NQF-ENDORSED VOLUNTARY CONSENSUS STANDARD FOR HOSPITAL CARE

Measure Information Form
Collected For: CMS Outcome Measures (Claims Based)

Measure Set: CMS Readmission Measures

Set Measure ID #: READM-30-HF

Performance Measure Name: Hospital 30-day all-cause risk standardized readmission rate (RSRR) following heart failure (HF) hospitalization.

Description: The measure estimates a hospital-level, risk-standardized, all-cause unplanned 30- day readmission rate for patients discharged from the hospital with a principal discharge diagnosis of HF.

Rationale: Readmission of patients who were recently discharged after hospitalization with HF represents an important, expensive, and often preventable adverse outcome. The risk of readmission can be modified by the quality and type of care provided to these patients. Improving readmission rates is the joint responsibility of hospitals and clinicians. Measuring readmission will create incentives to invest in interventions to improve hospital care, better assess the readiness of patients for discharge, and facilitate transitions to outpatient status. This measure is also responsive to the call by the Medicare Payment Advisory Commission (MedPAC) to develop readmission measures, with HF highlighted as one of seven conditions that account for nearly 30% of potentially preventable readmissions in the 15-day window after initial hospital discharge (MedPAC, 2007).

Type of Measure: Outcome

Improvement Noted As: A decrease in the RSRR.

Numerator Statement:
This outcome measure does not have a traditional numerator and denominator like a core process measure (e.g., percentage of adult patients with diabetes aged 18-75 years receiving one or more hemoglobin A1c tests per year); thus, we are using this field to define our outcome. The calculation of the rate is defined below under Measure Calculation.

The outcome for this measure is 30 day all-cause unplanned readmission. We define this as readmission for any unplanned cause within 30 days from the date of discharge of the index HF admission.

Denominator Statement:
The target population for this measure includes admissions for Medicare Fee-for-Service (FFS) and Veteran Health Administration (VA) beneficiaries aged greater than or equal to 65 years discharged from acute care non-federal hospitals or VA hospitals with a principal discharge diagnosis of HF.

Included Populations:
Admissions for Medicare FFS and VA beneficiaries greater than or equal to 65 years of age discharged from non-federal acute care hospitals or VA hospitals, having a principal discharge diagnosis of HF.

CMS FFS beneficiaries with an index hospitalization within an acute care non-federal hospital are included if they have been enrolled in Part A and Part B Medicare for the 12 months prior to the date of admission to ensure a full year of administrative data for risk-adjustment. (This requirement is dropped for patients with an index admission within a VA hospital.)

For patients who are transferred between one acute care hospital and another, the measures consider these multiple contiguous hospitalizations as a single acute episode of care. Readmission for transferred patients is 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, for patients who are transferred between two or more hospitals, if the patient is readmitted in the 30 days following the final hospitalization, the readmission is attributed to the final hospital.

ICD-9-CM codes that define the patient cohort

402.01	Hypertensive heart disease, malignant, with heart failure
402.11	Hypertensive heart disease, benign, with heart failure
402.91	Hypertensive heart disease, unspecified, with heart failure
404.01	Hypertensive heart and chronic kidney disease, malignant, with heart failure and with chronic kidney disease stage I through stage IV, or unspecified
404.03	Hypertensive heart and chronic kidney disease, malignant, with heart failure and with chronic kidney disease stage V or end stage renal disease
404.11	Hypertensive heart and chronic kidney disease, benign, with heart failure and with chronic kidney disease stage I through stage IV, or unspecified
404.13	Hypertensive heart and chronic kidney disease, benign, with heart failure and chronic kidney disease stage V or end stage renal disease
404.91	Hypertensive heart and chronic kidney disease, unspecified, with heart failure and with chronic kidney disease stage I through stage IV, or unspecified
404.93	Hypertensive heart and chronic kidney disease, unspecified, with heart failure and chronic kidney disease stage V or end stage renal disease
428.xx	Heart Failure

Cohort exclusions (excluded admissions):

- Admissions for patients with an in-hospital death are excluded because they are not eligible for readmission.
- Admissions for patients without at least 30 days post-discharge enrollment in FFS Medicare are excluded because the 30-day readmission outcome cannot be assessed in this group. This exclusion applies only to patients who have index admissions in non-VA hospitals.
- Admissions for patients having a principal diagnosis of HF during the index hospitalization and subsequently transferred to another acute care facility are excluded because we are focusing on discharges to non-acute care settings.
- Admissions for patients who are discharged against medical advice (AMA) are excluded because providers did not have the opportunity to deliver full care and prepare the patient for discharge.

