2023 Measure Updates and Specifications Report
Skilled Nursing Facility Value-Based Purchasing Program

Skilled Nursing Facility 30-Day All-Cause Readmission Measure – Version 2.0

Submitted By:
Yale New Haven Health Services Corporation – Center for Outcomes Research and Evaluation (YNHHSC/CORE)

Prepared For:
Centers for Medicare & Medicaid Services (CMS)

August 2023

Table of Contents

List of Tables

List of Figures

Center for Outcomes Research and Evaluation Project Team

Jacqueline N. Grady, M.S. – Division Director
Vivian S. Vigliotti, PhD, MSc– Project Lead
Sheng Zhou, MD, MSc – Lead Analyst
Chenxue Liang, MPH, MSc – Analyst
Rose Hu, MS – Analyst
Megan Rushkin, MPH – Analyst
Madeline L. Parisi, BA – Project Coordinator
Jennifer Jacque, MPH – Research Associate
Valerie Manghir, MPH – Research Associate
Erica Norton, BS – Project Manager
Karen Dorsey, MD, PhD – Project Director
Harlan M. Krumholz, MD, SM – Principal Investigator

Measure Reevaluation Team Contributors

Elina Kurkurina, MPH – Content Expert for CPT/HCPCS and ICD-10
Kristina Gaffney, BS – Content Expert for CPT/HCPCS and ICD-10

Acknowledgements

This work is a collaborative effort, and the authors gratefully acknowledge General Dynamics Information Technology; Bellese; Jinghong Gao, Jing Zhang, and Elizabeth Triche from CORE; and Janis Grady at CMS for their contributions to this work.

1. How to Use This Report

This report describes updates that have been made to the Skilled Nursing Facility 30-Day All-Cause Readmission Measure (SNFRM) used in the SNF Value-Based Purchasing (VBP) Program during annual reevaluation. The report provides background information about the measure and its development, a description of each update made since the prior AUS report (August 2022 report for the 2023 SNF VBP Program year baseline period), the impacts of the changes on the measure cohort and outcome, and overall measure results. Specifically, the report includes the following sections:

- Section 2 – **Background and Overview of Measure Methodology**
  - Background on SNFRM
  - Overview of methodology
  - Cohort – inclusions and exclusions
  - Outcome
  - Planned readmission algorithm
  - Risk-adjustment variables
  - Data sources
  - Measure calculation
- Section 3 – **FY 2022 Performance Period (FY 2024 Program Year) Measure Updates**
  - Background and rationale for measure updates
  - Detailed discussion of measure updates
  - Inclusion/exclusion criteria updates
  - Planned readmission algorithm updates
  - Impact of measure updates
- Section 4 – **Summary of Measure Performance After Updates**
  - SNFRM model parameters and performance
- Section 5 – **Glossary**

The Appendices contain detailed measure information:

- Statistical approach to calculating provider-level risk-standardized readmission rates (Appendix A);
- Summary of updates to the measure (Appendix B);
- Detailed measure specifications (Appendix C);
- Detailed description of the planned readmission algorithm (Appendix D).

For additional references, the original measure technical report and supplements are available on the SNF VBP Program's measures page.

- SNFRM Technical Report (March 2015)
- SNFRM Technical Report Supplement Update (April 2019)
- Planned Readmission Algorithm v3.0 Details
- SNFRM Reliability Testing Memo (April 2018)
- SNFRM Technical Report Supplement (April 2017)
- SNFRM Technical Report (March 2015)

This report references the SNFRM Data Dictionary for detailed coding; this dictionary will be available on SNF VBP Program's measures page as a supplement to this report.

2. Background and Overview of Measure Methodology

2.1. Background on the Skilled Nursing Facility 30-Day All-Cause Readmission Measure

The Centers for Medicare & Medicaid Services (CMS) initially contracted with RTI International to develop the Skilled Nursing Facility 30-Day All-Cause Readmission Measure (SNFRM), and the measure received National Quality Forum (NQF) endorsement in 2014 (NQF #2510). CMS finalized the SNFRM for use in the Skilled Nursing Facility (SNF) Value-Based Purchasing (VBP) Program (80 Federal Register 46419) and has used the measure to determine SNF payment rates since Fiscal Year (FY) 2019.

In 2020, CMS transitioned the measure to a contract with the Yale New Haven Health Services Corporation – Center for Outcomes Research and Evaluation (CORE). CORE reevaluates the measure annually to make refinements based on stakeholder input and to incorporate advances in science, changes in coding and impacts on care delivery such as the response to the COVID-19 pandemic. The updates described in this report were made in preparation for public reporting for the FY 2024 SNF VBP Program year. This report includes results for the FY 2022 performance period of the FY 2024 SNF VBP Program, which uses FY 2022 data.

2.2. Overview of Measure Methodology

The SNFRM was developed with the goal of improving the quality of care delivered to Medicare beneficiaries who are admitted to a SNF. This report provides a high-level summary of the current measure specifications, including updates from the reevaluation, which are discussed in detail in Section 3. A more comprehensive description of the measure development process is available in the 2015 Measure Technical Report located here.

The SNFRM estimates the risk-standardized rate of all-cause, unplanned hospital readmissions for SNF Medicare Fee-for-Service (FFS) beneficiaries within 30 days of discharge from a prior proximal acute hospitalization. The prior proximal hospitalization is defined as an admission to an inpatient prospective payment system (IPPS) hospital, critical access hospital (CAH), or Prospective Payment System (PPS)-exempt psychiatric or cancer hospital. The measure is risk-adjusted for patient demographics, principal diagnosis from the prior hospitalization, comorbidities, and other health status variables that affect the probability of a hospital readmission. The SNFRM includes Medicare FFS beneficiaries who were admitted to a SNF within 1 day of discharge from a hospital. The measure is calculated annually using a 12-month period.

2.2.1. Cohort

Inclusion Criteria

The target population for this measure is Medicare FFS patients who have been admitted to a SNF. The prior proximal hospitalization is defined as an admission to an IPPS, CAH, or PPS-exempt psychiatric or cancer hospital.

Exclusion Criteria

SNF stays may be excluded from the SNFRM for several reasons. We exclude stays if they are clinically different than most SNF stays, stays for which it would be inappropriate to hold SNFs accountable for possible readmissions, and stays for which the data is insufficient to track readmissions or apply risk adjustment. To ensure the SNFRM sample aligns with the population of SNFs eligible for the SNF VBP Program, stays at CAH swing beds are excluded from the denominator. Given CAH swing beds are not paid on the SNF PPS, they are not eligible for the SNF VBP Program. However, it should be noted that because the SNF VBP Program includes all SNFs paid on the SNF PPS, SNFs in U.S. territories are included.

The measure excludes:

- SNF stays where the patient had one or more intervening post-acute care (PAC) admissions (inpatient rehabilitation facility [IRF] or long-term care hospital [LTCH]) which occurred either between the prior proximal hospital discharge and SNF admission or after the SNF discharge, within the 30-day risk window. The measure also excludes SNF admissions as index admissions if more than one SNF stay occurred during the 30-day risk window.

  Rationale: Patients who are admitted to IRF or LTCH the day of discharge and then transferred to SNF the next day or patients with an IRF or LTCH admission after SNF discharge but within the 30-day risk window are receiving other additional types of services as compared to patients admitted directly to the SNF from the prior proximal hospitalization. They are clinically different and their risk for readmission is different than the rest of SNF admissions. Additionally, when patients have multiple PAC or SNF admissions, evaluating quality of care coordination is confounded by attributing responsibility for a readmission among multiple PAC providers.

- SNF stays with no prior proximal hospitalization, or SNF stays with a gap of greater than 1 day between discharge from the prior proximal hospitalization and the SNF admission, or SNF stays with an admission date before the discharge date of the prior proximal hospitalization.

  Rationale: SNF stays without a prior proximal hospitalization or SNF stays that begin more than one day after discharge from the prior proximal hospitalization cannot be assigned an outcome since the outcome window begins at the date of discharge from the prior proximal hospitalization. Moreover, these patients are likely clinically different and their risk for readmission is different than the rest of SNF admissions. SNF stays with an admission date that precedes the discharge date of the prior proximal hospitalization are excluded since it is unclear when they left the hospital and when they were admitted to a SNF.

- SNF stays where patients were not continuously enrolled in Medicare FFS for the year before prior proximal hospital discharge, the month of the prior proximal hospitalization, and 1 month after the hospitalization (measured as enrollment during the month of proximal hospital discharge, for 12 months prior to that discharge, and the month after the month of discharge).

  Rationale: Patients are required to be continuously enrolled in order to identify comorbidities during the 12-month period prior to the proximal hospital discharge for risk adjustment and whether a readmission occurred within the 30-day risk window.

- SNF stays where the patient was discharged from the SNF against medical advice.

  Rationale: The SNF was not able to complete care as needed.

- SNF stays in which the principal diagnosis for the prior proximal hospitalization was for the medical treatment of cancer. Patients with cancer whose principal diagnosis from the prior proximal hospitalization was for other diagnoses or for surgical treatment of their cancer remain in the measure.

  Rationale: Patients with a principal diagnosis of cancer for the prior hospitalization have a very different mortality and readmission risk than the rest of the Medicare population, and outcomes for these admissions do not correlate well with outcomes for other admissions.

- SNF stays, in which the principal primary diagnosis for the prior proximal hospitalization was for “rehabilitation care; fitting of prostheses and for the adjustment of devices.”

Rationale: Hospital admissions for these conditions are not for acute care.

