



ACUMEN

**Discharge Function Score for Skilled Nursing
Facilities (SNFs)**

Technical Report

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TABLE OF CONTENTS

- 1 Introduction..... 1**
- 2 Overview 3**
 - 2.1 Measure Name 3
 - 2.2 Measure Type 3
 - 2.3 Care Setting..... 3
 - 2.4 Data Source..... 3
 - 2.5 Brief Description of Measure 3
- 3 Measure Specifications 4**
 - 3.1 Measure Time Period..... 4
 - 3.2 Data Source..... 4
 - 3.3 Denominator 4
 - 3.3.1 Stay Construction..... 4
 - 3.3.2 Eligible Stays 5
 - 3.4 Numerator 6
 - 3.4.1 Observed Discharge Function Score..... 6
 - 3.4.2 Expected Discharge Function Score 8
 - 3.5 Statistical Imputation 8
 - 3.6 Risk Adjustment 10
 - 3.6.1 The Statistical Risk Model..... 11
 - 3.6.2 Variables 11
 - 3.7 Measure Calculation 12
 - 3.7.1 Steps Used in Calculation 13
- 4 Measure Testing..... 14**
 - 4.1 Reportability 14
 - 4.2 Variability 14
 - 4.3 Reliability..... 14
 - 4.4 Validity 15
 - 4.4.1 Measure Scores 15
 - 4.4.2 Imputation Model 17
- Appendix..... 20**

LIST OF TABLES AND FIGURES

- Table 1. Cross-Setting Function Item Set 6
- Table 2. GG Items Response 7
- Table 3. Publicly Reportable SNFs, FY2021..... 14
- Table 4. Facility- Level Distribution of Discharge Function Scores 14
- Table 5. Correlations between Discharge Function Score and Other Publicly Reported Measures 16
- Table A-1. Discharge Function Score Measure Risk Adjustment: Linear Regression Model Results, FY2021..... 20
- Table A-2. C-Statistics for Imputation Models across GG Items at Admission and Discharge, FY2021 24

1 INTRODUCTION

The Patient Protection and Affordable Care Act (ACA) of 2010¹ and Improving Medicare Post-Acute Care Transformation Act (IMPACT) of 2014² require the Secretary to establish public reporting requirements for quality measures for Skilled Nursing Facilities (SNFs) using standardized patient assessment data elements. As part of this mandate, the Centers for Medicare & Medicaid Services (CMS) has contracted with Acumen, LLC to develop a cross-setting functional outcome measure to be used in the SNF Quality Reporting Program (QRP) under the *Quality Measure & Assessment Instrument Development & Maintenance & QRP Support* contract (75FCMC18D0015/Task Order 75FCMC19F0003).

Measuring functional status of SNF residents can provide valuable information about a SNF's quality of care. Physical function predicts several outcomes including successful discharge to the community and re-hospitalization rates.³ Individual SNFs vary in rates of functional recovery for their residents, even after controlling for demographic and clinical characteristics.⁴ The type of therapy provided by SNFs (e.g., high intensity rehabilitation, enhanced medical rehabilitation) can influence resident outcomes like resident satisfaction, length of stay, gait speed change, and ADL improvement, which highlights the opportunity for SNFs to intervene effectively to improve their residents' functional status.^{3, 5}

The Discharge Function Score measure determines how successful each SNF is at achieving an expected level of functional ability for its residents at discharge. An expectation for discharge function score is built for each Medicare Part A SNF stay by accounting for resident characteristics that impact their functional status. The final Discharge Function Score for a given SNF is the proportion of that SNF's stays where a resident's observed discharge score meets or exceeds their expected discharge score. SNFs with low scores are not producing the functional gains that they could be for a larger share of their residents. The measure provides actionable feedback to SNFs that has the potential to hold providers accountable and encourage them to improve the quality of care they deliver. This measure also promotes resident wellness, encourages the provision of adequate therapy to help prevent adverse outcomes (e.g., re-hospitalization), and increases the transparency of quality of care in the SNF setting. The

¹ Section 3004(b) of the Patient Protection and Affordable Care Act of 2010, Pub.L. 111-148

² Amendment Section 1899B to the Social Security Act, Pub.L. 113-185

³ Gustavson, A. M., Malone, D. J., Boxer, R. S., Forster, J. E., & Stevens-Lapsley, J. E. (2020). Application of High-Intensity Functional Resistance Training in a Skilled Nursing Facility: An Implementation Study. *Physical therapy*, 100(10), 1746–1758.

⁴ Johnson J.K., Hohman J., Stilphen M., Bethoux F., Rothberg M.B. (2021). Functional Recovery Rate: A Feasible Method for Evaluating and Comparing Rehabilitation Outcomes Between Skilled Nursing Facilities. *JAMDA*, 22(8), P1633-1639.E3. <https://doi.org/10.1016/j.jamda.2020.09.037>

⁵ Downer, B., Pritchard, K., Thomas, K. S., & Ottenbacher, K. (2021). Improvement in Activities of Daily Living during a Nursing Home Stay and One-Year Mortality among Older Adults with Sepsis. *Journal of the American Geriatrics Society*, 69(4), 938–945. <https://doi.org/10.1111/jgs.16915>

Discharge Function Score measure adds value to the SNF QRP function measure portfolio by using specifications that allow for better comparisons across post-acute care (PAC) settings, considering both self-care and mobility activities in the function score, and refining the approach to addressing missing item scores.

Input from a variety of stakeholders has been taken into consideration throughout the measure development process. Feedback was sought and considered from residents and caregivers on the salience of the measure concept and from Technical Expert Panels (TEPs) on the appropriate specifications for the cross-setting measure.

This report presents the Discharge Function Score measure specifications. Section 2 provides an overview of the measure and a high-level summary of the key features of the measure that are described in detail in the remaining sections of the document. Section 3 describes the methodology used to construct the Discharge Function Score measure including its data sources, study population, measure outcome, and steps for calculating the final measure score. Section 4 discusses Discharge Function Score measure testing including the measure's reportability, variability, reliability, and validity testing results. Lastly, the Appendix includes risk adjustment model results and supporting information for the statistical imputation models used to estimate missing item scores.

