Development of Inpatient Rehabilitation Facility Quality Measures: Potentially Avoidable Readmissions, Community Discharge, and Functional Improvement

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Contractor Report

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I. INTRODUCTION

The quality of inpatient rehabilitation facilities (IRFs) is of great interest to policymakers as these facilities are tasked with providing high-intensity rehabilitation care to Medicare beneficiaries who have recently encountered health challenges resulting in compromised function. While the majority of post-acute rehabilitation care occurs in skilled nursing facilities and/or via home health agencies, IRFs provide care to patients who can tolerate at least 3 hours of therapy per day, commencing within a day of admission to the IRF. Furthermore, as conditions for participating in the Medicare program, IRFs must meet criteria for case-mix of patients (with a minimum of 60% falling into one of 21 distinct rehabilitation impairment categories), and criteria for staff licensure (with at least one physician specializing in physical medicine) (MedPAC 2014). These facilities are characterized by more than the patients and providers, however, with a majority of them situated within an acute care hospital (i.e., hospital-based units rather than freestanding facilities), and a disproportionate share being located in urban areas.

The objectives for this report include: One, to delineate the quality of IRFs using the most up-to-date data and methods; Two, to evaluate the patient characteristics that affect quality; and, Three, to identify the facility characteristics that affect quality.

II. METHODS AND RESULTS

In order to understand the quality of IRFs we examine the most recent annual data for which we were able to obtain a full complement of Medicare standard analytic inpatient claims files, enrollment data, patient assessment data, and provider-of-service information. In this case, the 2013 data are the most up-to-date. Using patient-level data and then tabulating facility-level measures, for example, by calculating the percentage of patient stays that experienced each of the dichotomous outcomes, we developed indicators of hospital readmission, discharge to community, discharge to a skilled nursing facility (SNF), and functional change. For hospital readmission, we distinguished between a hospital readmission for any cause and readmission for one of 13 clinical conditions for which a readmission may be potentially preventable, with the latter outcome being the preferred measure of IRF performance. We calculate two separate measures of potentially avoidable readmission—one that occurs at the end of the IRF stay, and one that occurs in days 2-30 after discharge from the IRF. To account for beneficiaries who are discharged from the IRF to a SNF, we calculated a separate measure of discharge to SNF discharge. For discharge to community, we distinguished those who utilized Medicare home health benefits in the 30 days following IRF discharge from those who did not. Last, to understand the effectiveness of rehabilitation care, we calculated change in the Functional Independence Measure (FIM) from admission to discharge, with facility-level measures representing average change among patients for the 13 motor items, and separately, average change among patients for the 5 cognitive items on the IRF-Patient Assessment Instrument (IRF-PAI). The numbers reported herein are based upon the final analytic file and may differ slightly (i.e. not statistically significant) from earlier versions used in the MedPAC Report to Congress.

1 Discharge Destination and Potentially Avoidable Readmissions Methods

1.1 IRF Quality Measure Development

The quality measures used in this report focus on facility-level measures of particular outcomes (e.g., community discharge, SNF discharge, hospital readmission, and functional change) for Medicare beneficiaries who had a hospitalization in the 30 days preceding an IRF stay. We selected the outcomes of interest because they each represent quality measures that have been used in previous studies of IRF quality, or because they have a strong conceptual basis for inclusion as facility performance measures (see Appendix A for outcomes research related to IRFs). MedPAC has been tracking IRF quality with measures that are similar to those used in this report, though the differences are noteworthy (RAND, 2012). In particular, rather than utilizing a multi-level model to assess resident and facility characteristics that are associated with quality, this report adopts the Observed-to-Expected (O/E) approach that is used to monitor quality in other Medicare settings (e.g., hospitals, nursing homes). For each outcome measure, the O/E approach is relatively straightforward to interpret, and in this instance, is transformed into a risk-adjusted or risk-standardized measure by multiplying the O/E ratio by the national average (using a logarithmic transform for dichotomous measures).

Using two groups or classes of quality measures, we describe the quality measures for IRFs and provide the results of our analyses. The data for these two groups are slightly different: the former are calculated from Medicare inpatient (Part A) claims files, while the latter are calculated from the IRF-PAI. Owing to the different information available in the datasets, these quality measures may be broadly grouped into one set related to discharge destination and hospital readmissions, and another related to functional change across a stay.

1.2 Measure definitions

The four facility-level discharge and hospitalization-related quality measures were calculated for each facility on an annual basis for fiscal years 2011, 2012, and 2013. Although researchers have studied the quality of IRFs, the dearth of published studies focused on the facility as a whole necessitated selecting outcome measures for which either relevant benchmarks may be missing, or for which studies have been restricted to particular diagnoses or conditions (Faulk and Cooper, 2013; Galloway, et al, 2013; Haines-Wood, et al, 1996; Hammond, et al, 2013; Hoyer, et al, 2013; Ottenbacher, et al, 2012; Ottenbacher, et al, 2014; Schneider, et al, 2012). They include:

1.2.1 Community Discharge: This measure reflects the percent of eligible stays where the patient was not discharged directly from the IRF to a hospital or a SNF. Hence, individuals who were discharged from the IRF to a nursing home as a non-SNF resident (i.e., for long-term care financed by Medicaid or private means) are included in this measure of community discharge. Patients who are discharged from the IRF to the community, but are admitted to a hospital within one day of discharge are not considered to be discharged to the community.

1.2.2 Discharge to SNF: This measure reflects the percent of eligible stays where the patient was discharged directly from the IRF to a SNF. More specifically, the measure reflects the rate at which individuals are discharged from the IRF for additional rehabilitation in a skilled

nursing facility, and whose SNF care is financed by the Medicare skilled nursing benefit (i.e., Medicare Part A). Patients who were discharged from the IRF to a nursing home for a non-SNF episode are not considered to be discharged to SNF.

1.2.3 During IRF Potentially Avoidable Readmission: This measure reflects the percent of eligible stays where the patient was discharged directly from the IRF to an acute care facility for one of 13 different conditions. The potentially avoidable readmission-related quality measures are classified via the primary diagnosis code at the time of hospital discharge using the inpatient claims file (Kramer, et al, 2014; see Appendix 2 for list of ICD-9 diagnoses for each condition). The one exception is for delirium, for which we expanded the classification to include the secondary diagnoses. Individuals who died during the IRF stay were excluded from the facility's readmission rate.

1.2.4 30-Day Post IRF Discharge Potentially Avoidable Readmission: This measure reflects the percent of a facility's discharged patients whose hospitalization in the 30 days following discharge from the IRF to the community (with or without home health) or SNF is for a diagnosis that is one of the 13 potentially avoidable conditions. In other words, this rate of hospitalization reflects readmissions among those patients who did not go from the IRF to a hospital at the end of the IRF stay. Individuals who died during this 30-day window were excluded from this facility-level readmission rate.

1.3 Stay-Level Covariates

In order to calculate a facility-level risk-adjusted rate, we developed risk models for each of the outcomes using data from all IRF patients. Ultimately, a set of covariates were employed to calculate an expected risk of each outcome. For each stay, a patient's diagnoses on inpatient claims are used to identify the presence of these risk factors, and these covariates are used to calculate an expected probability for each outcome. The set of candidate conditions for inclusion in the Medical Comorbidity Index were the hierarchical condition categories (HCC) utilized by CMS for the Medicare Advantage program. The data sources used for this risk adjustment of the IRF quality measures were restricted to the Part A hospital and IRF inpatient claims files, rather than drawing from all possible Medicare data sources.

Across all stays in an eligible facility, the probabilities from eligible stays were aggregated to generate an annual facility-level expected rate for each of the outcomes.

1.3.1 Comorbidity Index indicators

A medical comorbidity index represents one of the covariates used to estimate the probability of each outcome for a particular stay. More specifically, each patient's active diagnoses, gleaned from the Medicare Part A inpatient claims files for either hospitalizations in an acute care facility or a stay in the IRF, were tabulated to generate an index of medical conditions that are associated with the risk of particular outcomes. Tables 3 and 5 list the HCCs that were utilized in at least one of the risk models. For each of the discharge destination and potentially avoidable readmission measures, Table 7A provides the regression coefficients for each of the HCCs included in the medical comorbidity index.

