhere=1228890067794&blobheader=multipart%2Foctet-stream&blobheadername1=Content-Disposition&blobheadervalue1=attachment%3Bfilename%3DUpdated_HWRMSrUpdtRprt_080113.pdf&blobcol=urldata&blobtable=MungoBlobs). Accessed 30 April 2014.
3. Medicare Hospital Quality Chartbook 2013: Performance Report on Outcome Measures. Prepared by Yale New Haven Health Services Corporation Center for Outcomes Research and Evaluation for the Centers for Medicare and Medicaid Services 2013;  
<http://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/Downloads/-Medicare-Hospital-Quality-Chartbook-2013.pdf>.
4. Testing Publicly Reported 30-Day Acute Myocardial Infarction, Heart Failure, and Pneumonia Risk-Standardized Mortality and Readmission Measures in California All-Payer Data. Yale New Haven Health Services Corporation; 2011.
5. Normand S-LT, Shahian DM. Statistical and clinical aspects of hospital outcomes profiling. *Statistical Science*. 2007;22(2):206-226.
6. Daniels MJ, Gatsonis C. Hierarchical Generalized Linear Models in the Analysis of Variations in Health Care Utilization. *Journal of the American Statistical Association*. 1999/03/01 1999;94(445):29-42.
7. Normand SL, Wang Y, Krumholz H. Assessing surrogacy of data sources for institutional comparisons. *Health Serv Outcomes Res Method*. 2007/06/01 2007;7(1-2):79-96.

## 7. APPENDICES

### Appendix A. HWR Measure Statistical Approach to Risk-Standardized Readmission Rates

We estimate the hospital-specific RSRR using hierarchical generalized linear models, a strategy that accounts for within-hospital correlation of the observed outcome and accommodates the assumption that underlying differences in quality across hospitals lead to systematic differences in outcomes. We model the probability of readmission as a function of patient age, clinically relevant comorbidities, and index condition categories with an intercept for the hospital-specific random effect.

We calculated the hospital-specific readmission rates as the ratio of a hospital's "predicted" to "expected" readmissions multiplied by the national observed readmission rate. Specifically, the HWR measure is done at the specialty cohort level. The expected number of readmissions for each cohort in each hospital is estimated using its patient mix and the average hospital-specific intercept (that is, the average intercept among all hospitals in the sample). The predicted number of readmissions for each cohort in each hospital is estimated given the same patient-mix but an estimated hospital-specific intercept. Operationally, the expected number of readmissions for each hospital is obtained by summing the expected probabilities of readmissions for all patients in the hospital. The expected probability of readmission for each patient is calculated via the hierarchical model, which applies the estimated regression coefficients to the observed patient characteristics and adds the average of the hospital-specific intercept. The predicted number of readmissions for each hospital is calculated by summing the predicted probabilities for all patients in the hospital. The predicted probability for each patient is calculated through the hierarchical model, which applies the estimated regression coefficients to the patient characteristics observed and adds the hospital-specific intercept.

Specifically, for a given specialty cohort, we estimated a hierarchical logistic regression model as follows. Let  $Y_{ij}$  denote the outcome (equal to 1 if patient  $i$  is readmitted within 30 days, zero otherwise) for a patient in cohort  $C \subseteq \{1, \dots, 5$  at hospital  $j$ ;  $\mathbf{Z}_{ij}$  denotes a set of risk factors. Let  $M$  denote the total number of hospitals and  $m_j$  the number of index patient stays in hospital  $j$ . We assume the outcome is related linearly to the covariates via a logit function with dispersion:

$$\text{logit}(\text{Prob}(Y_i = 1)) = \alpha_j + \boldsymbol{\beta}^* \mathbf{Z}_{ij} + \varepsilon_i \quad (1)$$

$$\alpha_j = \mu + \omega_j; \omega_j \sim N(0, \tau^2)$$

where  $\mathbf{Z}_{ij} = (Z_1, Z_2, \dots, Z_k)$  is a set of  $k$  patient-level covariates.  $\alpha_j$  represents the hospital specific intercept;  $\mu$  is the adjusted average outcome over all hospitals; and  $\tau^2$  is the between hospital variance component and  $\varepsilon \sim N(0, \sigma^2)$  captures any over- or under-dispersion.<sup>6</sup> The hierarchical generalized linear models are estimated using the SAS software system (SAS 9.3 GLIMMIX).

## Hospital performance reporting

The previous section describes how the models for each specialty cohort are specified and estimated, using a separate hierarchical logistic regression model for that cohort. Each model is then used to calculate a standardized risk ratio (SRR) for each hospital that contributes index admissions to that model. These SRRs, weighted by volume, are pooled for each hospital to create a composite hospital-wide SRR.

### *SRR for each specialty cohort*

We used the results of each hierarchical logistic regression model to calculate the predicted number of readmissions and the expected number of readmissions at each hospital. The predicted number of readmissions in each cohort was calculated, using the corresponding hierarchical logistic regression model, as the sum of the predicted probability of readmission for each patient, including the hospital-specific (random) effect. The expected number of readmissions in each cohort for each hospital was similarly calculated as the sum of the predicted probability of readmission for each patient, ignoring the hospital specific (random) effect. Using the notation of the previous section, the model-specific risk-standardized readmission ratio is calculated as follows. To calculate the predicted number of admissions  $\text{pred}_{cj}$  for index admissions in cohort  $C=1,\dots,5$  at hospital  $j$ , we used

$$\text{pred}_{cj} = \sum \text{logit}^{-1}(\alpha_j + \beta^* \mathbf{Z}_{ij}) \quad (2)$$

where the sum is over all  $m_{cj}$  index admissions in cohort  $C$  with index admissions at hospital  $j$ . To calculate the expected number  $\text{exp}_{cj}$  we used

$$\text{exp}_{cj} = \sum \text{logit}^{-1}(\mu + \beta^* \mathbf{Z}_{ij}) \quad (3)$$

Then, as a measure of excess or reduced readmissions among index admissions in cohort  $C$  at hospital  $j$ , we calculated the standardized risk ratio  $\text{SRR}_{cj}$  as

$$\text{SRR}_{cj} = \text{pred}_{cj} / \text{exp}_{cj} \quad (4)$$

### *Risk-standardized hospital-wide 30-day readmission rate*

To report a single readmission score, the separate specialty cohort SRRs were combined into a single value. We created a single score as follows.

For a given hospital,  $j$ , which has patients in some subset of cohorts  $C \subseteq \{1,\dots,5\}$ , calculate the SRR as described for each specialty cohort for which the hospital discharged patients. If the hospital does not have index admissions in a given cohort  $c$ , then  $m_{cj} = 0$  and we take  $\text{SRR}_{cj} = 1$ . Then, calculate the volume-weighted logarithmic mean:

$$\text{SRR}_j = \exp \left( \left( \sum m_{cj} \log(\text{SRR}_{cj}) \right) / \sum m_{cj} \right) \quad (5)$$

where the sums are over all specialty cohorts; note that if a hospital does not have index admissions in a given cohort ( $m_{cj} = 0$ ) that cohort contributes nothing to the overall score  $\text{SRR}_j$ . This value,  $\text{SRR}_j$ , is the hospital-wide SRR for hospital  $j$ . To aid interpretation, this ratio is then multiplied by the overall national raw readmission rate for all index admissions in all cohorts,  $\bar{Y}$ , to produce the RSRR<sub>j</sub>.

$$RSRR_j = SRR_j^* \bar{Y} \quad (6)$$

### Creating Interval Estimates

Because the statistic described in Equation 6, that is,  $RSRR_j$ , is a complex function of parameter estimates, we use the re-sampling technique, bootstrapping, to derive an interval estimate. Bootstrapping has the advantage of avoiding unnecessary distributional assumptions.

Algorithm:

Let  $M$  denote the total number of hospitals in the sample. We repeat steps 1 – 4 below for  $b = 1, 2, \dots, B$  times:

1. Sample  $M$  hospitals with replacement.
2. Fit the five cohort hierarchical logistic regression models using all patients within each sampled hospital. As starting values, we use the parameter estimates obtained by fitting the model to all hospitals. If some hospitals are selected more than once in a bootstrapped sample, we treat them as distinct so that we have  $M$  random effects to estimate the variance components. At the conclusion of Step 2, we have
  - a.  $\beta^{(b)}$ , the vector of coefficients, and the corresponding variance covariance matrix  $V$ .
  - b.  $\mu^{(b)}$ , the average hospital rate;  $\tau^{2(b)}$ , the between hospital variance, and
  - c. the set of hospital-specific intercepts and corresponding variances;  $\{\alpha_j^{(b)}, \text{var}[\alpha_j^{(b)}] : j = 1, 2, \dots, M\}$
3. We generate a hospital random effect by sampling from the distribution of the hospital-specific distribution obtained in Step 2c. We approximate the distribution for each random effect by a normal distribution. Thus, we draw  $\alpha_j^{(b*)} \sim N(\alpha_j^{(b)}, \text{var}[\alpha_j^{(b)}])$  for the unique set of hospitals sampled in Step 1.
4. Within each unique hospital  $j$  sampled in Step 1, and using index admissions  $i = 1, \dots, m_j$  in that hospital, we calculate  $SRR_j^*$  and then  $RSRR_j^*$  as in equations (5) and (6).

