Nursing Home Compare Claims-Based Quality Measure Technical Specifications

Final

September 2018

Prepared for:
Centers for Medicare and Medicaid Services
7500 Security Blvd.
Baltimore, MD 21244

Submitted by:
Abt Associates
10 Fawcett Street
Cambridge, MA 02138

Revision History

Original Publication: April 26, 2016

Revision: September, 2018

> This update contains the specifications for the Number of Hospitalizations per 1,000 Long-Stay Resident Days measure, which is claims-based and risk-adjusted. This update also revises the MDS items included in the risk-adjustment models for the short-stay, claims-based quality measures, as well as the coefficients for the models.

Contents

PERCENTAGE OF SHORT-STAY RESIDENTS WHO WERE RE-HOSPITALIZED AFTER A NURSING HOME ADMISSION 1
Measure Name 1
Purpose of Measure 1
Measure Description and Specifications 1
Risk Adjustment 3
Measure Calculations 6
NUMBER OF HOSPITALIZATIONS PER 1,000 LONG-STAY RESIDENT DAYS 8
Measure Name 8
Purpose of Measure 8
Measure Description and Specifications 8
Risk Adjustment 10
Measure Calculations 13
SHORT-STAY RESIDENTS WHO HAVE HAD AN OUTPATIENT EMERGENCY DEPARTMENT VISIT 14
Measure Name 14
Purpose of Measure 14
Measure Description and Specifications 14
Risk Adjustment 16
Measure Calculations 19
PERCENTAGE OF SHORT-STAY RESIDENTS WHO WERE SUCCESSFULLY DISCHARGED TO THE COMMUNITY 20
Measure Name 20
Purpose of Measure 20
Measure Description and Specifications 20
Risk Adjustment 22
Measure Calculations 26

PERCENTAGE OF SHORT-STAY RESIDENTS WHO WERE RE-HOSPITALIZED AFTER A NURSING HOME ADMISSION

Measure Name

The measure name is Percentage of Short-Stay Residents Who Were Re-Hospitalized after a Nursing Home Admission.

Purpose of Measure

If a nursing home sends many residents back to the hospital, it may indicate that the nursing home is not properly assessing or taking care of its residents who are admitted to the nursing home from a hospital.

This claims-based quality measure was first reported by CMS in April 2016, and integrated into the Five-Star Quality Rating System in July 2016. It reports the percentage of short-stay residents who were re-hospitalized after a nursing home admission. This section describes the specifications and risk-adjustment methodology for this measure.

Measure Description and Specifications

The short-stay re-hospitalization measure determines the percentage of all new admissions or readmissions to a nursing home from a hospital where the resident was re-admitted to a hospital for an inpatient or observations stay within 30 days of entry or reentry. Planned inpatient readmissions are excluded. Note that higher values of the short-stay re-hospitalization measure indicate worse performance on the measure.

See Table 1 for detailed specifications for the measure.

Numerator: The numerator for the measure is the number of nursing home stays[1] where the resident had one or more unplanned inpatient admissions or one or more outpatient claims for an observation stay within 30 days of entry/reentry. This includes inpatient or observation stays occurring after discharge from the nursing home but within the 30 day timeframe.

Planned inpatient readmissions are not counted in the numerator since they are not a signal of quality of care. A modified version of CMS's Planned Readmissions Algorithm is used to classify hospitalizations as planned or unplanned.[2] The algorithm developed to identify planned hospital admissions uses the principal discharge diagnosis category and all procedure codes for each readmission coded using the AHRQ CCS software. Unless the hospital readmission met the algorithm definition of planned, it is considered unplanned and counted as a hospital admission in the measure. If any of the procedures denoted as planned occurs in conjunction with a diagnosis that disqualifies a readmission from being

---

1 Note that a stay is defined as a set of contiguous days in a facility. A stay begins when a resident enters a nursing facility (i.e., based on the entry/reentry date from the MDS) and ends when the person leaves the nursing home (based on discharge date from the MDS, regardless of whether the discharge was planned or the resident was anticipated to return to the facility).

2 We applied the same modified version of CMS's Planned Readmissions Algorithm use by RTI to calculate the SNFRM: Smith L, et al. Skilled Nursing Facility Readmission Measure (SNFRM) NQF #2510: All-Cause Risk-Standardized Readmission Measure. RTI International: Draft Technical Report. March, 2015. Accessed at: https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/NursingHomeQualityInits/Downloads/SNFRM-Technical-Report-3252015.pdf

considered planned, it is considered an unplanned hospital admission. The planned readmissions algorithm is based on two main principles:

1. Planned readmissions are those in which one of a pre-specified list of procedures took place or readmissions for one of the following took place: bone marrow, kidney, or other transplants. Planned diagnosis categories include maintenance chemotherapy and rehabilitation. Pregnancy diagnoses and procedures such as normal pregnancy, Cesarean section; forceps delivery, vacuum, and breech delivery are also considered planned. Readmissions to psychiatric hospitals or units are also classified as planned readmissions.
2. Admissions for acute illness or for complications of care are not classified as "planned." Even a typically planned procedure performed during an admission for an acute illness would not likely have been planned.

Note that observation stays are included in the measure regardless of their diagnosis.

Denominator: The measure includes Medicare fee-for-service enrollees[3] who entered or reentered the nursing home from a hospital, were not enrolled in hospice during their nursing home stay, and who were not identified as comatose based on the MDS admission assessment.

- Medicare fee-for-service enrollees are identified using the CMS Enrollment Database. Any stay that is for a beneficiary who was enrolled in a Medicare Advantage plan for any part of the stay or who was not enrolled in both Medicare Part A and B for any part of their stay is excluded.
- Stays that were preceded by an inpatient hospitalization are identified using stay dates linked to Medicare Part A claims. If the hospital discharge date is within one day of the stay start date, then the stay is defined as having been preceded by an inpatient hospitalization and is eligible to be included in the measure.
- We look at the 'from' and 'thru' dates on hospice claims. If these overlap the nursing home stay, then the stay is excluded.

The denominator for the measure is the number of eligible nursing home stays, after applying the exclusions described above.

[3] Because the measure uses Medicare claims data, it can only be calculated for Medicare fee-for-service beneficiaries.

Table 1. Percentage of Short-Stay Residents who were Re-hospitalized after a Nursing Home Admission

Measure Description	The percent of short-stay residents who entered or reentered the nursing home from a hospital and were re-admitted to a hospital for an unplanned inpatient stay or observation stay within 30 days of the start of the nursing home stay.
Numerator and Denominator Window	The numerator and denominator include stays that started over a 12-month period. The data are updated every quarter (in January, April, July, and October of each year), with a lag time of nine months (i.e., stays that started 9-21 months ago).
Numerator	The numerator includes nursing home stays for beneficiaries who: a) met the inclusion and exclusion criteria for the denominator; AND b) were admitted to a hospital for or an inpatient stay or outpatient observation stay within 30 days of entry/reentry to the nursing home, regardless of whether they were discharged from the nursing home prior to the hospital readmission. Note that inpatient hospitalizations and observation stays are identified using Medicare claims; AND c) the hospital readmission did not meet the definition of a planned hospital readmission (identified using principal discharge diagnosis and procedure codes on Medicare claims for the inpatient stay)
Denominator	Included in the measure are stays for residents who: a) entered or reentered the nursing home within 1 day of discharge from an inpatient hospitalization (Note that inpatient rehabilitation facility and long-term care hospitalizations are not included). These hospitalizations are identified using Medicare Part A claims; AND b) entered or reentered the nursing home within the target 12-month period
Denominator Exclusions	Short-stay residents are excluded if: a) the resident did not have Fee-for-Service Parts A and B Medicare enrollment for the entire risk period (measured as the month of the index hospitalization and the month after the month of discharge from the nursing home); OR b) the resident was ever enrolled in hospice care during their stay; OR c) the resident was comatose (B0100 =[01]) or missing data on comatose on the first MDS assessment after the start of the stay; OR d) data were missing for any of the claims or MDS items used to construct the numerator or denominator; OR e) the resident did not have an initial MDS assessment to use in constructing covariates for risk-adjustment.
Covariates	See Tables 2 and 3 for the list of claims-based and MDS-based covariates included in the logistic regression for calculating the facilities' expected rates, and the Appendix tables for the risk-adjustment model coefficients.