1.3.2 Other covariates

Other measures besides the medical comorbidity index were used to estimate the probability of each outcome for each stay. Candidate variables included FIM motor and FIM cognitive score at admission, Rehabilitation Impairment Category (RIC), and demographic characteristics. For each outcome, we selected a parsimonious set of customized risk adjustment factors based upon a combination of clinical judgment and exhibited statistical relationships such as explanatory power. (Kramer, et al, 2014).

1.4 Resident Exclusions and Facility Eligibility

The population of interest included any Medicare beneficiary who utilized an IRF beginning in the 30 days after a stay in an acute care facility. To be included in facility-level calculations, an individual beneficiary had to be enrolled in the Medicare Fee for Service (FFS) Part A program for the entire fiscal year. Hence, IRF stays without a preceding acute care stay were excluded. Rather than provide an imprecise estimate of quality for those IRFs with a low volume, only facilities with 25 or more IRF stays in a particular year were included in descriptive statistics and regression models. Therefore, facilities were included in descriptive statistics and in the regression models if they had at least 25 eligible stays in a given fiscal year for that particular outcome. Our analyses are conducted for the fiscal years 2011, 2012, and 2013.

1.5 Facility-Level Regressions

Each of the risk-adjusted facility-level outcome measures was regressed on a set of independent variables to facilitate inferences about the characteristics associated with facility performance. These facility characteristics were assessed via linear regression models, and included facility ownership (for-profit, government owned, or not-for-profit), volume (less than 100 stays / year, 100 stays or more but less than 700 stays /year, and 700 stays or more / year), calendar year (eligible in 2011 and/or 2013), and change over time.

1.6 Constraints and Limitations

These facility-level measures were restricted to the Medicare FFS population, so we are unable to comment on the quality of care provided to Medicare Advantage (i.e., Medicare Part C) and private-pay patients in these facilities. In addition, the individual characteristics employed in our medical comorbidity models utilized only inpatient diagnoses codes, rather than diagnoses from clinical encounters in outpatient settings (e.g., Medicare Part B).

2 Potentially Avoidable Readmission and Community Discharge Results

2.1 Outcome Measures

2.1.1 Stay Level

Table 1 provides descriptive statistics for the eligible stays using demographics (age, gender, marital status, and race), functional characteristics (FIM motor and FIM Cognitive scores), and select rehabilitation impairment categories (RICs). Over the three fiscal years analyzed for this report, the number of eligible stays declined from just over three hundred-and-six thousand (N=306,374) stays in 2011 to nearly two hundred-and-ninety-nine thousand (N=298,673) in 2013.

For eligible stays, Table 2 displays the distribution of potentially avoidable readmissions during the IRF stay by condition, as well as in aggregate, for the years 2011 through 2013. The most common condition for which a potentially avoidable readmission occurs during the IRF stay are respiratory problems, followed closely by sepsis and congestive heart failure. Furthermore, to understand how frequently an IRF patient is hospitalized for a potentially avoidable condition, we also include the percentage of all-cause readmissions that are potentially avoidable. All-cause readmission is defined as a direct readmission from the IRF to an acute-care facility within one day of IRF discharge. Broadly, nearly two-out-of-five hospital readmissions during an IRF stay are for a potentially avoidable condition.

Table 3 lists the prevalence of the various HCCs among eligible IRF stays, for 2011 through 2013. Across these years, the two most common HCCs among eligible beneficiaries are cardiac-related (specified heart arrhythmias and congestive heart failure).

Stratifying these results based on discharge destination, for the most recent year of data (i.e., Fiscal Year 2013) Table 4 provides demographic, functional characteristics, and select RIC-related information about the eligible stays, while Table 5 provides the presence of common HCCs among eligible stays. Patients that were discharged to a SNF differ from those discharged to the community (either with or without home health) on several dimensions including demographic characteristics such as marital status, functional characteristics such as FIM Motor and FIM Cognitive Scores at the time of IRF discharge, and comorbidities such as hip fracture, hip replacement, metastatic cancer, hemiplegia/hemiparesis, and atherosclerosis.

Table 6A provides the regression coefficients for each of the stay-level covariates used to risk adjust the discharge destination and potentially avoidable readmission measures. The model fit ranged from a c-index of 0.57 for potentially avoidable readmissions among those IRF patients discharged to a SNF, to a c-index of 0.72 for potentially avoidable readmissions that occurred at the end of the IRF stay. Table 7A provides the regression coefficients for the HCCs that are included in the outcome-specific medical comorbidity index. The model fit ranged from a c-index of 0.58 for discharge to SNF at the end of the IRF stay, to 0.66 for potentially avoidable readmissions that occurred at the end of the IRF stay.

2.1.2 Facility Level

For each year, Table 8 provides the average (i.e., mean) facility-level outcome rates among eligible facilities for each of the discharge destination and readmission-related quality measures. Both Observed and Risk-Adjusted rates are presented, with the latter reflecting the O/E ratio multiplied by the national average (using a logarithmic transform).

2.1.3 Facility Level Regression Analyses

Pooling both FY 2011 and FY 2013 data, we employed linear regression models to regress the risk-adjusted outcome measures on facility and geographic characteristics to understand the effect of facility characteristics on quality (Tables 10, 11, 12, and 13). The adjusted R-squared values for the final discharge destination and hospitalization-related quality measures were acceptable: for community discharge, discharge to SNF, during IRF potentially avoidable readmissions, and 30-day post IRF potentially avoidable readmission rate models they were 0.103, 0.109, 0.069, and 0.071, respectively. The low explanatory power of these models, in general, may be attributable to the highly skilled staff available in IRFs that leads to low rates and variability in these outcomes which were not available for inclusion in the models.

Compared to free-standing facilities, hospital-based facilities had no discernible difference in both the community discharge rate and the 30 days post-IRF discharge potentially avoidable readmission rate; however, hospital-based facilities had a lower potentially avoidable readmission rate during the IRF stay (by 0.6 percentage points), and a higher SNF discharge rate (by 1.0 percentage points) than the free-standing facilities.

Not-for-profit facilities had higher community discharge rates (by 0.7 percentage points) and lower potentially avoidable readmission rates (by 0.4 percentage points) than government owned IRFs, and lower potentially avoidable readmission rates (by 0.2 percentage points for readmissions at the end of the IRF stay, and by 0.3 percentage points for readmissions occurring in the 30 days post-IRF discharge) and higher discharge to SNF rates (by 0.5 percentage points) than for-profit facilities.

Compared to urban facilities, rural IRFs had similar community discharge rates and potentially avoidable readmission rates, as evidenced by the lack of statistically significant regression coefficients.

Low volume facilities (i.e., those with 100 or fewer stays in the year) had higher community discharge rates (by 0.8 percentage points) than facilities with 100 stays or more but fewer than 700 in the year, and lower (by 0.2 percentage points) potentially avoidable readmission rate at the end of the IRF stay. Volume did not appear to be related to rates of discharge to SNF or potentially avoidable readmissions within 30 days of IRF discharge.

3 Functional Change Methods

The purpose of inpatient rehabilitation facility (IRF) care is to provide high quality care for Medicare beneficiaries who are able to benefit from high intensity rehabilitative care. Hence, measures of functional improvement are likely to be of great interest to stakeholders.

3.1 Functional Change Measure Development

3.1.1 Data for Functional Outcome Assessment

To measure function and functional change, we utilized information from the Inpatient Rehabilitation Facility Patient Assessment Instrument (IRF-PAI).

3.1.2 Selection of Scales for Functional Outcome Assessment

The Functional Independent Measure (FIM) is a widely-used metric of IRF performance (MedPAC, 2014; RAND, 2012) that is based on 18 items in the IRF-PAI. When calculated as an aggregate measure (i.e., Total FIM), the FIM ranges from 18 to 126 because each of the items ranges from 1 to 7. However, rather than use the total FIM score, or a change in the total FIM score across an IRF stay, we utilize two distinct quality measures related to FIM change that that pertain to either motor FIM gain or cognitive FIM gain (CMS, 2012).