2 OVERVIEW

This section provides an overview of basic descriptive information on the Discharge Function Score measure, summarizing the key points contained in the rest of the document. A more detailed explanation of the measure specifications is available in Section 3.

2.1 Measure Name

Discharge Function Score

2.2 Measure Type

Outcome Measure

2.3 Care Setting

SNF

2.4 Data Source

Minimum Data Set (MDS)

2.5 Brief Description of Measure

The Discharge Function Score measure calculates the percent of Medicare Part A SNF residents who achieve a risk-adjusted expected function score at discharge. Functional status is measured through Section GG of MDS assessments, which evaluates a resident's capacity to perform daily activities related to self-care (GG0130) and mobility (GG0170). Coefficients from a risk adjustment model controlling for admission function score, age, and resident clinical characteristics are used to determine an expected discharge function score for each SNF stay. The provider score is calculated as the following proportion:

$$\frac{\text{Number of provider's stays where observed discharge score} \geq \text{expected discharge score}}{\text{Total number of provider's stays}} * 100$$

3 MEASURE SPECIFICATIONS

This section describes the methodology used to construct the Discharge Function Score. Section 3.1 describes the study window for the measure. Section 3.2 summarizes the data source used to calculate the measure score. Section 3.3 details the study population used for the measure denominator. Section 3.4 defines the discharge function outcome used for the measure numerator. Section 3.5 reviews the imputation methodology used to estimate missing item scores. Section 3.6 describes the risk adjustment model and variables used for risk adjustment. Section 3.7 presents the steps involved in calculating the final measure score.

3.1 Measure Time Period

This measure is calculated using 12 months (four quarters) of data. All Medicare Part A SNF stays with an assessment date that falls within this target period, except those that meet the exclusion criteria (refer to Section 3.3.2 for details), are included in the measure.

3.2 Data Source

This measure uses data from the MDS. The MDS data are collected on all Medicare residents who receive services from a Nursing Home (SNF/NF) or Swing Bed providers.⁶ This measure is calculated entirely using administrative data. There will be no additional data collection or submission burden for SNF providers as the data used in the measure are already collected on the MDS.

3.3 Denominator

The denominator is the total number of Medicare Part A SNF stays with a MDS record in the measure target period, which do not meet the exclusion criteria.

3.3.1 Stay Construction

A Medicare Part A SNF Stay includes consecutive time in the facility starting with the Medicare Part A Admission Record (PPS⁷ 5-Day assessment) through the Medicare Part A Discharge Record (PPS Discharge Assessment) or Death in Facility Tracking Record at the end the SNF stay and all intervening assessments. A Medicare Part A SNF Stay, thus defined, may include interrupted stays lasting three calendar days or less. Incomplete Medicare Part A SNF stays occur if the resident was discharged to an acute care setting (e.g., acute hospital, psychiatric hospital, or long-term care hospital), had an unplanned discharge, was discharged against medical advice, had a stay that was less than three days, or died while in the facility. All

⁶ Swing bed services at Critical Access Hospitals are not included

⁷ Prospective Payment System (PPS)

Medicare Part A SNF stays not meeting the criteria for incomplete stays will be considered complete stays.

The target date for a MDS record reflects the timeframe in which the assessment is to be completed. The target period for the measure is 12 months (4 quarters). To construct the SNF stays, all MDS records with a target date within the target period are selected.⁸ MDS records are sorted by the unique resident identifier, start date of the most recent Medicare stay (item A2400B), target date, record type, and assessment internal ID. Record type is a categorical variable indicating whether an assessment is a death in facility tracking record (4), PPS discharge assessment (3), PPS 5-day assessment (2), or another record type (1). Records are sorted in descending order of start date of the most recent Medicare stay, target date, and record type. The most recent stay for each resident is selected first. Then, assessments falling between the start of the target period and the day before the resident's most recent stay are identified, and stays are iteratively constructed in this manner. If a resident has multiple eligible SNF stays with an assessment date within the target period, then each eligible stay is included in the measure.

3.3.2 Eligible Stays

The eligible stays for this measure are all Medicare Part A MDS stays that do not meet the exclusion criteria during the target period. The SNF stay is excluded if any of the following are true:

- Residents with incomplete stays. Residents with incomplete stays include residents who have unplanned discharge, discharge against medical advice, or discharge to acute hospital, psychiatric hospital, or long-term care hospital; residents with a length of SNF PPS Part A stay less than three days; and residents who died during the SNF stay.

Rationale: When a resident has an incomplete stay, for example, the residents leave urgently due to a medical emergency, it can be challenging to gather accurate discharge functional status data.

- Resident has the following medical conditions at the time of admission: coma, persistent vegetative state, complete tetraplegia, locked-in state, severe anoxic brain damage, cerebral edema, or compression of brain.

Rationale: These residents are excluded because they may have limited or less predictable mobility improvement with the selected items.

⁸ One day is added to the end of the target period to account for stays where a PPS discharge assessment is combined with an Omnibus Budget Reconciliation Act (OBRA) assessment.

- Resident is younger than 18 years: Age in years is calculated based on the truncated difference between admission date and birth date, i.e., the difference is not rounded to the nearest whole number.

Rationale: Residents under 18 years old are not included in the target population for this measure because pediatric SNF residents may have different patterns of care than adult residents.

- Resident is discharged to hospice or received hospice care while a resident.

Rationale: Resident goals may change during the SNF stay, and functional improvement may no longer be a goal for a resident discharged to hospice or receiving hospice care while a resident.

- Resident did not receive physical or occupational therapy services at the time of admission.

Rationale: Residents not receiving therapy services may have functional improvement or maintenance goals and trajectories that differ from those of residents receiving therapy services.

3.4 Numerator

The numerator is the number of Medicare Part A residents in a SNF with an observed discharge function score (Section 3.4.1) for Section GG function items that is equal to or higher than the calculated expected discharge function score (Section 3.4.2).

