

Measuring Outcomes for CAH Swing Bed Patients: Results of a Field Test and
Comparison with SNF Patient Outcomes

Ira Moscovice PhD, Tongtan Chantararat MPH, Michelle Casey MS

University of Minnesota Rural Health Research Center

Division of Health Policy and Management

University of Minnesota

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Executive Summary

This study identifies relevant quality measures for CAH swing bed patients. Relevant outcome measures focus on the ability of CAHs: 1) to return swing bed patients to the community or prior residence and 2) to prevent unplanned readmissions to a hospital during the 30-day period following a discharge from a swing bed. Relevant functional status measures include two Minimum Data Set-based measures of changes in risk-adjusted self-care scores and mobility scores between CAH swing bed patient admission and discharge. CAH staff were successfully trained via webinars, in-person meetings and an inter-rater reliability exercise to collect detailed information on the above measures.

The analytical results indicate a significantly lower overall (i.e. during the swing bed stay and 30 days post swing bed discharge) risk-adjusted hospital readmission rate for swing bed patients (18.6%) compared to the overall risk-adjusted hospital readmission rate for rural SNF patients of 33.3%. Risk-adjusted changes in self-care and mobility scores were similar for patients in CAH swing beds and all SNF patients in the U.S. These results contribute to building an evidence base that quantifies the value of CAH swing beds and allows fair comparisons with rural SNFs and other post-acute care options.

Background

The Medicare swing bed program allows rural hospitals with fewer than 100 beds to use their inpatient beds either for acute care or skilled nursing facility (SNF)-level swing bed care.¹ Swing bed services provided in rural Prospective Payment System (PPS) hospitals are paid for under the SNF PPS, while Critical Access Hospitals (CAHs) receive cost-based reimbursement for swing bed services. Currently, approximately 1,182 CAHs (88%) nationally provide swing bed services.²

PPS hospitals with swing beds and SNFs are required to collect patient data and provide it to the Centers for Medicare & Medicaid Services (CMS) using the SNF Minimum Data Set (MDS), a tool to implement standardized assessment and facilitate care management, and used by Medicare to determine payment and measure quality. However, CAHs are exempt from this requirement. The lack of nationally comparable swing bed quality measure data for CAHs creates two problems. First, CAHs are not uniformly able to demonstrate the quality of care provided to their swing bed patients or compare it to national benchmarks. This leaves CAHs vulnerable to criticisms such as those raised by the Office of the Inspector General, which questioned whether the costs of CAH swing bed care are too high for the Medicare program.³ Although the OIG's methods have been criticized,⁴ the Medicare program is responsible for ensuring that beneficiaries are receiving high value care, so the quality of the care being provided in CAH swing beds is an important Medicare policy issue.

Second, the lack of quality data for their swing bed services limits the ability of CAHs to participate in alternative payment models involving post-acute care. For example, in the CMS Bundled Payments for Care Improvement Initiative, which linked payments for acute and post-acute services received during

an episode of care, the majority of the partner network for an organization with a Model 2 award had to consist of SNFs rated 3 stars or better under the 5-star Nursing Home Compare rating system, in order to qualify for a waiver of the 3-day hospital inpatient requirement for beneficiaries to receive Medicare-covered SNF care. The SNF star ratings are based on inspections, staffing, and resident assessment information collected through the MDS and reported to CMS. CAHs are not required to collect and report MDS data and are not assigned star ratings.

CAH swing beds also have not been included in recent national quality measurement efforts. The Improving Medicare Post-Acute Care Transformation Act of 2014 (IMPACT) requires post-acute providers, including Long-Term Care Hospitals (LTCHs), Skilled Nursing Facilities (SNFs), Home Health Agencies (HHAs), and Inpatient Rehabilitation Facilities (IRFs), to submit standardized and interoperable patient assessment data that will facilitate coordinated care, improved outcomes, and overall quality comparisons, but does not include CAH swing beds. Similarly, a National Quality Forum (NQF) Measure Application Partnership project to select post-acute and long-term care quality measures focused on SNFs, HHAs, hospice, IRFs, and LTCHs, but did not address swing beds.⁵

Purpose

The purpose of this study was:

- to identify measures that can be used to assess the quality of care provided to CAH swing bed patients,
- to implement a field test of these measures,
- to measure outcomes for CAH swing bed patients, and
- to compare patient outcomes in CAH swing beds and rural Skilled Nursing Facilities (SNFs)

Measuring Quality for Swing Bed Patients

For the first part of the study that identified relevant quality measures for CAH swing bed patients, a detailed description of the methods used is provided in a recent policy brief.⁶ The methods used included identification of a comprehensive list of quality measures currently being used in post-acute care settings; an email survey of State Office of Rural Health (SORH) and Flex Program staff; a series of key informant interviews with CAH networks, CAHs and consultant groups; an online survey of CAH quality experts; and further revision of measure specifications in collaboration with health care consultants.

This study's selection of quality measures for CAH swing beds focused on outcome and functional status measures for two main reasons. First, outcome and functional status measures were consistent with the interview respondents' reported motivations for assessing CAH swing bed quality, including 1) to assess whether CAH swing bed patients are getting appropriate care, help them return home as quickly as possible, and prevent hospital readmissions; 2) to market CAH swing bed programs, allow CAHs to participate in alternative payment contracts, increase CAH swing bed patient volume, and compare the quality of CAH swing bed care to SNF care; and 3) to ensure that CAHs are in compliance with CMS intent and requirements regarding swing bed care.

Second, a focus on outcome and functional status measures aligns with the priorities of the IMPACT Act of 2014, which required CMS to develop and implement quality measures for post-acute settings related to outcomes such as discharge to the community; potentially preventable hospital

readmissions; and resource use, as well as measures in five quality domains, including: 1) skin integrity/changes in skin integrity; 2) functional status, cognitive function, and changes in functional status and cognitive function; 3) medication reconciliation; 4) incidence of major falls; and 5) transfer of health information and care preferences when an individual transitions.⁷

Outcome Measures

Two types of outcome measures were selected for CAH swing bed patients: discharge of swing bed patients to the community or prior residence and 30-day follow-up status after a swing bed stay (Table 1). The purpose of the recommended discharge disposition measures is to assess whether a CAH swing bed program is successfully returning discharged patients to the community or prior residence. For quality improvement purposes, we recommend that each CAH swing bed program track the residence of each swing bed patient prior to the inpatient admission that usually precedes a swing bed stay (e.g., community, nursing home, etc.) as well as their discharge disposition after the swing bed stay (e.g., community, nursing home, return to inpatient acute care, etc.).