3.2 Measure Definition

The two facility-level quality measures related to functional change were calculated for each facility on an annual basis for fiscal years 2011, 2012, and 2013. They include:

3.2.1 FIM Motor Gain

This measure reflects the average change in the 13-item FIM Motor score among the eligible stays in an IRF during a given year. Patients with missing information for any of the 13 Motor-function items at either admission or discharge from the IRF are not included when calculating average change.

3.2.2 FIM Cognitive Gain

This measure reflects the average change in the 5-item FIM Cognitive score among the eligible stays in an IRF during a given year. Patients with missing information for any of the 5 cognitive-function items at either admission or discharge from the IRF are not included when calculating average change.

3.3 Stay-Level Covariates

Similar to our construction of the facility-level risk-adjusted rates for the discharge destination and hospitalization-related quality measures, we developed risk models for both FIM Motor Gain and FIM Cognitive Gain. The process for selecting covariates was identical, and the data sources for the HCCs were identical.

3.4 Resident level exclusions and facility eligibility

As with the discharge-destination and hospitalization-related quality measures, only those IRF patients who had received care in an acute care facility in the 30 days prior to the beginning of the IRF stay were included. Similarly, only those Medicare beneficiaries who were enrolled in Medicare FFS Part A for the entire year were included. Likewise, only those facilities with at least 25 eligible stays in a given year were eligible for facility-level analyses. To calculate functional change requires both admission and discharge functional assessment, so only those IRF patients with an admission and discharge FIM score were included in these analyses.

3.5 Facility-level Regressions

The two risk-adjusted functional change-related quality measures were separately regressed on a set of independent variables (i.e., covariates), and the selection criteria for inclusion or exclusion from the final model were identical.

4 Functional Change Results

4.1 Outcome Measures

4.1.1 Stay Level

As described previously, Table 1 provides functional characteristics across the eligible stays for each year. The average functional status at admission among IRF patients has remained relatively stable from 2011 to 2013, but the average FIM Motor score at discharge has increased by 0.8 points. Upon further examination of Table 4, the average FIM Motor and FIM Cognitive scores exhibited greater variation when stratified by the discharge destination at the end of the IRF stay. IRF patients who subsequently are discharged to a SNF exhibited the lowest average FIM Motor and FIM Cognitive score at admission and at discharge. Table 6B provides the covariates included in the final risk adjustment models used for FIM Motor Gain and FIM Cognitive Gain. The model fit for FIM Motor Gain was modest (adjusted R-square=0.062), while the model fit for FIM Cognitive Gain was quite good (adjusted R-square=0.242). Table 7B provides the regression coefficients for each of the HCCs included for medical comorbidity index used in the calculation of expected FIM Motor Gain and FIM Cognitive Gain.

4.1.2 Facility Level

For each of the three years, Table 8 provides both the observed and risk-adjusted facility-level FIM Motor Gain and FIM Cognitive Gain across eligible facilities. Table 9 provides insights related to the distribution of both facility-level functional change measures for 2013.

4.1.3 Facility Level Regression Analyses

Tables 14 and 15 provide insight into the facility characteristics associated with facility-level quality measures. The model fit for FIM Motor Gain is good (adjusted R-square=0.171), while the model fit for FIM Cognitive Gain is average (adjusted R-square=0.115).

In comparison to hospital-based IRFs, free-standing facilities had a higher FIM Motor Gain (by 2.33 points) and higher FIM Cognitive Gain (by 0.62 points).

With respect to facility ownership, for-profit IRFs had a higher FIM Motor Gain (by 1.01 points) and higher FIM Cognitive Gain (by 0.33 points) than non-profit IRFs. Government-owned IRFs did not differ from non-profit IRFs.

Rural IRFs exhibit a higher average (by 0.62 points) FIM Motor Gain than those in urban facilities. However, for FIM Cognitive Gain, the average gain in rural facilities is not statistically different than the average gain observed among urban facilities.

In terms of volume, IRFs with a high volume—facilities with 700 stays or more in the year—exhibited a higher FIM Motor gain (by 0.63 points), but a similar FIM Cognitive Gain as lower volume facilities with 100 stays or more but less than 700 stays.

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Section III
Report Tables

TABLE 1: Patient Characteristics

	Fiscal Year		
Demographics	2011[1]	2012[2]	2013[3]
Female	57.4%	57.2%	56.0%
Age at End of First IRF Stay (Years)	75.9	75.8	75.6
Age, Less Than 65 Years	12.6%	12.7%	12.9%
Age, 65 to Less Than 75 Years	29.8%	30.4%	31.3%
Age, 75 to Less Than 85 Years	36.7%	36.1%	35.0%
Age, 85 Years or Greater	20.9%	20.8%	20.8%
Never Married	10.5%	10.6%	10.9%
Married	45.9%	46.2%	46.9%
Widowed	33.5%	32.7%	31.4%
Separated	0.9%	0.9%	1.0%
Divorced	9.2%	9.6%	9.8%
Race/Ethnicity: White	83.9%	83.8%	83.5%
Race/Ethnicity: African American	9.8%	10.1%	10.2%
Race/Ethnicity: Hispanic	4.4%	4.2%	4.3%
Race/Ethnicity: Other	1.9%	1.9%	2.0%
Selected Functional and Other			
FIM Motor Score at Admission	35.5	35.3	35.3
FIM Motor Score at Discharge	59.4	59.8	60.2
FIM Motor Score Change During IRF Stay	23.8	24.4	24.9
FIM Cognitive Score at Admission	23.2	23.0	22.8
FIM Cognitive Score at Discharge	27.4	27.4	27.5
FIM Cognitive Score Change During IRF Stay	4.2	4.4	4.7
Hip Fracture or Dislocation	14.9%	14.3%	13.9%
RIC-08_Replacement of Lower Extremity Joint	3.9%	3.7%	3.4%
RIC-Miscellaneous	12.8%	12.2%	12.3%

[1] Includes 306,374 IRF stays. Excludes deaths during IRF stay.
[2] Includes 301,900 IRF stays. Excludes deaths during IRF stay.
[3] Includes 298,673 IRF stays. Excludes deaths during IRF stay.

Table 2: Observed Direct Readmission from IRF Rates for All-Cause, Potentially Avoidable, and Individual Conditions

	Fiscal Year		
Observed Direct Readmission	2011[1]	2012[2]	2013[3]
All-Cause	10.13%	9.80%	9.50%
Potentially Avoidable (All Conditions)	3.44%	3.29%	3.24%
CHF (Congestive Heart Failure)	0.60%	0.59%	0.58%
Electrolyte Imbalance / dehydration	0.12%	0.11%	0.10%
Respiratory illnesses and bronchitis (e.g., pneumonia, influenza, and pneumonitis due to inhalation of food or vomitus)	0.89%	0.80%	0.80%
Sepsis (septicemia)	0.80%	0.83%	0.89%
Urinary Tract and Kidney Infections (cystitis, urethritis, urethral stricture)	0.21%	0.19%	0.18%
Hypoglycemia and diabetic complications	0.06%	0.06%	0.05%
Anticoagulant complications	0.11%	0.11%	0.09%
Fractures and Musculoskeletal	0.33%	0.30%	0.28%
Adverse Drug Reaction	0.02%	0.02%	0.03%
Delirium	0.02%	0.01%	0.01%
Cellulitis / Wound Infection	0.05%	0.05%	0.04%
Pressure Ulcers	0.03%	0.03%	0.02%
Blood Pressure Management	0.21%	0.20%	0.17%

[1] Includes 306,374 IRF stays. Excludes deaths during IRF stay.
[2] Includes 301,900 IRF stays. Excludes deaths during IRF stay.
[3] Includes 298,673 IRF stays. Excludes deaths during IRF stay.