3.4.1 Observed Discharge Function Score

The observed discharge function score is the sum of individual function items at discharge. Section GG of each PAC assessment instrument other than Hospice includes standardized patient assessment data elements that measure functional status. The Discharge Function Score measure focuses on GG items that are currently available across these PAC settings (Table 1).

Table 1. Cross-Setting Function Item Set

Item	Item Description
GG0130A	Eating
GG0130B	Oral Hygiene
GG0130C	Toileting Hygiene
GG0170A	Roll Left and Right
GG0170C	Lying to Sitting on Side
GG0170D	Sit to Stand
GG0170E	Chair/Bed-to-Chair Transfer
GG0170F	Toilet Transfer

Item	Item Description
GG0170I	Walk 10 Feet
GG0170J	Walk 50 Feet with 2 Turns
GG0170R	Wheel 50 Feet with 2 Turns

Valid responses for GG items are reported in Table 2.

Table 2. GG Items Response

Category	GG Items Response	Response Description
Patient Functional Status Assessed	6	Independent
	5	Setup or clean-up assistance
	4	Supervision or touching assistance
	3	Partial/moderate assistance
	2	Substantial/maximal assistance
	1	Dependent
Activity Not Attempted (ANA) codes	7	Patient refused
	9	Not applicable
	10	Not attempted due to environmental limitations
	88	Not attempted due to medical condition or safety concerns
Other NA codes	^	Skip pattern
	-	Not assessed/no information

The following steps are used to determine the observed discharge function score for each stay:

Step 1: If the code for an item is between 1 and 6, then use code as the score for that item.

Step 2: If code for an item is 7, 9, 10, 88, dashed (-), skipped (^), or missing, then use statistical imputation to estimate the item score for that item (see Section 3.5).

Step 3: Sum scores across all items to calculate the total observed discharge function score. Different locomotion items are used if the resident uses a wheelchair than for the remaining residents.

Use 2 * Wheel 50 Feet with 2 Turns (GG0170R) score to calculate the total observed discharge function score for stays where (i) Walk 10 Feet (GG0170I) has an activity not attempted (ANA) code at both admission and discharge and (ii) either Wheel 50 Feet with 2 Turns (GG0170R) or Wheel 150 Feet (GG0170S) has a code between 1 and 6 at either admission or discharge. The remaining stays use Walk 10 Feet (GG0170I) + Walk 50 Feet with 2 Turns (GG0170J) to calculate the total observed discharge function score.

In either case, 10 items are used to calculate a resident's total observed discharge score and score values range from 10 – 60.

3.4.2 Expected Discharge Function Score

The expected discharge function score is determined by applying the regression equation determined from risk adjustment to each SNF stay. Risk adjustment controls for resident characteristics such as admission function score, age, and clinical conditions. Refer to Section 3.6 for details on risk adjustment.

3.5 Statistical Imputation

When an item score is missing because an ANA code, a dash (-), or a skip (^) has been recorded (henceforth referred to as NA) rather than a value of 1 to 6, item scores are estimated through statistical imputation. This approach refines the imputation method used in previously specified SNF QRP functional outcome measures: SNF Functional Outcome Measure: Discharge Self-Care Score for Skilled Nursing Facility Residents (NQF #2635) (CMS ID: S024.02), SNF Functional Outcome Measure: Discharge Mobility Score for Skilled Nursing Facility Residents (NQF #2636) (CMS ID: S025.02), SNF Functional Outcome Measure: Change in Self-Care Score for Skilled Nursing Facility Residents (NQF #2633) (CMS ID: S022.02), and SNF Functional Outcome Measure: Change in Mobility Score for Skilled Nursing Facility Residents (NQF #2634) (CMS ID: S023.02). The method used in previously specified measures recodes all NAs to 1, which implicitly assumes all NA codes signify residents who are completely dependent on a functional activity. On average, residents who are coded as NA on a GG item at admission tend to score higher at discharge (if assessed) than residents who are coded as dependent on admission. Treating both types of residents the same in risk adjustment can lead to less accurate expected discharge values for each of these types of residents. Statistical imputation allows NAs to take any value from 1 to 6, based on a resident's clinical characteristics and codes assigned on other GG items.

A separate statistical imputation model is constructed for each GG item used in the Discharge Function Score (Section 3.4.1) at admission and discharge. Imputation models include the predictors used in risk adjustment (Section 3.6.2) and covariates for scores on other GG items (Step 3 below). Notably, imputation models use all GG items available in SNF to estimate missing scores for the subset of GG items used for the Discharge Function Score numerator (detailed imputation model results are available upon request). The following steps are used to generate imputed item scores for stays with NA codes. Note that these steps first describe imputing a single item at admission and then describe the relevant modifications for discharge and for the other items.

Step 1: Start with Eating (GG0130A). Identify eligible stays where the item score is not missing (i.e., had a score 1-6) at admission. These scores are used as the outcome (i.e., left-hand-side variable) of the admission imputation model for GG0130A.

Step 2: For each stay, determine whether to use walking or wheeling items in the imputation model.

- a) If Walk 10 Feet (GG0170I) has an ANA code at both admission and discharge and either Wheel 50 Feet with 2 Turns (GG0170R) or Wheel 150 Feet (GG0170S) has a code between 1 and 6, then use wheeling items.
- b) Otherwise, use walking items.

Step 3: Create variables for the imputation model reflecting how each item (g_2 through g_{10}) except Eating (GG0130A) was scored at admission. GG item scores are described as independent variables (i.e., on the right-hand side) by three variables, collectively referred to as g' . The first reflects a score of 1-6 when available (g), the second is an indicator variable taking a value of 1 if the item had an ANA code, dash, or missing value (g^*), and the third is an indicator variable taking a value of 1 if the item was skipped (g^{**}).

$$\text{Function items : } G \in \{g_2, \dots, g_{10}\} \quad (1)$$

$$g' = [g, g^*, g^{**}] \quad (2)$$

$$g = \begin{cases} g, & g = \{1,2,3,4,5,6\} \\ 0, & \text{otherwise} \end{cases}$$

$$g^* = \begin{cases} 1, & g = \{7,9,10,88,-\} \\ 0, & \text{otherwise} \end{cases}$$

$$g^{**} = \begin{cases} 1, & g = \{\wedge\} \\ 0, & \text{otherwise} \end{cases}$$

$$\text{Function items with NA indicators : } G' \in \{g'_2, \dots, g'_{10}\} \quad (3)$$

Step 4: Estimate an ordered probit model using the sample identified in Step 1.