- SNF stays in which the prior proximal hospitalization was for pregnancy.
  Rationale: While SNF stays, in which the prior proximal hospitalization for pregnancy is very rare, this measure is not intended to measure care related to pregnancy.

- SNF stays in which data were missing or problematic on any covariate or variable used in the measure's constructions.
  Rationale: The needed data are not available to reliably calculate the measure score for the SNF.

- SNF stays that took place in a CAH swing bed.
  Rationale: CAHs are not paid on the SNF PPS, therefore they are not eligible for the SNF VBP Program.

2.2.2. Outcome

Unplanned Hospital Readmissions

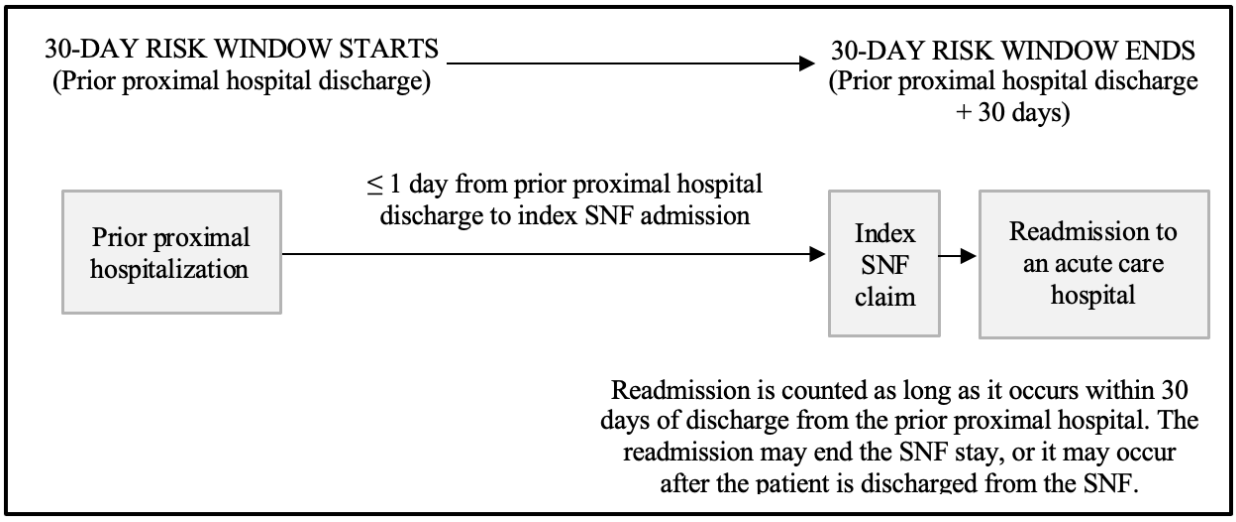
The measure is designed to capture any unplanned hospital readmissions that arise from acute clinical events requiring rehospitalization for any cause within 30 days of discharge from the patient's prior proximal hospitalization. If a patient is readmitted more than once during the 30-day window only one readmission is included in the outcome. Planned readmissions, which are generally not a signal of quality of care, are not considered readmissions in the measure outcome. For details about how planned readmissions are defined, refer to Section 2.2.3 and Appendix D.

All unplanned readmissions are included in the numerator, regardless of cause. There are several reasons for assessing unplanned readmissions for all causes. First, from a patient's perspective, an unplanned readmission for any cause is an adverse event. In addition, making inferences about quality of care based solely on the documented cause of readmission is difficult. For example, a patient with renal failure who develops a hospital-acquired infection may ultimately be readmitted for sepsis. In this context, considering the readmission to be unrelated to the care that the patient received for renal failure during the index admission would be inappropriate.

30-Day Time Frame

The measure limits the outcome of unplanned hospital readmissions to 30 days. To be included in the denominator, a patient must have a SNF admission within 1 day after discharge from the prior proximal hospital stay, and the SNF admission must occur within the target 12-month period used for SNFRM calculation. If a readmission occurs during a SNF stay within the 30-day risk window, or after the SNF stay but still within the 30-day risk window, it is counted in the outcome.

Figure 1. Risk Window for the SNFRM



Adapted from 2019 SNFRM Technical Report.[1]

2.2.3. Planned Readmission Algorithm (PRA)

The measure includes only unplanned readmissions in the measure outcome. "Planned" readmissions are those planned by providers for anticipated medical treatment or procedures that must be provided in the inpatient setting. The measure does not count these in the outcome because variation in planned readmissions does not reflect differences in quality of care.

Since it is not possible to use claims to identify planned readmissions directly, the measure uses an adapted version of an algorithm developed for CMS's hospital readmission measures, CMS's Planned Readmission Algorithm (PRA) Version 4.0 (2020).

In brief, the algorithm uses the procedure codes and principal discharge diagnosis code on each inpatient hospital claim to identify admissions that are typically planned and may occur after a discharge to SNF. A few specific types of care are always considered planned (for example, major organ transplant, rehabilitation, or maintenance chemotherapy). Otherwise, a planned readmission is defined as a claim that includes a potentially planned procedure (for example, scheduled elective total hip arthroplasty) without an acute principal discharge diagnosis (for example, hip fracture). Readmissions for an acute illness or for complications of care are never considered planned.

To define whether a readmission for the SNF setting was planned, the measure uses a modified version of the CMS PRA, which includes additional procedures specific to post-acute care (PAC) settings based on feedback from the measure development technical expert panel convened by RTI.

Appendix D provides a detailed description of the PRA adapted for the SNFRM, and the SNFRM Data Dictionary contains the code lists that define data elements used in the PRA and the post-acute care exclusions.

2.2.4. Risk-Adjustment Variables

The SNFRM risk-adjustment model accounts for variation across SNFs in case mix and patient characteristics. The measure adjusts for age, sex, length of stay during the prior proximal hospitalization, COVID-19 diagnoses, time spent in the intensive care unit (ICU) during the prior proximal hospitalization, disabled as original reason for Medicare coverage, end-stage renal disease (ESRD), number of acute care

hospitalizations in the 365 days before the prior proximal hospitalization, principal diagnosis using Agency for Healthcare Research and Quality (AHRQ) Clinical Classification Software (CCS) categories, system-specific surgical indicators, individual comorbidities based on CMS Hierarchical Condition Categories (CCs), and the presence of multiple comorbidities. The SNFRM Data Dictionary presents the definition of these variables.

2.2.5. Data Sources

CMS uses paid Medicare FFS claims to identify SNF admissions, as well as CMS enrollment and demographic data. Patient history is also normally assessed using claims data collected in the 12 months prior to the SNF admission. No additional information or data are needed from providers beyond what is present in claims and Medicare eligibility files (i.e., no additional data collection is required). The following specific files are used:

- Medicare Provider Analysis and Review (MedPAR) files. Documentation available at https://www.medric.info/data-enclave/data-pages/data-documentation.
- Medicare Denominator files. Documentation available at https://www.cms.gov/Research-Statistics-Data-and-Systems/Files-for-Order/LimitedDataSets/DenominatorLDS.

2.2.6. Measure Calculation

Measure scores are calculated by fitting the hierarchical logistic regression model to the data to calculate a standardized risk ratio (SRR) for each SNF. To calculate this ratio, we used the results from the hierarchical logistic regression model to calculate the predicted number of readmissions and the expected number of readmissions for each SNF. The predicted number of readmissions accounts for the unique impact of each SNF's case mix on the likelihood of readmission (quality), whereas the expected number of readmissions is based on the average SNF. The predicted number of readmissions for each SNF was calculated as the sum of the predicted probability of readmission for each patient in the facility, including the SNF-specific (random) effect. The expected number of readmissions for each SNF was calculated as the sum of the predicted probability of readmission for each patient in the facility, not including the SNF-specific (random) effect. See Appendix A for more information on the statistical risk-adjustment model and the calculation of a SNF-level Risk-standardized Readmission Rate (RSRR).

3. Updates to Measure for FY 2022 Performance Period (FY 2024 Program) Reporting

3.1. Background and Rationale for Measure Updates

The measure aims to improve the quality of care delivered to SNF patients within 30 days of discharge from a prior proximal hospitalization. The measure is reevaluated annually.

Section 3.2 below details the measure updates instituted during the measure reevaluation period and the impact of these updates on the measure cohort and outcome.

3.2. Measure Updates

3.2.1. Updates to Measure Specifications

We reviewed the FY 2022 and FY 2023 International Classification of Disease, 10th revision (ICD-10) Procedure Coding System (PCS) and FY 2022 as well as FY 2023 ICD-10 Clinical Modification (CM) codes to update the codes that define post-acute care exclusions. We did not identify any other coding updates to make to the measure specifications, other than to adopt the PRA v4.0_2020 (detailed in Section 3.2.2). All other measure specifications remained unchanged from the prior version of the SNFRM.

3.2.2. Updates to the Planned Readmission Algorithm

The SNFRM outcome does not include planned inpatient readmissions because they are not a signal of poor-quality care. A short description of the PRA follows. For more detailed information about the PRA see Appendix D. The PRA excludes inpatient admissions occurring within 30 days of discharge from a prior proximal hospitalization to a SNF if:

- The inpatient claim contains a procedure code or diagnosis that maps to the AHRQ CCS procedure or diagnosis category that is considered "always planned" (SNFRM Data Dictionary tabs *"PR.1 Always Planned Px (Gen)"* and *"PR.2 Always Planned Dx (Gen)"*) or
- The inpatient claim contains a procedure code that maps to an AHRQ CCS procedure category that is considered "potentially planned" (SNFRM Data Dictionary tabs *"PR.3 Pot Planned Px (Gen)" and "PR.5 Planned PX-A"*), and the principal diagnosis on the claim is not in an AHRQ CCS diagnosis group or an individual ICD-10 code that is considered acute (data dictionary tabs *"PR.4 Acute Dx Gen"*) or
- The inpatient claim contains a procedure code that is considered "potentially planned for patients residing in PAC settings" (SNFRM Data Dictionary tabs *"PR.5 Planned PX-B" and "PR.5 Planned PX-C"*), and the principal diagnosis on the claim is one of the codes listed in column D of the SNFRM Data Dictionary tabs *"PR.5 Planned PX-B" and "PR.5 Planned PX-C",* and the principal diagnosis on the claim is not in an AHRQ CCS diagnosis group or an individual ICD-10 code that is considered acute (data dictionary tabs *"PR.4 Acute Dx (Gen)"*).