TABLE 3: Prevalence of HCC Diagnoses During IRF Stay

Medical Hierarchical Condition Categories		Fiscal Year 2011[1]	2012[2]	2013[3]
HCC 8	Metastatic Cancer and Acute Leukemia	2.0%	2.1%	2.1%
HCC 18	Diabetes with Chronic Complications	7.5%	8.1%	8.4%
HCC 21	Protein-Calorie Malnutrition	6.6%	7.0%	7.1%
HCC 84	Cardio-Respiratory Failure and Shock	9.4%	12.0%	13.0%
HCC 85	Congestive Heart Failure	22.2%	23.3%	23.8%
HCC 96	Specified Heart Arrhythmias	24.9%	26.6%	27.4%
HCC 100	Ischemic or Unspecified Stroke	15.6%	15.7%	15.9%
HCC 103	Hemiplegia/Hemiparesis	11.6%	11.4%	11.4%
HCC 106	Atherosclerosis of the Extremities with Ulceration or Gangrene	2.2%	2.1%	2.2%
HCC 108	Vascular Disease	11.7%	12.8%	12.9%
HCC 111	Chronic Obstructive Pulmonary Disease	18.2%	19.6%	19.9%
HCC 114	Aspiration and Specified Bacterial Pneumonias	3.9%	3.9%	4.0%
HCC 135	Acute Renal Failure	14.4%	15.5%	16.7%
HCC 136	Chronic Kidney Disease (Stage 5)	4.1%	4.2%	4.5%

[1] Includes 306,374 IRF stays. Excludes deaths during IRF stay.
[2] Includes 301,900 IRF stays. Excludes deaths during IRF stay.
[3] Includes 298,673 IRF stays. Excludes deaths during IRF stay.

TABLE 4: Patient Characteristics for IRF Discharge Locations, FY2013[1]

	IRF Discharge Stays[1]	30 Days Post IRF Discharge Location		
		SNF	Home Health	Community w/o HH
Number of Stays	264,127	18,255	132,588	113,284
Percent of Stays	100.0%	6.9%	50.2%	42.9%
Demographics				
Female	56.9%	56.0%	59.4%	54.0%
Age (Years), End of First IRF Stay	75.6	78.1	76.2	74.4
Age, Less Than 65 Years	12.9%	10.0%	12.4%	13.9%
Age, 65 to Less Than 75 Years	31.6%	23.6%	29.1%	35.8%
Age, 75 to Less Than 85 Years	35.0%	37.2%	36.3%	33.1%
Age, 85 Years or Greater	20.5%	29.2%	22.2%	17.2%
Never Married	10.9%	12.7%	10.5%	11.1%
Married	46.8%	36.0%	45.1%	50.4%
Widowed	31.5%	39.1%	33.6%	27.8%
Separated	1.0%	1.0%	1.0%	1.0%
Divorced	9.8%	11.2%	9.8%	9.7%
White	83.6%	84.2%	82.7%	84.6%
African American	10.2%	10.0%	10.9%	9.3%
Hispanic	4.2%	3.9%	4.5%	4.0%
Other	2.0%	1.9%	1.9%	2.1%
Characteristics (Average Score or %)				
FIM Motor Score at Admission	36.0	27.3	35.8	37.7
FIM Motor Score at Discharge	62.6	46.5	63.5	64.3
FIM Motor Score Change	26.6	19.2	27.6	26.5
FIM Cognitive Score at Admission	23.0	19.4	23.2	23.5
FIM Cognitive Score at Discharge	28.0	24.1	28.3	28.4
FIM Cognitive Score Change	5.0	4.7	5.1	4.9
Hip Fracture or Dislocation	14.5%	18.5%	15.5%	12.6%
RIC-08_Replacement of LE Joint	3.6%	1.4%	3.8%	3.8%
RIC-Miscellaneous	11.8%	10.4%	13.0%	10.8%

[1] Excludes deaths during IRF stay, stays with direct readmission during the IRF stay (N=28,380, 9.5%), and deaths 30 days post IRF discharge (N=6,166, 2.3%).

TABLE 5: Prevalence of Hierarchical Condition Categories Diagnoses for IRF Discharge Locations, FY2013[1]

	IRF Discharge Stays[1]	30 Days Post IRF Discharge Location		
		SNF	Home Health	Community w/o HH
Number of Stays	264,127	18,255	132,588	113,284
Percent of Stays	100.0%	6.9%	50.2%	42.9%
Hierarchical Condition Categories				
Metastatic Cancer and Acute Leukemia	1.7%	1.6%	1.8%	1.6%
Diabetes with Chronic Complications	8.1%	9.5%	8.7%	7.2%
Protein-Calorie Malnutrition	6.5%	8.7%	6.7%	5.9%
Cardio-Respiratory Failure and Shock	12.1%	12.6%	12.5%	11.4%
Congestive Heart Failure	22.4%	26.2%	24.2%	19.7%
Specified Heart Arrhythmias	26.2%	32.1%	27.2%	24.0%
Ischemic or Unspecified Stroke	16.0%	23.0%	13.7%	17.6%
Hemiplegia/Hemiparesis	11.2%	18.9%	9.5%	12.1%
Atherosclerosis of the Extremities with Ulceration or Gangrene	2.1%	3.0%	2.4%	1.5%
Vascular Disease	12.3%	14.1%	13.1%	11.1%
Chronic Obstructive Pulmonary Disease	19.1%	19.4%	20.4%	17.4%
Aspiration and Specified Bacterial Pneumonias	3.6%	5.1%	3.5%	3.4%
Acute Renal Failure	15.7%	18.3%	16.6%	14.1%
Chronic Kidney Disease (Stage 5)	4.0%	5.1%	4.3%	3.3%

[1] Excludes deaths during IRF stay, stays with direct readmission during the IRF stay (N=28,380, 9.5%), and deaths 30 days post IRF discharge (N=6,166, 2.3%).

TABLE 6A: Risk Models for During IRF Stay and 30-Day Post IRF Discharge Outcomes, FY 2011

Model Covariates	During IRF Stay at 100 Days			30 Day Post IRF Discharge Potentially Avoidable Readmission		
	Community Discharge	Potentially Avoidable Readmission	Discharge to SNF	From SNF	From Community with Home Health Care	From Community No Home Health Care
Intercept	-1.262	1.310	-0.577	-0.158	0.941	2.002
Medical Comorbidity Index[1]	0.930	0.931	0.487	0.420	0.902	1.149
FIM Motor Score at Admission	0.030	-0.049	-0.048	-0.010		-0.014
FIM Cognitive Score at Admission	0.013		-0.017		-0.022	
Rehabilitation Impairment Category: Replacement of Lower Extremity Joint						
Rehabilitation Impairment Category: Miscellaneous						0.310
Female Indicator						
Age in Years			0.017	0.006		
Married			-0.505			
HHC 170: Hip Fracture / Dislocation					-0.348	
c-index	0.67	0.73	0.72	0.57	0.65	0.69

[1] Details about the Medical Comorbidity Index model are provided in Table 7A.

TABLE 6B: Risk Models for During IRF Stay FIM Outcomes, FY 2011

Model Covariates	FIM Motor Gain	FIM Cognitive Gain
Intercept	6.690	15.730
Medical Comorbidity Index[1]	0.988	-0.744
FIM Motor Score at Admission	-0.201	0.040
FIM Cognitive Score at Admission	0.228	-0.361
Rehabilitation Impairment Category: Replacement of Lower Extremity Joint	1.959	
Rehabilitation Impairment Category: Miscellaneous		
Female Indicator	0.780	0.250
Age in Years	-0.067	-0.022
Married		
HHC 170: Hip Fracture / Dislocation		
Adjusted R-Squared	0.062	0.242

[1] Details of the Medical Comorbidity Index model are provided in Table 7B.