The purpose of the recommended 30-day follow-up measures is to assess whether a CAH swing bed program is successfully preventing unplanned returns to a hospital. For quality improvement purposes, we recommend that each CAH swing bed program track the number and percent of their discharged CAH swing bed patients who are readmitted for an unplanned hospital inpatient stay, have an ED visit, and/or an observation stay, either at the CAH or another hospital, or have another swing bed/SNF admission within 30 days of discharge. The CAH should track whether the readmission, ED visit, or

observation stay is for the same/related condition as the swing bed stay, or a new condition, using a combination of hospital admission records and 30-day follow-up phone calls with discharged patients.

Functional Status Measures

Three instruments were initially identified that could potentially be used for calculating CAH swing bed patient functional assessment measures: 1) the Functional Independence Measure (FIM), 2) Barthel's Index, and 3) the MDS. All three instruments assess patient performance and need for assistance with activities of daily living.⁸⁻¹⁸ MDS and FIM are used to classify patients for PPS reimbursement purposes (MDS for Skilled Nursing Facility residents and rural PPS hospital swing bed patients, and FIM for Inpatient Rehabilitation Facility patients). Based on the literature, input from the key informant interviews, and the results of the online survey of CAH quality experts, we narrowed the choice of instruments to MDS and the Shah version of Barthel's Index.¹⁷ We weighed the pros and cons of each instrument and selected two MDS-based functional status measures: change in risk-adjusted self-care score between admission and discharge for CAH swing bed patients, and change in risk-adjusted mobility score between admission and discharge for CAH swing bed patients (Table 2).

The factors that weighed most heavily in the decision to recommend the MDS-based risk-adjusted functional status measures for CAH swing beds were their alignment with IMPACT goals, their approval by NQF for IRFs, their adoption by CMS for other post-acute settings, the fact that detailed measure specifications and risk-adjustment methods have already been developed, and their ability to allow comparison of outcomes for CAH swing bed patients with IRF, SNF, long-term care hospitals (LTCH) and PPS swing bed patients. Although scoring of the MDS self-care and mobility items and collection of the

data elements for risk-adjusting the measures will clearly involve more staff time than completing the Shah version of the Barthel Index, the MDS-based measures will enable CAHs to do a more comprehensive job of assessing the quality of swing bed care, and allow CAHs to compare their swing bed care to that of other post-acute care providers.

The risk-adjusted mean change in self-care score between admission and discharge for CAH Medicare swing bed patients discharged from a swing bed is based on the CMS functional outcome measure adopted for SNFs, IRFs, LTCHs and PPS swing beds under the IMPACT Act. NQF has endorsed the measure for IRFs as NQF measure #2633, and CMS is also seeking NQF endorsement of the measure for SNFs. The measure uses MDS Section GG elements and addresses the following self-care items: eating, oral hygiene, toilet hygiene, shower/bathing, upper body dressing, lower body dressing, and putting on/taking off footwear. All items are scored using a 1-6 rating scale based on the level of dependence/assistance required, with a potential score range for the measure of 7 to 42.¹⁹

The risk-adjusted mean change in mobility score between admission and discharge for CAH Medicare swing bed patients discharged from a swing bed is also based on a CMS functional outcome measure adopted for SNFs, IRFs, LTCHs and PPS swing beds under the IMPACT Act. NQF has endorsed this measure for IRFs as NQF measure #2634, and CMS is also seeking NQF endorsement of the measure for SNFs. The measure uses MDS Section GG elements and addresses the following mobility items: roll left and right, sit to lying, lying to sitting on side of bed, sit to stand, chair/bed-to-chair, ability to transfer to and from a chair (or wheelchair), ability to get on and off a toilet or commode, car transfer, walk 10 feet, walk 50 feet with two turns, walk 150 feet, walk 10 feet on uneven surfaces, 1 step

(curb), 4 steps, 12 steps, and picking up an object from the floor. All items are coded using a 1-6 rating scale (dependent to independent). All items are scored based on level of dependence/assistance required, with a potential score range for the measure of 15 to 90.¹⁹

To fairly compare changes in self-care and mobility scores between admission and discharge for CAH Medicare swing bed patients over time in a CAH, with other CAHs, and with other post-acute settings such as SNFs, it is necessary to risk-adjust the measures.¹⁹ Risk-adjustment requires data elements that are part of the revised MDS Section GG and selected items from other MDS Sections, including: patient age group at admission; primary medical condition category (a checklist of 13 conditions and “other”); whether the patient had major surgery during the 100 days prior to admission; patient’s prior level of dependence with regard to self-care, indoor ambulation, and use of stairs; falls history; prior use of devices (e.g., walker, manual wheelchair, etc.); presence and stage of pressure ulcer(s) at admission; cognitive abilities based on Brief Interview for Mental Status (BIMS) score or memory/recall questions; communication impairment; urinary and bowel continence; tube feeding or total parenteral nutrition; and comorbidities (15 hierarchical condition categories).

Implementing a Field Test of CAH Swing Bed Quality

In April 2018, in collaboration with Stroudwater Associates and Mary Guyot Consulting, we began implementation of a field test using the recommended swing bed outcome and risk-adjusted functional status quality measures for CAH swing bed programs. Prior to data collection, nurses with extensive swing bed experience and quality improvement expertise provided training (in-person and via webinars) to relevant hospital staff. Hospital staff used the data collection tool for three swing bed

patient cases developed by the nurse trainers. Each case had 82 items that required scoring with the majority of items related to risk adjustment and functional status changes. Overall, 88% of the items were scored correctly. Follow-up support was provided to staff on specific issues related to risk adjustment and functional status details. A web-based tool was developed to support data collection and entry with the capacity to produce analytics and benchmarking reports. The field test involved voluntary quarterly reporting of the measures by 131 CAHs in 14 states with 83 CAHs participating for 12 months and 48 participating for 6 months (Figure 1).

Results of the Field Test of CAH Swing bed Quality

For the period April 1, 2018 to March 31, 2019, the 131 CAHs participating (83 for 12 months and 48 for 6 months) in the field test had a total of 8420 swing bed patient stays with an average length of stay of 12.5 days and a median length of stay of 10 days. The characteristics of CAH swing bed patients are shown in Tables 3 and 4.

CAH swing bed patients in the sample were a chronically ill, elderly population with functional status needs. Almost 2/3 of swing bed patients were over age 75 and 90% had insurance coverage from Medicare or Medicare Advantage. Almost half of swing bed patients had a medical condition (often complex) as their primary reason for admission with fractures and other multiple trauma and hip and knee replacement representing almost one fourth of the primary reasons for admission. Prior to their current illness, approximately one third of swing bed patients were not independent in everyday activities including self-care, indoor mobility and functional cognition; 60% used a walker; and 17% used a manual or motorized wheelchair.