The SNFRM PRA uses procedures specific to PAC settings along with the coding in the PRA developed for CMS's hospital readmission measures. The PRA is updated annually to reflect coding updates and clinical expert review. The FY 2024 performance period code set file added 483 new FY 2022 and FY 2023 ICD-10 codes (177 ICD-10-CM codes and 306 ICD-10-PCS codes) and removed 1,015 retired ICD-10 codes (65 ICD-10-CM codes and 950 ICD-10-PCS codes) from the cohort and outcome PAA. Additionally, 1,338 codes were added, 128 codes were revised in the CCS diagnosis map, and 531 codes were added to the CCS procedure map. The complete set of codes reflected in the modified PRA V4.0_2020 adopted as the PRA for the SNFRM are available in the SNFRM Data Dictionary. This dictionary will be available on SNF VBP Program's measures page as a supplement to this report.

3.2.3. Accounting for COVID-19

CMS implemented an Extraordinary Circumstances Exception (ECE) Policy preventing January 1, 2020 – June 30, 2020, data from being used in measure calculations.[2] These six months of data cannot be used for any measurement purposes, including risk-adjustment. Since the performance period for the 2023 SNF VBP program year uses FY 2022 data (October 1, 2021 – September 30, 2022), the ECE Policy does impact the data period or the lookback period used to identify comorbidities. The FY 2022 data continues to include and adjust for patients admitted to SNFs with either a history or current diagnosis of COVID-19.

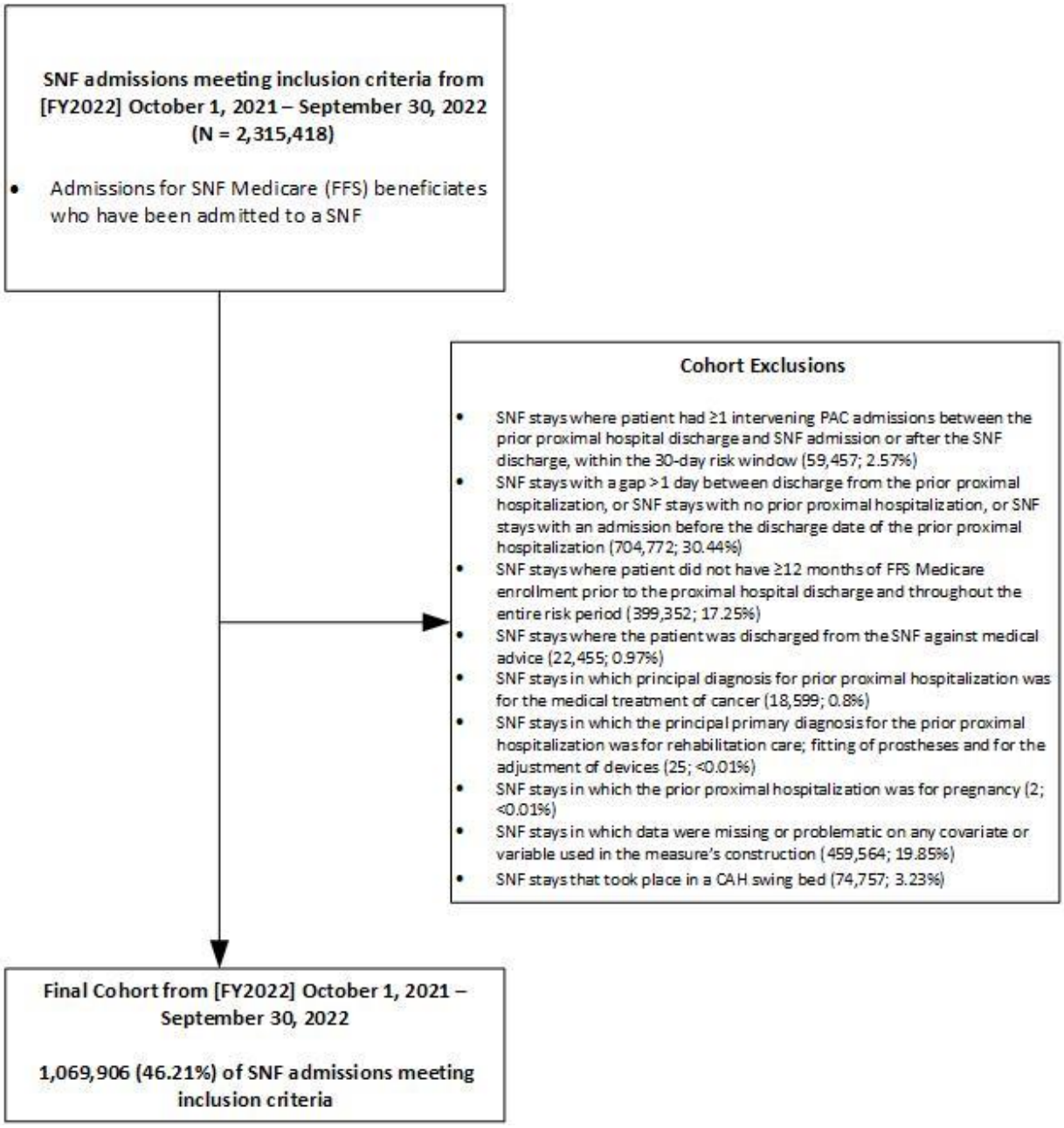
4. Summary of SNFRM Performance after Updates

This section presents updated information on the frequency and effect of model risk factors, model performance, SNF-level admission volume, and risk-standardized rates across SNFs after updating the codes that define post-acute care exclusions in FY 2022 data and adopting PRA v4.0. All analyses were performed in FY 2022 data which is used to calculate the performance period for the FY2024 SNF VBP Program year.

4.1. Final SNFRM Cohort

Figure 2 illustrates the final cohort using the FY 2022 data after applying all updates to inclusion and exclusion criteria described in Section 3.

Figure 2. SNFRM Cohort



4.2. SNFRM Model Parameters and Performance

We computed two summary statistics to assess model performance: the predictive ability and the area under the receiver operating characteristic (ROC) curve (c-statistic). To test model predictive ability, we calculated observed readmission rates in the lowest and highest deciles based on predicted readmission probabilities. The c-statistic is an indicator of the model's discriminant ability or ability to correctly classify those who did and did not have an unplanned readmission within 30 days of discharge from a prior proximal acute hospitalization. Potential values range from 0.5, meaning no better than chance, to 1.0, meaning perfect discrimination. A c-statistic of 1.0 indicates perfect prediction, implying patients'

outcomes can be predicted completely by their risk factors, and SNFs play no role in patients' outcomes. In Section 4.3, we present the distributions of SNF admissions and risk-standardized readmission rates across SNFs.

Table 1 shows the frequency of risk factors used in the risk-adjustment model and presents the corresponding odds ratios (ORs) and 95% confidence intervals (CIs) from the hierarchical logistic regression model. Table 2 presents the SNFRM model performance values.

Table 1. Logistic Regression Model Risk Factor Frequencies and Odds Ratios (ORs) of SNFRM Model (FY 2022)

Risk Factor	Prevalence (%) N = 1,069,906	OR (95% CI)
Unadjusted unplanned readmission rate	20.1	--
Age-Sex Groups	--	--
Male age 0-34	0.1	1.12 (0.93, 1.34)
Male age 35-44	0.3	0.96 (0.88, 1.06)
Male age 45-54	0.8	0.97 (0.92, 1.03)
Male age 55-59	1.0	0.92 (0.87, 0.97)
Male age 60-64	1.8	0.94 (0.90, 0.98)
Male age 65-69	4.4	0.96 (0.93, 0.99)
Male age 70-74	6.1	1.00 (0.97, 1.03)
Male age 75-79	7.1	1.04 (1.01, 1.07)
Male age 80-84	7.3	1.09 (1.06, 1.12)
Male age 85-89	6.3	1.10 (1.07, 1.13)
Male age 90-94	3.8	1.07 (1.03, 1.11)
Male age > 95	1.2	1.03 (0.98, 1.08)
Female age 0-34	0.1	1.20 (0.99, 1.46)
Female age 35-44	0.2	1.05 (0.94, 1.16)
Female age 45-54	0.6	0.98 (0.92, 1.05)
Female age 55-59	0.9	1.01 (0.96, 1.07)
Female age 60-64	1.6	0.99 (0.95, 1.04)
Female age 65-69 (REF)	--	--
Female age 70-74	7.9	0.98 (0.95, 1.01)
Female age 75-79	10.1	0.98 (0.95, 1.00)
Female age 80-84	11.1	0.96 (0.94, 0.99)
Female age 85-89	11.1	0.93 (0.90, 0.95)
Female age 90-94	8.2	0.87 (0.84, 0.90)
Female age > 95	3.6	0.84 (0.80, 0.87)
Prior Hospital Length of Stay (LOS)	--	--
LOS 1-3 days (REF)	--	--
LOS 4-7 days	42.8	1.11 (1.10, 1.13)
LOS 8-14 days	24.4	1.26 (1.24, 1.28)
LOS >14 days	10.5	1.38 (1.35, 1.41)
Eligibility	--	--
Patient originally entitled by disability	22.8	1.02 (1.01, 1.03)
End Stage Renal Disease Indicator	4.3	1.07 (1.02, 1.12)