TABLE 7A:Medical Comorbidity Index Models for During IRF Stay and 30-Day Post IRF Discharge Outcomes, FY 2011

	During IRF Stay at 100 Days			30 Day Post IRF Discharge Potentially Avoidable Readmission		
Model Covariates	Community Discharge	Potentially Avoidable Readmission	Discharge to SNF	From SNF	From Community with Home Health Care	From Community No Home Health Care
Intercept	1.422	-3.900	-2.903	-5.122	-3.981	-4.638
HCC 8: Metastatic Cancer and Acute Leukemia	-0.640	0.493	-0.199	-0.082*	0.282	0.595
HCC 18: Diabetes with Chronic Complications	-0.178	0.241	0.043*	0.137*	0.217	0.184
HCC 21: Protein-Calorie Malnutrition	-0.306	0.332	0.180	0.161	0.186	0.181
HCC 84: Cardio-Respiratory Failure and Shock	-0.163	0.296	-0.126	0.083*	0.131	0.115
HCC 85: Congestive Heart Failure	-0.348	0.498	0.113	0.383	0.554	0.541
HCC 96: Specified Heart Arrhythmias	-0.254	0.292	0.189	0.321	0.256	0.193
HCC 100: Ischemic or Unspecified Stroke	-0.054	-0.071	0.246	0.104*	-0.255	-0.253
HCC 103: Hemiplegia/Hemiparesis	-0.266	0.146	0.559	0.532	-0.194	-0.048*
HCC 106: Atherosclerosis of the Extremities with Ulceration or Gangrene	-0.422	0.066*	0.307	0.202*	-0.095*	-0.314
HCC 108: Vascular Disease	-0.196	0.111	0.024*	0.115	0.156	0.030*
HCC 111: Chronic Obstructive Pulmonary Disease	-0.239	0.350	-0.041	0.263	0.533	0.506
HCC 114: Aspiration and Specified Bacterial Pneumonias	-0.273	0.508	0.284	0.548	0.146	0.172
HCC 135: Acute Renal Failure	-0.350	0.373	0.068	0.219	0.368	0.329
HCC 136: Chronic Kidney Disease (Stage 5)	-0.714	0.521	-0.006*	0.356	0.650	0.762
c-index	0.62	0.66	0.58	0.63	0.66	0.65

Note: * denotes estimates that are not statistically significant (i.e., $p > 0.05$).

TABLE 7B:Medical Comorbidity Index Models for During IRF Stay FIM Outcomes, FY 2011

Model Covariates	FIM Motor Gain	FIM Cognitive Gain
Intercept	25.548	4.053
HCC 8: Metastatic Cancer and Acute Leukemia	-3.649	-0.575
HCC 18: Diabetes with Chronic Complications	-0.524	-0.112
HCC 21: Protein-Calorie Malnutrition	-1.313	0.083
HCC 84: Cardio-Respiratory Failure and Shock	0.169	0.312
HCC 85: Congestive Heart Failure	-1.159	-0.067
HCC 96: Specified Heart Arrhythmias	-0.761	0.015*
HCC 100: Ischemic or Unspecified Stroke	-1.920	0.577
HCC 103: Hemiplegia/Hemiparesis	-2.727	0.284
HCC 106: Atherosclerosis of the Extremities with Ulceration or Gangrene	-2.611	-0.401
HCC 108: Vascular Disease	-0.698	-0.079
HCC 111: Chronic Obstructive Pulmonary Disease	-0.331	0.013*
HCC 114: Aspiration and Specified Bacterial Pneumonias	-1.131	0.434
HCC 135: Acute Renal Failure	-0.720	-0.010*
HCC 136: Chronic Kidney Disease (Stage 5)	-3.187	-0.408
Adjusted R-Squared	0.024	0.005

Note: * denotes estimates that are not statistically significant (i.e., $p > 0.05$).

TABLE 8: Average Facility Outcome Measure Rates During IRF Stay and 30 Days Post IRF Discharge

Outcome Measure	Rate		
During IRF Stay[1]	FY 2011	FY 2012	FY 2013
Community Discharge with or without Home Health Care			
Observed	73.9%	74.5%	74.7%
Risk Adjusted	74.0%	75.2%	75.8%
Potentially Avoidable Readmission			
Observed	3.0%	2.9%	2.8%
Risk Adjusted	2.8%	2.6%	2.5%
Discharge to SNF			
Observed	6.4%	6.3%	6.3%
Risk Adjusted	6.9%	6.6%	6.7%
30-Day Post IRF Discharge Potentially Avoidable Readmission[2]			
Observed	5.1%	4.9%	4.9%
Risk Adjusted	5.0%	4.6%	4.6%
Average Functional Change[1]			
FIM Motor Observed	22.9	23.3	23.7
FIM Motor Risk Adjusted	22.2	22.7	23.1
FIM Motor Observed	3.8	4.0	4.3
FIM Motor Risk Adjusted	3.6	3.7	3.8

[1] Includes IRFs with 25 or more IRF stays excluding deaths during the IRF stay (Fiscal Year 2011 N=1,072, Fiscal Year 2012 N=1,057, Fiscal Year 2013 N=1,055).

[2] Includes IRFs with 25 or more IRF stays excluding deaths during the IRF stay, 30 days post IRF discharge stay, and readmissions during the IRF stay (Fiscal Year 2011 N=1,070, Fiscal Year 2012 N=1,047, Fiscal Year 2013 N=1,052).

TABLE 9: IRF Variation in Risk-Adjusted Outcome Measures and Facility Characteristics, FY 2013

All IRFs	N	Mean	Min	10th Pctl	25th Pctl	50th Pctl	75th Pctl	90th Pctl	Max
Community Discharge Rate at 100 Days[1]	1,051	75.8%	54.3%	69.6%	72.6%	75.9%	79.1%	82.0%	94.4%
Readmission Rate for Potentially Avoidable Diagnoses at 100 Days[1]	1,051	2.5%	0.0%	0.7%	1.5%	2.4%	3.3%	4.2%	20.6%
Discharge to SNF[1]	1,051	6.7%	0.0%	2.9%	4.3%	6.3%	8.9%	11.0%	23.1%
Change in Average Motor FIM Score During IRF Stay[1]	1,051	23.1	10.2	18.5	20.6	22.9	25.3	27.9	37.7
Change in Average Cognitive FIM Score During IRF Stay[1]	1,051	3.8	0.5	2.3	3.0	3.7	4.6	5.5	8.0
30-Day Post IRF Discharge Potentially Avoidable Readmission Rate[2]	1,017	4.6%	0.0%	2.2%	3.2%	4.5%	5.7%	6.9%	14.0%
Hospital-Based Indicator[1]	1,051	76.7%							
Free Standing Indicator[1]	1,051	23.3%							
For Profit Ownership[1]	1,012	28.8%							
Not For Profit Ownership[1]	1,012	57.9%							
Government or Other Ownership[1]	1,012	12.8%							
Rural Indicator[1]	1,046	16.4%							
Urban Indicator[1]	1,046	83.6%							
Number of IRF Beds[1]	1,012	34.6	5	12	16	24	42	70	336

[1] Includes IRF Community Discharge stays (with or without Home Health) with 25 or more IRF stays excluding IRF stays ending in death.
[2] Includes IRFs with 25 or more IRF stays excluding all deaths during and 30 days post IRF discharge, and all readmissions during the IRF stay.

Table 10: Association Between Community[1] Discharge Rate and Facility Characteristics[2]

Variable	Coefficient	p-value
INTERCEPT	0.74490	<.0001
CHANGE FROM 2011 TO 2013	0.01814	<.0001
FACILITY ELIGIBLE BOTH 2011/2013	Referent	-
FACILITY ELIGIBLE 2011 ONLY	-0.00907	0.1751
FACILITY ELIGIBLE 2013 ONLY	-0.01245	0.0596
NON-PROFIT OWNERSHIP	Referent	-
FOR PROFIT OWNERSHIP	-0.00213	0.4433
GOVERNMENT OWNERSHIP	-0.00674	0.0499
STAY COUNT GE 100 and LT 700	Referent	-
LOW STAY COUNT (LT 100)	0.00830	0.0037
HIGH STAY COUNT (GE 700)	0.00361	0.3772
ALL OTHER STATES	Referent	-
NC(34)-NORTH CAROLINA	0.02640	0.0010
WI(52)-WISCONSIN	0.02261	0.0036
CA(05)-CALIFORNIA	0.02302	<.0001
AZ(03)-ARIZONA	0.01358	0.1028
GA(11)-GEORGIA	0.01297	0.0644
OK(37)-OKLAHOMA	0.00631	0.4315
TN(44)-TENNESSEE	-0.00169	0.8018
TX(45)-TEXAS	-0.00210	0.6095
VA(49)-VIRGINIA	-0.00527	0.4784
LA(19)-LOUISIANA	-0.00680	0.2291
IN(15)-INDIANA	-0.00826	0.1653
MI(23)-MICHIGAN	-0.01083	0.0792
AR(04)-ARKANSAS	-0.01300	0.0866
OH(36)-OHIO	-0.01601	0.0025
PA(39)-PENNSYLVANIA	-0.01601	0.0007
FL(10)-FLORIDA	-0.01613	0.0058
MO(26)-MISSOURI	-0.02031	0.0043
NY(33)-NEW YORK	-0.02223	<.0001
IL(14)-ILLINOIS	-0.04176	<.0001

Adjusted R^2 = 0.103

[1] Includes all discharges to the community with and without home health care.
[2] All eligible IRFs for FYs 2011 and 2013 (N=2,026).