Detailed information on additional CAH swing bed patient characteristics were collected to facilitate risk adjustment of patient outcome measures (Table 4). These data document the frailty of a large subgroup of CAH swing bed patients as evidenced by:

- More than 40% had a fall in the 6 months prior to admission
- More than 40% were not always urinary continent and 25% were not always bowel continent
- Almost one quarter did not clearly understand the verbal content of others and 20% were not able to be fully understood
- More than one third had a Brief Interview for Mental Status (BIMS) score of 12 or lower which indicates moderate or severe impairment
- Almost 10% had at least one unhealed pressure ulcer at swing bed admission
- More than one quarter had a comorbidity of diabetes, more than one quarter had chronic ischemic heart disease and more than 10% had dementia

The field test tracked CAH swing bed patient status as well as 30-day follow-up status after a swing bed stay (Tables 5 and 6). 72% of swing bed patients were discharged to a community setting and three fourths of swing bed patients returned to their prior living situation or a more independent level of care after their swing bed stay. During the 30-day period following discharge from a CAH swing bed, the self-reported hospital readmission rate was 14.5% and the self-reported emergency department visit rate was 9.3%.

The field test also tracked changes in patient functional status, as measured by self-care score and mobility score, between swing bed admission and discharge (Table 7). The average non-risk adjusted

improvement in patient self-care score was 7.2 units with an average overall patient self-care score at admission of 25.4 units. This represents a 28.3% improvement in the patient's self-care score from admission to discharge. The average non-risk adjusted improvement in patient mobility score was 19.7 units with an average overall patient mobility score at admission of 37.2 units. This represents a 53% improvement in the patient mobility score from admission to discharge.

Comparison of Patient Outcomes in CAH Swing Beds and Rural Skilled Nursing Facilities (SNFs)

The data in the previous section are based on self-reported CAH swing bed patient outcomes during the time frame of the field test (April 2018-March 2019). To provide fair comparison of outcomes for patients in different types of facilities (e.g. CAH swing beds and SNFs) it is necessary to risk-adjust outcomes based on patient characteristics. We adapted risk-adjustment methodologies used by CMS for facility-level change in hospital readmission rates and functional status.¹⁹ Hospital readmission rates were risk-adjusted for patient age, length of swing bed stay, primary diagnosis, comorbidities, BIMS score, mobility score at discharge, self-care score at discharge and tube/parenteral feeding. Self-care score and mobility scores were risk-adjusted for patient age, self-care score and mobility score at admission, primary diagnosis, major surgery during 100 days prior to admission, comorbidities, BIMS score, bladder and bowel continence, prior use of devices and aids, falls history, and tube/parenteral feeding. Appendix 1 provides a detailed description of the risk-adjustment methodology and results.

The following 3 data sources were used for the comparison of risk-adjusted outcome measure results for patients in CAH swing bed and rural SNFs:

- The field test data collection forms with 124 participating CAHs with swing beds provided information on changes in the functional status between CAH swing bed admission and discharge as measured by self-care score and mobility score as well as information on hospital readmission rates during the swing bed stay and 30 days after discharge from the swing bed. These data were risk-adjusted as described above.
- CMS 2018 Nursing Home Compare data for SNFs located in rural counties as designated by HRSA provided detailed information on hospital readmission rates after the hospitalization that resulted in a rural SNF stay. In addition, a CMS SNF Quality Reporting Program Measures and Technical Information Brief provided information on changes in the functional status between SNF admission and discharge as measured by self-care score and mobility score for all SNFs in the U.S. in 2018. The above data are risk-adjusted by CMS as described in Appendix 1.
- Using 2018 Medicare claims data, a large ACO management firm provided information on hospital readmission rates 30 days after discharge from a rural SNF for 521 SNFs participating in ACOs and located in rural counties as designated by HRSA in 12 states. These data are risk-adjusted using the CMS Hierarchical Condition Category (HCC) risk-adjustment model, which accounts for beneficiary age, sex, disability status, Medicaid enrollment and clinical conditions as measured by Hierarchical Condition Category (HCCs).

The comparison of risk-adjusted outcome measures found (Tables 8 and 9):

- A significantly lower ($p \leq .0001$) overall hospital readmission rate for CAH swing bed patients of 18.6% (5% during swing bed stay + 13.6% during 30 days after swing bed stay discharge) compared to an overall hospital readmission rate of 33.3% (21.1% during the 30 days after

hospitalization that resulted in rural SNF stay + 12.2% during 30 days after rural SNF discharge).

The average length of a rural SNF stay in the ACO sample was 28.7 days, which is slightly less than the 30-day period after the hospitalization that results in a rural SNF stay.

- A slightly lower improvement in risk-adjusted changes in self-score and mobility scores in patients in CAH swing beds compared to all U.S. SNFs. It should be noted that the percent improvement from admission to discharge based on the average score at admission cannot be compared as this information is not currently available on the CMS website for SNF patients.

Conclusion

This study identified measures that can be used to assess quality for CAH swing bed patients, discussed the results of a field test of these measures and compared patient outcomes in CAH swing beds with those achieved in SNFs. The results indicate that:

- Relevant quality measures for CAH swing bed patients include outcome and functional status components. Two types of outcome measures include the percent of swing bed patients discharged to the community or prior residence, and risk-adjusted 30-day hospital readmission rate post swing bed stay. Two types of relevant swing bed patient functional assessment measures include changes in self-care score and mobility score between swing bed admission and discharge.
- Relevant hospital staff were successfully trained to collect detailed information on the outcome and functional status measures described above as well as information on patient characteristics necessary for risk adjustment.

- Based on multiple data sources, the overall risk-adjusted hospital readmission rate (during the swing bed stay and 30 days post discharge) for CAH swing bed patients of 18.6% was significantly lower than the overall risk-adjusted hospital readmission rate for rural SNF patients of 33.3%.
- The improvement in risk-adjusted changes in self-care and mobility scores were similar for CAH swing bed patients and all SNF patients in the U.S. Unfortunately, similar information just for rural SNF patients is not currently available on the CMS website.
- These results contribute to the development of a national evidence base that quantifies the cost and quality dimensions of CAH swing beds and allows fair comparisons with other rural post-acute care options such as SNFs.