Two types of predictors (i.e., right-hand-side variables) are used in the imputation method: clinical covariates (C) and function items with NA indicators (G') constructed in Step 3.

$$\text{Clinical items := } C \in \{c_1, \dots, c_k\} \quad (4)$$

$$\text{Function items with NA indicators : } G' \in \{g'_2, \dots, g'_{10}\} \quad (5)$$

The model we estimate for g_i , GG0130A, is

$$z_i = C_i\beta + G_i'\phi + \varepsilon_i \quad (6)$$

$$g_i = \begin{cases} 1, & z_i \leq \alpha_1 \\ 2, & \alpha_1 < z_i \leq \alpha_2 \\ 3, & \alpha_2 < z_i \leq \alpha_3 \\ 4, & \alpha_3 < z_i \leq \alpha_4 \\ 5, & \alpha_4 < z_i \leq \alpha_5 \\ 6, & z_i > \alpha_5 \end{cases} \quad (7)$$

The latent variable, z_i , is interpreted as resident i 's underlying degree of independence on assessment item GG0130A, and is a continuous variable. The error term, ε_i , is assumed to be independent and identically distributed $N(0,1)$. The model assumes that the assessment item, g_i , because it only can take on six levels, discretizes the underlying continuous independence. It does this using thresholds: residents whose underlying independence is lower than the lowest threshold, α_1 , are coded as most dependent and given a score of 1; residents whose level of dependence is a bit higher, higher than the lowest threshold α_1 but lower than the second lowest threshold α_2 , achieve a score of 2 on this item. This proceeds until we are considering residents whose independence is higher than the highest threshold, α_5 , who receive a score of 6.

We compute the imputed value of g_i as

$$\hat{g}_i = \Pr(z_i \leq \alpha_1) + 2 * \Pr(\alpha_1 < z_i \leq \alpha_2) + 3 * \Pr(\alpha_2 < z_i \leq \alpha_3) + 4 * \Pr(\alpha_3 < z_i \leq \alpha_4) + 5 * \Pr(\alpha_4 < z_i \leq \alpha_5) + 6 * \Pr(z_i > \alpha_5) \quad (8)$$

Step 5: Repeat Steps 1 - 4 for Eating (GG0130A) at discharge, replacing the word “admission” with the word “discharge” in Steps 1 - 4.

Step 6: Repeat Steps 1 - 5 for each GG item included in the observed discharge function score (Section 3.4.1), as above replacing the Eating (GG0130A) item with each successive GG item in Steps 1-5. For Wheel 50 Feet with 2 Turns (GG0170R), use only the sample of stays that satisfies the conditions in Step 2a. For Walk 10 Feet (GG0170I) and Walk 50 Feet with 2 Turns (GG0170J), use only the sample of stays that satisfies the conditions in Step 2b.

3.6 Risk Adjustment

The purpose of risk adjustment is to account for differences across SNF residents that affect their functional status. Risk adjustment creates an individualized expectation for discharge function score for each stay that controls for admission functional status, age, and clinical characteristics. This ensures that each stay is measured against an expectation that is calibrated to

the resident's individual circumstances when determining the numerator for each SNF. See the Appendix A for risk adjustment model results.

3.6.1 The Statistical Risk Model

The statistical risk model is an ordinary least squares linear regression model, which estimates the relationship between discharge function score and a set of risk adjusters. Observed discharge function score is determined for each SNF stay, incorporating imputed item scores when NA codes are encountered. The risk adjustment model is run on all SNF stays to determine the model intercept (β_0) and risk adjuster coefficients (β_1, \dots, β_n). Expected discharge function scores are calculated by applying the regression equation to each SNF stay.

$$\text{Expected Discharge Function Score} = \beta_0 + \beta_1 x_1 + \dots + \beta_n x_n \quad (9)$$

where $x_1 - x_n$ are the risk adjusters.

3.6.2 Variables

This section contains a listing of covariates groups used to calculate the risk-adjusted discharge function scores. Information on the covariates were obtained from the MDS data.

- *Age Category*

Age was calculated as the difference between the admission date of the SNF stay and the beneficiary's date of birth.

- *Admission Function Score*

Admission function score is the sum of admission scores for function items included in the discharge score (Section 3.4.1) and can range from 10-60, with a higher score indicating greater independence. NAs in the admission item scores are treated the same way as NAs in the discharge item scores, with NAs replaced with imputed scores (Steps 1-2 in Section 3.4.1). Walking items and wheeling item are used in the same manner as in the discharge score (Step 3 in Section 3.4.1). Admission score squared is also included as a risk adjuster.

- *Primary Medical Condition Category*

Primary Medical Condition is the principal reason for admitting the resident into SNF care.

- *Interaction between Primary Medical Condition Category and Admission Function Score*

These covariates are the admission function score multiplied by each primary medical condition indicator.

- *Prior surgery*

This covariate captures whether or not the resident had prior surgery.

- *Prior Function/Device Use*

These covariates capture resident's functional status prior to the stay.

- *Pressure Ulcers*

These covariates capture the presence of pressure ulcer(s) at different stages.

- *Cognitive Function*

These covariates capture the resident's cognitive function by assessing whether or not the resident's mental status at admission is impaired, and if impaired, at what level.

- *Communication impairment*

These covariates capture the resident's communication function, and indicate whether or not the resident's communication status at admission is impaired, and if impaired, at what level.

- *Incontinence*

These covariates indicate the resident's level of bladder and bowel incontinence.