Risk Factor	Prevalence (%) N = 1,069,906	OR (95% CI)
Surgical Groups	--	--
Vascular Surgery	1.0	1.21 (1.15, 1.26)
Orthopedic Surgery	15.7	0.94 (0.91, 0.96)
General Surgery	4.7	1.01 (0.98, 1.04)
Cardio Thoracic Surgery	1.1	0.91 (0.86, 0.96)
Urologic Surgery	0.9	1.01 (0.95, 1.06)
Neurosurgery	1.0	1.07 (1.01, 1.13)
Plastic Surgery	2.6	1.04 (1.01, 1.07)
Otolaryngologic Surgery	0.2	0.93 (0.82, 1.05)
Obstetric/Gynecologic Surgery	0.1	0.94 (0.81, 1.09)
Prior Care Utilization - Count of Prior Acute Stays (365-Day Look-back)	--	--
Count: 0 (REF)	--	--
Count: 1-3	46.6	1.05 (1.04, 1.07)
Count: 4-6	6.7	1.22 (1.19, 1.25)
Count: 7-9	1.1	1.56 (1.50, 1.63)
Count: 10+	0.3	2.19 (2.04, 2.36)
ICU use: at least one day in ICU During Proximal Stay	38.1	1.11 (1.10, 1.12)
COVID-19	--	--
No COVID-19 diagnoses in history or the prior proximal hospitalization (REF)	--	--
COVID-19 during the prior proximal hospitalization	9.2	1.05 (1.03, 1.07)
History of COVID-19 but no COVID-19 during the prior proximal hospitalization	5.9	0.90 (0.88, 0.92)
Principal diagnosis on prior acute stay, Clinical Classifications Software (CCS) Groupings	--	--
Septicemia (except in labor) (CCS: 2)	13.2	1.21 (1.17, 1.24)
Mycoses (CCS: 4)	0.1	1.34 (1.14, 1.58)
HIV infection (CCS: 5)	<0.1	1.34 (0.88, 2.03)
Hepatitis (CCS: 6)	<0.1	1.82 (1.37, 2.40)
Infections: Tuberculosis/Bacterial/Viral/Other/Sexually transmitted (not HIV or hepatitis) (CCS: 1, 3, 7, 8, 9)	0.2	1.16 (1.04, 1.30)
Immunizations and screening for infectious disease (CCS: 10) (REF)	--	--
Cancer of head and neck (CCS: 11)	<0.1	1.19 (0.89, 1.58)
Cancers of gastrointestinal system (CCS: 12, 13, 14, 15)	0.3	1.12 (1.02, 1.23)
Cancers of liver/pancreas/ other gastrointestinal organs (CCS: 16, 17, 18)	0.1	1.30 (1.07, 1.57)

Risk Factor	Prevalence (%) N = 1,069,906	OR (95% CI)
Cancers of respiratory system (CCS: 19, 20)	<0.1	1.14 (0.90, 1.44)
Cancer of bone and connective tissue (CCS: 21)	<0.1	1.45 (1.06, 1.98)
Cancers of skin (CCS: 22, 23)	<0.1	1.02 (0.68, 1.55)
Cancer of breast (CCS: 24)	<0.1	1.00 (0.64, 1.57)
Cancers of female genitalia (CCS: 25, 26, 27, 28)	0.1	1.36 (1.06, 1.75)
Cancers of male genitalia (CCS: 29, 30, 31)	<0.1	1.19 (0.81, 1.77)
Cancer of bladder (CCS: 32)	0.1	1.65 (1.39, 1.96)
Cancers of kidney/renal/other urinary (CCS: 33, 34)	<0.1	1.23 (0.98, 1.56)
Cancer of brain and nervous system (CCS: 35)	<0.1	1.59 (1.19, 2.14)
Thyroid cancer/disorders (CCS: 36, 48)	0.1	1.00 (0.84, 1.20)
Hodgkin's/Leukemia/Myeloma (CCS: 37, 38, 39, 40)	<0.1	1.27 (0.98, 1.64)
Secondary malignancies (CCS: 42)	0.1	1.48 (1.29, 1.71)
Other cancers/Neoplasms (CCS: 41, 43, 44)	<0.1	1.51 (1.15, 1.98)
Maintenance chemotherapy; radiotherapy (CCS: 45)	<0.1	0.73 (0.29, 1.81)
Benign neoplasms (CCS: 46, 47)	0.1	1.38 (1.20, 1.58)
Diabetes (CCS: 49, 50)	2.2	1.15 (1.10, 1.20)
Other endocrine disorders (CCS: 51)	0.5	1.14 (1.06, 1.24)
Nutritional deficiencies (CCS: 52)	0.1	1.09 (0.94, 1.27)
Disorders of lipid metabolism (CCS: 53) (REF)	--	--
Gout and other crystal arthropathies (CCS: 54)	0.1	1.20 (1.02, 1.42)
Fluid and electrolyte disorders (CCS: 55)	1.8	1.18 (1.13, 1.24)
Cystic Fibrosis COPD (CCS: 56, 127)	0.8	1.38 (1.31, 1.46)
Immunity/White Blood Cell Disorders (CCS: 57, 63)	0.1	1.31 (1.07, 1.59)
Other disorders: Nutritional/Endocrine/Metabolic (CCS: 58)	0.5	1.19 (1.1, 1.29)
Deficiency and other anemia (CCS: 59)	0.5	1.39 (1.29, 1.49)
Acute posthemorrhagic anemia (CCS: 60)	0.3	1.35 (1.23, 1.48)
Blood disorders (CCS: 61, 62, 64)	0.2	1.27 (1.15, 1.40)
Meningitis (except that caused by tuberculosis or sexually transmitted disease) (CCS: 76)	<0.1	1.24 (0.91, 1.69)
Encephalitis (except that caused by tuberculosis or sexually transmitted disease) (CCS: 77)	<0.1	1.18 (0.93, 1.49)
Other CNS infection and poliomyelitis (CCS: 78)	<0.1	1.45 (1.19, 1.78)
Parkinson's disease (CCS: 79)	0.3	0.95 (0.86, 1.06)
Multiple sclerosis (CCS: 80)	<0.1	1.41 (1.12, 1.79)
Other hereditary and degenerative nervous system conditions (CCS: 81)	0.1	0.99 (0.85, 1.16)
Paralysis (CCS: 82)	<0.1	1.12 (0.84, 1.48)

Risk Factor	Prevalence (%) N = 1,069,906	OR (95% CI)
Epilepsy; convulsions (CCS: 83)	0.7	1.11 (1.04, 1.19)
Headache, including migraine (CCS: 84)	<0.1	1.04 (0.73, 1.48)
Coma, stupor, and brain damage (CCS: 85)	<0.1	2.31 (1.42, 3.76)
Conditions associated with dizziness or vertigo (CCS: 93)	0.1	0.66 (0.55, 0.80)
Eye/Ear/ Sensory Disorders (CCS: 86, 87, 88, 89, 90, 91, 92, 94)	0.1	1.08 (0.89, 1.32)
Other nervous system disorders (CCS: 95)	1.9	1.10 (1.05, 1.15)
Heart valve disorders (CCS: 96)	0.4	1.22 (1.12, 1.34)
Peri- endo- & myocarditis cardiomyopathy (except caused by tuberculosis or sexually transmitted disease) (CCS: 97)	0.1	1.38 (1.22, 1.55)
Essential hypertension (CCS: 98)	<0.1	1.03 (0.60, 1.78)
Hypertension with complications and secondary hypertension (CCS: 99)	5.8	1.26 (1.22, 1.30)
Acute myocardial infarction (CCS: 100)	1.1	1.29 (1.23, 1.36)
Coronary atherosclerosis and other heart disease (CCS: 101)	0.4	1.11 (1.01, 1.21)
Nonspecific chest pain (CCS: 102)	0.1	1.12 (0.98, 1.27)
Pulmonary heart disease (CCS: 103)	0.7	1.11 (1.04, 1.18)
Other and ill-defined heart disease (CCS: 104)	<0.1	0.89 (0.67, 1.17)
Conduction disorders (CCS: 105)	0.3	0.90 (0.81, 1.00)
Cardiac dysrhythmias (CCS: 106)	1.7	1.29 (1.23, 1.34)
Cardiac arrest and ventricular fibrillation (CCS: 107)	<0.1	1.20 (0.94, 1.54)
Congestive heart failure, Non hypertensive (CCS: 108)	0.3	1.29 (1.19, 1.40)
Acute cerebrovascular disease (CCS: 109)	3.1	1.23 (1.18, 1.28)
Occlusion or stenosis of precerebral arteries (CCS: 110)	0.1	0.98 (0.83, 1.17)
Other and ill-defined cerebrovascular disease (CCS: 111)	<0.1	0.94 (0.74, 1.20)
Transient cerebral ischemia (CCS: 112)	0.3	0.97 (0.87, 1.08)
Late effects of cerebrovascular disease (CCS: 113)	0.2	0.97 (0.85, 1.11)
Peripheral and visceral atherosclerosis (CCS: 114)	0.3	1.41 (1.29, 1.54)
Aortic, peripheral, and visceral artery aneurysms (CCS: 115)	0.2	1.30 (1.16, 1.47)
Aortic and peripheral arterial embolism or thrombosis (CCS: 116)	0.1	1.29 (1.07, 1.55)
Other circulatory disease (CCS: 117)	0.6	1.05 (0.98, 1.12)