Risk Adjustment

The goal of risk adjustment is to account for differences across nursing homes in patient demographic and clinical characteristics that might be related to the outcome but not to the quality of care provided by the nursing home. Covariates include both items from claims that preceded the start of the stay and information from the first Minimum Data Set 3.0 (MDS) assessment with a target date within 14 days of the beginning of the stay.

Claims-based covariates: Table 2 details the rationale for each of the final selected set of covariates constructed using Medicare claims and enrollment data and used in the risk-adjustment model of the short-stay re-hospitalization measure.

Table 2. Covariates constructed from claims and used in the risk-adjustment model for Short-Stay Residents who were Re-hospitalized after a Nursing Home Admission

Variable	Rationale
Age	Demographic characteristic that is often important for outcomes of nursing home residents and associated with higher frailty and increasing number of comorbidities.
Sex	Demographic characteristic that is important for predicting hospital readmission for the nursing home population.
Length of stay during the hospitalization preceding the nursing home stay	Patients who are hospitalized for longer periods of time may require more complex care because they are often sicker. In addition, bed rest from prolonged hospitalizations often leads to deconditioning and functional impairment.
Any time spent in the intensive care unit (ICU) during the hospitalization preceding the nursing stay	ICU stays are an important indicator of medical severity and a predictor of post-acute care resource use.
Ever enrolled in Medicare under Disability coverage	This is an indicator of overall patient complexity, as qualification for Medicare because of disability requires the presence of serious chronic medical conditions that limit the ability to work.
ESRD	This factor has been identified as a risk factor in prior studies of outcomes among nursing home residents.
Number of acute care hospitalizations in the 365 days before the beginning of the nursing stay	More hospitalizations in the previous year may be associated with declining health and increased complexity of care
Principal diagnosis as categorized using AHRQ's single-level CCS	First diagnosis from the Medicare claim corresponding to the prior proximal hospitalization as coded by AHRQ's CCS
Outcome-specific Comorbidity Index	Patients with multiple or more severe comorbidities will tend to be frailer, putting them at increased risk for being readmitted to a hospital. This Index is based on the clinical conditions included in the Charlson Comorbidity Index and captures the complexity beyond the linear additivity of the individual comorbidities. See the sub-section below for more details.

MDS-based covariates: For each measure, a clinical/MDS expert identified a list of MDS items most likely to increase or decrease the likelihood of the outcome. These items span multiple domains: functional status, clinical conditions, clinical treatments, and clinical diagnoses. Some of the "risk factors" were dropped from the list because they were closely related to existing quality metrics used in the Five-Star Quality Rating, and the outcome is only adjusted for risk factors that are unrelated to the quality of care at the facilities. Likewise, we also excluded factors related to conditions that increase the risk for readmission to the hospital by short-stay nursing home resident only when proper care and management is not provided by the facility. These exclusions were based on the set of conditions considered to be potentially preventable for the Potentially Preventable 30-Day Post-Discharge Readmission Measure for the Skilled Nursing Facility Quality Reporting Program (QRP).[4]

The remaining set of MDS-based risk factors were included in the final model if they were statistically significant predictors of the outcome after adjusting for the claims-based variables, regardless of whether

[4] RTI International. Measure Specifications for Measures Adopted in the FY 2017 SNF QRP Final Rule. July 2016. Accessed at: https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/NursingHomeQualityInits/Downloads/Measure-Specifications-for-FY17-SNF-QRP-Final-Rule.pdf

they were positively or negatively associated with the outcome. In general, our approach involved the following steps using national data from calendar year 2016:

(1) divide the MDS-based covariates into groups with similar content focus;
(2) run separate logistic regressions of the outcome on the claims-based covariates and these groups of MDS-based covariates, and retain the MDS-based covariates statistically significant at the $p<0.20$ level;
(3) regroup the retained MDS-based covariates into fewer groups but with similar content focus;
(4) run separate logistic regressions of the outcome on the claims-based covariates and these fewer groups MDS-based covariates and retain the MDS-based covariates with statistical significance at the $p<0.10$ level;
(5) combine all MDS-based covariates into one model with the claims-based covariates, run a logistic regression and retain the MDS-based covariates statistically significant at the $p<0.05$ level;
(6) calculate goodness of fit statistics to assess how well predicted values generated by the model were related to actual outcomes;
(7) apply the final model to two smaller randomly selected validation samples from the 2016 data and retain the model if the goodness of fit is similar to the goodness of fit when applied to the national data set (else, reconsider the initial set of MDS-based covariates that were tested).

The set of items included in the risk adjustment model are listed in Table 3.

Table 3. Covariates constructed from the MDS items and used in the final risk-adjustment model for Short-Stay Residents who were Re-hospitalized after a Nursing Home Admission

Category	MDS Item
Functional status	Rarely makes self-understood by others (B0700) Cognitive status not completely intact (C0100 – C1000) Cognitive assessment missing (C0100 and C0600) Acute change in mental status (C1600) Rejected care for past four to seven days (E0800) Wandering once or more in the past week (E0900) Walks in room independently or with supervision or limited assistance (G0110C1) Walks in corridor independently or with supervision or limited assistance (G0110D1) Wanders *and* walks in room or corridor independently or with supervision or limited assistance (E0900, G0110C1 and G0110D1) Two-person support needed with one or more ADLs (G0110A2 – G0110J2) Dependence in eating (G0110H1) Coughing or choking during meals or when swallowing medications (K0100C)
Clinical conditions	Shortness of breath with exertion (J1100A) Shortness of breath when sitting at rest (J1100B) End-stage prognosis (J1400) Internal bleeding (J1550D) Venous/Arterial ulcer present (M1030) Surgical wound (M1040E)
Clinical treatments	Ostomy care (H0100C) Parenteral/IV feeding (K0510A2) Feeding tube (K0510B2) Antibiotic received (N0410F) Chemotherapy for cancer (O0100A1 or O0100A2) Radiation for cancer (O0100B1 or O0100B2)

Category	MDS Item
	Oxygen therapy (O0100C1 or O0100C2) Ventilator or respirator (O0100F2) IV medications (O0100H1 or O0100H2) Transfusions (O0100I2) Respiratory Therapy (O0400D2)
Clinical diagnoses	Cancer (I0100) Anemia (I0200) Ulcerative Colitis/Crohn's disease/inflammatory bowel disease (I1300) Viral hepatitis (I2400) Alzheimer's disease (I4200) Non-Alzheimer's dementia (I4800) Seizure disorder or epilepsy (I5400)
Other	Returned to the nursing home following hospitalization (A1700 and A1800) First assessment was for significant change in status (A0310A)

Comorbidity index: The risk-adjustment model includes an outcome-specific comorbidity index to partially adjust facility-level rates for the case-mix of residents at the facility with respect to comorbidity status at the start of the residents' stay. The comorbidity index is based on the 17 disease condition categories initially developed by Charlson/Deyo.[5] Using the ICD-10-CM coding algorithm developed by Quan et al.,[4] we identified the Charlson comorbidities in any of the 21 diagnosis coding fields on all acute hospitalizations claims in the 365 days preceding the patient's nursing home stay. Weights were calculated for each diagnosis indicator through logistic regression of the short-stay re-hospitalization measure, using all available nursing home stays after a hospital discharge for the time period covered by the measure. The comorbidity index includes only the subset of the 17 ICD-10-CM based disease conditions for which the logistic regression coefficient was significant at a probability level of 0.05 or better. The appropriate coefficients were used to create a comorbidity index value for each nursing home stay, and these values were used in the logistic regression risk-adjustment model.