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Figure 1: States with CAHs Participating in Field Test

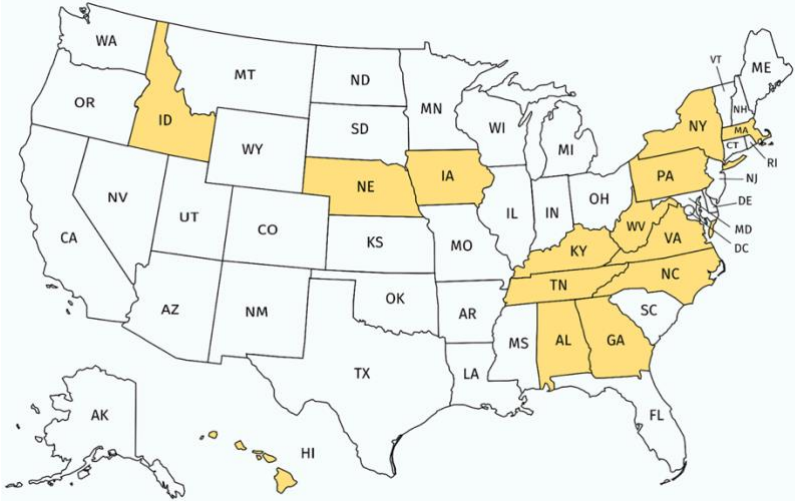


Table 1. Recommended CAH Swing Bed Outcome Measures		
Outcome	Measures	Recommended Data Sources
Discharge disposition	Number and percent of CAH swing bed patients who resided in the community prior to the swing bed stay who were: 1) discharged back to the community; 2) transferred to a nursing home; and 3) transferred to higher level of care.	CAH swing bed admission and discharge records
	Number and percent of CAH swing bed patients who resided in a nursing home prior to the swing bed stay who were: 1) discharged back to the nursing home; 2) transferred to a nursing home; and 3) transferred to higher level of care.	
	Risk-adjusted rate of discharge to the community for CAH swing bed patients.	CMS calculation based on Medicare claims data
30-day follow-up status	Number and percent of discharged CAH swing bed patients who had: an unplanned hospital inpatient stay, another swing bed stay, an Emergency Department visit, an observation stay, and/or a nursing home stay within 30 days of discharge for: 1) the same or related condition as the swing bed stay or 2) a new condition different from the swing bed stay.	Follow-up phone calls to swing bed patients 30 days post-discharge; CAH hospital inpatient and outpatient admission records
	Risk-adjusted 30-day unplanned readmission rate for CAH swing bed patients.	
		CMS calculation based on Medicare claims data

Table 2. Recommended CAH Swing Bed Functional Status Measures		
Functional Status	Measures	Recommended Data Sources
Improvement in swing bed patient self-care	Risk-adjusted mean change in self-care score between admission and discharge for CAH swing bed patients	MDS Section GG, with risk-adjustment data from selected other MDS sections
Improvement in swing bed patient mobility	Risk-adjusted mean change in mobility score between admission and discharge for CAH swing bed patients	MDS Section GG, with risk-adjustment data from selected other MDS sections

Table 3. CAH Swing Bed Patient Characteristics	
Age	88.2% over age 65 64.4% over age 75
Residence prior to hospitalization that preceded swing bed stay	94.1% Community 3.6% Nursing Home
Expected primary payer source for swing bed stay	90.2% Medicare or Medicare Advantage 5.4% Commercial Insurance 2.0% Medicaid
Primary medical condition (Most frequent categories)	27.9% Other Medical Conditions 20.0% Medically Complex Conditions 17.8% Debility, Cardiorespiratory Conditions 12.5% Fractures and Other Multiple Traumas 9.9% Hip and Knee Replacement
Had major surgery during 100 days prior to admission	34.4% Yes
Prior functioning independence <ul style="list-style-type: none"> • Self-care • Indoor mobility • Stairs • Functional cognition 	62% 70% 48.8% 62%
Prior device use <ul style="list-style-type: none"> • Manual wheelchair • Motorized vehicle or scooter • Walker • None of the above 	14.6% 2.8% 60.5% 3.6%

Table 4. CAH Swing Bed Patient Risk Adjustment Characteristics	
Had a fall in 6 months prior to admission	43.9%
Had at least one unhealed pressure ulcer at swing bed admission	9.6%
Makes self fully understood	80.2%
Clearly understands others	76.9%
Brief Interview for Mental Status (BIMS) summary score (0 to 15)	63.7% Cognitively intact (score 13-15) 24.9% Moderately impaired (score 8-12) 11.6% Severely impaired (score 0-7)
Always urinary continent	57.3%
Always bowel continent	74.8%
Tube feeding	1.3%
Parenteral nutrition	0.7%
Medical comorbidities	
• Diabetes	28.5%
• Chronic Ischemic Heart Disease	25.7%
• Major Infections	18.2%
• Dementia	10.8%

Table 5. CAH Swing Bed Patient Discharge Status	
Community	71.9%
SNF	13.3%
Acute Hospital	8.6%
Deceased	2.5%
Hospice	1.9%

Table 6. CAH Swing Bed Patient Outcome Results (Non-risk adjusted)	
30-day hospital readmission rate after swing bed discharge	14.5%
30-day ED visit rate after swing bed discharge	9.3%

Table 7. CAH Swing Bed Functional Status Results	
Average non-risk adjusted improvement in patient self-care	7.2 units Based on 7 items with each item scored on a scale of 1-6 at admission and discharge (average overall patient self-care score at admission of 25.4)
Average non-risk adjusted improvement in patient mobility	19.7 units Based on 15 items with each item scored on a scale of 1-6 at admission and discharge (average overall patient mobility score at admission of 37.2)

	CAHs in sample (n=124)	Rural SNFs* (n=4,250)	Rural SNFs** (N=521)
Hospital readmission rate during swing bed stay	5.0%		
30-day hospital readmission rate after swing bed discharge	13.6%		
30-day hospital readmission rate after hospitalization that resulted in rural SNF stay		21.1%	
30-day hospital readmission rate after rural SNF discharge			12.2%

*Source: 2018 Nursing Home Compare data for SNFs located in rural counties as designated by HRSA

**Source: A large ACO management firm, based on 2018 Medicare claims data analysis for 521 SNFs participating in ACOs and located in rural counties as designated by HRSA

Table 9. Comparison of Risk-Adjusted Functional Status Results for CAH Swing Beds and U.S. SNFs		
	CAHs in sample (n=124)	U.S. SNFs* (n=15,304)
Change in self-care score	7.1	8.3
Change in mobility score	20.0	21.3

*Source: CMS SNF Quality Reporting Program Measures and Technical Information Brief, 2018 data for all SNFs in the U.S.