Risk Factor	Prevalence (%) N = 1,069,906	OR (95% CI)
Phlebitis; thrombophlebitis and thromboembolism (CCS: 118)	0.3	1.17 (1.07, 1.28)
Vein/ Lymphatic Disease (CCS: 119, 120, 121, 247)	0.2	1.06 (0.95, 1.2)
Pneumonia (except that caused by tuberculosis or sexually transmitted disease) (CCS: 122)	2.5	1.27 (1.22, 1.32)
Influenza (CCS: 123)	0.1	0.86 (0.73, 1.00)
Acute bronchitis (CCS: 125)	0.1	0.80 (0.62, 1.02)
Upper respiratory infection/ Tonsillitis (CCS: 124, 126)	<0.1	1.07 (0.77, 1.48)
Asthma (CCS: 128)	<0.1	1.06 (0.82, 1.38)
Aspiration pneumonitis; food/ vomitus (CCS: 129)	1.1	1.30 (1.23, 1.36)
Pleurisy, pneumothorax, pulmonary collapse (CCS: 130)	0.3	1.22 (1.11, 1.34)
Respiratory failure, insufficiency, arrest (adult) (CCS: 131)	1.3	1.42 (1.36, 1.49)
Lung disease due to external agents/ Other lower respiratory disease (CCS: 132, 133)	0.2	1.38 (1.24, 1.53)
Other upper respiratory disease (CCS: 134)	<0.1	1.29 (1.05, 1.59)
Intestinal infection (CCS: 135)	0.5	1.27 (1.18, 1.36)
Disorders of teeth and jaw/Diseases of the mouth (excluding dental) (CCS: 136, 137)	0.1	1.03 (0.82, 1.29)
Esophageal disorders (CCS: 138)	0.3	1.22 (1.11, 1.34)
Gastroduodenal ulcer (except hemorrhage) (CCS: 139)	0.1	1.58 (1.34, 1.86)
Gastritis and duodenitis (CCS: 140)	0.2	1.24 (1.12, 1.38)
Other disorders of stomach and duodenum (CCS: 141)	0.2	1.35 (1.22, 1.50)
Appendicitis and other appendiceal conditions (CCS: 142)	<0.1	1.20 (0.95, 1.50)
Abdominal hernia (CCS: 143)	0.4	1.07 (0.97, 1.17)
Regional enteritis and ulcerative colitis (CCS: 144)	0.1	1.52 (1.29, 1.78)
Intestinal obstruction without hernia (CCS: 145)	0.8	1.22 (1.15, 1.29)
Diverticulosis and diverticulitis (CCS: 146)	0.6	1.35 (1.26, 1.44)
Anal and rectal conditions (CCS: 147)	0.1	1.29 (1.13, 1.48)
Peritonitis and intestinal abscess (CCS: 148)	<0.1	1.66 (1.36, 2.03)
Biliary tract disease (CCS: 149)	0.5	1.19 (1.10, 1.28)
Other liver diseases (CCS: 151)	0.4	1.73 (1.61, 1.86)
Pancreatic disorders (not diabetes) (CCS: 152)	0.2	1.21 (1.07, 1.35)
Gastrointestinal hemorrhage (CCS: 153)	1.3	1.27 (1.21, 1.33)
Noninfectious gastroenteritis (CCS: 154)	0.2	1.16 (1.04, 1.29)
Other gastrointestinal disorders (CCS: 155)	0.5	1.28 (1.20, 1.38)

Risk Factor	Prevalence (%) N = 1,069,906	OR (95% CI)
Nephritis; nephrosis; renal sclerosis (CCS: 156)	<0.1	1.39 (1.03, 1.88)
Acute and unspecified renal failure (CCS: 157)	3.3	1.27 (1.23, 1.32)
Chronic renal failure (CCS: 158)	<0.1	1.28 (0.87, 1.88)
Urinary tract infections (CCS: 159)	4.1	1.12 (1.08, 1.16)
Calculus of urinary tract (CCS: 160)	<0.1	0.91 (0.71, 1.15)
Other diseases of kidney and ureters (CCS: 161)	0.1	1.45 (1.26, 1.67)
Other diseases of bladder and urethra (CCS: 162)	0.1	1.31 (1.10, 1.56)
Genitourinary symptoms and ill-defined conditions (CCS: 163)	0.1	1.34 (1.15, 1.55)
Hyperplasia of prostate (CCS: 164)	0.1	1.35 (1.13, 1.60)
Inflammatory conditions of male genital organs (CCS: 165)	0.1	0.92 (0.74, 1.16)
Other male genital disorders (CCS: 166)	<0.1	0.83 (0.51, 1.36)
Nonmalignant female disorders: Breast/ Pelvis/Genital/Ovarian/ Endometriosis (CCS: 167, 168, 169, 170, 172, 173, 175)	0.1	1.18 (0.96, 1.44)
Menstrual disorders (CCS: 171) (REF)	--	--
Skin and subcutaneous tissue infections (CCS: 197)	1.3	1.03 (0.98, 1.09)
Chronic ulcer of skin (CCS: 199)	0.3	1.10 (1.00, 1.20)
Other inflammatory conditions of the skin/Other skin disorders (CCS: 198, 200)	<0.1	1.67 (1.36, 2.06)
Infective arthritis and osteomyelitis (except that caused by tuberculosis or sexually transmitted) (CCS: 201)	0.4	1.08 (0.99, 1.17)
Rheumatoid arthritis and related disease (CCS: 202)	<0.1	1.07 (0.80, 1.44)
Osteoarthritis (CCS: 203) (REF)	--	--
Other non-traumatic joint disorders (CCS: 204)	0.2	0.85 (0.74, 0.97)
Spondylosis; intervertebral disc disorders; other back problems/ Osteoporosis (CCS: 205, 206)	1.5	1.14 (1.08, 1.20)
Pathological fracture (CCS: 207)	1.4	0.99 (0.93, 1.04)
Foot/Other Deformities (CCS: 208, 209)	0.2	1.14 (0.99, 1.32)
Systemic lupus erythematosus and connective tissue disorders (CCS: 210)	<0.1	1.47 (1.14, 1.90)
Other connective tissue disease (CCS: 211)	0.7	0.91 (0.85, 0.98)
Other bone disease and musculoskeletal deformities (CCS: 212)	0.1	1.04 (0.85, 1.27)
Congenital anomalies: Cardiac and circulatory/Digestive/	<0.1	1.14 (0.88, 1.47)

Risk Factor	Prevalence (%) N = 1,069,906	OR (95% CI)
Genitourinary/Nervous/ Other (CCS: 213, 214, 215, 216, 217)		
Joint disorders and dislocations; trauma-related (CCS: 225)	0.1	1.15 (0.95, 1.38)
Fracture of neck of femur (hip) (CCS: 226)	7.1	1.05 (1.01, 1.09)
Spinal cord injury (CCS: 227)	0.1	1.54 (1.26, 1.90)
Skull and face fractures (CCS: 228)	0.1	0.99 (0.82, 1.19)
Fracture of upper limb (CCS: 229)	1.1	0.99 (0.93, 1.05)
Fracture of lower limb (CCS: 230)	2.3	1.03 (0.98, 1.08)
Other fractures (CCS: 231)	3.1	0.96 (0.92, 1.00)
Sprains and strains (CCS: 232)	0.1	0.80 (0.67, 0.96)
Intracranial injury (CCS: 233)	1.2	1.30 (1.23, 1.37)
Crushing injury or internal injury (CCS: 234)	0.3	1.13 (1.03, 1.24)
Open wounds of head, neck, and trunk (CCS: 235)	0.1	1.03 (0.85, 1.25)
Open wounds of extremities (CCS: 236)	0.1	1.12 (0.92, 1.35)
Complication of device, implant or graft (CCS: 237)	3.7	1.27 (1.23, 1.32)
Complications of surgical procedures or medical care (CCS: 238)	1.7	1.25 (1.20, 1.31)
Superficial injury; contusions/Burns (CCS: 239, 240)	0.4	1.02 (0.93, 1.12)
Poisoning: Psychotropic agents/Other medications/Nonmedical substances (CCS: 241, 242, 243)	0.2	1.00 (0.90, 1.12)
Other injuries and conditions due to external causes (CCS: 244)	0.5	0.90 (0.83, 0.98)
Syncope (CCS: 245)	0.3	0.95 (0.86, 1.05)
Fever of unknown origin (CCS: 246)	<0.1	0.99 (0.75, 1.29)
Gangrene (CCS: 248)	0.2	1.40 (1.26, 1.56)
Shock (CCS: 249)	<0.1	0.96 (0.75, 1.24)
Nausea and vomiting (CCS: 250)	<0.1	1.40 (1.10, 1.78)
Abdominal pain (CCS: 251)	<0.1	1.32 (1.05, 1.67)
Malaise and fatigue (CCS: 252)	0.4	1.03 (0.94, 1.13)
Allergic reactions (CCS: 253)	<0.1	1.44 (1.09, 1.91)
Administrative/social admission (CCS: 255) (REF)	--	--
Medical examination/evaluation (CCS: 256) (REF)	--	--
Other aftercare (CCS: 257)	0.1	0.86 (0.69, 1.09)
Screening for suspected conditions/Residual codes; unclassified (CCS: 258, 259)	0.2	1.16 (1.03, 1.31)
Delirium (CCS: 653)	1.3	0.92 (0.87, 0.97)