Measure Calculations

Observed rate: The actual (observed) rate for a nursing home is calculated as the number of stays where the resident met the numerator criteria divided by the total number of stays that met the denominator criteria in the year.

***Expected rate**:* The risk adjustment model is estimated using logistic regression. The results from the logistic regression are used to calculate the probability of the outcome for each nursing home stay. This probability can be interpreted as the patient's risk of that outcome given their profile. The expected rate for each nursing home is the average probability across all nursing home stays used to calculate the measure at that nursing home in the past year. The logistic regression coefficients used to calculate the probability, including the weights used to calculate the outcome-specific comorbidity index, are updated annually. The coefficients estimated for the most recent period are reported in Appendix Table A.

---

[5] Quan H, Sundararajan V, Halfon P, et al. Coding algorithms for defining comorbidities in ICD-9-CM and ICD-10 administrative data. Medical Care 2005;43(11):1130-1139. The 17 conditions categories include: Myocardial infarction, chronic heart failure, peripheral vascular disease, cerebrovascular disease, dementia, chronic obstructive pulmonary disease, rheumatoid arthritis, ulcers, mild liver disease, diabetes mellitus, diabetes with sequalae, paralysis, chronic renal disease, cancer, moderate to severe liver disease, metastatic cancer, and HIV/AIDS.

Risk-standardized rate*:* To obtain the risk-standardized rate for any nursing home, the observed rate is divided by the expected rate which is then multiplied by the nationally observed rate—i.e., the sum of all nursing home stays where the resident met the numerator criteria divided by the sum of all nursing home stays that met the denominator criteria in the year.

$$\frac{Observed\ Rate}{Expected\ Rate} \times National\ Rate = Risk\ Standardized\ Rate$$

NUMBER OF HOSPITALIZATIONS PER 1,000 LONG-STAY RESIDENT DAYS

Measure Name

The measure name is Number of Hospitalizations per 1,000 Long-Stay Resident Days.

Purpose of Measure

If a nursing home sends many residents back to the hospital, it may indicate that the nursing home is not properly assessing or taking care of its residents who are admitted to the nursing home from a hospital.

This claims-based quality measure will be reported on Nursing Home Compare starting in October 2018, and integrated into the Five-Star Quality Rating System in April 2019. It reports the ratio of unplanned hospitalizations per 1,000 long-stay resident days. This document describes the specifications for this measure.

Measure Description and Specifications

The long-stay hospitalizations measure determines the number of unplanned inpatient admissions or outpatient observation stays that occurred among permanent (i.e. long-stay) residents of a nursing home during a one-year period, expressed as the number of unplanned hospitalizations for every 1,000 days that the long-stay residents were admitted to the facility (i.e. "long-stay resident days"). Higher values of the long-stay hospitalizations measure indicate worse performance on the measure. See Table 4 for detailed specifications for the measure.

Numerator: The numerator for the measure is the number of admissions to an acute care or critical access hospital, for an inpatient or outpatient observation stay, occurring while the individual is a long-term nursing home resident.

Planned inpatient admissions are not counted in the numerator since they are unrelated to the quality of care at the nursing home. Hospitalizations are classified as planned or unplanned using the same version of CMS's Planned Readmissions Algorithm used to calculate the Short-Stay hospital readmissions measure used in the Nursing Home Compare Five-Star Rating system.[6] The algorithm identifies planned admission using the principal discharge diagnosis category and all procedure codes listed on inpatient claims, coded using the AHRQ CCS software. Observation stays are included in the measure regardless of diagnosis. The numerator also excludes unplanned inpatient admissions and observation stays that occur while a resident is enrolled in hospice.[7]

Denominator: The measure includes Medicare FFS enrollees[8] with a single stay or sequence of stays during which the individual resides in the nursing home for a total of 101 days or more without a gap of

[6] The Planned Readmissions algorithm is also used by RTI to calculate the SNFRM. It is described in more detail in the current version of the Claims-based Measures Technical Specifications document, or in the following link: https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/NursingHomeQualityInits/Downloads/SNFRM-Technical-Report-3252015.pdf

[7] Hospice days are identified by Medicare FFS Hospice claims.

[8] Because the measure uses Medicare claims data, it can only be calculated for Medicare fee-for-service beneficiaries.

30 contiguous days living in the community or other institution. The denominator is the total number of days (in thousands) during the target period that all long-stay residents were in the nursing home facility after they attained long-term resident status (i.e., after 100 cumulative days at the facility).[9] The denominator does not include the days between nursing home stays, including days that a resident is admitted to an inpatient facility or other institution, or days the resident was enrolled in hospice.

Table 4: Number of Hospitalizations per 1,000 Long-Stay Resident Days

Measure Description	Number of unplanned inpatient admissions or all-cause outpatient observation stays at an acute care or critical access hospital occurring in the target period and while the individual is a long-term nursing home resident.
Numerator and Denominator Window	All days after the resident's one-hundredth cumulative day in the nursing home or the beginning of the 12-month target period (whichever is later) and until the day of discharge, the day of death, or end of the 12-month target period (whichever is earlier).
Numerator	The numerator includes all inpatient hospital admissions or outpatient observation stays for Medicare beneficiaries who: a) met the inclusion and exclusion criteria for the denominator; AND b) were admitted to an acute care or critical access hospital for or an inpatient stay or outpatient observation stay while they were residing in the nursing home and not enrolled in hospice; AND c) were not admitted for a planned hospital inpatient admission (defined by the principal discharge diagnosis and procedure codes on Medicare claims for the inpatient stay).
Denominator	The sum of all long-stay days in the target period, divided by 1,000. A long-stay day is any day after a resident's one-hundredth cumulative day in the nursing home or the beginning of the 12-month target period (whichever is later) and until the day of discharge, the day of death, or the end of the 12-month target period (whichever comes first).
Denominator Exclusions	Long-stay residents meeting any of the following criteria are excluded: a) the resident was not a Medicare beneficiary or the resident was enrolled in Medicare managed care during any portion of the stay, i.e. between admission and discharge or the end of the target period (whichever comes first); Long-stay days meeting any of the following criteria are excluded: a) the resident was enrolled in hospice care; b) the resident was not in the nursing home for any reason during the episode, including days admitted to an inpatient facility or other institution, or days temporarily residing in the community.
Covariates	See Tables 5 and 6 for the list of claims-based and MDS-based covariates included in the negative binomial regression for calculating the facilities' expected rates, and the Appendix tables for the risk-adjustment model coefficients.

[9] In other words, for each resident, the total number of long-stay days is the cumulative days residing in the facility, beginning with the time the resident became a long-stay resident (or the start of the observation period if long-stay status was already attained) and ending with either a discharge or the end of the reporting period (whichever comes first). The denominator is the sum of all long-stay days in the target period, divided by 1,000.

Example of Measure Calculation

For an example of how the measure is calculated, consider the following scenario. Nursing Home Z had a total of 75 long-stay residents, who had a total of 27,375 eligible days as long-stay residents during the measure reporting period. There were a total of 28 unplanned hospitalizations and 7 observation stays among these residents during the period. The denominator is equal to 27,375 long-stay resident days divided by 1000, or 27.375. The numerator is equal to 35 (28 unplanned hospitalizations and 7 observation stays). Nursing Home Z's long-stay hospitalizations rate for 2018 is 1.28 hospitalizations per 1,000 long-stay resident days (= 35 / 27.375). For a facility with an average daily census of 75 long-stay residents, this equates to approximately 3 residents being sent to the hospital in a given month (= 75 residents * 30 days * 1.28 hospitalizations / 1000 days).