- *Nutritional Status*

These covariates indicate resident's total parenteral nutrition status at SNF admission and resident's body mass index.

- *History of Falls*

This covariate indicates a history of falls prior to the SNF admission.

- *HCC Comorbidities*

Comorbidities are obtained from Section I in SNF-MDS. Comorbidities are grouped using CMS Hierarchical Condition Categories (HCC) software version 24.

3.7 Measure Calculation

The Discharge Function Score is the proportion of Medicare Part A SNF stays where residents achieve an expected discharge function score at discharge. A higher score indicates better performance in functional outcomes. For each SNF stay, the observed discharge function score (Section 3.4.1) and the expected discharge function score (Section 3.4.2) are determined. For each SNF, the Discharge Function Score is the proportion of Medicare Part A stays where the observed discharge function score is larger than or equal to the risk-adjusted expected function score.

3.7.1 Steps Used in Calculation

Step 1: Calculate the observed discharge function score as described in Section 3.4.1, incorporating imputed item scores (Section 3.5).

Step 2: Identify excluded SNF stays using the criteria mentioned in Section 3.3.2.

Step 3: Calculate the expected discharge function score. For each SNF stay: use the intercept and regression coefficients to calculate the expected discharge function score using the formula described in Section 3.6. Note that any expected discharge function score greater than the maximum (i.e., 60) would be recoded to the maximum score.

Step 4: Calculate the difference in observed and expected discharge function scores. For each Medicare Part A SNF stay which does not meet the exclusion criteria, compare each resident's observed discharge function score (Step 1) and expected discharge function score (Step 3) and classify the difference as one of the following:

- Observed discharge score is equal to or higher than the expected discharge score.
- Observed discharge score is lower than the expected discharge score.

Step 5: Determine the denominator count. Determine the total number of Medicare Part A SNF stays with a MDS in the measure target period, which do not meet the exclusion criteria.

Step 6: Determine the numerator count. The numerator for this quality measure is the number of SNF stays in which the observed discharge score is the same as or higher than the expected discharge score, as determined in Step 4.

Step 7: Calculate the facility-level discharge function percent. Divide the facility's numerator count (Step 6) by its denominator count (Step 5) to obtain the facility-level discharge function percent, then multiply by 100 to obtain a percent value.

Step 8: Round the percent value to two decimal places. If the digit in the third decimal place is 5 or greater, add 1 to the second decimal place; otherwise, leave the second decimal place unchanged. Drop all digits following the second decimal place.

4 MEASURE TESTING

4.1 Reportability

Reportability testing examines the total number and proportion of stays that would have at least 20 eligible stays for the Discharge Function Score measure in the reporting period. In FY2021, 11,914 out of a total of 14,985 SNFs (79.5%) met this threshold. This indicates high reportability and usability of the measure.

Table 3. Publicly Reportable SNFs, FY2021

Number of SNFs with ≥ 20 stays	Percentage of SNFs with ≥ 20 stays
11,914	79.5%

4.2 Variability

Variability testing summarizes the distribution of the facility-level final Discharge Function Scores. In FY2021, the mean final score among SNFs with at least 20 stays was 52.2% (median: 52.6%, IQR: 42.4% - 62.5%). Final scores ranged from a minimum of 0.0% to a maximum of 97.3%. This wide variation indicates there is a performance gap in Discharge Function Scores across SNFs.

Table 4. Facility- Level Distribution of Discharge Function Scores

N	Mean Score	Std Dev.	Minimum	25th percentile	50th percentile	75th percentile	Maximum
11,914	52.2%	15.0%	0.0%	42.4%	52.6%	62.5%	97.3%

4.3 Reliability

The split-half reliability test examined agreement between two Discharge Function Scores for a facility based on randomly-split, independent subsets of stays in the same measurement period. Good agreement between the two measure scores calculated in this manner provides evidence that the measure is capturing an attribute of the facility (quality of care) rather than the resident stays (case-mix). For SNFs with at least 20 eligible stays in FY2021, each provider's stays were randomly divided into halves, thus ensuring that resident stays were evenly distributed across the split-halves. Provider measure scores for each split-half sample were calculated. The Shrout-Fleiss intraclass correlation coefficient (ICC (2, 1)) was calculated between the split-half scores to measure reliability, applying the Spearman-Brown correction.⁹

⁹ McGraw, K. O., & Wong, S. P. Forming inferences about some intraclass correlation coefficients. *Psychological methods*, 1996, 1(1), 30.

The intraclass correlation coefficient for SNFs with more than 20 eligible stays was 0.80, which indicates good reliability.¹⁰

4.4 Validity

This section reviews validity tests conducted to support the Discharge Function Score measure. Section 4.4.1 reports results that support the validity of measure scores. Section 4.4.2 describes analyses validating the imputation model results.

4.4.1 Measure Scores

To evaluate the validity of measure scores, convergent validity with other SNF QRP measures, face validity, and risk adjustment model performance were assessed. The following subsections describe comparisons with other measures; webinars convened to gather expert, resident, and caregiver perspectives; and risk adjustment model calibration and fit analyses.

Convergent Validity

To evaluate convergent validity of measure scores, we measured Spearman's rank correlation between the Discharge Function Score measure and other SNF QRP measures (Table 5). The analysis used FY2021 data and only included data from SNFs with at least 20 stays. Higher functional status corresponds with higher likelihood of community discharge and lower rates of re-hospitalizations.¹¹ As expected, this measure demonstrated positive correlation with the Discharge to Community measure (0.13) and negative correlation with the Potentially Preventable Readmissions within 30-Days Post-Discharge measure (-0.06). Because higher functioning residents are likely to have lower levels of medical complexity, it follows that their stays would cost less. As expected, this measure had a negative correlation with Medicare Spending Per Beneficiary (-0.05). Additionally, as expected, since the SNF QRP self-care and mobility functional outcome measures use overlapping but not identical GG items and a different method for handling NA codes, scores for these measures correlated well but not perfectly with functional outcome measures: Change in Self-Care Score (0.74), Discharge Self-Care Score (0.76), Change in Mobility Score (0.78), and Discharge Mobility Score (0.79). All correlation coefficients were significant ($p < 0.01$).