In addition, if a patient has one or more HF admissions within 30 days of discharge from the index HF admission, only one is counted as a readmission. No admissions within 30 days of discharge from an index admission are considered as additional index admissions for heart failure. The next eligible admission after the 30-day time period following an index admission will be considered another index admission.

Admissions not counted as readmissions ("Planned readmissions")
Admissions identified as planned by the planned readmissions algorithm are not counted as readmissions. The "algorithm" is a set of criteria for classifying readmissions as planned using Medicare claims. The algorithm identifies admissions that are typically planned and may occur within 30 days of discharge from the hospital. CMS based the planned readmission algorithm on three principles:

1. A few specific, limited types of care are always considered planned (obstetrical delivery, transplant surgery, maintenance chemotherapy, 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 planned readmission algorithm uses a flow chart and four tables of procedures and conditions to operationalize these principles and to classify readmissions as planned. The flow chart and tables are available in a report, CMS Planned Readmission Algorithm Version 2.1 – General Population at Centers for Medicare & Medicaid Services Planned Readmission Algorithm Version 2.1: General Population report.

Risk Adjustment:
Our approach to risk adjustment is tailored to and appropriate for a publicly reported outcome measure, as articulated in the American Heart Association (AHA) Scientific Statement, "Standards for Statistical Models Used for Public Reporting of Health Outcomes" (Krumholz et al., 2006).

The measures adjust for key variables that are clinically relevant and have strong relationships with the outcome (e.g., age, sex, comorbid diseases, and indicators of frailty). For each patient, covariates are obtained from administrative data extending 12 months prior to, and including, the index admission. For all patients, information from

Medicare inpatient claims, physician Part B claims and hospital outpatient claims are used for risk adjustment. For patients with an index admission in a VA hospital, VA administrative data is also obtained.

The VA administrative data includes 41 diagnosis and 46 procedure codes (as opposed to 25 and 25, respectively, in CMS administrative data). For the index hospitalization, all diagnosis and procedure codes were retained. For risk adjustment, all diagnosis and procedure codes were retained for visits prior to the index hospitalization.

The models seek to adjust for case differences based on the clinical status of the patient at the time of the index admission. Accordingly, only comorbidities that convey information about the patient at that time or in the 12 months prior, and not complications that arise during the course of the index hospitalization are included in the risk adjustment.

The final set of risk-adjustment variables included:

Demographic	Age-65 (years above 65, continuous)
	Male
Cardiovascular	History of coronary artery bypass graft (CABG) surgery
	Cardio-respiratory failure and shock
	Congestive heart failure
	Acute coronary syndrome
	Chronic atherosclerosis or angina
	Valvular and rheumatic heart disease
	Specified Arrhythmias
	Vascular or circulatory disease
	Other or unspecified heart disease
Comorbidity	Metastatic cancer or acute leukemia
	Cancer
	Diabetes mellitus (DM) or DM complications
	Protein-calorie malnutrition
	Disorders of fluid, electrolyte, acid-base
	Liver and biliary disease
	Peptic ulcer, hemorrhage, other specified gastrointestinal disorders
	Other gastrointestinal disorders
	Severe hematological disorders
	Iron deficiency or other anemias and blood disease
	Dementia or other specified brain disorders
	Drug/alcohol abuse/dependence/psychosis
	Major psychiatric disorders
	Depression
	Other psychiatric disorders
	Hemiplegia, paraplegia, paralysis, functional disability
	Stroke
	Chronic obstructive pulmonary disease
	Fibrosis of lung and other chronic lung disorders
	Asthma
	Pneumonia
	End-stage renal disease or dialysis
	Renal failure
	Nephritis
	Other urinary tract disorders
	Decubitus ulcer or chronic skin ulcer

Full details of the development of the risk-standardization model for this measure are available at: http://www.qualitynet.org.

Data Collection Approach: Medicare claims data

Data Accuracy: The administrative claims data used to calculate the measure are maintained by CMS' Office of Information Services. These data undergo additional quality assurance checks during measure development and maintenance.