Risk Adjustment

The goal of risk adjustment is to account for differences across nursing homes in medical acuity, functional impairment, and frailty of the long-stay residents but not factors related to the quality of care provided by the nursing home. The data for the risk adjustment model is derived from Medicare inpatient claims data prior to the day the resident became a long-stay resident (i.e., after 100 cumulative days in the facility) and from the most recent quarterly or comprehensive MDS assessment within 120 days prior to the day the resident became a long-stay resident. Variables for the risk-adjustment model were identified based primarily on clinical relevance, but also on the criteria of statistical significance and contribution to the explanatory power of the model.

Claims-based covariates: Table 5 details the rationale for each of the claims based covariates constructed using Medicare claims and enrollment data and used in the risk-adjustment model of the long-stay hospitalizations measure.

Table 5. Covariates constructed from claims and used in the risk-adjustment model for the number of unplanned hospitalizations among long-stay nursing home residents

Variable	Rationale
Age	Demographic characteristic that is often important for outcomes of nursing home residents and associated with higher frailty and increasing number of comorbidities.
Sex	Demographic characteristic that is important for predicting hospitalization for the nursing home population.
Number of acute care hospitalizations in the 365 days before the day the resident became a long-stay resident	More hospitalizations in the previous year may be associated with declining health and increased complexity of care
Outcome-Specific Comorbidity Index	Patients with multiple or more severe comorbidities will tend to be frailer, putting them at increased risk for being admitted to a hospital. This Index is based on 17 clinical conditions included in the Charlson Comorbidity Index and captures the complexity beyond the linear additivity of the individual comorbidities. Diagnoses are identified using inpatient claims in the 365 days before the day the resident became a long-stay resident.

MDS-based covariates: For each measure, a clinical/MDS expert identified a list of MDS items most likely to increase or decrease the likelihood of the outcome. These items span multiple domains: functional status, clinical conditions, clinical treatments, and clinical diagnoses. Some of the "risk factors" were dropped from the list because they were closely related to existing quality metrics used in the Five-Star Quality Rating, and the outcome is only adjusted for risk factors that are unrelated to the quality of care at the facilities. Likewise, we also excluded factors related to conditions that increase the risk for hospitalization only when proper care and management is not provided by the facility. These exclusions were based on the set of conditions selected by CMS and RTI International as potentially avoidable hospitalizations among dually eligible beneficiaries in a nursing home setting.[10]

The remaining set of MDS-based risk factors were included in the final model if they were statistically significant predictors of the outcome after adjusting for the claims-based variables, regardless of whether they were positively or negatively associated with the outcome. In general, our approach involved the following steps using national data from calendar year 2016:

(1) divide the MDS-based covariates into groups with similar content focus;
(2) run separate logistic regressions of the outcome on the claims-based covariates, the number of long-stay days the resident was in the facility, the number of long-stay days squared, and these groups of MDS-based covariates, then retain the MDS-based covariates statistically significant at the $p<0.20$ level;
(3) regroup the retained MDS-based covariates into fewer groups but with similar content focus;
(4) run separate logistic regressions of the outcome on the claims-based covariates, long-stay days and days squared, and these fewer groups MDS-based covariates and retain the MDS-based covariates with statistical significance at the $p<0.10$ level;
(5) combine all MDS-based covariates into one model with the claims-based covariates, long-stay days and days squared, and run a logistic regression and retain the MDS-based covariates statistically significant at the $p<0.05$ level;
(6) calculate goodness of fit statistics to assess how well predicted values generated by the model were related to actual outcomes;
(7) apply the final model to two smaller randomly selected validation samples from the 2016 data and retain the model if the goodness of fit is similar to the goodness of fit when applied to the national data set (else, reconsider the initial set of MDS-based covariates that were tested).

The set of items included in the risk adjustment model are listed in Table 6.

Table 6. Covariates constructed from the MDS items and used in the final risk-adjustment model for the number of unplanned hospitalizations among long-stay nursing home residents

Category	MDS Item
Functional status	Rarely makes self-understood by others (B0700) Cognitive status moderately impaired, severely impaired, assessed by staff, or not assessed (C0100 – C1000) Rejected care for past four to seven days (E0800) Wandering once or more in the past week (E0900) Walks in room independently or with supervision or limited assistance (G0110C1)

[10] Walsh EG, Frieman M, Haber S, et al. Cost Drivers for Dually Eligible Beneficiaries: Potentially Avoidable Hospitalizations from Nursing Facility, Skilled Nursing Facility, and Home and Community-Based Services Waiver Programs. RTI International: Final Task 2 Report. August 2010. Accessed at: https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Reports/downloads/costdriverstask2.pdf

Category	MDS Item
	Walks in corridor independently or with supervision or limited assistance (G0110D1) Dependence in eating (G0110H1)
Clinical conditions	Shortness of breath with exertion (J1100A) Shortness of breath when lying flat (J1100C) End-stage prognosis (J1400) Internal bleeding (J1550D)
Clinical treatments	Anticoagulant received (N0400E) Antibiotic received (N0400F) Diuretic received (N0400G) Chemotherapy for cancer (O0100A2) Radiation for cancer (O0100B2) Oxygen therapy (O0100C2) IV medications (O0100H2) Transfusions (O0100I2) Hospice care (O0100K2) Isolation or quarantine for active infectious disease (00100M2) Speech therapy (O0400A4) Respiratory therapy (O0400D2)
Clinical diagnoses	Gastroesophageal reflux disease (GERD) or ulcer (I1200) Ulcerative Colitis/Crohn's disease/inflammatory bowel disease (I1300) Neurogenic bladder (I1550) Multidrug-resistant organism (MDRO) (I1700) Septicemia (I2100) Cerebrovascular accident, transient ischemic attack, or stroke (I4500) Quadriplegia (I5100) Multiple Sclerosis (I5200) Parkinson's disease (I5300) Anxiety disorder (I5700) Respiratory failure (I6300)
Other	Entered facility from a psychiatric hospital (A1800)

Comorbidity index: The risk-adjustment model includes an outcome-specific comorbidity index to partially adjust facility-level rates for the case-mix of residents at the facility with respect to comorbidity status shortly before the day that the resident became a long-stay resident. The comorbidity index is based on the 17 disease condition categories initially developed by Charlson/Deyo.[11] Using the ICD-10-CM coding algorithm developed by Quan et al.,[9] we identified the Charlson comorbidities in any of the 21 diagnosis coding fields on all acute hospitalizations claims in the 365 days preceding the day the resident became a long-stay resident. Weights are calculated for each diagnosis indicator through negative binomial regression of the number of hospitalizations for each long-stay resident. The regression also controls for the number of long-stay days in the facility and the number of long-stay days squared. The comorbidity index includes the regression intercept coefficient and the coefficients for the subset of the

[11] Quan H, Sundararajan V, Halfon P, et al. Coding algorithms for defining comorbidities in ICD-9-CM and ICD-10 administrative data. Medical Care 2005;43(11):1130-1139. The 17 conditions categories include: Myocardial infarction, chronic heart failure, peripheral vascular disease, cerebrovascular disease, dementia, chronic obstructive pulmonary disease, rheumatoid arthritis, ulcers, mild liver disease, diabetes mellitus, diabetes with sequalae, paralysis, chronic renal disease, cancer, moderate to severe liver disease, metastatic cancer, and HIV/AIDS.

17 ICD-10-CM based disease conditions for which the regression coefficient was significant at a probability level of 0.05 or better. The appropriate coefficients were used to create a comorbidity index value for each nursing home stay, and these values were used in the negative binomial regression risk-adjustment model of long-stay hospitalizations.