Appendix 1 Risk Adjustment Methodology

This appendix describes the details of the risk adjustment methods used for this study including the measures used, the criteria used to exclude swing bed patients from the study population, and the four-step process used for risk adjustment as well as the results of the estimated models.

Measures: We assessed two types of outcome measures for risk-adjustment. *Functional status* includes self-care (NQF#2633) and mobility (NQF#2634) components. Both were assessed using questionnaires adapted from Section GG (Functional Abilities and Goals) of the Minimum Data Set 3.0 Resident Assessment Instrument (MDS 3.0 RAI). Self-care was based on seven questions, assessing patient's ability to perform activities related to eating, oral hygiene, toileting hygiene, showering/bathing, upper body dressing, lower body dressing, and putting on/taking off footwear. Mobility was based on fifteen questions, assessing patient's ability to roll left and right, sitting to lying, lying to sitting on side of bed, sit to stand, chair/bed-to-chair transfer, car transfer, walk 10 feet, walk 50 feet with two turns, walk 150 feet, walk 10 feet on uneven surfaces, take one step and down a curb and/or up and down one step, go up and down four steps with or without a rail, go up and down 12 steps with or without a rail, and pick up an object. The interdisciplinary health team may rate each question from one (dependent) to six (independent), with the total score of 7 to 42 for self-care and 15 to 90 for mobility. Higher scores indicate increased independence. We measured functional status of all swing bed patients at admission but only for patients who did not have any of the exclusion criteria listed below (Table A1). This is similar to the procedure used by CMS for collection and reporting of assessment data for patients who received care at long-term care hospitals (LTCHs), Skilled Nursing Facilities (SNFs), home health agencies (HHAs), and inpatient rehabilitation facilities (IRFs).

Readmission was assessed for the 30-day period after patients were discharged from the swing bed. Patients who were readmitted for acute or swing bed care at the same or a different facility were considered to be readmitted. Of the total of 8,420 CAH swing bed patients in the study, 1,637 (19.4%) had one of the exclusion criteria and were not followed up.

Statistical Analysis: Descriptive analyses assessed distributions of patient's demographic characteristics, residence and health status prior to the CAH swing bed admission, physical and cognitive status at admission, and disposition status at discharge as well as 30 days after discharge follow-up status. Mean, median, standard deviation, and quartiles were calculated to summarize data measured on a continuous scale (e.g., length of stay, summary score of the Brief Interview for Mental Status (BIMS) and functional status), while frequencies were calculated for categorical measures (e.g., residence prior to CAH swing bed admission, 30-day follow-up status, etc.).

Risk adjustment: Mean observed changes in patient functional status and readmission rates were calculated for each CAH. Prior literature suggests that the disparity in these measures across facilities can be partially attributed to differences in the patient case mix and that risk adjustment is required to allow for fair comparisons of quality measures across facilities.¹⁻³ We adapted methodologies used by CMS to risk adjust facility-level change in functional status and readmission rates. Our methodologies were modeled after methods described in *Specification for the Function Quality Measures Adopted in the Skilled Nursing Facility Quality Reporting Program*⁴ (developed by RTI International) and *Nursing Home Compare Claims-based Quality Measure Technical Specifications*⁵ (developed by Abt Associates) for change in functional status and readmission, respectively. The four-step process used for the change in functional status measures includes:

Step 1: Generalized linear models were created with a generalized estimation equation (GEE) to estimate patient-level expected changes in functional status scores. The GEE with a compound symmetry correlation matrix structure and robust standard errors was used to account for correlation of the data among patients who received swing bed care at the same CAH. To ensure comparability between the risk adjusted measures from the CAH-based models and those estimated by the CMS models, we used the same sample exclusion criteria and attempted to fit as many risk adjustors as in the CMS models. Figure A1 shows the exclusion strategy used to arrive at the final analytical sample (N=6,403; 76% of the original sample). Unlike the CMS model, non-Medicare patients were not excluded since swing bed services are not used exclusively by Medicare beneficiaries.

Tables A2 and A3 show the risk adjustors, their coefficients and the significance level for the models used in estimating expected change in self-care and mobility. The models did not include all risk adjustors used in the CMS models since we did not have access to claims data. Per our assessment, the relationships between the risk adjustors that were not included and changes in functional status were likely mediated by the risk adjustors included in the models. Hence, their omission from the models should minimally affect the models' predictability. R-squared statistics for the models estimating expected change in self care and mobility were 0.24 and 0.19, respectively.

Step 2: Using the models created in *Step 1*, expected changes in functional status were estimated for all patients in the analytical sample. For each CAH, the mean of these values among their patients was calculated to estimate the facility-level expected changes in functional status.

Step 3: The 14-state mean observed changes in functional status using the patient-level scores from all patients in the analytical sample was calculated. These values are referred to as the 14-state sample changes in functional status.

Step 4: Facility-level, risk-adjusted changes in functional status were calculated using the process used by CMS to calculate these measures for SNFs.⁴ Specifically, for each CAH, the difference between the facility-level observed and expected changes in functional status was calculated and then added to the 14-state sample changes from Step 4.

$$(observed\ change - expected\ change) + sample\ change = risk\ adjusted\ change$$

Finally, the mean of the facility-level, risk-adjusted changes in functional status was calculated. The mean among all CAHs in the sample can be used for comparison with those of other post-acute facilities such as SNFs.

For 30-day hospital readmission rates after swing bed discharge, the risk adjustment procedure followed similar steps to the risk adjustment procedure used for the change in functional status. A generalized linear model with GEE was created to predict the probability of readmission for CAH swing bed patients. Specifications of the readmission model resembled the change in functional status models, except for the use of the logit link to accommodate the binary outcome. Figure A2 shows the exclusion scheme used to arrive at the final analytical sample (N=5,349; 63.5% of the original sample). Similar to the change in functional status models, non-Medicare patients were not excluded.

Risk adjustors included in the CMS readmission model were extensive, including close to 300 variables abstracted from patient's claims records (e.g., age, sex, history of acute care hospitalization in the past year, history of care received in intensive care units, disability status, end-stage renal disease status,

and a host of medical diagnoses and comorbidities) and from the MDS 3.0 assessment (e.g., functional status, treatments provided during the SNF stay).⁶ Table A4 shows the risk adjustors, their coefficients, and their significance level for the readmission model. Consistent with the CMS model, adjustments were made for patient's age, length of stay, cognitive status (based on the BIMS score), and ability to make oneself understood. For primary diagnoses and comorbidities, only those that are common among swing bed patients were included in the model. In lieu of the assessment of dependency with respect to activities of daily living and walking ability included in the CMS model, the summary score of the self-care and mobility assessments were used. The scores assessed at discharge were used instead of those from admission because the former are more likely to predict readmission. Lastly, adjustments for an extensive list of procedures the patient received during the stay were not made except for parenteral and/or tube feeding since these data were not collected in the field test data collection forms. The Harrell C-statistic for the model was 0.645.