Ninety-five percent interval estimates (or alternative interval estimates) for the hospital-standardized outcome can be computed by identifying the 2.5<sup>th</sup> and 97.5<sup>th</sup> percentiles of randomly half of the  $B$  estimates (or the percentiles corresponding to the alternative desired intervals).<sup>7</sup>



## **Appendix B. Data Quality Assurance (QA)**

We use a two-phase approach to internal QA for the readmission measure reevaluation process. Refer to [Figure B.1](#) for details about phase I and [Figure B.2](#) for details about phase II.

This section represents QA for the subset of the work CORE conducted to maintain and report the readmission measures. It does not describe the QA to process data and create the input files, nor does it include the QA for the final processing of production data for public reporting because another contractor conducts that work. The task of creating the input files for the measures was transitioned to a different contractor this year, which impacted the QA approach. In prior years, data were compared to previous years' data files. This year, since the final data were obtained from a different source, we compared these data to data from our original source using a similar time period.

### **Phase I**

The first step in the QA process is to ensure the validity of the input data files. No new variables were added to the input files; thus, our main task was to ensure that variable frequencies and distributions in the newly created input data files were consistent with data from our prior data source for similar time periods.

In general, we use both manual scan and descriptive analyses to conduct data validity checks, including crosschecking of readmission information, distributions of ICD-9-CM codes, and frequencies of key variables. The results are reviewed for accuracy and changes compared to data from our prior data source. Any new variable constructs and other changes in formatting to the input files are also verified. We share our QA findings with our data extraction contractor as needed.

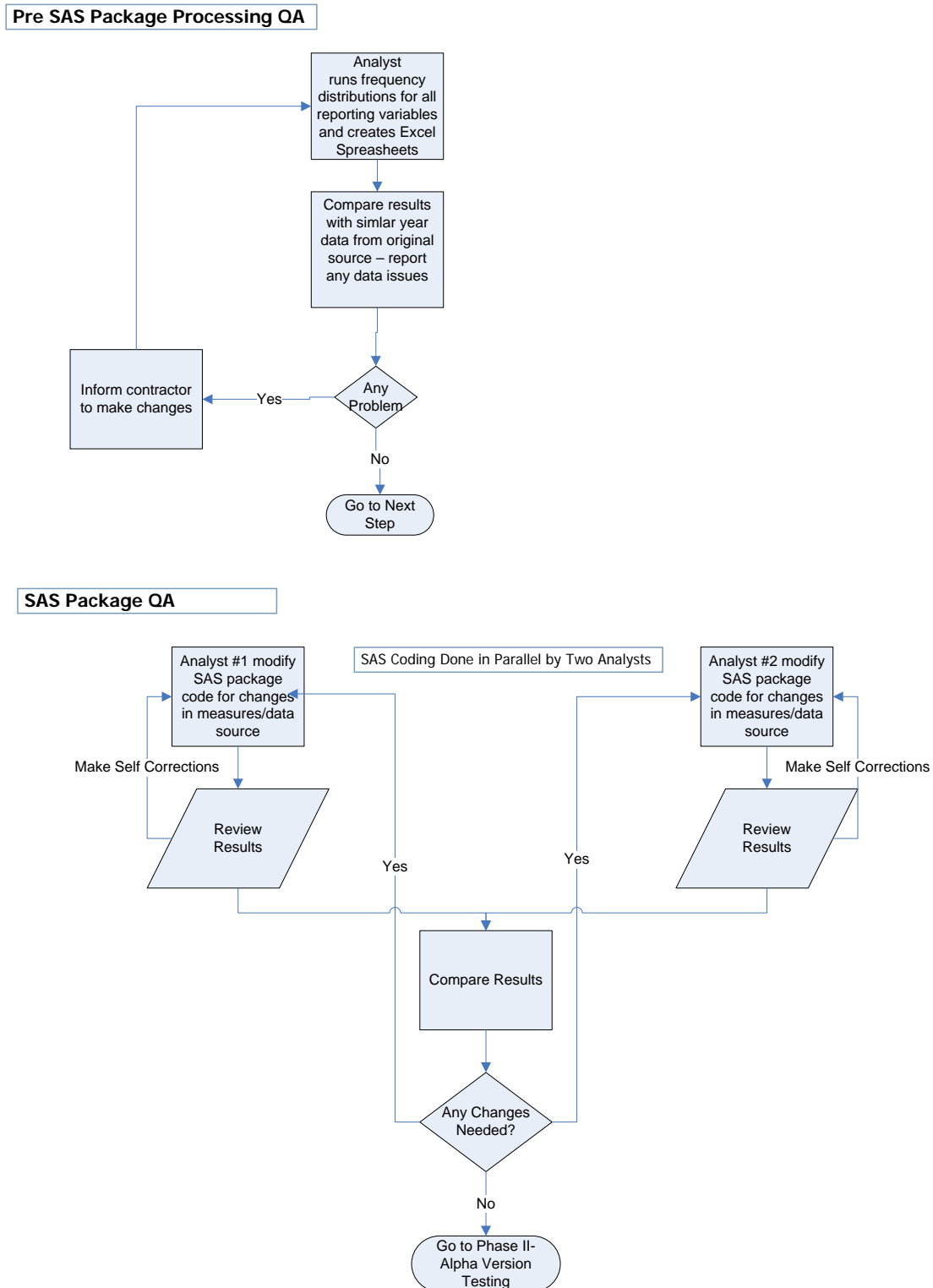
To assure accuracy in SAS analytic package coding, two analysts independently write SAS code for any changes made in calculating the readmission measures: data preparation, sample selection, hierarchical modeling, and calculation of RSRR. This process highlights any programming errors in syntax or logic. Once the parallel programming process is complete, the analysts crosscheck their codes by analyzing datasets in parallel, checking for consistency of output, and reconciling any discrepancies.

### **Phase II**

A third analyst reviews the finalized SAS code and recommends changes to the coding and readability of the SAS analytic package, where appropriate. The primary analyst receives the suggested changes for possible re-coding or program documentation.

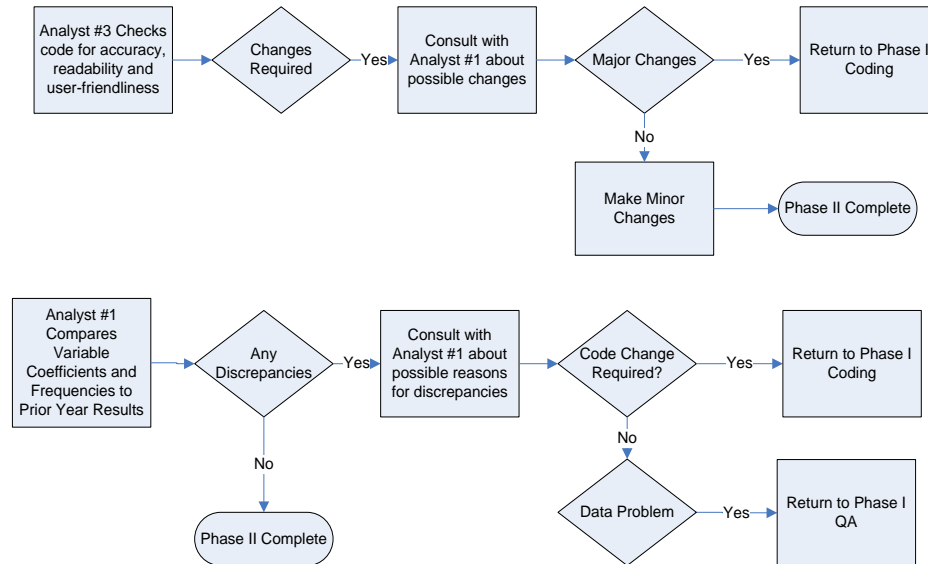
This phase also compares prior years' risk-adjustment coefficients and variable frequencies, which allows us to check for potential inconsistencies in the data and the impact of any changes to the SAS analytic package.

**Figure B.1 – CORE QA Phase I**



**Figure B.2 – CORE QA Phase II**

**Results Testing – Alpha Version**



## Appendix C. Annual Updates

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

### 2014

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#### **2014 Measure Updates and Specifications Report HWR (Version 3.0)**

1. Respecified the measure by updating to CMS planned readmission algorithm version 3.0.
  - Rationale: Version 3.0 incorporates improvements made following a validation study of the algorithm using data from a medical record review. These changes improve the accuracy of the algorithm by decreasing the number of readmissions that the algorithm mistakenly designated as planned by removing two procedure categories and adding several acute diagnoses.
2. Updated version of the AHRQ CCS software
  - Rationale: An updated version of the AHRQ CCS software was released in 2013.