Measure Calculations

Observed rate: The actual (observed) rate for a nursing home facility is calculated as the total number of inpatient hospital admissions or outpatient observation stays meeting the numerator criteria divided by the total number of all long-stay days that met the denominator criteria (in thousands) in the target period. Note that the measure will be reported only for nursing homes that have at least 20 long-stay residents during the reporting period.

Expected rate*:* The risk adjustment model is estimated using negative binomial regression of the number of hospitalizations after the resident was a long-stay resident and during the target period. Covariates include the claims-based and MDS-based variables listed in Tables 5 and 6, as well as the number of long-stay days the resident was in the facility and the number of long-stay days squared. The results from the negative binomial regression are used to predict the number of hospitalizations for each long-stay resident given the patient's risk profile. The expected rate for each nursing home facility is the sum of the predicted number of hospitalizations for every long-stay resident in the facility divided by the total number of all long-stay days that met the denominator criteria in the target period (in thousands).

The measure will be calculated and updated on Nursing Home Compare every calendar quarter. The negative binomial regression coefficients, including the weights used to calculate the outcome-specific comorbidity index, are updated annually. The coefficients estimated for the most recent period are reported in the Appendix.

Risk-standardized rate*:* To obtain the risk-standardized rate for a nursing home facility, the observed rate is divided by the expected rate which is then multiplied by the nationally observed rate. The national rate is calculated as the total number of inpatient hospital admissions or outpatient observation stays meeting the numerator criteria, across all facilities, divided by the total number of all long-stay days that met the denominator criteria (in hundreds), across all facilities.

$$\frac{Observed\ Rate}{Expected\ Rate} \times National\ Rate = Risk\ Standardized\ Rate$$

SHORT-STAY RESIDENTS WHO HAVE HAD AN OUTPATIENT EMERGENCY DEPARTMENT VISIT

Measure Name

The measure name is Percentage of Short-Stay Residents Who Have had an Outpatient Emergency Department Visit.

Purpose of Measure

If a nursing home often sends many of its residents to the emergency department (ED), it may indicate that the nursing home is not properly assessing or taking care of its residents who are admitted to the nursing home from a hospital. Better preventative care and access to physicians and nurse practitioners in an emergency may reduce rates of ED visits.

This claims-based quality measure was first reported by CMS in April 2016, and integrated into the Five-Star Quality Rating System in July 2016. It reports the percentage of short-stay residents who had an outpatient ED visit after a nursing home admission. This section describes the specifications and risk-adjustment methodology for this measure.

Measure Description and Specifications

The short-stay outpatient ED visit measure determines the percentage of all new admissions or readmissions to a nursing home from a hospital where the resident had an outpatient ED visit (i.e., an ED visit not resulting in an inpatient hospital admission) within 30 days of entry or reentry. Note that higher values of the short-stay outpatient ED visit measure indicate worse performance on the measure.

See Table 7 for detailed specifications for the measure.

Numerator: The numerator for the measure is the number of nursing home stays[12] where the resident had one or more outpatient claims for an ED visit within 30 days of entry/reentry. This includes outpatient ED visits occurring after discharge from the nursing home but within the 30 day timeframe. Note that outpatient ED visits are included in the measure regardless of their diagnosis.

Outpatient ED visits are not counted in the numerator if the 'thru' date on the outpatient claim for the ED visit was equal to the 'from' date on an outpatient claim for an observation stay or an inpatient claim for an unplanned hospitalization.[13] In other words, ED visits that were billed as an outpatient event but resulted in admission to a hospital for an observation stay or an unplanned inpatient stay would not be "double-counted" across the short-stay outpatient ED visit measure and the short-stay re-hospitalization measure, which also being added to Nursing Home Compare.

---

[12] Note that a stay is defined as a set of contiguous days in a facility. A stay begins when a resident enters a nursing facility (i.e., based on the entry/reentry date from the MDS) and ends when the person leaves the nursing home (based on discharge date from the MDS, regardless of whether the discharge was planned or the resident was anticipated to return to the facility).

[13] See the specifications for the short-stay residents who were re-hospitalized after a nursing home admission measure for the description of planned versus unplanned hospital admissions.

Denominator: The measure includes Medicare fee-for-service enrollees[14] who entered or reentered the nursing home from a hospital, were not enrolled in hospice during their nursing home stay, and who were not identified as comatose based on the MDS admission assessment.

- Medicare fee-for-service enrollees are identified using the CMS Enrollment Database. Any stay that is for a beneficiary who was enrolled in a Medicare Advantage plan for any part of the stay or who was not enrolled in both Medicare Part A and B for any part of their stay is excluded.
- Stays that were preceded by an inpatient hospitalization are identified using stay dates linked to Medicare Part A claims. If the hospital discharge date is within one day of the stay start date, then the stay is defined as having been preceded by an inpatient hospitalization and is eligible to be included in the measure.
- We look at the 'from' and 'thru' dates on hospice claims. If these overlap the nursing home stay, then the stay is excluded.

The denominator for the measure is the number of eligible nursing home stays, after applying the exclusions described above.

Table 7. Percentage of Short-Stay Residents who have had an Outpatient Emergency Department Visit

Measure Description	The percent of short-stay residents who entered or reentered the facility from a hospital, visited an emergency department within 30 days of the start of the stay, and this visit did not result in an inpatient or observation stay.
Numerator and Denominator Window	The numerator and denominator include stays that started over a 12-month period.
Numerator	The numerator includes nursing home stays for beneficiaries who: a) met the inclusion and exclusion criteria for the denominator; AND b) was admitted to an emergency department within 30 days of entry/reentry to the nursing home, regardless of whether they were discharged from the nursing home prior to the emergency department visit. These emergency department visits are identified using Medicare Part B claims; AND c) were not admitted to a hospital for an inpatient stay or observation stay immediately after the visit to the emergency department. Inpatient and observation stays are determined using Medicare Parts A and B claims.
Denominator	Included in the measure are stays for residents who: a) entered or reentered the nursing home within 1 day of discharge from an inpatient hospitalization (Note that inpatient rehabilitation facility and long-term care hospitalizations are not included). These hospitalizations are identified using Medicare Part A claims; AND b) entered or reentered the nursing home within the target 12-month period

[14] Because the measure uses Medicare claims data, it can only be calculated for Medicare fee-for-service beneficiaries.

Denominator Exclusions	Short-stay residents are excluded if: a) the resident did not have Fee-for-Service Parts A and B Medicare enrollment for the entire risk period (measured as the month of the index hospitalization and the month after the month of discharge from the nursing home); OR b) the resident was ever enrolled in hospice care during their nursing home stay; OR c) the resident was comatose (B0100 =[01]) or missing data on comatose on the first MDS assessment after the start of the stay; OR d) data were missing for any of the claims or MDS items used to construct the numerator or denominator; OR e) the resident did not have an initial MDS assessment to use in constructing covariates for risk-adjustment.
Covariates	See Tables 8 and 9 for the list of claims-based and MDS-based covariates included in the logistic regression for calculating the facilities' expected rates and the Appendix tables for the risk-adjustment model covariates.

Risk Adjustment

The goal of risk adjustment is to account for differences across nursing homes in patient demographic and clinical characteristics that might be related to the outcome but not to the quality of care provided by the nursing home. Covariates include both items from claims that preceded the start of the stay and information from the first Minimum Data Set 3.0 (MDS) assessment with a target date within 14 days of the beginning of the stay.

Claims-based covariates: Table 8 details the rationale for each of the final selected set of covariates constructed using Medicare claims and enrollment data and used in the risk-adjustment model of the short-stay outpatient ED visit measure.