The facility-level and 14-state sample observed readmission rate represented the proportion of patients readmitted among the patients receiving care at each CAH and the whole analytical sample, respectively. Using the readmission model described above, each patient's probability of readmission was calculated and the facility-level expected readmission rate was derived by calculating the mean for each CAH. Finally, the facility-level, risk adjusted readmission rate was calculated with the equation used by CMS for SNFs shown below:

$$\frac{\textit{observed rate}}{\textit{expected rate}} * \textit{sample rate} = \textit{risk adjusted rate}$$

As described in the report, the overall risk-adjusted hospital readmission rate (during swing bed stay + 30 days after swing bed stay discharge) for patients in CAHs with swing beds was calculated and

compared with the overall risk-adjusted hospital readmission rate for patients in rural SNFs using data from Nursing Home Compare and Medicare claims data from a large ACO management firm.

Data management and descriptive analyses were conducted in SAS version 9.4 (Cary, NC). Estimation of risk-adjusted models was conducted in R (Vienna, Austria). Information related to CMS model development was publicly available on the CMS website.

References

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Table A1: Exclusion criteria for CAH swing bed patient functional status assessment

Criteria	N (%)
Died while in swing bed	193 (2.9%)
Left the swing bed program against medical advice	35 (0.4%)
Discharged to hospice care	151 (1.8%)
Unexpectedly discharged to a short-stay acute hospital/CAH	429 (5.1%)
Length of stay less than 3 days	412 (4.9%)
Independent with all self-care activities at the time of admission	105 (1.3%)
Patients with any of the following medical conditions: <ul style="list-style-type: none">▪ coma/persistent vegetative state;▪ complete tetraplegia;▪ locked-in syndrome ▪ severe anoxic brain damage;▪ cerebral edema; or▪ compression of brain	10 (0.1%)
Younger than 21 years old	1 (0.0%)
Not receiving physical therapy or occupational therapy	600 (7.1%)
Total Number of Exclusions	1637 (19.4%)

Figure A1: Exclusion criteria for the functional status models

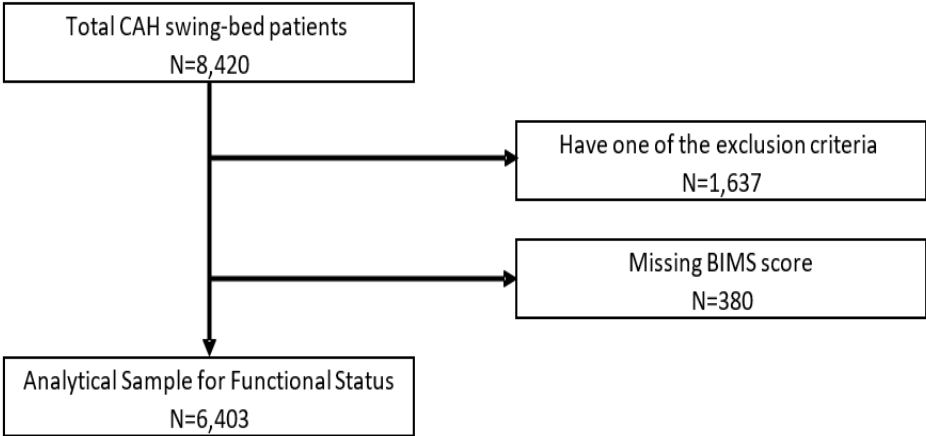


Table A2: Risk adjustors for self-care model

Variable	Coefficient	SE	p-value
Intercept	12.089	1.770	0.000
Younger than 35	-0.068	0.788	0.931
35-44	-0.217	0.914	0.813
45-54	0.970	0.505	0.054
55-64	-0.181	0.282	0.522
75-84	-0.618	0.226	0.006
85-90	-0.822	0.257	0.001
Older than 90	-1.882	0.328	0.000
Self-care score at admission - continuous form	0.333	0.112	0.003
Self-care score at admission - squared form	-0.015	0.002	0.000
Primary diagnosis: Stroke	-1.630	1.236	0.187
Primary diagnosis: Non-traumatic brain dysfunction	4.767	9.957	0.632
Primary diagnosis: Traumatic brain dysfunction	-10.371	4.356	0.017
Primary diagnosis: Non-traumatic spinal cord dysfunction	-4.224	3.543	0.233
Primary diagnosis: Traumatic spinal cord dysfunction	1.012	2.400	0.673
Primary diagnosis: Progressive neurological conditions	0.879	4.316	0.839
Primary diagnosis: Other neurological conditions	-0.814	2.756	0.768
Primary diagnosis: Fractures and other multiple trauma	0.431	1.290	0.739
Primary diagnosis: Amputation	0.233	3.226	0.942
Primary diagnosis: Other orthopedic conditions	-2.409	1.714	0.160
Primary diagnosis: Debility, cardiorespiratory conditions	-0.153	1.218	0.900
Primary diagnosis: Medically complex conditions	0.489	1.268	0.700
Interaction: Stroke	0.062	0.042	0.142
Interaction: Non-traumatic brain dysfunction	-0.115	0.377	0.761

Variable	Coefficient	SE	p-value
Interaction: Traumatic brain dysfunction	0.373	0.141	0.008
Interaction: Non-traumatic spinal cord dysfunction	0.174	0.128	0.173
Interaction: Traumatic spinal cord dysfunction	0.049	0.127	0.700
Interaction: Progressive neurological conditions	-0.079	0.160	0.621
Interaction: Other neurological conditions	0.035	0.103	0.735
Interaction: Fractures and other multiple trauma	-0.040	0.048	0.404
Interaction: Amputation	-0.016	0.111	0.884
Interaction: Other orthopedic conditions	0.059	0.057	0.300
Interaction: Debility, cardiorespiratory conditions	0.018	0.041	0.664
Interaction: Medically complex conditions	-0.027	0.048	0.573
Prior surgery	1.109	0.206	0.000
Prior self-care - Dependent	-2.804	0.555	0.000
Prior self-care - Some help	-1.616	0.240	0.000
Prior indoor ambulation - Dependent/some help	-0.603	0.253	0.017
Walker	-0.571	0.176	0.001
Wheelchair/scooter full time/part time	-1.562	0.262	0.000
Mechanical lift	-3.044	0.716	0.000
Orthotics/prosthetics	0.791	0.759	0.297
Stage 2 pressure ulcer	-0.311	0.399	0.436
Stage 3, 4 or unstageable pressure ulcer	-1.725	0.563	0.002
Brief Interview for Mental Status score - Moderately impaired	-0.002	0.213	0.993
Brief Interview for Mental Status score - Severely impaired	-0.338	0.232	0.145
Communication impairment - Moderate to severe	-1.397	0.373	0.000
Bladder incontinence - Less than daily, daily, always incontinent	-0.574	0.226	0.011
Bladder incontinence - Urinary catheter	-1.866	0.442	0.000