Table 11: Association Between Readmission Rate for Potentially Avoidable Conditions During IRF Stay and Facility Characteristics[1]

Variable	Coefficient	p-value
INTERCEPT	0.02454	<.0001
CHANGE FROM 2011 TO 2013	-0.00383	<.0001
FACILITY ELIGIBLE BOTH 2011/2013	Referent	-
FACILITY ELIGIBLE 2011 ONLY	-0.00231	0.2797
FACILITY ELIGIBLE 2013 ONLY	-0.00129	0.5419
FREE STANDING FACILITY	0.00617	<.0001
NON-PROFIT OWNERSHIP	Referent	-
FOR PROFIT OWNERSHIP	0.00238	0.0122
GOVERNMENT OWNERSHIP	0.00412	0.0002
STAY COUNT GE 100 and LT 700	Referent	-
LOW STAY COUNT (LT 100)	-0.00233	0.0117
HIGH STAY COUNT (GE 700)	-0.00174	0.2196
ALL OTHER STATES	Referent	-
LA(19)-LOUISIANA	-0.00244	0.1773
OK(37)-OKLAHOMA	-0.00159	0.5368
NC(34)-NORTH CAROLINA	-0.00074	0.7720
WI(52)-WISCONSIN	-0.00039	0.8760
GA(11)-GEORGIA	-0.00028	0.9007
AZ(03)-ARIZONA	0.00021	0.9382
TX(45)-TEXAS	0.00020	0.8805
CA(05)-CALIFORNIA	0.00030	0.8504
VA(49)-VIRGINIA	0.00066	0.7825
OH(36)-OHIO	0.00183	0.2809
IN(15)-INDIANA	0.00284	0.1363
PA(39)-PENNSYLVANIA	0.00435	0.0039
FL(10)-FLORIDA	0.00437	0.0192
MI(23)-MICHIGAN	0.00475	0.0161
AR(04)-ARKANSAS	0.00511	0.0353
MO(26)-MISSOURI	0.00545	0.0164
TN(44)-TENNESSEE	0.00553	0.0103
IL(14)-ILLINOIS	0.00846	<.0001
NY(33)-NEW YORK	0.00996	<.0001

Adjusted R^2 = 0.069

[1] All eligible IRFs for FYs 2011 and 2013 (N=2,026).

Table 12: Association Between Discharge to SNF From IRF and Facility Characteristics[1]

Variable	Coefficient	p-value
INTERCEPT	0.07323	<.0001
CHANGE FROM 2011 TO 2013	-0.00073	0.6100
FACILITY ELIGIBLE BOTH 2011/2013	Referent	-
FACILITY ELIGIBLE 2011 ONLY	0.00917	0.0297
FACILITY ELIGIBLE 2013 ONLY	-0.00169	0.6865
FREE STANDING FACILITY	-0.00960	<.0001
NON-PROFIT OWNERSHIP	Referent	-
FOR PROFIT OWNERSHIP	-0.00532	0.0047
GOVERNMENT OWNERSHIP	-0.00087	0.6895
ALL OTHER STATES	Referent	-
AZ(03)-ARIZONA	-0.02328	<.0001
CA(05)-CALIFORNIA	-0.02280	<.0001
GA(11)-GEORGIA	-0.01943	<.0001
NC(34)-NORTH CAROLINA	-0.01754	0.0006
TN(44)-TENNESSEE	-0.01308	0.0023
WI(52)-WISCONSIN	-0.00940	0.0568
AR(04)-ARKANSAS	-0.00520	0.2818
VA(49)-VIRGINIA	-0.00528	0.2644
PA(39)-PENNSYLVANIA	-0.00484	0.1067
FL(10)-FLORIDA	-0.00389	0.2940
MI(23)-MICHIGAN	-0.00138	0.7259
NY(33)-NEW YORK	-0.00109	0.7520
TX(45)-TEXAS	0.00290	0.2643
LA(19)-LOUISIANA	0.00518	0.1475
MO(26)-MISSOURI	0.00769	0.0887
OK(37)-OKLAHOMA	0.00983	0.0542
IN(15)-INDIANA	0.00987	0.0093
OH(36)-OHIO	0.01401	<.0001
IL(14)-ILLINOIS	0.01611	<.0001

Adjusted R^2 = 0.109

[1] All eligible IRFs for FYs 2011 and 2013 (N=2,026).

Table 13: Association Between Potentially Avoidable Readmission Rate 30 Days Post IRF Discharge and Facility Characteristics[1]

Variable	Coefficient	p-value
INTERCEPT	0.07703	<.0001
CHANGE FROM 2011 TO 2013	-0.00453	<.0001
FACILITY ELIGIBLE BOTH 2011/2013	Referent	-
FACILITY ELIGIBLE 2011 ONLY	-0.00133	0.6244
FACILITY ELIGIBLE 2013 ONLY	0.00107	0.6951
NON-PROFIT OWNERSHIP	Referent	-
FOR PROFIT OWNERSHIP	0.00339	0.0025
GOVERNMENT OWNERSHIP	0.00274	0.0520
DISCHARCED TO SNF	Referent	-
DISCHARGED TO COM WITH HOME HEALTH	-0.01763	0.1978
DISCHARGED TO COM WITHOUT HOME HEALTH	-0.04976	0.0003
ALL OTHER STATES	Referent	-
NC(34)-NORTH CAROLINA	-0.00297	0.3669
GA(11)-GEORGIA	-0.00113	0.6956
OK(37)-OKLAHOMA	0.00056	0.8651
NY(33)-NEW YORK	-0.00079	0.7265
CA(05)-CALIFORNIA	-0.00035	0.8630
WI(52)-WISCONSIN	0.00021	0.9471
AZ(03)-ARIZONA	-0.00036	0.9173
VA(49)-VIRGINIA	0.00106	0.7310
FL(10)-FLORIDA	0.00143	0.5546
PA(39)-PENNSYLVANIA	0.00187	0.3454
OH(36)-OHIO	0.00190	0.3827
MO(26)-MISSOURI	0.00244	0.4024
MI(23)-MICHIGAN	0.00312	0.2201
TX(45)-TEXAS	0.00441	0.0094
IL(14)-ILLINOIS	0.00466	0.0588
IN(15)-INDIANA	0.00554	0.0245
TN(44)-TENNESSEE	0.00669	0.0160
AR(04)-ARKANSAS	0.00951	0.0023
LA(19)-LOUISIANA	0.01016	<.0001

Adjusted R^2 = 0.071

[1] All eligible IRFs for FYs 2011 and 2013 (N=2,023).

Table 14: Association Between FIM Motor Gain During IRF Stay and Facility Characteristics[1]

Variable	Coefficient	p-value
INTERCEPT	21.50713	<.0001
CHANGE FROM 2011 TO 2013	0.81657	<.0001
FACILITY ELIGIBLE BOTH 2011/2013	Referent	-
FACILITY ELIGIBLE 2011 ONLY	-0.52460	0.2516
FACILITY ELIGIBLE 2013 ONLY	-0.62393	0.1674
FREE STANDING FACILITY	2.33081	<.0001
NON-PROFIT OWNERSHIP	Referent	-
FOR PROFIT OWNERSHIP	1.00562	<.0001
GOVERNMENT OWNERSHIP	-0.13608	0.5621
POS RURAL INDICATOR	0.62390	0.0037
STAY COUNT GE 100 and LT 700	Referent	-
LOW STAY COUNT (LT 100)	0.12838	0.5224
HIGH STAY COUNT (GE 700)	0.62793	0.0387
ALL OTHER STATES	Referent	-
TN(44)-TENNESSEE	1.21233	0.0084
AR(04)-ARKANSAS	1.01048	0.0520
VA(49)-VIRGINIA	0.72269	0.1556
PA(39)-PENNSYLVANIA	0.44984	0.1623
MO(26)-MISSOURI	0.33404	0.4908
IN(15)-INDIANA	0.31329	0.4416
AZ(03)-ARIZONA	-0.08506	0.8810
FL(10)-FLORIDA	-0.12141	0.7615
NY(33)-NEW YORK	-0.16003	0.6670
TX(45)-TEXAS	-0.23454	0.4063
OH(36)-OHIO	-0.25822	0.4765
CA(05)-CALIFORNIA	-0.31932	0.3513
WI(52)-WISCONSIN	-0.64939	0.2214
NC(34)-NORTH CAROLINA	-0.78563	0.1512
IL(14)-ILLINOIS	-0.81519	0.0464
OK(37)-OKLAHOMA	-0.93428	0.0893
GA(11)-GEORGIA	-1.00032	0.0369
MI(23)-MICHIGAN	-1.20595	0.0042
LA(19)-LOUISIANA	-2.06201	<.0001

Adjusted R^2 = 0.171

[1] All eligible IRFs for FYs 2011 and 2013 (N=2,026).