### 2013

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#### **2013 Measure Updates and Specifications Report HWR (Version 2.0)**

1. Respecified the measure by updating to CMS planned readmission algorithm version 2.1.
  - Rationale: Version 2.1 incorporated improvements to the original algorithm made following an extensive review by clinical experts and stakeholder feedback submitted during the HWR measure's public comment period and 2012 dry run.
2. Updated CC map.
  - Rationale: The ICD-9-CM CC map is updated annually to capture all relevant comorbidities coded in patient administrative claims data.<sup>§</sup>
3. Removed procedure CCS 61 from the list of procedures qualifying an admission for the surgery cohort.
  - Rationale: This procedure CCS was removed from the surgical cohort because patients undergoing this procedure are typically admitted primarily for cardiovascular or medical care.

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<sup>§</sup> The CC groups of ICD-9-CM codes was not updated this year due to the upcoming transition to International Statistical Classification of Diseases and Related Health Problems 10<sup>th</sup> Revision (ICD-10).

## Appendix D. Measure Specifications

### Cohort

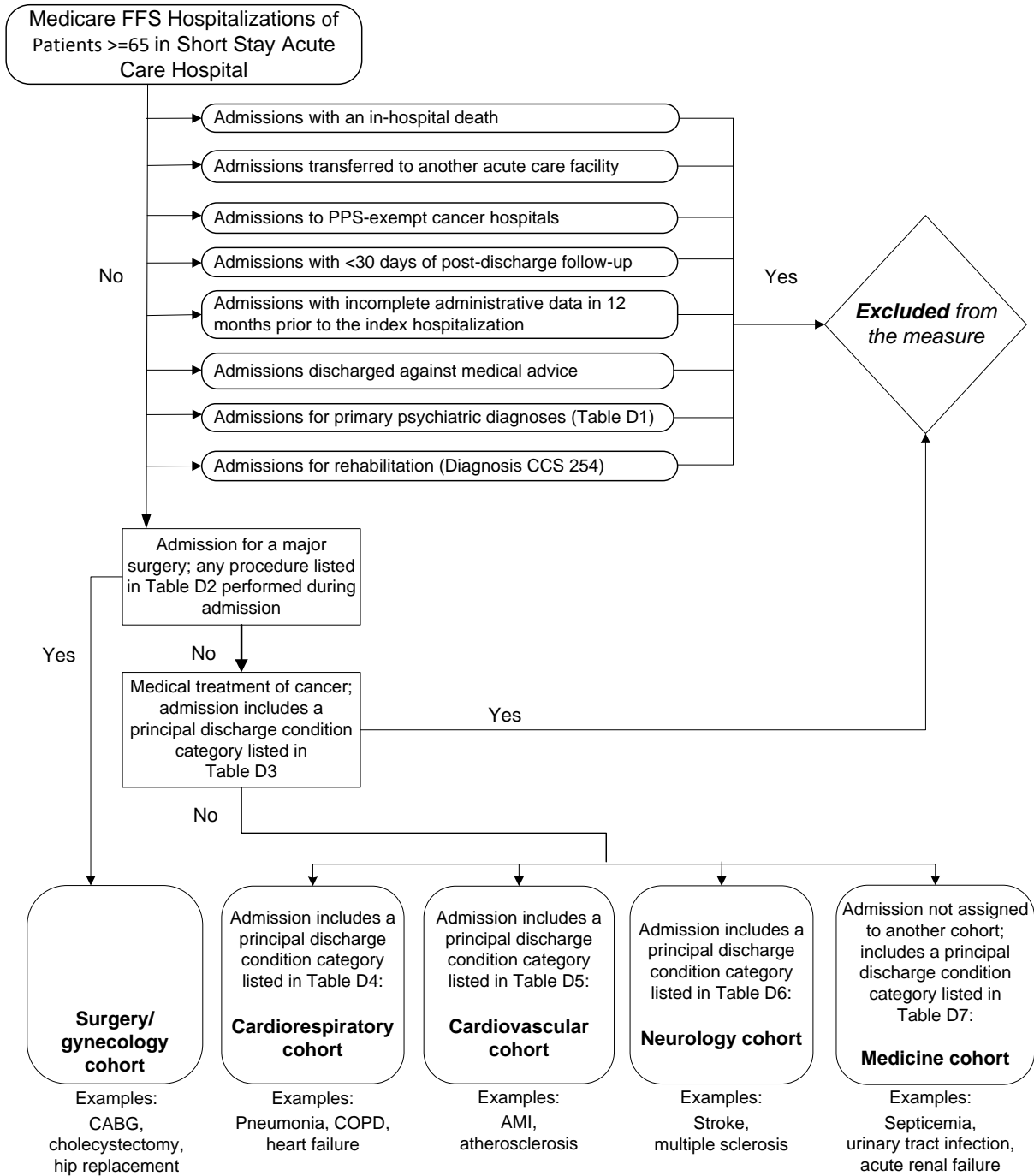
#### Inclusion Criteria for HWR Measure

- 1. Enrolled in Medicare FFS**  
Rationale: Claims data are consistently available only for Medicare FFS.
- 2. Aged 65 or older**  
Rationale: Medicare patients younger than 65 usually qualify for the program due to severe disability. They are not included in the measure because Medicare patients younger than 65 are considered to be too clinically distinct from Medicare patients 65 and over.
- 3. Discharged from non-federal acute care hospitals**  
Rationale: Data from federal hospitals were not available during the development of this measure.
- 4. Without an in-hospital death**  
Rationale: Patients who are discharged alive are eligible for readmission.
- 5. Not transferred to another acute care facility**  
Rationale: Readmission is attributed to the hospital that discharged the patient to the non-acute care setting. Transferred patients are still included in the measure cohort, but the initial admitting hospital is not accountable for the outcome.
- 6. Enrolled in Part A for the 12 months prior to and including the date of the index admission**  
Rationale: The 12-month prior enrollment ensures a full year of administrative data for risk adjustment.

#### Exclusion Criteria for HWR Measure

- 1. Admissions to Prospective Payment System (PPS)-exempt cancer hospitals**  
Rationale: These hospitals care for a unique population of patients that cannot reasonably be compared to patients admitted to other hospitals.
- 2. Without at least 30 days of post-discharge enrollment in FFS Medicare**  
Rationale: The 30-day readmission outcome cannot be assessed in this group since claims data are used to determine whether a patient was readmitted.
- 3. Discharged against medical advice (AMA)**  
Rationale: Providers did not have the opportunity to deliver full care and prepare the patient for discharge.
- 4. Admissions for primary psychiatric diagnoses**  
Rationale: Patients admitted for psychiatric treatment are typically cared for in separate psychiatric or rehabilitation centers that are not comparable to acute care hospitals.
- 5. Admissions for rehabilitation**  
Rationale: These admissions are not typically to an acute care hospital and are not for acute care.
- 6. Admissions for medical treatment of cancer**  
Rationale: These admissions have a different mortality and readmission profile than the rest of the Medicare population, and outcomes for these admissions do not correlate well with outcomes for other admissions. Patients with cancer admitted for other diagnoses or for surgical treatment of their cancer remain in the measure.

**Figure D.1 – HWR Flow Diagram of Inclusion and Exclusion Criteria and Specialty Cohort Assignment for the Index Admission**



**Table D.1 – Psychiatric Discharge Diagnosis Categories Excluded from the Measure**

AHRQ Procedure CCS	Description
650	Adjustment disorders
651	Anxiety disorders
652	Attention-deficit, conduct, and disruptive behavior disorders
654	Developmental disorders
655	Disorders usually diagnosed in infancy, childhood, or adolescence
656	Impulse control disorders, NEC
657	Mood disorders
658	Personality disorders
659	Schizophrenia and other psychotic disorders
662	Suicide and intentional self-inflicted injury
670	Miscellaneous disorders

**Table D.2 – Procedure Categories Defining the Surgery/Gynecology Cohort\***

AHRQ Procedure CCS	Description
1	Incision and excision of CNS
2	Insertion; replacement; or removal of extracranial ventricular shunt
3	Laminectomy; excision intervertebral disc
9	Other OR therapeutic nervous system procedures
10	Thyroidectomy; partial or complete
12	Other therapeutic endocrine procedures
13	Corneal transplant
14	Glaucoma procedures
15	Lens and cataract procedures
16	Repair of retinal tear; detachment
17	Destruction of lesion of retina and choroid
20	Other intraocular therapeutic procedures
21	Other extraocular muscle and orbit therapeutic procedures
22	Tympanoplasty
23	Myringotomy
24	Mastoidectomy
26	Other therapeutic ear procedures
28	Plastic procedures on nose
30	Tonsillectomy and/or adenoidectomy
33	Other OR therapeutic procedures on nose; mouth and pharynx
36	Lobectomy or pneumonectomy
42	Other OR Rx procedures on respiratory system and mediastinum
43	Heart valve procedures
44	Coronary artery bypass graft (CABG)
49	Other OR heart procedures
51	Endarterectomy; vessel of head and neck
52	Aortic resection; replacement or anastomosis

\* Not mutually exclusive; multiple procedures may be performed during a single admission