Risk Factor	Prevalence (%) N = 1,069,906	OR (95% CI)
Behavioral/ Developmental Disorders (CCS: 650, 651, 652, 654, 662)	0.1	0.75 (0.59, 0.94)
Disorders usually diagnosed in infancy (CCS: 655) (REF)	--	--
Impulse control disorders (CCS: 656) (REF)	--	--
Mood disorders (CCS: 657) (REF)	--	--
Personality disorder/ Schizophrenia/ Other (CCS: 658, 659)	0.5	0.75 (0.68, 0.82)
Alcohol/ Substance-related disorders/ Screening (CCS: 660, 661, 663)	0.5	1.08 (1.00, 1.17)
Miscellaneous disorders (CCS: 670)	<0.1	1.11 (0.78, 1.58)
Adverse effects of medical drugs (CCS: 2617) (REF)	--	--
Comorbidities, HCC Groupings	**--**	**--**
HCC1 HIV/AIDS	0.3	1.08 (1.00, 1.17)
HCC6 Opportunistic Infections	0.8	1.11 (1.06, 1.17)
HCC8 Metastatic Cancer and Acute Leukemia	3.1	1.38 (1.34, 1.42)
HCC9 Lung and Other Severe Cancers	1.9	1.20 (1.17, 1.24)
HCC10 Lymphoma and Other Cancers	1.7	1.18 (1.14, 1.23)
HCC11 Colorectal, Bladder, and Other Cancers	1.4	1.07 (1.03, 1.11)
HCC12 Breast, Prostate, and Other Cancers and Tumors	2.5	1.01 (0.98, 1.04)
HCC14_15 Other digestive and urinary neoplasms; Other neoplasms	2.8	0.99 (0.97, 1.02)
HCC17_18 Diabetes with Acute complications; Diabetes with chronic complications	8.3	1.04 (1.02, 1.06)
HCC19 Diabetes without Complication	32.4	1.13 (1.11, 1.14)
HCC20 Type I Diabetes Mellitus	1.0	1.17 (1.12, 1.23)
HCC21 Protein-Calorie Malnutrition	19.6	1.09 (1.07, 1.10)
HCC23 Other Significant Endocrine and Metabolic Disorders	8.8	1.09 (1.07, 1.10)
HCC24 Disorders of Fluid/ Electrolyte/ Acid-Base Balance	64.0	1.10 (1.08, 1.11)
HCC27 End-Stage Liver Disease	1.9	1.45 (1.40, 1.50)
HCC28 Cirrhosis of Liver	1.9	1.13 (1.10, 1.17)
HCC29 Chronic Hepatitis	0.5	1.04 (0.97, 1.11)
HCC31 Other Hepatitis and Liver Disease	3.3	1.02 (1.00, 1.05)
HCC33 Intestinal Obstruction/Perforation	6.3	1.04 (1.02, 1.06)
HCC34 Chronic Pancreatitis	0.6	1.09 (1.03, 1.16)
HCC35 Inflammatory Bowel Disease	1.2	1.06 (1.02, 1.11)

Risk Factor	Prevalence (%) N = 1,069,906	OR (95% CI)
HCC36 Peptic Ulcer, Hemorrhage, Other Specified Gastrointestinal Disorders	14.5	1.08 (1.06, 1.09)
HCC40 Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	6.5	1.10 (1.08, 1.12)
HCC46 Severe Hematological Disorders	0.9	1.36 (1.29, 1.42)
HCC47 Disorders of Immunity	5.2	1.14 (1.12, 1.17)
HCC48 Coagulation Defects and Other Specified Hematological Disorders	14.9	1.10 (1.08, 1.12)
HCC49 Iron Deficiency and Other/Unspecified Anemias and Blood Disease	42.0	1.10 (1.09, 1.12)
HCC50 Delirium and Encephalopathy	34.8	1.05 (1.04, 1.06)
HCC60 Personality Disorders	0.1	1.02 (0.90, 1.16)
HCC63 Other Psychiatric Disorders	7.8	1.02 (1.00, 1.04)
HCC64_65 Profound/ Severe Mental Retardation	0.2	1.13 (1.00, 1.27)
HCC66 Moderate Mental Retardation/Developmental Disability	0.1	1.06 (0.91, 1.24)
HCC69 Attention Deficit Disorder	0.2	0.90 (0.81, 1.00)
HCC70 Quadriplegia	1.5	1.06 (1.02, 1.10)
HCC71 Paraplegia	0.7	1.04 (0.99, 1.10)
HCC72 Spinal Cord Disorders/ Injuries	1.2	0.98 (0.94, 1.03)
HCC73 Amyotrophic Lateral Sclerosis and Other Motor Neuron Disease	0.1	0.95 (0.80, 1.13)
HCC75 Polyneuropathy	1.0	1.01 (0.97, 1.06)
HCC79 Seizure Disorders and Convulsions	7.8	0.99 (0.98, 1.01)
HCC80 Coma, Brain Compression/Anoxic Damage	1.8	1.07 (1.03, 1.11)
HCC82 Respirator Dependence/Tracheostomy Status	0.7	1.21 (1.15, 1.28)
HCC83 Respiratory Arrest	<0.1	0.69 (0.47, 1.01)
HCC84 Cardio-Respiratory Failure and Shock	31.7	1.12 (1.11, 1.14)
HCC85 Congestive Heart Failure	42.1	1.12 (1.11, 1.14)
HCC86 Acute Myocardial Infarction	9.1	1.07 (1.05, 1.09)
HCC87 Unstable Angina and Other Acute Ischemic Heart Disease	5.6	1.04 (1.02, 1.07)
HCC88 Angina Pectoris	1.0	1.07 (1.02, 1.12)
HCC89 Coronary Atherosclerosis/Other Chronic Ischemic Heart Disease	26.7	1.06 (1.04, 1.07)
HCC90 Heart Infection/ Inflammation, Except Rheumatic	2.3	1.08 (1.05, 1.11)
HCC91 Valvular and Rheumatic Heart Disease	16.1	1.05 (1.04, 1.06)
HCC96 Specified Heart Arrhythmias	41.3	1.10 (1.09, 1.11)
HCC99 Cerebral Hemorrhage	1.5	1.05 (1.01, 1.09)

Risk Factor	Prevalence (%) N = 1,069,906	OR (95% CI)
HCC100 Ischemic or Unspecified Stroke	3.7	1.06 (1.04, 1.09)
HCC106 Atherosclerosis of the Extremities with Ulceration or Gangrene	3.1	1.13 (1.10, 1.17)
HCC107 Vascular Disease with Complications	4.4	1.04 (1.02, 1.06)
HCC108 Vascular Disease	17.5	1.06 (1.04, 1.07)
HCC109 Other Circulatory Disease	15.8	1.03 (1.02, 1.04)
HCC111 Chronic Obstructive Pulmonary Disease	25.9	1.11 (1.09, 1.12)
HCC112 Fibrosis of Lung and Other Chronic Lung Disorders	1.6	1.10 (1.06, 1.15)
HCC114 Aspiration and Specified Bacterial Pneumonias	8.7	1.10 (1.08, 1.12)
HCC116 Viral and Unspecified Pneumonia, Pleurisy	18.0	1.06 (1.05, 1.08)
HCC117 Pleural Effusion/ Pneumothorax	7.4	1.10 (1.08, 1.12)
HCC122 Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	0.2	1.01 (0.93, 1.10)
HCC124 Exudative Macular Degeneration	0.1	0.87 (0.73, 1.03)
HCC132 Kidney Transplant Status	0.6	1.58 (1.49, 1.67)
HCC134 Dialysis Status	4.0	1.49 (1.42, 1.55)
HCC135 Acute Renal Failure	39.0	1.21 (1.20, 1.23)
HCC136 Chronic Kidney Disease, Stage 5	0.4	1.48 (1.37, 1.60)
HCC137 Chronic Kidney Disease, Severe (Stage 4)	1.0	1.32 (1.26, 1.39)
HCC138 Chronic Kidney Disease, Moderate (Stage 3)	6.6	1.06 (1.04, 1.09)
HCC139 Chronic Kidney Disease, Mild or Unspecified (Stages 1-2 or Unspecified)	3.1	1.06 (1.03, 1.09)
HCC140 Unspecified Renal Failure	<0.1	1.12 (0.89, 1.40)
HCC141 Nephritis	0.2	0.96 (0.85, 1.08)
HCC142 Urinary Obstruction and Retention	18.0	1.06 (1.05, 1.08)
HCC144 Urinary Tract Infection	33.7	0.99 (0.98, 1.00)
HCC145 Other Urinary Tract Disorders	9.6	1.03 (1.01, 1.04)
HCC148 Other Female Genital Disorders	0.9	1.05 (1.00, 1.10)
HCC157 Pressure Ulcer of Skin with Necrosis Through to Muscle, Tendon, or Bone	1.4	1.15 (1.10, 1.19)
HCC158 Pressure Ulcer of Skin with Full Thickness Skin Loss	3.2	1.13 (1.10, 1.16)
HCC159 Pressure Ulcer of Skin with Partial Thickness Skin Loss	3.0	1.09 (1.06, 1.12)
HCC160 Pressure Pre-Ulcer Skin Changes or Unspecified Stage	3.1	1.04 (1.01, 1.07)

Risk Factor	Prevalence (%) N = 1,069,906	OR (95% CI)
HCC169 Vertebral Fractures without Spinal Cord Injury	5.2	0.97 (0.95, 1.00)
HCC173 Traumatic Amputations and Complications	1.0	0.92 (0.88, 0.97)
HCC177 Other Complications of Medical Care	7.5	1.05 (1.03, 1.07)
HCC178 Major Symptoms, Abnormalities	62.3	1.02 (1.00, 1.03)
HCC186 Major Organ Transplant or Replacement Status	0.4	1.03 (0.97, 1.11)
HCC187 Other Organ Transplant Status/ Replacement	3.4	1.02 (0.99, 1.05)
HCC188 Artificial Openings for Feeding or Elimination	3.9	1.20 (1.17, 1.23)
HCC189 Amputation Status, Lower Limb/ Amputation Complications	1.9	1.01 (0.97, 1.04)
HCC190 Amputation Status, Upper Limb	0.1	1.01 (0.89, 1.15)
The sum of HCCs is greater than or equal to 2	96.3	1.23 (1.18, 1.28)

Notes: In Table 1, results are based on FY 2022 performance period. CC-related risk factors are defined by v24 of CC map; OR=Odds ratio CI=Confidence interval; HCC=Hierarchical Condition Categories

Table 2. SNFRM Logistic Regression Model Performance Among SNFs (FY 2022)

Characteristic	FY 2022
Predictive ability, % (lowest decile – highest decile)	7.9 – 39.3%
c-statistic	66.1%

Note: In Table 2, results are based on FY 2022 performance period data.