Variable	Coefficient	SE	p-value
Bowel incontinence - Always incontinent	-2.108	0.505	0.000
Bowel incontinence - Less than daily	-0.754	0.254	0.003
Tube/Parenteral Feeding	-3.205	0.913	0.000
Comorbidity: Major infections	-0.135	0.236	0.567
Comorbidity: Metastatic cancer and acute leukemia	-0.826	0.426	0.053
Comorbidity: Diabetes	-0.360	0.197	0.067
Comorbidity: Other endocrine/metabolic disorders	0.609	0.444	0.171
Comorbidity: Delirium and encephalopathy	-0.162	0.578	0.779
Comorbidity: Dementia	-1.741	0.282	0.000
Comorbidity: Tetraplegia and paraplegia	-2.130	1.723	0.217
Comorbidity: Multiple sclerosis	-1.349	1.397	0.334
Comorbidity: Parkinson's and Huntington's disease	-0.278	0.526	0.597
Comorbidity: Hemiplegia, other late effects of cerebrovascular accident	-0.580	0.502	0.248
Comorbidity: Dialysis status and chronic kidney disease stage 5	-0.220	0.445	0.620
Comorbidity: Urinary obstruction/retention	-0.072	0.538	0.894
Comorbidity: Amputation	-1.630	0.571	0.004

R²=0.25, n=6403

Table A3: Risk adjustors for the mobility model

Variable	Coefficient	SE	p-value
Intercept	23.873	2.016	0.000
Younger than 35	0.222	3.285	0.946
35-44	-0.757	2.743	0.782
45-54	0.969	1.135	0.393
55-64	-0.467	0.715	0.514
75-84	-1.268	0.471	0.007
85-90	-2.331	0.573	0.000
Older than 90	-4.322	0.652	0.000
Mobility score at admission - continuous form	0.429	0.082	0.000
Mobility score at admission - squared form	-0.009	0.001	0.000
Primary diagnosis: Stroke	-9.824	2.563	0.000
Primary diagnosis: Non-traumatic brain dysfunction	-6.246	16.637	0.707
Primary diagnosis: Traumatic brain dysfunction	-28.950	6.402	0.000
Primary diagnosis: Non-traumatic spinal cord dysfunction	-5.333	9.229	0.563
Primary diagnosis: Traumatic spinal cord dysfunction	19.225	9.176	0.036
Primary diagnosis: Progressive neurological conditions	0.224	5.696	0.969
Primary diagnosis: Other neurological conditions	-8.345	5.325	0.117
Primary diagnosis: Fractures and other multiple trauma	-7.064	2.285	0.002
Primary diagnosis: Amputation	-0.549	5.448	0.920
Primary diagnosis: Other orthopedic conditions	-8.111	2.951	0.006
Primary diagnosis: Debility, cardiorespiratory conditions	-6.352	1.869	0.001
Primary diagnosis: Medically complex conditions	-7.195	1.481	0.000
Interaction: Stroke	0.361	0.097	0.000
Interaction: Non-traumatic brain dysfunction	0.425	0.710	0.549

Variable	Coefficient	SE	p-value
Interaction: Traumatic brain dysfunction	1.056	0.234	0.000
Interaction: Non-traumatic spinal cord dysfunction	0.174	0.373	0.641
Interaction: Traumatic spinal cord dysfunction	-1.110	0.681	0.103
Interaction: Progressive neurological conditions	-0.222	0.240	0.354
Interaction: Other neurological conditions	0.288	0.205	0.159
Interaction: Fractures and other multiple trauma	0.234	0.080	0.004
Interaction: Amputation	-0.118	0.187	0.529
Interaction: Other orthopedic conditions	0.247	0.104	0.017
Interaction: Debility, cardiorespiratory conditions	0.199	0.062	0.001
Interaction: Medically complex conditions	0.203	0.052	0.000
Prior surgery	3.352	0.512	0.000
Prior indoor ambulation - Dependent	-2.584	1.136	0.023
Prior indoor ambulation - Some help	-3.021	0.556	0.000
Prior stair negotiation - Dependent	-0.992	0.930	0.286
Prior stair negotiation - Some help	-0.247	0.543	0.649
Prior cognition - Dependent	-0.400	0.893	0.654
Walker	-1.270	0.437	0.004
Wheelchair/scooter full time/part time	-5.244	0.709	0.000
Mechanical lift	-6.824	1.635	0.000
Orthotics/prosthetics	0.578	2.212	0.794
Stage 2 pressure ulcer	-0.707	0.816	0.386
Stage 3, 4 or unstageable pressure ulcer	-3.665	1.307	0.005
Brief Interview for Mental Status score - Moderately impaired	0.251	0.469	0.592
Brief Interview for Mental Status score - Severely impaired	0.086	0.562	0.879
Communication impairment - Moderate to severe	-3.405	0.908	0.000
Communication impairment - Mild	-1.583	0.534	0.003

Variable	Coefficient	SE	p-value
Bladder incontinence - Less than daily, daily, always incontinent	-0.071	0.437	0.871
Bowel incontinence - Always incontinent	-6.276	1.018	0.000
Bowel incontinence - Less than daily, daily	-2.222	0.636	0.000
History of fall	-1.143	0.356	0.001
Tube/Parenteral Feeding	-2.214	1.565	0.157
Comorbidity: Major infections	-0.948	0.591	0.109
Comorbidity: Metastatic cancer and acute leukemia	-3.258	0.906	0.000
Comorbidity: Diabetes	-0.672	0.396	0.089
Comorbidity: Other endocrine/metabolic disorders	-0.469	1.327	0.724
Comorbidity: Delirium and encephalopathy	-2.327	0.628	0.000
Comorbidity: Dementia	-8.926	3.633	0.014
Comorbidity: Tetraplegia and paraplegia	-5.607	2.597	0.031
Comorbidity: Multiple sclerosis	-2.845	1.021	0.005
Comorbidity: Parkinson's and Huntington's disease	-2.328	1.600	0.146
Comorbidity: Hemiplegia, other late effects of cerebrovascular accident	-1.789	0.986	0.070
Comorbidity: Dialysis status and chronic kidney disease stage 5	0.281	0.848	0.741
Comorbidity: Urinary obstruction/retention	-0.078	0.887	0.930
Comorbidity: Amputation	-4.664	1.495	0.002