Table 15: Association Between FIM Cognitive Gain During IRF Stay Facility Characteristics[1]

Variable	Coefficient	p-value
INTERCEPT	3.43222	<.0001
CHANGE FROM 2011 TO 2013	0.25398	<.0001
FACILITY ELIGIBLE BOTH 2011/2013	Referent	-
FACILITY ELIGIBLE 2011 ONLY	-0.07963	0.6129
FACILITY ELIGIBLE 2013 ONLY	0.01665	0.9154
FREE STANDING FACILITY	0.61960	<.0001
NON-PROFIT OWNERSHIP	Referent	-
FOR PROFIT OWNERSHIP	0.33170	<.0001
GOVERNMENT OWNERSHIP	0.15755	0.0529
ALL OTHER STATES	Referent	-
TN(44)-TENNESSEE	0.21374	0.1823
AZ(03)-ARIZONA	0.17075	0.3873
PA(39)-PENNSYLVANIA	0.11610	0.3002
VA(49)-VIRGINIA	0.04403	0.8031
AR(04)-ARKANSAS	0.03945	0.8267
TX(45)-TEXAS	-0.02357	0.8081
NC(34)-NORTH CAROLINA	-0.05485	0.7732
NY(33)-NEW YORK	-0.07279	0.5718
OH(36)-OHIO	-0.14903	0.2366
IN(15)-INDIANA	-0.15208	0.2829
FL(10)-FLORIDA	-0.16091	0.2447
CA(05)-CALIFORNIA	-0.16316	0.1664
MO(26)-MISSOURI	-0.17170	0.3087
IL(14)-ILLINOIS	-0.17317	0.2207
WI(52)-WISCONSIN	-0.18965	0.3033
MI(23)-MICHIGAN	-0.39610	0.0070
LA(19)-LOUISIANA	-0.63415	<.0001
GA(11)-GEORGIA	-0.70067	<.0001
OK(37)-OKLAHOMA	-0.77359	<.0001

Adjusted R^2 = 0.115

[1] All eligible IRFs for FYs 2011 and 2013 (N=2,026).

Section IV
Appendices

Appendix A: List of Studies focused on hospital readmissions and inpatient rehabilitation facilities

Author(s)	Title of Study	Journal Information	Notes on Methods and Sample	Notes on Results
Haines-Wood J, Gilmore DH, Beringer TR	"Re-admission of elderly patients after in-patient rehabilitation."	Ulster Medical Journal, 1996; 65: 142-144.	All elderly patients (n=97) from a 24-bed rehabilitation unit for a Belfast, Ireland hospital over a 6 month period. Avoidable was deemed as 1) recurrence of disorder leading to initial admission; 2) recognized avoidable condition; 3) readmission for social or psychological condition within control of hospital services. However, falls/fractures and unrelated diagnoses were deemed to be unavoidable.	15% readmission rate at 30 days; 9% were deemed avoidable readmissions.
Intrator O, Berg K	"Benefits of Home Health After Inpatient Rehabilitation for Hip Fracture: Health Service Use by Medicare Beneficiaries, 1987-1992."	Archives of Physical Medicine and Rehabilitation, 1998; 79: 1195-1199.	All hip fracture Medicare beneficiaries in the 1% sample who were 70+ years of age, lived in the community before the hip fracture, who went home after an IRF stay. This study used propensity scores to control for the likelihood of receiving home health.	Of the 129 that had the IRF stay but no home health, 44 or 34.1% had a hospital readmission within one year (12 months) of the hospital discharge. Of the 195 that had home health after the IRF stay, 53 or 27.2% had a

Author(s)	Title of Study	Journal Information	Notes on Methods and Sample	Notes on Results
				readmission. Home health lowered the risk of readmission (AOR=0.66, 95% CI=0.44-1.00). The individuals receiving home health were older, sicker (e.g., higher Charlson, more likely to have diabetes or other fractures, and had a longer rehab stay.
Niehaus DJ, Koen L, Galal U, et al	"Crisis Discharges and Readmission Risk in Acute Psychiatric Male Inpatients."	BMC Psychiatry, 2008; 8: 44-49.	This study of 438 patients took place in South Africa where they had instituted a 'crisis discharge policy' to address severe bed shortages in acute care facilities. This retrospective study focused on males between the ages of 18 and 60 years of age.	Within one year, 37.2% were readmitted to a hospital after controlling for LOS, marital status, and income, though only the LOS had a significant effect (shorter LOS had longer time until readmission).
DeJong G, Tian W, Smout RJ, et al	"Use of Rehabilitation and Other Health Care Services by Patients with Joint	Archives of Physical Medicine and Rehabilitation,	Among the 856 patients, 294 were IRF patients who had knee replacement, and 171 were IRF patients who	Among knee replacement patients in IRFs, 7.1% were

Author(s)	Title of Study	Journal Information	Notes on Methods and Sample	Notes on Results
	Replacement after Discharge from Skilled Nursing and Inpatient Rehabilitation Facilities"	2009; 90: 1297-1305.	had a hip replacement. These patients are included from the JOINTS II study.	readmitted to a hospital for reasons probably or possibly related to knee replacement, 5.8% were readmitted for reasons probably not related to knee replacement. Among hip replacement, these numbers are 9.4% and 6.4%, respectively.
Riggs RV, Roberts PS, Aronow H, Younan T.	"Joint Replacement and Hip Fracture Readmission Rates: Impact of Discharge Destinations."	Physical Medicine and Rehabilitation, 2010; 2: 806-810.	The study took place at an urban academic medical center, and included 606 orthopedic patients discharged from January 2004 to September 2006. The outcome of interest was readmission to an acute care hospital within 180 days of discharge.	The readmission rate was 5.1% for those discharged home, 10.5% among those discharged home with home health, 12.3% among those discharged to a SNF, 4.2% among those discharged to an IRF. No demographic characteristics were predictive of readmission, but cancer, higher comorbidity,

Author(s)	Title of Study	Journal Information	Notes on Methods and Sample	Notes on Results
				longer than average LOS (i.e., 75% or higher), and one or more days of ICU were all significant predictors.
Joynt KE, Orav EJ, Jha AK	"Patient Race, Site of Care, and 30-Day Readmission Rates among Elderly Americans."	JAMA, 2011; 305(7): 675-681.	This retrospective analysis of the MedPAR 100% files from 2006-2008 focused on those with primary discharge diagnoses of CHF, AMI, or pneumonia. Only FFS residents 65 and older were included. Model 1: age only; Model 2: Elixhauser risk-adjustment; Model 3: include discharge destination; Model 4: hospital characteristics; Model 5: % Medicaid and DSH index.	White patients at non-minority-intensive hospitals had the lowest readmission rates, while black patients at minority-serving hospitals had the highest rates.
Schneider JC, Gerrard P, Goldstein R, et al	"Predictors of Transfer from Rehabilitation to Acute Care in Burn Injuries."	Journal of Trauma and Acute Care Surgery, 2012; 73(6): 1596-1601.	This study of 4572 IRF patients from 537 facilities during 2002-2010 is restricted to those with a burn impairment code. Exclusions were those who were less than 18 years of age, those who were discharged against medical advice, those who died during rehabilitation,	The authors created a risk-scoring system based on demographic, medical, and facility data. FIM Motor score was the most predictive factor.