¹⁰ Koo T.K. & Li M.Y. A Guideline of Selecting and Reporting Intraclass Correlation Coefficients for Reliability Research. *Journal of Chiropractic Medicine*, 2016, 15(2), 155-163.

¹¹ Gustavson, A. M., Malone, D. J., Boxer, R. S., Forster, J. E., & Stevens-Lapsley, J. E. (2020). Application of High-Intensity Functional Resistance Training in a Skilled Nursing Facility: An Implementation Study. *Physical therapy*, 100(10), 1746–1758. <https://doi.org/10.1093/ptj/pzaa126>

Table 5. Correlations between Discharge Function Score and Other Publicly Reported Measures

Measure	Spearman's Correlation	P value
Discharge to Community - PAC SNF QRP	0.13	<0.01
Medicare Spending Per Beneficiary – Post-Acute Care (PAC) SNF QRP	-0.05	<0.01
Potentially Preventable 30-Day Post-Discharge Readmission Measure – SNF QRP	-0.06	<0.01
SNF Functional Outcome Measure: Change in Self-Care Score for Medical Rehabilitation Patients (NQF #2633)	0.74	<0.01
SNF Functional Outcome Measure: Discharge Self-Care Score for Medical Rehabilitation Patients (NQF #2635)	0.76	<0.01
SNF Functional Outcome Measure: Change in Mobility Score for Medical Rehabilitation Patients (NQF #2634)	0.78	<0.01
SNF Functional Outcome Measure: Discharge Mobility Score for Medical Rehabilitation Patients (NQF #2636)	0.79	<0.01

Face Validity

To assess face validity of the Discharge Function Score measure, two Technical Expert Panel (TEP) meetings (July 2021 and January 2022), as well as a Patient and Family Engagement Listening Session, were convened. TEP members showed strong support for the face validity of this measure. Though a vote was not taken at the meeting, the TEP agreed with the conceptual and operational definition of the measure. Panelists reviewed the validity analyses described herein and agreed they demonstrated measure validity.

The Patient and Family Engagement Listening Session demonstrated that the measure concept resonates with residents and caregivers. Participants’ views of self-care and mobility were aligned with the functional domains captured by the measure, and they found them to be critical aspects of care. Participants emphasized the importance of measuring functional outcomes and were specifically interested in metrics that show how many residents discharged from particular facilities made improvements in self-care and mobility.

Risk Adjustment Model Performance

The risk adjustment model is an ordinary least squares linear regression. We assessed risk adjustment model calibration and fit using FY2021 data. A well-calibrated model demonstrates good predictive ability to distinguish high-risk from low-risk residents. To assess risk adjustment model calibration, the ratios of observed-to-predicted discharge function score across eligible stays by decile of predicted discharge function score (risk) were calculated. The average ratios of observed-to-predicted scores for each risk decile ranged from 0.98 to 1.01, which suggested good

calibration across the range of residents without evidence of concerning under- or over-estimation. Model fit was analyzed using adjusted R-squared to determine if the risk adjustment model can accurately predict discharge function while controlling for resident case-mix. The adjusted R-squared value was 0.58, which suggests good model discrimination.

4.4.2 Imputation Model

This section discusses the validity testing results of the imputation models used to estimate missing item scores. Validity testing included (1) assessments of model results and (2) calculation of bias and error of imputed item scores.

Model Results

To assess the validity of the imputation models, model fit and face validity of model coefficients were evaluated. The C-statistic is a measure of model discrimination that determines the probability that predicting the outcome is better than chance. The C-statistic can range from 0.5 to 1. Using FY2021 data, the C-statistic averaged 0.94 and ranged from 0.83 to 0.99 across the imputation models for each item at both admission and discharge (see Table A-2). These results suggest good model discrimination across all imputation models.

The face validity of model results was assessed by reviewing model coefficients. For each item at both admission and discharge, imputation models produced sensible coefficients. Worse health conditions generally predicted lower item scores, as did prior functional status. Coefficients on related GG items were positively predictive, and larger for GG items more closely related to the item being imputed (e.g., bed mobility items were generally more predictive for a bed mobility item imputation model than transfer or ambulation items).¹²

Bias and Mean Squared Error

A bootstrapping method was used to measure bias and mean squared error (MSE) in the imputation method. Bias measures the average amount by which the imputed value differs from the true value. Bias is signed, with a positive amount meaning that the imputed values were higher, on average, than the true values. MSE measures how far away the method is, on average from the truth. It is unsigned and can be positive even if bias is zero. The absolute size of bias is an inverse measure of accuracy, while the size of MSE is an inverse measure of the combination of precision and accuracy. The goal of the bootstrapping method was to determine how similar imputed values were to the true item score. This similarity could not be measured directly since the true value of the measure score was unknown in the case of the individuals for whom imputation was necessary (imputation was needed precisely because the missing values prevented calculating the measure score for these individuals). Therefore, a bootstrapping

¹² Detailed model results are available upon request.

strategy was implemented using the following steps to assess the accuracy of the statistical imputation method:

Step 1: Identified observations from the original sample with no NAs recorded across all items needed for measure calculation.

Step 2: Generated a bootstrap sample that draws from the no-NA observations until there were as many observations in the bootstrap sample as the original sample. A stratified random sampling algorithm was used. The first stratum of each bootstrap sample consisted of no-NA observations. This stratum had the same number of observations as there were no-NA observations in the original data. This stratum of the bootstrap sample was filled by simple random sampling from the no-NA observations.

To fill the bootstrap sample observations corresponding to the observations from the original data having NAs, it was not possible to use simple random sampling. This is because the distribution of clinical and function characteristics was different between observations with and without NAs. Therefore, the sampling to fill the bootstrap sample for these observations was done using a stratification method which matched observations with NA to similar observations without NA.

Therefore, ten additional strata were filled corresponding to the observations from the original data with NAs. These strata were defined by the deciles of a predicted score estimated, as described in Section 3.5. Bootstrap observations corresponding to the observations with NAs were chosen by simple random sampling within each of these strata.