The data used to identify index admissions as well as inpatient and outpatient histories for the VA index hospitalizations come from administrative data extracted from the National Patient Care Database, originally constituted from the patient treatment files of each VA hospital.

Measure Analysis Suggestions: None

Sampling: No

Data Reported As: Hospital 30-day, all-cause, risk-standardized readmission rate (RSRR) following heart failure (HF) hospitalization.

Measure Calculation:
The measure estimates hospital-level 30 day all-cause RSRR for HF using hierarchical logistic regression modeling (a form of hierarchical generalized linear modeling [HGLM]). In brief, the approach simultaneously models two levels (patient and hospital) to account for the variance in patient outcomes within and between hospitals. At the patient level, the model adjusts the log-odds of a hospital readmission within 30 days of discharge for age, sex, 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 in order to account for the clustering (non-independence) of patients within the same hospital. If there were no differences among hospitals, then adjustment for patient risk would yield hospital intercepts that should be identical across all hospitals.

The RSRR is calculated as the ratio of the number of "predicted" readmissions to the number of "expected" readmissions, multiplied by the national unadjusted readmission rate. For each hospital, the "numerator" of the ratio is the number of readmissions within 30 days predicted on the basis of the hospital's performance with its observed case-mix, and the "denominator" is the number of readmissions expected on the basis of the nation's performance with that hospital's case-mix. This approach is analogous to a ratio of "observed" to "expected" used in other types of statistical analyses. It conceptually allows for a comparison of a particular hospital's performance given its case-mix to an average hospital's performance with the same case-mix. Thus, a lower ratio indicates lower-than-expected readmission (i.e., better quality), and a higher ratio indicates higher-than-expected readmission (i.e., worse quality).

The "predicted" number of readmissions (the numerator) is calculated by regressing the risk factors and the hospital-specific intercept on the risk of readmission, multiplying the estimated regression coefficients by the patient characteristics in the hospital, transforming, and then summing over all patients attributed to the hospital to get a value. The expected number of readmissions (the denominator) is obtained by regressing the risk factors and a common intercept on the readmission outcome using all hospitals in our sample, multiplying the subsequent estimated regression coefficients by the patient characteristics observed in the hospital, transforming, and then summing over all patients in the hospital to get a value. To assess hospital performance in any reporting period, we re-estimate the model coefficients using the years of data in that period.

The statistical modeling approach is described fully in the original methodology report (Krumholz et al., 2008).

Selected References:

- Fisher ES, Wennberg JE, Stukel TA, et al. 1994. Hospital readmission rates for cohorts of Medicare beneficiaries in Boston and New Haven. *N Engl J Med* 331(15):989-995.
- Krumholz HM, Brindis RG, Brush JE, et al. 2006. Standards for Statistical Models Used for Public Reporting of Health Outcomes: An American Heart Association Scientific Statement From the Quality of Care and Outcomes Research Interdisciplinary Writing Group: Cosponsored by the Council on Epidemiology and Prevention and the Stroke Council Endorsed by the American College of Cardiology Foundation. *Circulation* 113: 456-462.
- Krumholz HM, Normand S-LT, Keenan PS, et al. 2008. Hospital 30-Day Heart Failure Readmission Measure: Methodology. Report prepared for the Centers for Medicare & Medicaid Services.
- Medicare Payment Advisory Commission (MedPAC). 2007. Report to Congress: Promoting Greater Efficiency in Medicare. Available at: http://www.medpac.gov/documents/Jun07_EntireReport.pdf.
- Normand S-LT, Shahian DM. 2007. Statistical and clinical aspects of hospital outcomes profiling. *Stat Sci* 22 2):206-226.
- Philbin EF, DiSalvo TG. 1999. Prediction of hospital readmission for heart failure: development of a simple risk score based on administrative data. *J Am Coll Cardiol* 33(6):1560-1566.
- Pope GC, Ellis RP, Ash AS et al. 2000. Diagnostic cost group hierarchical condition category models for Medicare risk adjustment. Report prepared for the Health Care Financing Administration. *Health Economics Research, Inc.* Available at: http://www.cms.hhs.gov/Reports/downloads/pope_2000_2.pdf.
- Yamokoski LM, Hasselblad V, Moser DK, et al. 2007. Prediction of rehospitalization and death in severe heart failure by physicians and nurses of the ESCAPE trial. *J Card Fail* 13(1):8-13.