AHRQ Procedure CCS	Description
53	'Varicose vein stripping; lower limb
55	Peripheral vascular bypass
56	Other vascular bypass and shunt; not heart
59	Other OR procedures on vessels of head and neck
60	Embolectomy and endarterectomy of lower limbs
66	Procedures on spleen
67	Other therapeutic procedures; hemic and lymphatic system
72	Colostomy; temporary and permanent
73	Ileostomy and other enterostomy
74	Gastrectomy; partial and total
75	Small bowel resection
78	Colorectal resection
79	Local excision of large intestine lesion (not endoscopic)
80	Appendectomy
84	Cholecystectomy and common duct exploration
85	Inguinal and femoral hernia repair
86	Other hernia repair
89	Exploratory laparotomy
90	Excision; lysis peritoneal adhesions
94	Other OR upper GI therapeutic procedures
96	Other OR lower GI therapeutic procedures
99	Other OR gastrointestinal therapeutic procedures
101	Transurethral excision; drainage; or removal urinary obstruction
103	Nephrotomy and nephrostomy
104	Nephrectomy; partial or complete
105	Kidney transplant
106	Genitourinary incontinence procedures
112	Other OR therapeutic procedures of urinary tract
113	Transurethral resection of prostate (TURP)
114	Open prostatectomy
118	Other OR therapeutic procedures; male genital
119	Oophorectomy; unilateral and bilateral
120	Other operations on ovary
121	Ligation or occlusion of fallopian tubes
122	Removal of ectopic pregnancy
123	Other operations on fallopian tubes
124	Hysterectomy; abdominal and vaginal
125	Other excision of cervix and uterus
126	Abortion (termination of pregnancy)
127	Dilatation and curettage (D&C); aspiration after delivery or abortion
129	Repair of cystocele and rectocele; obliteration of vaginal vault
131	Other non-OR therapeutic procedures; female organs
132	Other OR therapeutic procedures; female organs
133	Episiotomy
134	Cesarean section
135	Forceps; vacuum; and breech delivery
136	Artificial rupture of membranes to assist delivery
137	Other procedures to assist delivery



<b>AHRQ Procedure CCS</b>	<b>Description</b>
139	Fetal monitoring
140	Repair of current obstetric laceration
141	Other therapeutic obstetrical procedures
142	Partial excision bone
143	Bunionectomy or repair of toe deformities
144	Treatment; facial fracture or dislocation
145	Treatment; fracture or dislocation of radius and ulna
146	Treatment; fracture or dislocation of hip and femur
147	Treatment; fracture or dislocation of lower extremity (other than hip or femur)
148	Other fracture and dislocation procedure
150	Division of joint capsule; ligament or cartilage
151	Excision of semilunar cartilage of knee
152	Arthroplasty knee
153	Hip replacement; total and partial
154	Arthroplasty other than hip or knee
157	Amputation of lower extremity
158	Spinal fusion
160	Other therapeutic procedures on muscles and tendons
161	Other OR therapeutic procedures on bone
162	Other OR therapeutic procedures on joints
164	Other OR therapeutic procedures on musculoskeletal system
166	Lumpectomy; quadrantectomy of breast
167	Mastectomy
172	Skin graft
175	Other OR therapeutic procedures on skin and breast
176	Other organ transplantation

**Table D.3 – Cancer Discharge Diagnosis Categories Excluded from the Measure for Admissions not Included in the Surgical Cohort**

<b>AHRQ Diagnosis CCS</b>	<b>Description</b>
11	Cancer of head and neck
12	Cancer of esophagus
13	Cancer of stomach
14	Cancer of colon
15	Cancer of rectum and anus
16	Cancer of liver and intrahepatic bile duct
17	Cancer of pancreas
18	Cancer of other GI organs; peritoneum
19	Cancer of bronchus; lung
20	Cancer; other respiratory and intrathoracic
21	Cancer of bone and connective tissue
22	Melanomas of skin
23	Other non-epithelial cancer of skin
24	Cancer of breast

AHRQ Diagnosis CCS	Description
25	Cancer of uterus
26	Cancer of cervix
27	Cancer of ovary
28	Cancer of other female genital organs
29	Cancer of prostate
30	Cancer of testis
31	Cancer of other male genital organs
32	Cancer of bladder
33	Cancer of kidney and renal pelvis
34	Cancer of other urinary organs
35	Cancer of brain and nervous system
36	Cancer of thyroid
37	Hodgkin's disease
38	Non-Hodgkin's lymphoma
39	Leukemias
40	Multiple myeloma
41	Cancer; other and unspecified primary
42	Secondary malignancies
43	Malignant neoplasm without specification of site
44	Neoplasms of unspecified nature or uncertain behavior
45	Maintenance chemotherapy; radiotherapy

**Table D.4 – Diagnosis Categories Defining the Cardiorespiratory Cohort**

AHRQ Diagnosis CCS	Description
56	Cystic Fibrosis
103	Pulmonary heart disease
108	Congestive heart failure; nonhypertensive
122	Pneumonia (except that caused by tuberculosis or sexually transmitted disease)
125	Acute bronchitis
127	Chronic obstructive pulmonary disease and bronchiectasis
128	Asthma
131	Respiratory failure; insufficiency; arrest (adult)

**Table D.5 – Diagnosis Categories Defining the Cardiovascular Cohort**

AHRQ Diagnosis CCS	Description
96	Heart valve disorders
97	Peri-; endo-; and myocarditis; cardiomyopathy (except that caused by tuberculosis or sexually transmitted)
100	Acute myocardial infarction
101	Coronary atherosclerosis and other heart disease
102	Nonspecific chest pain
104	Other and ill-defined heart disease

AHRQ Diagnosis CCS	Description
105	Conduction disorders
106	Cardiac dysrhythmias
107	Cardiac arrest and ventricular fibrillation
114	Peripheral and visceral atherosclerosis
115	Aortic; peripheral; and visceral artery aneurysms
116	Aortic and peripheral arterial embolism or thrombosis
117	Other circulatory disease
213	Cardiac and circulatory congenital anomalies

**Table D.6 – Diagnosis Categories Defining the Neurology Cohort**

AHRQ Diagnosis CCS	Description
78	Other CNS infection and poliomyelitis
79	Parkinson's disease
80	Multiple sclerosis
81	Other hereditary and degenerative nervous system conditions
82	Paralysis
83	Epilepsy; convulsions
85	Coma; stupor; and brain damage
95	Other nervous system disorders
109	Acute cerebrovascular disease
110	Occlusion or stenosis of precerebral arteries
111	Other and ill-defined cerebrovascular disease
112	Transient cerebral ischemia
113	Late effects of cerebrovascular disease
216	Nervous system congenital anomalies
227	Spinal cord injury
233	Intracranial injury

**Table D.7 – Diagnosis Categories Defining the Medicine Cohort**

AHRQ Diagnosis CCS	Description
1	Tuberculosis
2	Septicemia (except in labor)
3	Bacterial infection; unspecified site
4	Mycoses
5	HIV infection
6	Hepatitis
7	Viral infection
8	Other infections; including parasitic
9	Sexually transmitted infections (not HIV or hepatitis)
10	Immunizations and screening for infectious disease
46	Benign neoplasm of uterus
47	Other and unspecified benign neoplasm

AHRQ Diagnosis CCS	Description
48	Thyroid disorders
49	Diabetes mellitus without complication
50	Diabetes mellitus with complications
51	Other endocrine disorders
52	Nutritional deficiencies
53	Disorders of lipid metabolism
54	Gout and other crystal arthropathies
55	Fluid and electrolyte disorders
57	Immunity disorders
58	Other nutritional; endocrine; and metabolic disorders
59	Deficiency and other anemia
60	Acute posthemorrhagic anemia
61	Sickle cell anemia
62	Coagulation and hemorrhagic disorders
63	Diseases of white blood cells
64	Other hematologic conditions
76	Meningitis (except that caused by tuberculosis or sexually transmitted disease)
77	Encephalitis (except that caused by tuberculosis or sexually transmitted disease)
84	Headache; including migraine
86	Cataract
87	Retinal detachments; defects; vascular occlusion; and retinopathy
88	Glaucoma
89	Blindness and vision defects
90	Inflammation; infection of eye (except that caused by tuberculosis or sexually transmitted disease)
91	Other eye disorders
92	Otitis media and related conditions
93	Conditions associated with dizziness or vertigo
94	Other ear and sense organ disorders
98	Essential hypertension
99	Hypertension with complications and secondary hypertension
118	Phlebitis; thrombophlebitis and thromboembolism
119	Varicose veins of lower extremity
120	Hemorrhoids
121	Other diseases of veins and lymphatics
123	Influenza
124	Acute and chronic tonsillitis
126	Other upper respiratory infections
129	Aspiration pneumonitis; food/vomitus
130	Pleurisy; pneumothorax; pulmonary collapse
132	Lung disease due to external agents
133	Other lower respiratory disease
134	Other upper respiratory disease
135	Intestinal infection
136	Disorders of teeth and jaw
137	Diseases of mouth; excluding dental
138	Esophageal disorders