Step 3: Created two copies of this sample.

- a) One copy served as the gold standard source of truth because all observations in the bootstrap sample were sampled from no-NA observations.
- b) In the other copy, NAs were imposed on some of the GG items. This was done in a way which preserved both the pattern of NAs within the data and the pattern of clinical characteristics among NA observations. NAs were imposed by randomly selecting observations from the original data which i) had NAs and ii) were in the same stratum (see Step 2) as the corresponding target observation in the second copy. The GG items which were missing in the sampled observation were made missing in the target observation.

Step 4: In the second copy produced in Step 3b, imputed values for the NAs imposed onto the bootstrap sample were generated. For comparison, applied “recode to 1” method and calculated resulting measure scores.

Step 5: Calculated bias and mean-squared error of the imputation method by comparing observation by observation to the measure scores produced from the gold standard copy (Step 3a).

Step 6: Repeated Steps 2-5 many times. Reported average bias/mean-squared error across iterations/bootstrap replications.

Bias and MSE were compared between statistical imputation and the current method, which recodes all NAs to 1. Using this bootstrapping method, statistical imputation resulted in lower levels of bias (-0.21 at admission; -0.17 at discharge) and MSE (1.71 at admission; 1.41 at discharge) compared to the bias (-1.24 at admission; -0.72 at discharge) and MSE (5.05 at admission; 4.18 at discharge) produced from the current recode, which supports the validity of the statistical imputation method.

APPENDIX

Table A-1. Discharge Function Score Measure Risk Adjustment: Linear Regression Model Results, FY2021

Covariate	Number of Stays	Percent of Stays	Average Observed Score	Estimate	P-value
Age <= 54 years	22,298	2%	43.64	0.20	0.00
Age 55-64 years	63,811	6%	44.24	0.21	0.00
Age 75-84 years	331,834	34%	43.70	-0.45	0.00
Age 85 - 90 years	193,159	20%	42.23	-0.98	0.00
Age > 90 years	131,635	13%	40.42	-1.70	0.00
Primary Medical Condition Category: Stroke	47,759	5%	38.65	-4.31	0.00
Primary Medical Condition Category: Non-Traumatic Brain Dysfunction and Traumatic Brain Dysfunction	20,488	2%	41.23	-1.32	0.00
Primary Medical Condition Category: Non-Traumatic Spinal Cord Dysfunction	3,856	0%	46.21	-0.63	0.16
Primary Medical Condition Category: Traumatic Spinal Cord Dysfunction	889	0%	36.98	-7.83	0.00
Primary Medical Condition Category: Progressive Neurological Conditions	16,970	2%	38.72	-1.96	0.00
Primary Medical Condition Category: Other Neurological Conditions	53,012	5%	40.78	-0.54	0.02
Primary Medical Condition Category: Fractures and Other Multiple Trauma	159,790	16%	44.33	3.79	0.00
Primary Medical Condition Category: Amputation	6,974	1%	42.50	-2.11	0.00
Primary Medical Condition Category: Other Orthopedic Conditions	67,909	7%	45.69	2.35	0.00
Primary Medical Condition Category: Debility, Cardiorespiratory Conditions	129,300	13%	43.90	-0.61	0.00
Primary Medical Condition Category: Medically Complex Conditions and Other Medical Condition	451,164	46%	42.97	-0.76	0.00
Admission Score - continuous score	-	-	.	1.34	0.00
Admission Score - squared form	-	-	.	-0.01	0.00
Interaction of Admission Score and Primary Medical Condition Category: Stroke	-	-	.	0.10	0.00
Interaction of Admission Score and Primary Medical Condition Category: Non-Traumatic Brain Dysfunction and Traumatic Brain Dysfunction	-	-	.	0.03	0.00
Interaction of Admission Score and Primary Medical Condition Category: Non-Traumatic Spinal Cord Dysfunction	-	-	.	0.02	0.18

Covariate	Number of Stays	Percent of Stays	Average Observed Score	Estimate	P-value
Interaction of Admission Score and Primary Medical Condition Category: Traumatic Spinal Cord Dysfunction	-	-	.	0.18	0.00
Interaction of Admission Score and Primary Medical Condition Category: Progressive Neurological Conditions	-	-	.	0.02	0.02
Interaction of Admission Score and Primary Medical Condition Category: Other Neurological Conditions	-	-	.	0.01	0.10
Interaction of Admission Score and Primary Medical Condition Category: Fractures and Other Multiple Trauma	-	-	.	-0.10	0.00
Interaction of Admission Score and Primary Medical Condition Category: Amputation	-	-	.	0.01	0.10
Interaction of Admission Score and Primary Medical Condition Category: Other Orthopedic Conditions	-	-	.	-0.06	0.00
Interaction of Admission Score and Primary Medical Condition Category: Debility, Cardiorespiratory Conditions	-	-	.	0.01	0.00
Interaction of Admission Score and Primary Medical Condition Category: Medically Complex Conditions and Other Medical Conditions	-	-	.	0.02	0.00
Prior Surgery	255,363	26%	45.32	0.91	0.00
Prior Functioning: Self-Care Some Help	432,014	44%	38.97	-1.61	0.00
Prior Functioning: Self-Care Dependent	43,478	4%	24.84	-3.26	0.00
Prior Functioning: Indoor Mobility (Ambulation) - Dependent	35,770	4%	27.12	-1.63	0.00
Prior Functioning: Indoor Mobility (Ambulation) - Some Help	238,734	24%	37.81	-1.10	0.00
Prior Functioning: Stairs - Dependent	25,953	3%	34.66	0.39	0.00
Prior Functioning: Stairs - Some Help	121,245	12%	42.36	0.15	0.00
Prior Functioning: Functional Cognition - Dependent	71,836	7%	30.47	-0.85	0.00
Prior Mobility Device Use: Walker	529,190	54%	43.46	-0.11	0.00
Prior Mobility Device Use: Manual Wheelchair or Motorized Wheelchair and/or Scooter	275,348	28%	35.42	-2.30	0.00
Prior Mobility Device Use: Mechanical Lift	25,332	3%	24.00	-4.38	0.00
Prior Mobility Device Use: Orthotics/Prosthetics	10,604	1%	40.91	0.07	0.33
Stage 2 Pressure Ulcer - Admission	49,689	5%	37.06	-1.14	0.00