Table 8. Covariates constructed from claims and used in the risk-adjustment model for Short-Stay Residents who have had an Outpatient Emergency Department Visit

Variable	Rationale
Age	Demographic characteristic that is often important for outcomes of nursing home residents and associated with higher frailty and increasing number of comorbidities.
Sex	Demographic characteristic that is important for predicting ED visits and hospital readmissions for the nursing home population.
Length of stay during the hospitalization preceding the nursing home stay	Patients who are hospitalized for longer periods of time may require more complex care because they are often sicker. In addition, bed rest from prolonged hospitalizations often leads to deconditioning and functional impairment.
Any time spent in the intensive care unit (ICU) during the hospitalization preceding the nursing home stay	ICU stays are an important indicator of medical severity and a predictor of post-acute care resource use.
Ever enrolled in Medicare under Disability coverage	This is an indicator of overall patient complexity, as qualification for Medicare because of disability requires the presence of serious chronic medical conditions that limit the ability to work.

Variable	Rationale
ESRD	This factor has been identified as a risk factor in prior studies of outcomes among nursing home residents.
Number of acute care hospitalizations in the 365 days before the beginning of the nursing home stay	More hospitalizations in the previous year may be associated with declining health and increased complexity of care
Principal diagnosis as categorized using AHRQ's single-level CCS	First diagnosis from the Medicare claim corresponding to the prior proximal hospitalization as coded by AHRQ's CCS
Outcome-specific Comorbidity Index	Patients with multiple or more severe comorbidities will tend to be frailer, putting them at increased risk for an ED visit. This Index is based on the clinical conditions included in the Charlson Comorbidity Index and captures the complexity beyond the linear additivity of the individual comorbidities. See the sub-section below for more details.

MDS-based covariates: For each measure, a clinical/MDS expert identified a list of MDS items most likely to increase or decrease the likelihood of the outcome. These items span multiple domains: functional status, clinical conditions, clinical treatments, and clinical diagnoses. Some of the "risk factors" were dropped from the list because they were closely related to existing quality metrics used in the Five-Star Quality Rating, and the outcome is only adjusted for risk factors that are unrelated to the quality of care at the facilities. Likewise, we also excluded factors related to conditions that increase the risk for ED visits by short-stay nursing home residents only when proper care and management is not provided by the facility. These exclusions were based on the set of conditions considered to be potentially preventable for the Potentially Preventable 30-Day Post-Discharge Readmission Measure for the Skilled Nursing Facility Quality Reporting Program (QRP).[15]

The remaining set of MDS-based risk factors were included in the final model if they were statistically significant predictors of the outcome after adjusting for the claims-based variables, regardless of whether they were positively or negatively associated with the outcome. In general, our approach involved the following steps using national data from calendar year 2016:

(1) divide the MDS-based covariates into groups with similar content focus;
(2) run separate logistic regressions of the outcome on the claims-based covariates and these groups of MDS-based covariates, and retain the MDS-based covariates statistically significant at the $p<0.20$ level;
(3) regroup the retained MDS-based covariates into fewer groups but with similar content focus;
(4) run separate logistic regressions of the outcome on the claims-based covariates and these fewer groups MDS-based covariates and retain the MDS-based covariates with statistical significance at the $p<0.10$ level;
(5) combine all MDS-based covariates into one model with the claims-based covariates, run a logistic regression and retain the MDS-based covariates statistically significant at the $p<0.05$ level;
(6) calculate goodness of fit statistics to assess how well predicted values generated by the model were related to actual outcomes;

[15] RTI International. Measure Specifications for Measures Adopted in the FY 2017 SNF QRP Final Rule. July 2016. Accessed at: https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/NursingHomeQualityInits/Downloads/Measure-Specifications-for-FY17-SNF-QRP-Final-Rule.pdf

(7) apply the final model to two smaller randomly selected validation samples from the 2016 data and retain the model if the goodness of fit is similar to the goodness of fit when applied to the national data set (else, reconsider the initial set of MDS-based covariates that were tested).

The set of items included in the risk adjustment model are listed in Table 9.

Table 9. Covariates constructed from the MDS items and used in the final risk-adjustment model for Short-Stay Residents who have had an Outpatient Emergency Department Visit

Category	MDS Item
Functional status	Rarely makes self-understood by others (B0700) Cognitive status not completely intact (C0100 – C1000) Cognitive assessment missing (C0100 and C0600) Acute change in mental status (C1600) Rejected care for past four to seven days (E0800) Wandering once or more in the past week (E0900) Walks in room independently or with supervision or limited assistance (G0110C1) Walks in corridor independently or with supervision or limited assistance (G0110D1) Wanders and walks in room or corridor independently or with supervision or limited assistance (E0900, G0110C1 and G0110D1) Two-person support needed with one or more ADLs (G0110A2 – G0110J2) Dependence in eating (G0110H1) Coughing or choking during meals or when swallowing medications (K0100C)
Clinical conditions	Shortness of breath with exertion (J1100A) Shortness of breath when sitting at rest (J1100B) End-stage prognosis (J1400) Internal bleeding (J1550D) Venous/Arterial ulcer present (M1030) Surgical wound (M1040E) Burn(s) (M1040F)
Clinical treatments	Ostomy care (H0100C) Parenteral/IV feeding (K0510A2) Feeding tube (K0510B2) Anticoagulant received (N0410E) Antibiotic received (N0410F) Oxygen therapy (O0100C1 or O0100C2) Tracheostomy care (O0100E1 or O0100E2) Ventilator or respirator (O0100F2) IV medications (O0100H1 or O0100H2) Transfusions (O0100I2) Speech-Language Pathology and Audiology Services (O0400A4) Respiratory Therapy (O0400D2)
Clinical diagnoses	Cancer (I0100) Viral hepatitis (I2400) Seizure disorder or epilepsy (I5400) Respiratory Failure (I6300)
Other	Returned to the nursing home following hospitalization (A1700 and A1800) First assessment was for significant change in status (A0310A)

Comorbidity index: The risk-adjustment model includes an outcome-specific comorbidity index to partially adjust facility-level rates for the case-mix of residents at the facility with respect to comorbidity

status at the start of the residents' stay. The comorbidity index is based on the 17 disease condition categories initially developed by Charlson/Deyo.[16] Using the ICD-10-CM coding algorithm developed by Quan et al.,[13] we identified the Charlson comorbidities in any of the 21 diagnosis coding fields on all acute hospitalizations claims in the 365 days preceding the patient's nursing home stay. Weights were calculated for each diagnosis indicator through logistic regression of the short-stay outpatient ED visit measure, using all available nursing home stays after a hospital discharge for the time period covered by the measure. The comorbidity index includes only the subset of the 17 ICD-10-CM based disease conditions for which the logistic regression coefficient was significant at a probability level of 0.05 or better. The appropriate coefficients were used to create a comorbidity index value for each nursing home stay, and these values were used in the logistic regression risk-adjustment model.

Measure Calculations

Observed rate: The actual (observed) rate for a nursing home is calculated as the number of stays where the resident met the numerator criteria divided by the total number of stays that met the denominator criteria in the year.

Expected rate: The risk adjustment model is estimated using logistic regression. The results from the logistic regression are used to calculate the probability of the outcome for each nursing home stay. This probability can be interpreted as the patient's risk of that outcome given their profile. The expected rate for each nursing home is the average probability across all nursing home stays from the hospital at that nursing home in the past year. The logistic regression coefficients used to calculate the probability, including the weights used to calculate the outcome-specific comorbidity index, are updated annually. The coefficients estimated for the most recent period are reported in Appendix Table C.

Risk-standardized rate: To obtain the risk-standardized rate for any nursing home, the observed rate is divided by the expected rate which is then multiplied by the nationally observed rate—i.e., the sum of all nursing home stays where the resident met the numerator criteria divided by the sum of all nursing home stays that met the denominator criteria in the year.

$$\frac{Observed\ Rate}{Expected\ Rate} \times National\ Rate = Risk\ Standardized\ Rate$$

---

[16] Quan H, Sundararajan V, Halfon P, et al. Coding algorithms for defining comorbidities in ICD-9-CM and ICD-10 administrative data. Medical Care 2005;43(11):1130–1139. The 17 conditions categories include: Myocardial infarction, chronic heart failure, peripheral vascular disease, cerebrovascular disease, dementia, chronic obstructive pulmonary disease, rheumatoid arthritis, ulcers, mild liver disease, diabetes mellitus, diabetes with sequalae, paralysis, chronic renal disease, cancer, moderate to severe liver disease, metastatic cancer, and HIV/AIDS.