AHRQ Diagnosis CCS	Description
139	Gastroduodenal ulcer (except hemorrhage)
140	Gastritis and duodenitis
141	Other disorders of stomach and duodenum
142	Appendicitis and other appendiceal conditions
143	Abdominal hernia
144	Regional enteritis and ulcerative colitis
145	Intestinal obstruction without hernia
146	Diverticulosis and diverticulitis
147	Anal and rectal conditions
148	Peritonitis and intestinal abscess
149	Biliary tract disease
151	Other liver diseases
152	Pancreatic disorders (not diabetes)
153	Gastrointestinal hemorrhage
154	Noninfectious gastroenteritis
155	Other gastrointestinal disorders
156	Nephritis; nephrosis; renal sclerosis
157	Acute and unspecified renal failure
158	Chronic renal failure
159	Urinary tract infections
160	Calculus of urinary tract
161	Other diseases of kidney and ureters
162	Other diseases of bladder and urethra
163	Genitourinary symptoms and ill-defined conditions
164	Hyperplasia of prostate
165	Inflammatory conditions of male genital organs
166	Other male genital disorders
167	Nonmalignant breast conditions
168	Inflammatory diseases of female pelvic organs
169	Endometriosis
170	Prolapse of female genital organs
171	Menstrual disorders
172	Ovarian cyst
173	Menopausal disorders
175	Other female genital disorders
174	Female infertility
197	Skin and subcutaneous tissue infections
198	Other inflammatory condition of skin
199	Chronic ulcer of skin
200	Other skin disorders
201	Infective arthritis and osteomyelitis (except that caused by tuberculosis or sexually transmitted disease)
202	Rheumatoid arthritis and related disease
203	Osteoarthritis
204	Other non-traumatic joint disorders
205	Spondylosis; intervertebral disc disorders; other back problems
206	Osteoporosis

AHRQ Diagnosis CCS	Description
207	Pathological fracture
208	Acquired foot deformities
209	Other acquired deformities
210	Systemic lupus erythematosus and connective tissue disorders
211	Other connective tissue disease
212	Other bone disease and musculoskeletal deformities
214	Digestive congenital anomalies
215	Genitourinary congenital anomalies
217	Other congenital anomalies
225	Joint disorders and dislocations; trauma-related
226	Fracture of neck of femur (hip)
228	Skull and face fractures
229	Fracture of upper limb
230	Fracture of lower limb
231	Other fractures
232	Sprains and strains
234	Crushing injury or internal injury
235	Open wounds of head; neck; and trunk
236	Open wounds of extremities
237	Complication of device; implant or graft
238	Complications of surgical procedures or medical care
239	Superficial injury; contusion
240	Burns
241	Poisoning by psychotropic agents
242	Poisoning by other medications and drugs
243	Poisoning by nonmedicinal substances
244	Other injuries and conditions due to external causes
245	Syncope
246	Fever of unknown origin
247	Lymphadenitis
248	Gangrene
249	Shock
250	Nausea and vomiting
251	Abdominal pain
252	Malaise and fatigue
253	Allergic reactions
255	Administrative/social admission
256	Medical examination/evaluation
257	Other aftercare
258	Other screening for suspected conditions (not mental disorders or infectious disease)
259	Residual codes; unclassified
653	Delirium, dementia, and amnestic and other cognitive disorders
660	Alcohol-related disorders
661	Substance-related disorders
663	Screening and history of mental health and substance abuse codes

## Risk Adjustment

**Table D.8 – Principal Discharge Diagnosis Risk Variables for Surgery/Gynecology Specialty Cohort \*\***

Variable	Description
CCS 1	Tuberculosis
CCS 2	Septicemia (except in labor)
CCS 3	Bacterial infection; unspecified site
CCS 4	Mycoses
CCS 5	HIV infection
CCS 6	Hepatitis
CCS 7	Viral infection
CCS 8	Other infections; including parasitic
CCS 9	Sexually transmitted infections (not HIV or hepatitis)
CCS 10	Immunizations and screening for infectious disease
CCS 11	Cancer of head and neck
CCS 12	Cancer of esophagus
CCS 13	Cancer of stomach
CCS 14	Cancer of colon
CCS 15	Cancer of rectum and anus
CCS 16	Cancer of liver and intrahepatic bile duct
CCS 17	Cancer of pancreas
CCS 18	Cancer of other GI organs; peritoneum
CCS 19	Cancer of bronchus; lung
CCS 20	Cancer; other respiratory and intrathoracic
CCS 21	Cancer of bone and connective tissue
CCS 22	Melanomas of skin
CCS 23	Other non-epithelial cancer of skin
CCS 24	Cancer of breast
CCS 25	Cancer of uterus
CCS 26	Cancer of cervix
CCS 27	Cancer of ovary
CCS 28	Cancer of other female genital organs
CCS 29	Cancer of prostate
CCS 30	Cancer of testis
CCS 31	Cancer of other male genital organs
CCS 32	Cancer of bladder
CCS 33	Cancer of kidney and renal pelvis
CCS 34	Cancer of other urinary organs

\*\* The principal discharge diagnosis risk variables for the other cohorts are the same as the principal discharge diagnosis CCS categories that define each cohort.

Variable	Description
CCS 35	Cancer of brain and nervous system
CCS 36	Cancer of thyroid
CCS 37	Hodgkin's disease
CCS 38	Non-Hodgkin's lymphoma
CCS 39	Leukemias
CCS 40	Multiple myeloma
CCS 41	Cancer; other and unspecified primary
CCS 42	Secondary malignancies
CCS 43	Malignant neoplasm without specification of site
CCS 44	Neoplasms of unspecified nature or uncertain behavior
CCS 45	Maintenance chemotherapy; radiotherapy
CCS 46	Benign neoplasm of uterus
CCS 47	Other and unspecified benign neoplasm
CCS 48	Thyroid disorders
CCS 49	Diabetes mellitus without complications
CCS 50	Diabetes mellitus with complications
CCS 51	Other endocrine disorders
CCS 52	Nutritional deficiencies
CCS 53	Disorders of lipid metabolism
CCS 54	Gout and other crystal arthropathies
CCS 55	Fluid and electrolyte disorders
CCS 57	Immunity disorders
CCS 58	Other nutritional; endocrine; and metabolic disorders
CCS 59	Deficiency and other anemia
CCS 60	Acute posthemorrhagic anemia
CCS 61	Sickle cell anemia
CCS 62	Coagulation and hemorrhagic disorders
CCS 63	Diseases of white blood cells
CCS 64	Other hematologic conditions
CCS 76	Meningitis (except that caused by tuberculosis or sexually transmitted disease)
CCS 77	Encephalitis (except that caused by tuberculosis or sexually transmitted disease)
CCS 78	Other CNS infection and poliomyelitis
CCS 79	Parkinson's disease
CCS 80	Multiple sclerosis
CCS 81	Other hereditary and degenerative nervous system conditions
CCS 82	Paralysis
CCS 83	Epilepsy; convulsions
CCS 84	Headache; including migraine
CCS 85	Coma; stupor; and brain damage
CCS 86	Cataract
CCS 87	Retinal detachments; defects; vascular occlusion; and retinopathy
CCS 88	Glaucoma



Variable	Description
CCS 89	Blindness and vision defects
CCS 90	Inflammation; infection of eye (except that caused by tuberculosis or sexually transmitted disease)
CCS 91	Other eye disorders
CCS 92	Otitis media and related conditions
CCS 93	Conditions associated with dizziness or vertigo
CCS 94	Other ear and sense organ disorders
CCS 95	Other nervous system disorders
CCS 96	Heart valve disorders
CCS 97	Peri-; endo-; and myocarditis; cardiomyopathy (except that caused by tuberculosis or sexually transmitted disease)
CCS 98	Essential hypertension
CCS 99	Hypertension with complications and secondary hypertension
CCS 100	Acute myocardial infarction
CCS 101	Coronary atherosclerosis and other heart disease
CCS 102	Nonspecific chest pain
CCS 103	Pulmonary heart disease
CCS 104	Other and ill-defined heart disease
CCS 105	Conduction disorders
CCS 106	Cardiac dysrhythmias
CCS 107	Cardiac arrest and ventricular fibrillation
CCS 108	Congestive heart failure; non-hypertensive
CCS 109	Acute cerebrovascular disease
CCS 110	Occlusion or stenosis of precerebral arteries
CCS 111	Other and ill-defined cerebrovascular disease
CCS 112	Transient cerebral ischemia
CCS 113	Late effects of cerebrovascular disease
CCS 114	Peripheral and visceral atherosclerosis
CCS 115	Aortic; peripheral; and visceral artery aneurysms
CCS 116	Aortic and peripheral arterial embolism or thrombosis
CCS 117	Other circulatory disease
CCS 118	Phlebitis; thrombophlebitis and thromboembolism
CCS 119	Varicose veins of lower extremity
CCS 120	Hemorrhoids
CCS 121	Other diseases of veins and lymphatics
CCS 122	Pneumonia (except that caused by tuberculosis or sexually transmitted disease)
CCS 123	Influenza
CCS 124	Acute and chronic tonsillitis
CCS 125	Acute bronchitis
CCS 126	Other upper respiratory infections
CCS 127	Chronic obstructive pulmonary disease and bronchiectasis
CCS 128	Asthma
CCS 129	Aspiration pneumonitis; food/vomit