Author(s)	Title of Study	Journal Information	Notes on Methods and Sample	Notes on Results
			and those facilities that are zero-onset. The outcome of interest was readmission within 3 days of hospital discharge.	
Ottenbacher KJ, Graham JE, Ottenbacher AJ, et al.	"Hospital Readmission in Persons with Stroke Following Postacute Inpatient Rehabilitation."	Journal of Gerontology: Medical Sciences, 2012; 67(8): 875-881.	This is a prospective cohort study of 674 persons with stroke across 11 facilities during 2005-2006. Participants were asked at 3 months whether they had been readmitted.	18% were readmitted within 3 months. FIM motor and cognitive scores, along with LOS, CES-D, and Duke Social Support scale were associated with risk of readmission.
Dharmarajan K, Hsieh AF, Lin Z, et al	"Diagnoses and Timing of 30-Day Readmissions After Hospitalization for Heart Failure, AMI, or Pneumonia"	JAMA, 2013; 309(4): 355-363.	Medicare FFS beneficiaries were studied via the Part A files for 2007-2009. Readmission diagnoses were assessed via the 189 CMS condition categories, although only 30 were prevalent.	AMI patients had a 19.9% readmission rate, pneumonia patients had a 18.3% rate, and heart failure patients had a 24.8% rate. Heart failure was the most common reason for readmission among AMI and heart failure patients, and recurrent pneumonia was the most

Author(s)	Title of Study	Journal Information	Notes on Methods and Sample	Notes on Results
				common reason among pneumonia patients.
Faulk CE, Cooper NR, Staneata JA, et al	"Rate of Return to Acute Care Hospital Based on Day and Time of Rehabilitation Admission."	Physical Medicine and Rehabilitation, 2013; 5:757-762.	All 2282 patients admitted to an IRF from Jan 1, 2009 to June 30, 2011 were included. The outcome was a readmission, labeled as an RTACH (return to an acute care hospital).	256 or 10.85% were readmitted. The later in the day, and the lower the FIM score, the more likely the patient would have an RTACH.
Whyte J, Nordenbo AM, Kalmar K, et al.	"Medical Complications during Inpatient Rehabilitation among Patients with Traumatic Disorders of Consciousness."	Archives of Physical Medicine and Rehabilitation, 2013; 94(10): 1877-1883.	184 patients with non-penetrating traumatic brain injury are included in this study of 11 clinical facilities in US, Germany, and Denmark.	14.7% were readmitted during the six week study period.
Galloway RV, Granger CV, Karmarkar AM, et al.	"The Uniform Data System for Medical Rehabilitation Report of Patients with Debility Discharged from Inpatient Rehabilitation Programs in 2000-2010."	American Journal of Physical Medicine and Rehabilitation, 2013; 92(1): 14-27.	Over a quarter million patients with debility (n=260,373) from 830 rehabilitation facilities were included in this study.	12.3% of IRF residents were discharged back to an acute care facility over the course of the study. In 2000, this rate was 12.3%, and in 2010, this rate was 13.1%.
Hammond FM, Horn SD, Smout RJ, et al.	"Acute Rehospitalizations During Inpatient Rehabilitation for Spinal Cord Injury."	Archives of Physical Medicine and Rehabilitation, 2013; 94(4): S98-S105.	1376 individuals with spinal cord injury at six IRFs were included over a 5-year study period. Trained abstractors reviewed	11% were readmitted to a hospital. Surgery (36%), infection (22%), and

Author(s)	Title of Study	Journal Information	Notes on Methods and Sample	Notes on Results
			the patients' medical records to assess whether the readmission was due to surgery or one of the following: infection, respiratory problem, GI, venous thromboembolism, cardiac problem, mental status change, neurologic, anemia, hypotension, pain, or unknown.	non-infectious respiratory problems (14%) were the most common reasons.
Ottenbacher KJ, Karmarkar A, Graham JE, et al.	"Thirty-Day Hospital Readmission Following Discharge from Postacute Rehabilitation in Fee-for-Service Medicare Patients."	JAMA, 2014; 311(6): 604-614.	This retrospective cohort study looked at 736,536 Medicare FFS patients from 2006-2011 in 1365 IRFs. Readmission rates were calculated for the 6 largest diagnostic impairment categories.	Rates vary by year and RIC, with the low being 5.8% for lower extremity joint replacement, and highest being 18.8% for patients with debility.
Hoyer EH, Needham DM, Atanelov L, et al	"Association of Impaired Functional Status at Hospital Discharge and Subsequent Rehospitalization."	Journal of Hospital Medicine, 2014; 9(5): 277-282.	This is a retrospective cohort study of 9405 IRF patients that took place between 7/1/2006 and 12/31/2012. FIM scores were stratified into high, medium, and low based upon tertiles (<60, 60 to 76, 77+).	13% had a readmission within 30 days of discharge from the acute care hospital. FIM score was predictive.

Appendix B: Conditions included in definition of Potentially Avoidable Readmission among IRF patients

Condition	ICD-9 Codes	Notes
CHF (Congestive Heart Failure)	428.xx; 518.4	We omit the hypertensive heart (and renal) disease codes that Walker, et al (2009) include.
Electrolyte Imbalance / dehydration	276.xx	Compared to most other researchers who have restricted this potentially avoidable readmission to one dehydration code (276.5), we have included electrolyte and acid-base balance because they are manageable in the SNF environment.
Respiratory illnesses and bronchitis (e.g., pneumonia, influenza, and pneumonitis due to inhalation of food or vomitus)	466.xx; 480.xx – 487.x; 491.xx; 492.xx; 493.xx; 494.xx; 496.xx; 507.0	We have added several of the COPD codes related to bronchitis because without the secondary diagnoses, if a respiratory infection triggers COPD, we may not capture the infection without these codes. It is generally agreed that bronchitis hospitalizations are potentially avoidable. We have elected to retain the influenza and pneumonitis codes and not restrict just to pneumonia like other authors. Last, we included several of the asthma related conditions for these should be manageable in the SNF.
Sepsis (septicemia)	038.xx; 0031.xx; 0545.xx	We exclude 0223.xx that Walker, et al (2009) include.
Urinary Tract and Kidney Infections (cystitis, urethritis, urethral stricture)	590.xx; 595.0; 595.1; 595.2; 595.4; 595.89; 595.9; 597.0; 598.0x; 599.0	We have excluded the less specific inflammatory prostate diagnosis code from our prior list.
Hypoglycemia and diabetic complications	250.1-250.3; 250.8; 250.9; 250.0; 251.0; 251.1; 251.2; 790.29	We include ketoacidosis, hyperosmolar coma, diabetes with specified complications, and diabetes without specified complications under a single category.

(Continued)

Appendix B: Conditions included in definition of Potentially Avoidable Readmission among IRF patients

Condition	ICD-9 Codes	Notes
Anticoagulant complications	451.xx; 453.xx	We include readmission of anticoagulated residents for thromboembolic stroke that should be prevented with sufficient anticoagulation.
Fractures and Musculoskeletal Problems	800.xx-854.xx or 910.xx-929.xx	Fractures and musculoskeletal injuries likely from a fall.
Adverse Drug Reaction	960.xx-979.xx	Adverse drug or medication reactions.
Delirium	290.3; 290.41; 290.81; 293.0; 293.1; 297.xx; 298.xx or (294.xx, 296.xx, 331.xx and secondary DX from first list above)	We include several delirium codes that represent acute delirium.
Cellulitis / Wound Infection	681.xx; 682.xx; 683.xx; 686.xx	To include IRF residents whose wounds or skin lesions get infected, we include several wound infection/cellulitis codes.
Pressure Ulcers	707.xx	We include these because the facility should be able to manage pressure ulcers without hospitalization among all residents.
Blood Pressure Management	401.0; 401.9; 402.0; 402.1; 402.9; 403.0; 403.1; 403.9; 404.0; 404.1; 404.9; 458.0; 458.1; 458.21; 458.29; 458.8; 458.9	We include both hypertension and hypotension