R²=0.19, n=6403

Figure A2: Exclusion criteria for the readmission model

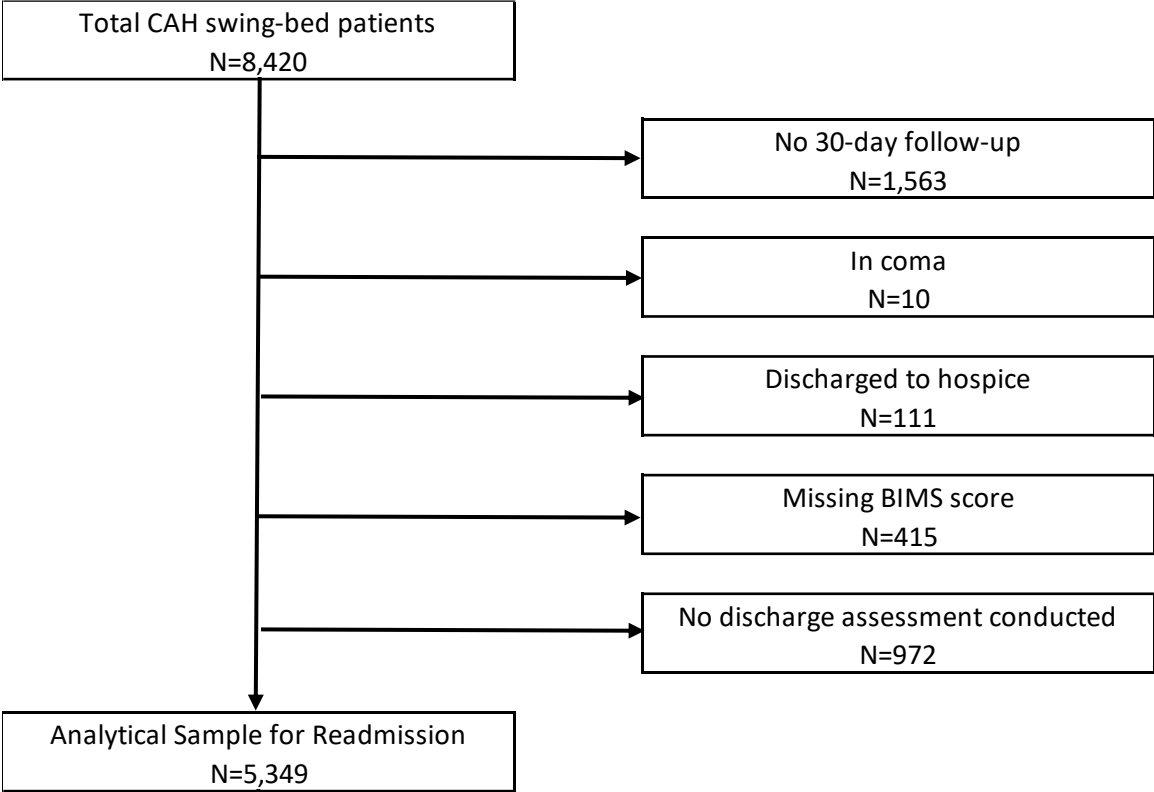


Table A4: Risk adjustors for the readmission model

Variable	Coefficient	SE	p-value
Intercept	-1.673	0.479	0
Younger than 35	0.353	0.476	0.458
35-44	0.036	0.627	0.954
45-54	0.259	0.277	0.349
55-64	-0.216	0.197	0.272
75-84	-0.084	0.119	0.484
85-90	-0.1	0.128	0.436
Older than 90	-0.399	0.173	0.021
Length of stay: 4-7 days	-0.059	0.156	0.706
Length of stay: 8-14 days	-0.092	0.168	0.584
Length of stay: 15+ days	-0.072	0.177	0.683
Primary diagnosis: Stroke	0.099	0.301	0.742
Primary diagnosis: Non-traumatic brain dysfunction	1.254	0.571	0.028
Primary diagnosis: Traumatic brain dysfunction	-0.356	0.758	0.639
Primary diagnosis: Non-traumatic spinal cord dysfunction	-1.278	1.172	0.275
Primary diagnosis: Traumatic spinal cord dysfunction	-8.196	5.544	0.139
Primary diagnosis: Progressive neurological conditions	0.386	0.527	0.463
Primary diagnosis: Other neurological conditions	-0.418	0.584	0.475
Primary diagnosis: Fractures and other multiple trauma	-0.683	0.157	0
Primary diagnosis: Amputation	0.189	0.417	0.651
Primary diagnosis: Other orthopedic conditions	-0.049	0.184	0.788
Primary diagnosis: Debility, cardiorespiratory conditions	0.207	0.118	0.08
Primary diagnosis: Medically complex conditions	0.295	0.131	0.025
Comorbidity: Metastatic cancer and acute leukemia	0.335	0.238	0.159
Comorbidity: Diabetes	0.012	0.098	0.902
Comorbidity: Dialysis status and chronic kidney disease stage 5	0.348	0.151	0.021

Variable	Coefficient	SE	p-value
Comorbidity: Hemiplegia, other late effects of cerebrovascular accident	0.054	0.308	0.86
Comorbidity: Dementia	-0.033	0.16	0.837
Comorbidity: Pressure ulcer (Stage 2,3,4, or unstageable)	0.303	0.155	0.05
Makes self understood - Rarely/Never	-0.43	0.377	0.254
Brief Interview for Mental Status score - Moderately impaired	-0.051	0.091	0.573
Brief Interview for Mental Status score - Severely impaired	-0.144	0.103	0.163
Mobility score at discharge - continuous form	-0.006	0.018	0.743
Mobility score at discharge - squared form	0	0	0.472
Self-care score at discharge - continuous form	0.053	0.034	0.115
Self-care score at discharge - squared form	-0.001	0.001	0.089
Tube/Parenteral Feeding	0.52	0.237	0.029

Harrell C-Statistic=0.645, n=5349