4.3. Distribution of Provider-Level Measure Score

Table 3 presents the number of SNF stays. There were 14,897 SNFs with at least one admission during FY 2022. The median number of SNF admissions was 71.82 (interquartile range [IQR] = 23 – 91).

Table 4 shows the mean and median risk-standardized readmission rates (RSRRs). The median RSRR was 0.20 (IQR = 0.19 – 0.21). Figure 3 shows the overall distribution of RSRRs rates for SNFs.

Table 3. Distribution of SNF Stays (FY 2022)

	Mean (SD)	Min.	10th percentile	Lower quartile	Median	Upper quartile	90th percentile	Max
Count of SNF stays	71.82 (79.09)	1	11	23	47	91	160	1,193

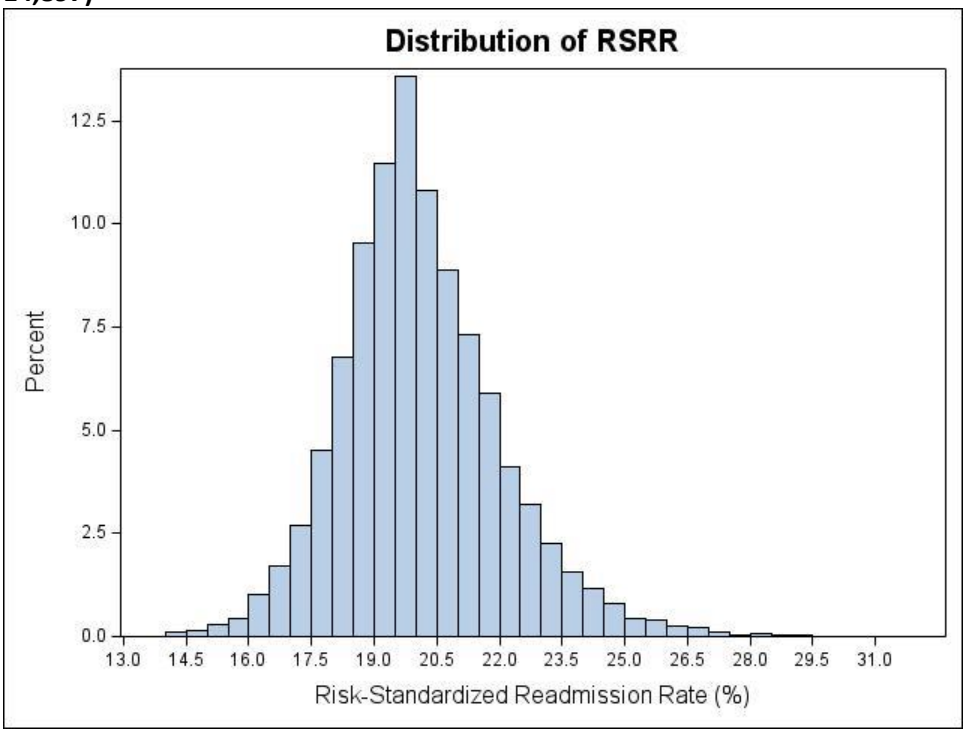
Note: In Table 3, results are based on FY 2022 performance period data

Table 4. Distribution of SNF-Level Observed Readmission Rates and RSRRs (FY 2022; total number of SNFs = 14,897)

Readmission rate	Mean (SD)	Min.	10th percentile	Lower quartile	Median	Upper quartile	90th percentile	Max
Observed	19.2 (9.8)	0	7.7	13.3	19	24.5	30.1	100
RSRR	20.1 (1.9)	13.3	17.9	18.9	19.9	21.2	22.6	32.4

Note: In Table 4, results are based on FY 2022 performance period data. SD=standard deviation; RSRR=risk-standardized readmission rate.

Figure 3. Distribution of SNF Risk-Standardized Readmission Rates (FY 2022; total number of SNFs = 14,897)



5. Glossary

Case mix: The particular comorbidity profile and age characteristics of patients with index colonoscopies at a given facility.

Clinical Classification Software (CCS): Software maintained by the AHRQ that groups thousands of individual procedure and diagnosis codes into clinically coherent, mutually exclusive procedure and diagnosis categories. AHRQ CCS categories are used to determine if a readmission is planned. AHRQ CCS procedure categories are used to define planned and potentially planned procedures. AHRQ CCS diagnosis categories are used to define acute diagnoses and complications of care that are considered unplanned, as well as a few specific types of care that are always considered planned (for example, maintenance chemotherapy). Mappings which show the assignment of ICD-10 codes to the AHRQ CCS diagnosis and procedure categories are available here on the AHRQ website.

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

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

Condition Categories (CCs): Groupings of diagnosis codes in clinically relevant categories, from the Hierarchical Condition Categories (HCCs) system. The measure uses the grouping but not the hierarchical logic of the system to create risk factor variables. Description of the CCs can be found at http://www.cms.hhs.gov/Reports/downloads/pope_2000_2.pdf. Mappings which show the assignment of ICD-10 codes to the CCs are available (in code set file).

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

Hierarchical logistic regression model: A class of generalized linear models for clustered data. The model not only considers patient risk factors, but also estimates a provider-specific effect, an estimate of the additional impact a facility has on the log odds of having an unplanned hospital readmission.

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

Provider-specific intercept: A measure of the provider quality of care calculated based on the provider's (SNF) actual unplanned hospital readmission rate relative to SNFs with similar patients, considering how many patients it served, its patients' risk factors, and how many experienced a subsequent unplanned hospital readmission. The provider-specific effect will be negative for a better-than-average SNF, positive for a worse-than-average SNF, and close to zero for an average SNF. The provider-specific effect is used in the numerator to calculate "predicted" readmissions.

Medicare Fee-For-Service (FFS): Original Medicare plan in which providers receive a fee or payment directly from Medicare for each individual service provided. Only beneficiaries in Medicare FFS, rather than managed care (Medicare Advantage), are included in the measure.

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

Outcome: The result of a broad set of healthcare activities that affect patients' well-being. For this measure, the outcome is unplanned hospital readmissions.

Planned readmissions: A readmission that is a scheduled part of the patient's plan of care; also includes additional procedures specific to post-acute care (PAC) settings. Planned readmissions are not captured in the outcome of this measure.

Predicted readmissions: The number of readmissions predicted based on the SNF's performance with its observed case mix.

Prior proximal hospitalization: Refers to any admission to an IPPS acute-care hospital, CAH, psychiatric, or cancer hospital included in the measure calculation as the initial admission for an episode of care and evaluated for the outcome. All patients who have been admitted to a SNF within 1 day of discharge are included in the cohort.

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

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

Unplanned readmissions: Acute clinical events a patient experiences that require urgent rehospitalization. Unplanned readmissions are the outcomes of the measure.

6. References

1. Baker B, Billings K, Daras LC, et al. Skilled Nursing Facility 30-Day All-Cause Readmission Measure (SNFRM) NQF #2510: All-Cause Risk-Standardized Readmission Measure. 2019; https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/Value-Based-Programs/SNF-VBP/Downloads/SNFRM-TechReportSupp-2019-.pdf. Accessed June 13, 2023.
2. Centers for Medicare & Medicaid Services (CMS). COVID-19 Quality Reporting Programs Guidance Memo. 2020; https://www.cms.gov/files/document/guidance-memo-exceptions-and-extensions-quality-reporting-and-value-based-purchasing-programs.pdf. Accessed June 13, 2023.
3. Healthcare Cost and Utilization Project (HCUP). Clinical Classifications Software (CCS) for ICD-9-CM. 2017; https://hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp. Accessed June 13, 2023.

7. Appendices

Appendix A: Statistical Approach to Calculating Risk-Standardized Readmission Rate

The SNFRM employs a hierarchical logistic regression model to model the log odds of readmission for each index SNF stay. The hierarchical model is used to account for the clustering of observations within SNFs. We modeled "readmission within 30 days" as a function of patient- level demographic and clinical characteristics with a random SNF-level intercept. The use of a random intercept accounts for within-SNF correlation of the observed outcomes and the underlying differences in quality among the SNF facilities being evaluated.