Variable	Description
CCS 130	Pleurisy; pneumothorax; pulmonary collapse
CCS 131	Respiratory failure; insufficiency; arrest (adult)
CCS 132	Lung disease due to external agents
CCS 133	Other lower respiratory disease
CCS 134	Other upper respiratory disease
CCS 135	Intestinal infection
CCS 136	Disorders of teeth and jaw
CCS 137	Diseases of mouth; excluding dental
CCS 138	Esophageal disorders
CCS 139	Gastroduodenal ulcer (except hemorrhage)
CCS 140	Gastritis and duodenitis
CCS 141	Other disorders of stomach and duodenum
CCS 142	Appendicitis and other appendiceal conditions
CCS 143	Abdominal hernia
CCS 144	Regional enteritis and ulcerative colitis
CCS 145	Intestinal obstruction without hernia
CCS 146	Diverticulosis and diverticulitis
CCS 147	Anal and rectal conditions
CCS 148	Peritonitis and intestinal abscess
CCS 149	Biliary tract disease
CCS 151	Other liver diseases
CCS 152	Pancreatic disorders (not diabetes)
CCS 153	Gastrointestinal hemorrhage
CCS 154	Noninfectious gastroenteritis
CCS 155	Other gastrointestinal disorders
CCS 156	Nephritis; nephrosis; renal sclerosis
CCS 157	Acute and unspecified renal failure
CCS 158	Chronic kidney disease
CCS 159	Urinary tract infections
CCS 160	Calculus of urinary tract
CCS 161	Other diseases of kidney and ureters
CCS 162	Other diseases of bladder and urethra
CCS 163	Genitourinary symptoms and ill-defined conditions
CCS 164	Hyperplasia of prostate
CCS 165	Inflammatory conditions of male genital organs
CCS 166	Other male genital disorders
CCS 167	Nonmalignant breast conditions
CCS 168	Inflammatory diseases of female pelvic organs
CCS 169	Endometriosis
CCS 170	Prolapse of female genital organs
CCS 171	Menstrual disorders
CCS 172	Ovarian cyst

Variable	Description
CCS 173	Menopausal disorders
CCS 175	Other female genital disorders
CCS 197	Skin and subcutaneous tissue infections
CCS 198	Other inflammatory condition of skin
CCS 199	Chronic ulcer of skin
CCS 200	Other skin disorders
CCS 201	Infective arthritis and osteomyelitis (except that caused by tuberculosis or sexually transmitted disease)
CCS 202	Rheumatoid arthritis and related disease
CCS 203	Osteoarthritis
CCS 204	Other non-traumatic joint disorders
CCS 205	Spondylosis; intervertebral disc disorders; other back problems
CCS 206	Osteoporosis
CCS 207	Pathological fracture
CCS 208	Acquired foot deformities
CCS 209	Other acquired deformities
CCS 210	Systemic lupus erythematosus and connective tissue disorders
CCS 211	Other connective tissue disease
CCS 212	Other bone disease and musculoskeletal deformities
CCS 213	Cardiac and circulatory congenital anomalies
CCS 214	Digestive congenital anomalies
CCS 215	Genitourinary congenital anomalies
CCS 216	Nervous system congenital anomalies
CCS 217	Other congenital anomalies
CCS 225	Joint disorders and dislocations; trauma-related
CCS 226	Fracture of neck or femur (hip)
CCS 227	Spinal cord injury
CCS 228	Skull and face fractures
CCS 229	Fracture of upper limb
CCS 231	Other fractures
CCS 234	Crushing injury or internal injury
CCS 236	Open wounds of extremities
CCS 237	Complication of device; implant or graft
CCS 230	Fracture of lower limb
CCS 232	Sprains and strains
CCS 233	Intracranial injury (CCS 233)
CCS 235	Open wounds of head; neck; and trunk
CCS 238	Complications of surgical procedures or medical care
CCS 239	Superficial injury; contusion
CCS 240	Burns
CCS 241	Poisoning by psychotropic agents
CCS 242	Poisoning by other medications and drugs

Variable	Description
CCS 243	Poisoning by nonmedical substances
CCS 244	Other injuries and conditions due to external causes
CCS 248	Gangrene
CCS 249	Shock
CCS 250	Nausea and vomiting
CCS 251	Abdominal pain
CCS 252	Malaise and fatigue
CCS 253	Allergic reactions
CCS 256	Medical examination/evaluation
CCS 257	Other aftercare
CCS 258	Other screening for suspected conditions (not mental disorders or infectious disease)
CCS 259	Residual codes; unclassified
CCS 653	Delirium, dementia, and amnestic and other cognitive disorders
CCS 660	Alcohol-related disorders
CCS 661	Substance-related disorders
CCS 663	Screening and history of mental health and substance abuse codes

**Table D.9 – Comorbidity Risk Variables Common to All HWR Specialty Cohorts**

Variable	Description
n/a	Mean age, years
CC 7	Metastatic cancer/acute leukemia
CC 8, 9	Severe Cancer
CC 10-12	Other cancers
CC 44	Severe hematological disorders
CC 46	Coagulation defects and other specified hematological disorders
CC 47	Iron deficiency or other unspecified anemias and blood disease
CC 25, 26	End-stage liver disease
CC 32	Pancreatic disease
CC 130	Dialysis status
CC 131	Acute renal failure
CC 128, 174	Transplants
CC 1, 3-5	Severe Infection
CC 6, 111-113	Other infectious diseases and pneumonias
CC 2	Septicemia/Shock
CC 80	CHF
CC 81-84, 89, 98, 99, 103-106	Coronary atherosclerosis or angina, cerebrovascular disease
CC 92, 93	Specified arrhythmias
CC 79	Cardio-respiratory failure or cardio-respiratory shock
CC 108	COPD

Variable	Description
CC 109	Fibrosis of lung or other chronic lung disorders
CC 21	Protein-calorie malnutrition
CC 22, 23	Disorders of fluid, electrolyte, acid-base
CC 38	Rheumatoid arthritis and inflammatory connective tissue disease
CC 15-20, 119, 120	Diabetes mellitus
CC 148, 149	Decubitus ulcer or chronic skin ulcer
CC 67-69, 100-102, 177, 178	Hemiplegia, paraplegia, paralysis, functional disability
CC 74	Seizure disorders and convulsions
CC 77	Respirator dependence/tracheostomy status
CC 51, 52	Drug and Alcohol disorders
CC 54-56, 58, 60	Psychiatric comorbidity
CC 158	Hip fracture/dislocation

**Table D.10 – Complications of Care Variables Not Used in Risk Adjustment If Occurring Only During the Index Admission**

Variable	Description
CC 2	Septicemia/Shock
CC 6	Other Infectious Diseases
CC 17	Diabetes with Acute Complications
CC 23	Disorders of Fluid/Electrolyte/Acid-Base
CC 28	Acute Liver Failure/Disease
CC 31	Intestinal Obstruction/Perforation
CC 34	Peptic Ulcer, Hemorrhage, Other Specified Gastrointestinal Disorders
CC 46	Coagulation Defects and Other Specified Hematological Disorders
CC 48	Delirium and Encephalopathy
CC 75	Coma, Brain Compression/Anoxic Damage
CC 77	Respirator Dependence/Tracheostomy Status
CC 78	Respiratory Arrest
CC 79	Cardio-Respiratory Failure and Shock
CC 80	Congestive Heart Failure
CC 81	Acute Myocardial Infarction
CC 82	Unstable Angina and Other Acute Ischemic Heart Disease
CC 92	Specified Heart Arrhythmias
CC 93	Other Heart Rhythm and Conduction Disorders
CC 95	Cerebral Hemorrhage
CC 96	Ischemic or Unspecified Stroke
CC 97	Precerebral Arterial Occlusion and Transient Cerebral Ischemia
CC 100	Hemiplegia/Hemiparesis
CC 101	Diplegia (Upper), Monoplegia, and Other Paralytic Syndromes

Variable	Description
CC 102	Speech, Language, Cognitive, Perceptual
CC 104	Vascular Disease with Complications
CC 105	Vascular Disease
CC 106	Other Circulatory Disease
CC 111	Aspiration and Specified Bacterial Pneumonias
CC 112	Pneumococcal Pneumonia, Emphysema, Lung Abscess
CC 114	Pleural Effusion/Pneumothorax
CC 129	End Stage Renal Disease
CC 130	Dialysis Status
CC 131	Renal Failure
CC 132	Nephritis
CC 133	Urinary Obstruction and Retention
CC 135	Urinary Tract Infection
CC 148	Decubitus Ulcer of Skin
CC 152	Cellulitis, Local Skin Infection
CC 154	Severe Head Injury
CC 155	Major Head Injury
CC 156	Concussion or Unspecified Head Injury
CC 158	Hip Fracture/Dislocation
CC 159	Major Fracture, Except of Skull, Vertebrae, or Hip
CC 163	Poisonings and Allergic Reactions
CC 164	Major Complications of Medical Care and Trauma
CC 165	Other Complications of Medical Care
CC 174	Major Organ Transplant Status
CC 175	Other Organ Transplant/Replacement
CC 176	Artificial Openings for Feeding or Elimination
CC 177	Amputation Status, Lower Limb/Amputation
CC 178	Amputation Status, Upper Limb
CC 179	Post-Surgical States/Aftercare/Elective

## **Outcome**

### **Outcome Criteria for HWR Measure**

#### **1. 30-day time frame**

Rationale: Outcomes occurring within 30 days of discharge can be influenced by hospital care and the early transition to the outpatient setting. The use of the 30-day time frame is a clinically meaningful period for hospitals to collaborate with their communities to reduce readmissions.