Covariate	Number of Stays	Percent of Stays	Average Observed Score	Estimate	P-value
Stage 3, 4 or Unstageable Pressure Ulcer/Injury - Admission	76,873	8%	34.20	-2.03	0.00
Cognitive Function: Brief Interview for Mental Status score - Admission - Moderately Impaired	250,302	25%	42.26	-1.72	0.00
Cognitive Function: Brief Interview for Mental Status score - Admission - Severely Impaired	214,234	22%	34.33	-3.50	0.00
Communication Impairment - Admission - Moderate to Severe	85,309	9%	30.45	-2.05	0.00
Communication Impairment - Admission - Mild	155,668	16%	38.80	-0.81	0.00
Bladder Incontinence - Admission - Indwelling Urinary Catheter	83,811	8%	36.94	-2.37	0.00
Urinary Continence - Admission - Occasionally incontinent, Frequently incontinent, or Always incontinent	665,649	67%	40.93	-1.05	0.00
Bowel Continence - Admission - Occasionally incontinent, Frequently incontinent, or Always incontinent	558,617	57%	38.23	-1.85	0.00
History of Falls - Admission	452,831	46%	44.11	0.20	0.00
Swallowing Ability at Admission -- modified food consistency	250,667	25%	36.58	-1.03	0.00
Total Parental/IV Feeding or Tube Feeding - Admission	39,984	4%	32.45	-1.77	0.00
High BMI (BMI > 50)	17,389	2%	41.44	-1.04	0.00
Low BMI	6,736	1%	41.08	-0.31	0.08
Metastatic Cancer and Acute Leukemia (HCC8)	99,999	10%	43.75	-0.36	0.00
Lymphoma and Other Cancers (HCC10)	6,746	1%	43.74	-1.80	0.00
Other Major Cancers: Colorectal, Bladder, and Other Cancers (HCC11)	9,093	1%	45.26	-0.93	0.00
Dementia: Dementia With Complications (HCC51), Dementia Without Complications (HCC52)	258,989	26%	37.70	-0.77	0.00
Mental Health Disorders: Schizophrenia (HCC57), Major Depressive, Bipolar, and Paranoid Disorders (HCC58), Reactive and Unspecified Psychosis (HCC59), Personality Disorders (HCC60)	428,701	43%	42.17	-0.33	0.00
Tetraplegia (excluding complete tetraplegia) (HCC70) and paraplegia (HCC71)	8,614	1%	29.41	-3.38	0.00
Multiple Sclerosis (HCC77)	7,336	1%	36.19	-1.97	0.00

Covariate	Number of Stays	Percent of Stays	Average Observed Score	Estimate	P-value
Hemiplegia/Other Late Effects of CVA: Hemiplegia/Hemiparesis (HCC103)	71,866	7%	35.03	-2.11	0.00
Aspiration, Bacterial, and Other Pneumonias: Aspiration and Specified Bacterial Pneumonias (HCC114), Pneumococcal Pneumonia, Empyema, Lung Abscess (HCC115)	76,545	8%	40.88	-0.04	0.20
Dialysis Status (HCC134), Chronic Kidney Disease, Stage 5 (HCC136)	37,629	4%	41.88	-1.62	0.00
Chronic Kidney Disease - Stages 1-4, Unspecified: Chronic Kidney Disease, Severe (Stage 4) (HCC137), Chronic Kidney Disease, Moderate (Stage 3) (HCC138), Chronic Kidney Disease, Mild or Unspecified (Stages 1-2 or Unspecified) (HCC139)	296,368	30%	42.85	0.25	0.00
Amputations: Traumatic Amputations and Complications (HCC173), Amputation Status, Lower Limb/Amputation Complications (HCC189), Amputation Status.	17,123	2%	41.55	-1.03	0.00
Other Significant Endocrine and Metabolic Disorders (HCC23)	19,713	2%	44.13	0.04	0.52
Major Infections: Septicemia, Sepsis, Systemic Inflammatory Response Syndrome/Shock (HCC2)	71,059	7%	40.35	0.16	0.00
Intestinal Obstruction/Perforation (HCC33)	14,896	2%	43.95	0.17	0.01
Major Head Injury (HCC167)	3,158	0%	40.94	0.38	0.01
Diabetes: Diabetes with Chronic Complications (HCC18) or Diabetes without Complications (HCC19)	366,304	37%	42.73	-0.26	0.00
Parkinson's and Huntington's Diseases (HCC78)	44,931	5%	39.27	-0.66	0.00
Angina Pectoris (HCC88)	3,543	0%	44.58	-0.36	0.00
Intercept	.	.	.	21.53	0.00

Table A-2. C-Statistics for Imputation Models across GG Items at Admission and Discharge, FY2021

Item	Description	Assessment Timing	C-Statistic
GG0130A	Eating	Admission	0.83
		Discharge	0.90
GG0130B	Oral Hygiene	Admission	0.83
		Discharge	0.92
GG0130C	Toileting Hygiene	Admission	0.92
		Discharge	0.94
GG0170A	Roll left/right	Admission	0.93
		Discharge	0.97
GG0170C	Lying to sit - bed	Admission	0.98
		Discharge	0.99
GG0170D	Sit to stand	Admission	0.97
		Discharge	0.98
GG0170E	Chair to bed trans.	Admission	0.98
		Discharge	0.99
GG0170F	Toilet trans.	Admission	0.97
		Discharge	0.98
GG0170I	Walk 10'	Admission	0.92
		Discharge	0.97
GG0170J	Walk 50'	Admission	0.95
		Discharge	0.98
GG0170R	Wheel 50'	Admission	0.92
		Discharge	0.93