PERCENTAGE OF SHORT-STAY RESIDENTS WHO WERE SUCCESSFULLY DISCHARGED TO THE COMMUNITY

Measure Name

The measure name is Percentage of Short-Stay Residents who were Successfully Discharged to the Community.

Purpose of Measure

Many nursing home residents enter skilled nursing facilities for rehabilitation services. For many short-stay patients, return to the community is the most important outcome associated with nursing home care. If a nursing home discharges few residents back to the community successfully, it may indicate that the nursing home is not properly assessing its residents who are admitted to the nursing home from a hospital or not adequately preparing them for transition back to the community.

This claims-based quality measure was first reported by CMS in April 2016, and integrated into the Five-Star Quality Rating System in July 2016. It reports the percentage of short-stay residents who were successfully discharged to the community after a nursing home admission. This section describes the specifications and risk-adjustment methodology for this measure.

Measure Description and Specifications

The short-stay successful community discharge measure determines the percentage of all new admissions to a nursing home from a hospital where the resident was discharged to the community within 100 calendar days of entry and for 30 subsequent days, they did not die, were not admitted to a hospital for an unplanned inpatient stay, and were not readmitted to a nursing home. Note that lower values of the short-stay successful community discharge measure indicate worse performance on the measure.

See Table 10 for detailed specifications for the measure.

Numerator: The numerator for the measure is the number of nursing home episodes[17] where the resident was discharge to the community within 100 calendar days of entry, and the resident did not die, did not have a claim for an unplanned inpatient admission,[18] and did not enter/reenter a nursing home within 30 days of discharge to the community.

Note that outpatient emergency department visits, outpatient observation stays, and planned inpatient admission are not counted as failed community discharges.

Denominator: The measure includes Medicare fee-for-service enrollees[19] who entered the nursing home from a hospital, were not a resident of the nursing home in the previous 30 days, were not enrolled in

---

[17] Note that an episode is defined as a period of time spanning one or more stays in a facility. An episode begins when a resident is admitted to a nursing facility and ends when the person is discharged from the nursing home and did not return for at least 30 days.

[18] See the specifications for the short-stay residents who were re-hospitalized after a nursing home admission measure for the description of planned versus unplanned hospital admissions.

[19] Because the measure uses Medicare claims data, it can only be calculated for Medicare fee-for-service beneficiaries.

hospice during their nursing home stay, and were not identified as comatose based on the MDS admission assessment.

- By definition, a nursing home episode begins when a resident is admitted to a nursing home and ends when a resident is discharged from the nursing home and does not return for at least 30 days.
- Medicare fee-for-service enrollees are identified using the CMS Enrollment Database. Any episode that is for a beneficiary who was enrolled in a Medicare Advantage plan for any part of the episode or who was not enrolled in both Medicare Part A and B for any part of their episode is excluded.
- Episodes that were preceded by an inpatient hospitalization are identified using episode dates linked to Medicare Part A claims. If the hospital discharge date is within one day of the episode start date, then the episode is defined as having been preceded by an inpatient hospitalization and is eligible to be included in the measure.
- We look at the 'from' and 'thru' dates on hospice claims. If these overlap the nursing home episode, then the episode is excluded.

The denominator for the measure is the number of eligible nursing home episodes, after applying the exclusions described above.

Table 10. Percentage of Short-Stay Residents who were Successfully Discharged to the Community

Measure Description	The percent of short-stay residents admitted to the nursing home from a hospital who were discharged to the community with 100 calendar days of the start of the episode, and who remained in the community for 30 consecutive days following discharge to the community.
Numerator and Denominator Window	The numerator and denominator include episodes that started over a 12-month period. The data are updated every quarter (in January, April, July, and October of each year), with a lag time of 12 months (i.e., episodes that started 12-23 months ago).
Numerator	The numerator includes nursing home episodes for beneficiaries who: a) met the inclusion and exclusion criteria for the denominator; AND b) had a discharge assessment within 100 calendar days of the start of the episode; AND c) was not admitted to a nursing home within 30 days of the community discharge, as determined from Medicare claims; AND d) did not have an unplanned inpatient hospital stay within 30 days of the community discharge, as determined from the principal diagnosis and procedure codes on Medicare claims; AND e) did not die within 30 days of the community discharge, as determined from the Medicare Enrollment Data Base.
Denominator	Included in the measure are episodes for residents who: a) entered the nursing home within 1 day of discharge from an inpatient hospitalization (Note that inpatient rehabilitation facility and long-term care hospitalizations are not included). These hospitalizations are identified using Medicare Part A claims; AND b) entered the nursing home within the target 12-month period

Denominator Exclusions	Short-stay residents are excluded if: a) the resident did not have Fee-for-Service Parts A and B Medicare enrollment for the entire risk period (measured as the month of the index hospitalization and the month after the month of discharge from the nursing home); OR b) the resident was ever enrolled in hospice care during their nursing home episode; OR c) the resident was comatose (B0100 =[01]) or missing data on comatose on the first MDS assessment after the start of the episode; OR d) data were missing for any of the claims or MDS items used to construct the numerator or denominator; OR e) the resident did not have an initial MDS assessment to use in constructing covariates for risk-adjustment.
Covariates	See Tables 11 and 12 for the list of claims-based and MDS-based covariates included in the logistic regression for calculating the facilities' expected rates, and the Appendix tables for the risk-adjustment model coefficients.

Risk Adjustment

The goal of risk adjustment is to account for differences across nursing homes in patient demographic and clinical characteristics that might be related to the outcome but not to the quality of care provided by the nursing home. Covariates include both items from claims that preceded the start of the episodes and information from the first Minimum Data Set 3.0 (MDS) assessment with a target date within 14 days of the beginning of the episode.

Claims-based covariates: Table 11 details the rationale for each of the final selected set of covariates constructed using Medicare claims and enrollment data and used in the risk-adjustment model of the short-stay successful discharge to the community measure.

Table 11. Covariates constructed from claims and used in the risk-adjustment model for Short-Stay Residents who were Successfully Discharged to the Community

Variable	Rationale
Age	Demographic characteristic that is often important for outcomes of nursing home residents and associated with higher frailty and increasing number of comorbidities.
Sex	Demographic characteristic that is important for predicting outcomes for the nursing home population.
Length of stay during the hospitalization preceding the nursing home stay	Patients who are hospitalized for longer periods of time may require more complex care because they are often sicker. In addition, bed rest from prolonged hospitalizations often leads to deconditioning and functional impairment.
Any time spent in the intensive care unit (ICU) during the hospitalization preceding the nursing home stay	ICU stays are an important indicator of medical severity and a predictor of post-acute care resource use.
Ever enrolled in Medicare under Disability coverage	This is an indicator of overall patient complexity, as qualification for Medicare because of disability requires the presence of serious chronic medical conditions that limit the ability to work.

Variable	Rationale
ESRD	This factor has been identified as a risk factor in prior studies of outcomes among nursing home residents.
Number of acute care hospitalizations in the 365 days before the beginning of the nursing home stay	More hospitalizations in the previous year may be associated with declining health and increased complexity of care
Principal diagnosis as categorized using AHRQ's single-level CCS	First diagnosis from the Medicare claim corresponding to the prior proximal hospitalization as coded by AHRQ's CCS
Outcome-specific Comorbidity Index	Patients with multiple or more severe comorbidities will tend to be frailer, inhibiting their successful discharge to the community. This Index is based on the clinical conditions included in the Charlson Comorbidity Index and captures the complexity beyond the linear additivity of the individual comorbidities. See the sub-section below for more details.