#### **2. All-cause unplanned readmission**

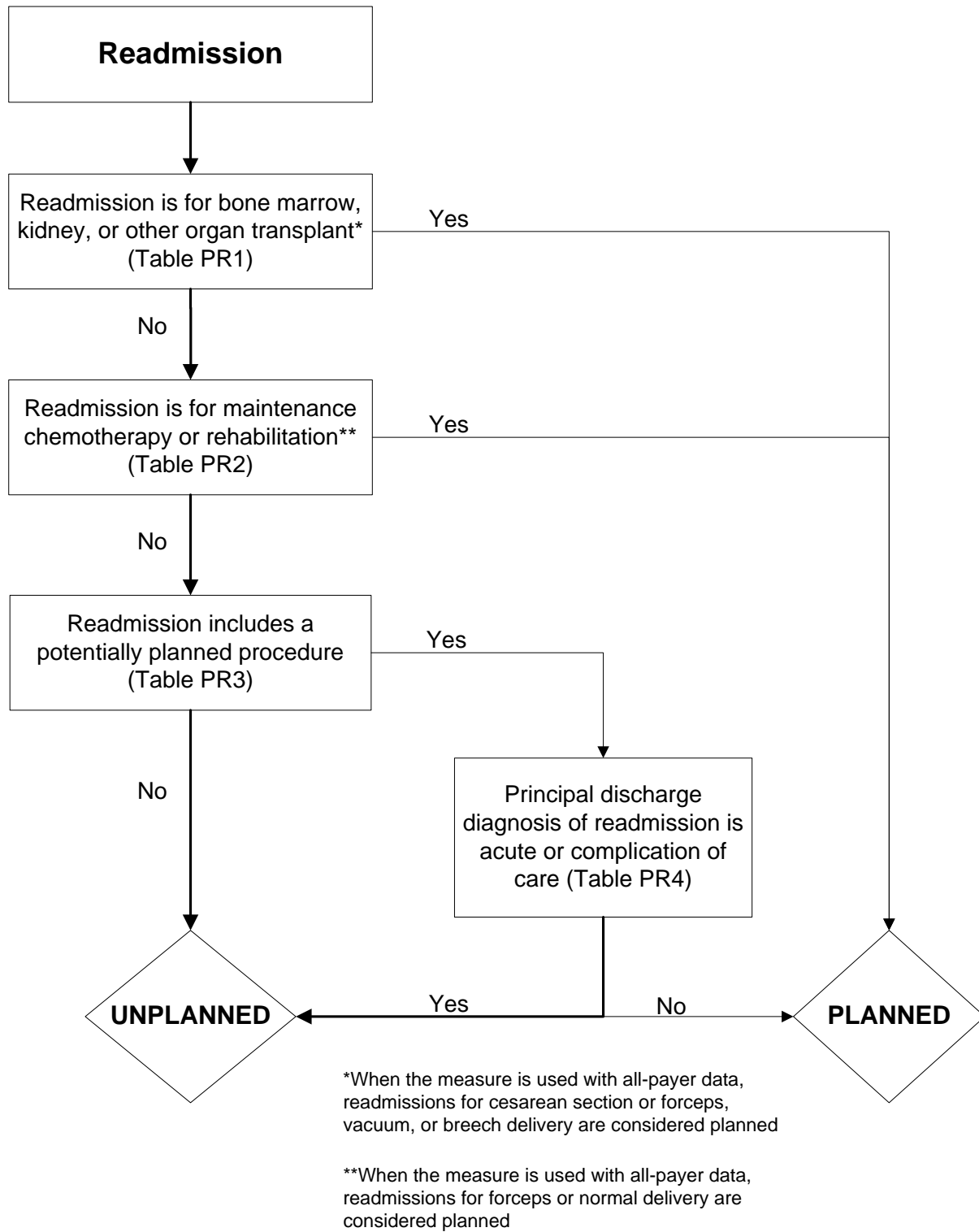
Rationale: From a patient perspective, an unplanned readmission from any cause is an adverse event.

#### **3. Unplanned readmission**

Rationale: Planned readmissions are generally not a signal of quality of care. Including planned readmissions in a readmission measure could create a disincentive to provide appropriate care to patients who are scheduled for elective or necessary procedures within 30 days of discharge.

## Appendix E. Planned Readmission Algorithm

Figure PR.1 – Planned Readmission Algorithm Version 3.0 Flowchart





## Planned Readmission Algorithm Version 3.0 Tables – HWR Measure

**Table PR.1 – Procedure Categories that are Always Planned (Version 3.0)**

Procedure CCS	Description
64	Bone marrow transplant
105	Kidney transplant
134	Cesarean section <sup>††</sup>
135	Forceps; vacuum; and breech delivery <sup>††</sup>
176	Other organ transplantation

**Table PR.2 – Diagnosis Categories that are Always Planned (Version 3.0)**

Diagnosis CCS	Description
45	Maintenance chemotherapy
194	Forceps delivery <sup>§§</sup>
196	Normal pregnancy and/or delivery <sup>***</sup>
254	Rehabilitation

<sup>††</sup> CCS to be included only in all-payer settings, not intended for inclusion in CMS's claims-based readmission measures for Medicare fee-for-service beneficiaries aged 65+ years.

<sup>††</sup> CCS to be included only in all-payer settings, not intended for inclusion in CMS's claims-based readmission measures for Medicare fee-for-service beneficiaries aged 65+ years.

<sup>§§</sup> CCS to be included only in all-payer settings, not intended for inclusion in CMS's claims-based readmission measures for Medicare fee-for-service beneficiaries aged 65+ years.

<sup>\*\*\*</sup> CCS to be included only in all-payer settings, not intended for inclusion in CMS's claims-based readmission measures for Medicare fee-for-service beneficiaries aged 65+ years.

**Table PR.3 – Potentially Planned Procedure Categories (Version 3.0)**

Procedure CCS	Description
3	Laminectomy; excision intervertebral disc
5	Insertion of catheter or spinal stimulator and injection into spinal
9	Other OR therapeutic nervous system procedures
10	Thyroidectomy; partial or complete
12	Other therapeutic endocrine procedures
33	Other OR therapeutic procedures on nose; mouth and pharynx
36	Lobectomy or pneumonectomy
38	Other diagnostic procedures on lung and bronchus
40	Other diagnostic procedures of respiratory tract and mediastinum
43	Heart valve procedures
44	Coronary artery bypass graft (CABG)
45	Percutaneous transluminal coronary angioplasty (PTCA)
47	Diagnostic cardiac catheterization; coronary arteriography
48	Insertion; revision; replacement; removal of cardiac pacemaker or cardioverter/defibrillator
49	Other OR heart procedures
51	Endarterectomy; vessel of head and neck
52	Aortic resection; replacement or anastomosis
53	Varicose vein stripping; lower limb
55	Peripheral vascular bypass
56	Other vascular bypass and shunt; not heart
59	Other OR procedures on vessels of head and neck
62	Other diagnostic cardiovascular procedures
66	Procedures on spleen
67	Other therapeutic procedures; hemic and lymphatic system
74	Gastrectomy; partial and total
78	Colorectal resection
79	Local excision of large intestine lesion (not endoscopic)
84	Cholecystectomy and common duct exploration
85	Inguinal and femoral hernia repair
86	Other hernia repair
99	Other OR gastrointestinal therapeutic procedures
104	Nephrectomy; partial or complete
106	Genitourinary incontinence procedures
107	Extracorporeal lithotripsy; urinary
109	Procedures on the urethra
112	Other OR therapeutic procedures of urinary tract
113	Transurethral resection of prostate (TURP)

Procedure CCS	Description
114	Open prostatectomy
119	Oophorectomy; unilateral and bilateral
120	Other operations on ovary
124	Hysterectomy; abdominal and vaginal
129	Repair of cystocele and rectocele; obliteration of vaginal vault
132	Other OR therapeutic procedures; female organs
142	Partial excision bone
152	Arthroplasty knee
153	Hip replacement; total and partial
154	Arthroplasty other than hip or knee
157	Amputation of lower extremity
158	Spinal fusion
159	Other diagnostic procedures on musculoskeletal system
166	Lumpectomy; quadrantectomy of breast
167	Mastectomy
169	Debridement of wound; infection or burn
170	Excision of skin lesion
172	Skin graft
ICD-9 Codes	Description
30.1, 30.29, 30.3, 30.4, 31.74, 34.6	Laryngectomy, revision of tracheostomy, scarification of pleura (from Proc CCS 42- Other OR Rx procedures on respiratory system and mediastinum)
38.18	Endarterectomy leg vessel (from Proc CCS 60- Embolectomy and endarterectomy of lower limbs)
55.03, 55.04	Percutaneous nephrostomy with and without fragmentation (from Proc CCS 103- Nephrotomy and nephrostomy)
94.26, 94.27	Electroshock therapy (from Proc CCS 218- Psychological and psychiatric evaluation and therapy)