We estimate the hierarchical logistic regression model as follows. Let Y_{ij}, denote the outcome (equal to 1 if patient is readmitted within 30 days, 0 otherwise) for patient *i* at SNF$_j$. Z_{ij} denotes a set of risk factors. We assume the outcome is related linearly to the covariates via a logit function with dispersion:

$$\text{logit}(\text{Prob}(Y_{ij}=1)) = \alpha_j + \beta * Z_{ij} \quad (1)$$

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

where $Z_{ij} = (Z_1, Z_2, \ldots Z_k)$, a set of *k* patient-level covariates, α_j represents the SNF-specific intercept, μ is the adjusted average outcome over all SNFs, τ^2 is the between-SNF variance component.

The HGLM is estimated using the SAS software system (GLIMMIX procedure).

A.1. Skilled Nursing Facility Performance Reporting

The risk-adjustment model is specified and estimated using hierarchical logistic regression to calculate a standardized risk ratio (SRR) for each SNF. To calculate this ratio, we used the results from the hierarchical logistic regression model to calculate the *predicted* and *expected* number of readmissions for each SNF. The predicted number of readmissions considers the unique impact of each SNF on the likelihood of readmission (quality), whereas the expected number of readmissions is based on the average SNF. The predicted number of readmissions for each SNF was calculated as the sum of the predicted probability of readmission for each patient in the facility, including the SNF-specific (random) effect. The expected number of readmissions for each SNF was calculated as the sum of the predicted probability of readmission for each patient in the facility, *not* including the SNF-specific (random) effect.

Using the notation of the previous section, the RSRR for each SNF is calculated as follows. To calculate the predicted number of readmissions, pred$_j$, for index SNF stays at SNF*j*, we used

$$\text{pred}_j = \Sigma \text{logit}^{-1}(\mu + \omega_i + \beta * Z_{ij}) \quad (2)$$

where the sum is over all stays in SNF*j*, and ω_i is the random intercept. To calculate the expected number, exp$_j$, we used

$$\text{exp}_j = \Sigma \text{logit}^{-1}(\mu + \beta * Z_{ij}) \quad (3)$$

As a measure of excess or reduced readmissions among index stays at SNF*j*, we calculated the standardized risk ratio SRR$_j$ as

$$SRR_j = pred_j/exp_j \quad (4)$$

This value, SRR_j, is the standardized risk ratio for SNF*j*. The standardized risk ratio, SRR_j, is multiplied by the overall national raw readmission rate for all SNF stays, $\bar{Y}$, to produce $RSRR_j$

$$RSRR_j = SRR_j * \bar{Y} \quad (5)$$

Because the statistic described in step (5) is a complex function of parameter estimates, re-sampling and simulation techniques (e.g., bootstrapping) are necessary to derive a confidence interval estimate for the final risk-standardized rate, to characterize the uncertainty of the estimate.

Appendix B: Updates to Measure Since Measure Development

Prior updates for the measure can be found on the SNF VBP Program's webpage here on cms.gov. For convenience, we have listed all prior updates here under the year of the corresponding report.

B.1. 2023

2023 Measure Updates and Specifications Report

- Reverted the risk-adjustment lookback period to 12 months instead of 90 days.
  Rationale: The 12-month lookback period is no longer in violation of the ECE policy.

- Updated the ICD-10 code-based specifications used in the measure.
  Rationale: Revisions to the measure specifications were warranted to accommodate updated versions of the ICD-10-CM/PCS, AHRQ CCS, and CMS-HCC crosswalk.

B.2. 2022

2022 Measure Updates and Specifications Report

- Updated the ICD-10 code-based specifications used in the measure.
  Rationale: Revisions to the measure specifications were warranted to accommodate updated versions of the ICD-10-CM/PCS, AHRQ CCS, and CMS-HCC crosswalk.

- Updated the risk-adjustment model to include a multi-level variable for COVID-19.
  Rationale: Patients with a current or historical diagnoses of COVID-19 may be at higher risk for readmission and this should be adjusted for in the model.

- Updated the risk-adjustment lookback period to 90 days instead of 12 months.
  Rationale: CMS' COVID-19 ECE, policy adopted in the FY 2019 SNF PPS final rule, prevented the use of January 1 – June 30, 2020 data from being used for any quality measurement purposes, including risk adjustment. To use the same lookback period for all patients we had to shorten the lookback period to 90 days, since using a longer lookback period would violate the ECE policy for patients admitted on October 1, 2020.

B.3. 2021

2021 Measure Updates and Specifications Report

- Updated the ICD-10 code-based specifications used in the measure.
  Rationale: Revisions to the measure specifications were warranted to accommodate updated versions of the ICD-10-CM/PCS, AHRQ CCS, and CMS-HCC crosswalk.

B.4. 2019

2019 Measure Updates and Specifications Report (Prepared by RTI International)

- No changes were made to the SNFRM's technical specifications or risk-adjustment model since the April 2017 Technical Report Supplement.

B.5. 2017

2017 Measure Updates and Specifications Report (Prepared by RTI International)

- Updated denominator to exclude stays at critical access hospital (CAH) swing-beds. **Rationale:** This change aligned the SNFRM sample with the population of SNFs eligible for the SNF VBP Program under which the SNFRM is implemented. CAHs are not paid on the SNF PPS, therefore they are not eligible for the SNF VBP Program.

Appendix C: Measure Specifications

The SNFRM is described in more detail in Section 2.

C.1. Cohort

The measure includes admissions for SNF Medicare FFS beneficiaries who have been admitted to a SNF within 1 day of discharge from a prior proximal hospitalization.

The measure excludes SNF stays:

- Where the patient had one or more intervening post-acute care (PAC) admissions (inpatient rehabilitation facility [IRF] or long-term care hospital [LTCH]) which occurred either between the prior proximal hospital discharge and SNF admission or after the SNF discharge, within the 30-day risk window. Also excluded are SNF admissions where the patient had multiple SNF admissions after the prior proximal hospitalization, within the 30-day risk window.
- With no prior proximal hospitalization, or SNF stays with a gap of greater than 1 day between discharge from the prior proximal hospitalization and the SNF admission, or SNF stays with an admission date before the discharge date of the prior proximal hospitalization.
- Where the patient did not have at least 12 months of FFS Medicare enrollment prior to the proximal hospital discharge and throughout the entire risk period (measured as enrollment during the month of proximal hospital discharge, for 12 months prior to that discharge, and the month after the month of discharge).
- Where the patient was discharged from the SNF against medical advice.
- In which the principal primary diagnosis for the prior proximal hospitalization was for "rehabilitation care; fitting of prostheses and for the adjustment of devices."
- In which the prior proximal hospitalization was for pregnancy.
- In which data were missing or problematic on any covariate or variable used in the measure's construction.
- That took place in a CAH swing bed.
- In which the principal diagnosis for the prior proximal hospitalization was for the medical treatment of cancer. Patients with cancer whose principal diagnosis from the prior proximal hospitalization was for other diagnoses or for surgical treatment of their cancer remain in the measure.

C.2. Risk Adjustment
The SNFRM adjusts for age, sex, length of stay during prior proximal hospitalization, time spent in the ICU during the prior proximal hospitalization, disabled as original reason for Medicare coverage, ESRD, number of acute care hospitalizations in the 365 days before prior proximal hospitalization, principal diagnosis, system-specific surgical indicators, individual comorbidities based on HCCs, and the presence of multiple comorbidities.

C.3. Outcome
The measure outcome is unplanned hospital inpatient readmissions of SNF patients to any short-term acute care hospital for any cause within 30 days from the date of discharge from the patient's prior proximal acute hospitalization, excluding planned readmissions as defined below. See Section 2 and Appendix D for more detail on the definition of unplanned versus planned hospital admissions.

Appendix D: Planned Readmission Algorithm
D.1. Planned Readmission Algorithm Overview
The planned readmission algorithm for the SNFRM is adapted from the CMS Planned Readmission Algorithm Version 4.0. The algorithm is a set of criteria for classifying readmissions as planned or unplanned using Medicare claims. CMS seeks to count only unplanned readmissions in the measure outcome, because variation in planned readmissions does not reflect quality differences. In order to define whether a readmission is planned or unplanned, the measure uses a modified version of the algorithm, which includes additional procedures specific to PAC settings and the addition of carefully selected ICD-10 codes released for the pertinent data periods.

The algorithm classifies admissions as planned or unplanned using a flow chart (Figure 4) and seven tables of procedures and conditions:

- Tab *"PR.1 Always Planned Px (Gen)"* identifies procedures that, if present in an admission, classify the admission as planned. This list also includes the additional procedures specific to the PAC settings.
- Tab *"PR.2 Always Planned Dx (Gen)"* identifies principal discharge diagnoses that classify admissions as planned. This list also includes the additional procedures specific to the PAC settings.
- Tabs *"PR.3 Pot Planned Px (Gen),"* "*PR.5 RTI Planned Px-A,"* "*PR.5 RTI Planned Px-B," and* "*PR.5 RTI Planned Px-C"* identify procedures that, if present, classify an admission as planned as long as that admission does not have an acute (unplanned) principal discharge diagnosis. These tabs also include the additional procedures specific to the PAC settings.
- Tab *"PR.4 Acute Dx (Gen)"* lists the acute (unplanned) principal discharge diagnoses that disqualify admissions with a potentially planned procedure as planned.

The algorithm uses the Agency for Healthcare Research and Quality's (AHRQ's) Clinical Classification Software (CCS)[3] codes to group thousands of individual procedure and diagnosis ICD-10 codes into clinically coherent, mutually exclusive procedure CCS categories and mutually exclusive diagnosis CCS categories, respectively.

Figure 4. SNFRM Planned Readmission Algorithm Flowchart