MDS-based covariates: For each measure, a clinical/MDS expert identified a list of MDS items most likely to increase or decrease the likelihood of the outcome. These items span multiple domains: functional status, clinical conditions, clinical treatments, and clinical diagnoses. Some of the "risk factors" were dropped from the list because they were closely related to existing quality metrics used in the Five-Star Quality Rating, and the outcome is only adjusted for risk factors that are unrelated to the quality of care at the facilities. The remaining set of MDS-based risk factors were included in the final model if they were statistically significant predictors of the outcome after adjusting for the claims-based variables, regardless of whether they were positively or negatively associated with the outcome. In general, our approach involved the following steps using national data from calendar year 2016:

(1) divide the MDS-based covariates into groups with similar content focus;

(2) run separate logistic regressions of the outcome on the claims-based covariates and these groups of MDS-based covariates, and retain the MDS-based covariates statistically significant at the $p<0.20$ level;

(3) regroup the retained MDS-based covariates into fewer groups but with similar content focus;

(4) run separate logistic regressions of the outcome on the claims-based covariates and these fewer groups MDS-based covariates and retain the MDS-based covariates with statistical significance at the $p<0.10$ level;

(5) combine all MDS-based covariates into one model with the claims-based covariates, run a logistic regression and retain the MDS-based covariates statistically significant at the $p<0.05$ level;

(6) calculate goodness of fit statistics to assess how well predicted values generated by the model were related to actual outcomes;

(7) apply the final model to two smaller randomly selected validation samples from the 2016 data and retain the model if the goodness of fit is similar to the goodness of fit when applied to the national data set (else, reconsider the initial set of MDS-based covariates that were tested).

The set of items included in the risk adjustment model are listed in Table 12.

Table 12. Covariates constructed from the MDS items and used in the final risk-adjustment model for Short-Stay Residents who were Successfully Discharged to the Community

Category	MDS Item
Functional status	Makes self-understood by others (B0700) Ability to understand others (B0800) Vision Impairment (B1000) Cognitive status moderately impaired, severely impaired, assessed by staff, or not assessed (C0100 – C1000) Acute change in mental status (C1600) Overall ADL functioning/summary AND cognitive impairment based on the BIMS scale (G0110A,B,D,E,H,J and C0500 and C0600) Overall ADL function/summary missing (G0110A,B,D,E,H,J) Any potential indicators of psychosis or behavioral symptoms (E0100 and E0200) Wandering once or more in the past week (E0900) Dependence in transfer (G0110B1) Transfer missing (G0110B1) Dependence in walking in room (G0110C1) Walking in room missing (G0110C1) Dependence in walking in corridor (G0110D1) Walking in corridor missing (G0110D1) Dependence in locomotion on unit (G0110E1) Locomotion on unit missing (G0110E1) Dependence in dressing (G0110G1) Dressing missing (G0110G1) Dependence in eating (G0110H1) Eating missing (G0110H1) Dependence in toilet use (G0110I1) Toilet use missing (G0110I1) Dependence in personal hygiene (G0110J1) Personal hygiene missing (G0110J1) Dependence in bathing (G0120A) Bathing missing (G0120A) Balance moving from standing to seated position (G0300A) Balance walking (G0300B) Medicare RUG IV Hierarchical Group (Z0100A)

Category	MDS Item
Clinical conditions	Any condition related to ID/DD status (A1550) Urinary Incontinence (H0300) Shortness of breath with exertion (J01100A) Shortness of breath when sitting at rest (J01100B) Shortness of breath when lying flat (J01100C) Any swallowing disorder (K0100) Weight loss (K0300) Wound infection (I2500) Hemiplegia (I4900) Paraplegia (I5000) Quadriplegia (I5100) Multiple Sclerosis (I5200) Huntington's disease (I5250) Seizure disorder or epilepsy (I5400) Infection of the foot (M1040A) Diabetic foot ulcer (M1040B) Surgical wound (M1040E)
Clinical treatments	Parenteral/IV feeding, feeding tube, or mechanically altered diet (K0500A–C) Maximum number of injections (N0300 and N0350A) Chemotherapy for cancer (O0100A2) Radiation for cancer (O0100B2) Oxygen therapy (O0100C2) Suctioning (O0100D2) Tracheostomy (O0100E2) Ventilator or respirator (O0100F2) Transfusions (O0100I2) Dialysis (O0100J2)
Clinical diagnoses	Anemia (I0200) Heart failure (I0600) Hypertension (I0700) Pneumonia (I2000) Viral hepatitis (I2400) Diabetes mellitus (I2900) Hyperkalemia (I3200) Hip fracture (I3900) Other fracture (I4000) Alzheimer's disease (I4200) Non-Alzheimer's dementia (I4800) Malnutrition (I5600) Anxiety disorder (I5700) Manic depression (I5900) Psychotic disorder (I5950) Schizophrenia (I6000) Asthma, COPD, chronic lung disease (I6200)

Comorbidity index: The risk-adjustment model includes an outcome-specific comorbidity index to partially adjust facility-level rates for the case-mix of residents at the facility with respect to comorbidity status at the start of the residents' stay. The comorbidity index is based on the 17 disease condition

categories initially developed by Charlson/Deyo.[20] Using the ICD-10-CM coding algorithm developed by Quan et al.,[17] we identified the Charlson comorbidities in any of the 21 diagnosis coding fields on all acute hospitalizations claims in the 365 days preceding the patient's nursing home episode. Weights were calculated for each diagnosis indicator through logistic regression of the short-stay successful discharge to the community measure, using all available nursing home episodes after a hospital discharge for the time period covered by the measure. The comorbidity index includes only the subset of the 17 ICD-10-CM based disease conditions for which the logistic regression coefficient was significant at a probability level of 0.05 or better. The appropriate coefficients were used to create a comorbidity index value for each nursing home episode, and these values were used in the logistic regression risk-adjustment model.

Measure Calculations

Observed rate: The actual (observed) rate for a nursing home is calculated as the number of episodes where the resident met the numerator criteria divided by the total number of stays that met the denominator criteria in the year.

Expected rate*:* The risk adjustment model is estimated using logistic regression. The results from the logistic regression are used to calculate the probability of the outcome for each nursing home episode. This probability can be interpreted as the patient's risk of that outcome given their profile. The expected rate for each nursing home is the average probability across all nursing home episodes from the hospital at that nursing home in the past year. The logistic regression coefficients used to calculate the probability, including the weights used to calculate the outcome-specific comorbidity index, are updated annually. The coefficients estimated for the most recent are reported in Appendix Table E.

Risk-standardized rate*:* To obtain the risk-standardized rate for any nursing home, the observed rate is divided by the expected rate which is then multiplied by the nationally observed rate—i.e., the sum of all nursing home episodes where the resident met the numerator criteria divided by the sum of all nursing home episodes that met the denominator criteria in the year.

$$\frac{Observed\ Rate}{Expected\ Rate} \times National\ Rate = Risk\ Standardized\ Rate$$

---

[20] Quan H, Sundararajan V, Halfon P, et al. Coding algorithms for defining comorbidities in ICD-9-CM and ICD-10 administrative data. Medical Care 2005;43(11):1130–1139. The 17 conditions categories include: Myocardial infarction, chronic heart failure, peripheral vascular disease, cerebrovascular disease, dementia, chronic obstructive pulmonary disease, rheumatoid arthritis, ulcers, mild liver disease, diabetes mellitus, diabetes with sequalae, paralysis, chronic renal disease, cancer, moderate to severe liver disease, metastatic cancer, and HIV/AIDS.