**Table PR.4 – Acute Diagnosis Categories (Version 3.0)**

Diagnosis CCS	Description
1	Tuberculosis
2	Septicemia (except in labor)
3	Bacterial infection; unspecified site
4	Mycoses
5	HIV infection
7	Viral infection
8	Other infections; including parasitic
9	Sexually transmitted infections (not HIV or hepatitis)
54	Gout and other crystal arthropathies
55	Fluid and electrolyte disorders
60	Acute posthemorrhagic anemia
61	Sickle cell anemia
63	Diseases of white blood cells
76	Meningitis (except that caused by tuberculosis or sexually transmitted disease)
77	Encephalitis (except that caused by tuberculosis or sexually transmitted disease)
78	Other CNS infection and poliomyelitis
82	Paralysis
83	Epilepsy; convulsions
84	Headache; including migraine
85	Coma; stupor; and brain damage
87	Retinal detachments; defects; vascular occlusion; and retinopathy
89	Blindness and vision defects
90	Inflammation; infection of eye (except that caused by tuberculosis or sexually transmitted disease)
91	Other eye disorders
92	Otitis media and related conditions
93	Conditions associated with dizziness or vertigo
99	Hypertension with complications
100	Acute myocardial infarction (with the exception of ICD-9 codes 410.x2)
102	Nonspecific chest pain
104	Other and ill-defined heart disease
107	Cardiac arrest and ventricular fibrillation
109	Acute cerebrovascular disease
112	Transient cerebral ischemia
116	Aortic and peripheral arterial embolism or thrombosis
118	Phlebitis; thrombophlebitis and thromboembolism
120	Hemorrhoids
122	Pneumonia (except that caused by TB or sexually transmitted disease)
123	Influenza
124	Acute and chronic tonsillitis
125	Acute bronchitis

Diagnosis CCS	Description
126	Other upper respiratory infections
127	Chronic obstructive pulmonary disease and bronchiectasis
128	Asthma
129	Aspiration pneumonitis; food/vomitus
130	Pleurisy; pneumothorax; pulmonary collapse
131	Respiratory failure; insufficiency; arrest (adult)
135	Intestinal infection
137	Diseases of mouth; excluding dental
139	Gastroduodenal ulcer (except hemorrhage)
140	Gastritis and duodenitis
142	Appendicitis and other appendiceal conditions
145	Intestinal obstruction without hernia
146	Diverticulosis and diverticulitis
148	Peritonitis and intestinal abscess
153	Gastrointestinal hemorrhage
154	Noninfectious gastroenteritis
157	Acute and unspecified renal failure
159	Urinary tract infections
165	Inflammatory conditions of male genital organs
168	Inflammatory diseases of female pelvic organs
172	Ovarian cyst
197	Skin and subcutaneous tissue infections
198	Other inflammatory condition of skin
225	Joint disorders and dislocations; trauma-related
226	Fracture of neck of femur (hip)
227	Spinal cord injury
228	Skull and face fractures
229	Fracture of upper limb
230	Fracture of lower limb
232	Sprains and strains
233	Intracranial injury
234	Crushing injury or internal injury
235	Open wounds of head; neck; and trunk
237	Complication of device; implant or graft
238	Complications of surgical procedures or medical care
239	Superficial injury; contusion
240	Burns
241	Poisoning by psychotropic agents
242	Poisoning by other medications and drugs
243	Poisoning by nonmedicinal substances

Diagnosis CCS	Description
244	Other injuries and conditions due to external causes
245	Syncope
246	Fever of unknown origin
247	Lymphadenitis
249	Shock
250	Nausea and vomiting
251	Abdominal pain
252	Malaise and fatigue
253	Allergic reactions
259	Residual codes; unclassified
650	Adjustment disorders
651	Anxiety disorders
652	Attention-deficit, conduct, and disruptive behavior disorders
653	Delirium, dementia, and amnestic and other cognitive disorders
656	Impulse control disorders, NEC
658	Personality disorders
660	Alcohol-related disorders
661	Substance-related disorders
662	Suicide and intentional self-inflicted injury
663	Screening and history of mental health and substance abuse codes
670	Miscellaneous disorders
ICD-9 codes	Description
<b>Acute ICD-9 codes within Dx CCS 97: Peri-; endo-; and myocarditis; cardiomyopathy</b>	
032.82	Diphtheritic myocarditis
036.40	Meningococcal carditis nos
036.41	Meningococcal pericarditis
036.42	Meningococcal endocarditis
036.43	Meningococcal myocarditis
074.20	Coxsackie carditis nos
074.21	Coxsackie pericarditis
074.22	Coxsackie endocarditis
074.23	Coxsackie myocarditis
112.81	Candidal endocarditis
115.03	Histoplasma capsulatum pericarditis
115.04	Histoplasma capsulatum endocarditis
115.13	Histoplasma duboisii pericarditis
115.14	Histoplasma duboisii endocarditis
115.93	Histoplasmosis pericarditis
115.94	Histoplasmosis endocarditis
130.3	Toxoplasma myocarditis
391.0	Acute rheumatic pericarditis
391.1	Acute rheumatic endocarditis

Diagnosis CCS	Description
391.2	Acute rheumatic myocarditis
391.8	Acute rheumatic heart disease nec
391.9	Acute rheumatic heart disease nos
392.0	Rheumatic chorea w heart involvement
398.0	Rheumatic myocarditis
398.90	Rheumatic heart disease nos
398.99	Rheumatic heart disease nec
420.0	Acute pericarditis in other disease
420.90	Acute pericarditis nos
420.91	Acute idiopath pericarditis
420.99	Acute pericarditis nec
421.0	Acute/subacute bacterial endocarditis
421.1	Acute endocarditis in other diseases
421.9	Acute/subacute endocarditis nos
422.0	Acute myocarditis in other diseases
422.90	Acute myocarditis nos
422.91	Idiopathic myocarditis
422.92	Septic myocarditis
422.93	Toxic myocarditis
422.99	Acute myocarditis nec
423.0	Hemopericardium
423.1	Adhesive pericarditis
423.2	Constrictive pericarditis
423.3	Cardiac tamponade
429.0	Myocarditis nos
<b>Acute ICD-9 codes within Dx CCS 105: Conduction disorders</b>	
426.0	Atrioventricular
426.10	Atrioventricular block nos
426.11	Atrioventricular block-1st degree
426.12	Atrioventricular block-mobitz ii
426.13	Atrioventricular block-2nd degree nec
426.2	Left bundle branch hemiblock
426.3	Left bundle branch block nec
426.4	Right bundle branch block
426.50	Bundle branch block nos
426.51	Right bundle branch block/left posterior fascicular block
426.52	Right bundle branch block/left ant fascicular block
426.53	Bilateral bundle branch block nec
426.54	Trifascicular block
426.6	Other heart block
426.7	Anomalous atrioventricular excitation
426.81	Lown-ganong-levine syndrome

Diagnosis CCS	Description
426.82	Long qt syndrome
426.9	Conduction disorder nos
<b>Acute ICD-9 codes within Dx CCS 106: Dysrhythmia</b>	
427.2	Paroxysmal tachycardia nos
785.0	Tachycardia nos
427.89	Cardiac dysrhythmias nec
427.9	Cardiac dysrhythmia nos
427.69	Premature beats nec
<b>Acute ICD-9 codes within Dx CCS 108: Congestive heart failure; nonhypertensive</b>	
398.91	Rheumatic heart failure
428.0	Congestive heart failure
428.1	Left heart failure
428.20	Unspecified systolic heart failure
428.21	Acute systolic heart failure
428.23	Acute on chronic systolic heart failure
428.30	Unspecified diastolic heart failure
428.31	Acute diastolic heart failure
428.33	Acute on chronic diastolic heart failure
428.40	Unspec combined syst & dias heart failure
428.41	Acute combined systolic & diastolic heart failure
428.43	Acute on chronic combined systolic & diastolic heart failure
428.9	Heart failure nos
<b>Acute ICD-9 codes within Dx CCS 149: Biliary tract disease</b>	
574.0	Calculus of gallbladder with acute cholecystitis
574.00	Calculus of gallbladder with acute cholecystitis without mention of obstruction
574.01	Calculus of gallbladder with acute cholecystitis with obstruction
574.3	Calculus of bile duct with acute cholecystitis
574.30	Calculus of bile duct with acute cholecystitis without mention of obstruction
574.31	Calculus of bile duct with acute cholecystitis with obstruction
574.6	Calculus of gallbladder and bile duct with acute cholecystitis
574.60	Calculus of gallbladder and bile duct with acute cholecystitis without mention of obstruction
574.61	Calculus of gallbladder and bile duct with acute cholecystitis with obstruction
574.8	Calculus of gallbladder and bile duct with acute and chronic cholecystitis
574.80	Calculus of gallbladder and bile duct with acute and chronic cholecystitis without mention of obstruction
574.81	Calculus of gallbladder and bile duct with acute and chronic cholecystitis with obstruction
575.0	Acute cholecystitis
575.12	Acute and chronic cholecystitis
576.1	Cholangitis
<b>Acute ICD-9 codes with Dx CCS 152: Pancreatic disorders</b>	
577.0	Acute pancreatitis