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# Poststroke Rehabilitation

## Outcomes and Reimbursement of Inpatient Rehabilitation Facilities and Subacute Rehabilitation Programs

Anne Deutsch, PhD, RN, CRRN; Carl V. Granger, MD; Allen W. Heinemann, PhD, ABPP;  
Roger C. Fiedler, PhD; Gerben DeJong, PhD; Robert L. Kane, MD;  
Kenneth J. Ottenbacher, PhD, OTR; John P. Naughton, MD; Maurizio Trevisan, MD, MPH

**Background and Purpose**—To assess whether poststroke rehabilitation outcomes and reimbursement for Medicare beneficiaries differ across inpatient rehabilitation facilities (IRFs) and skilled nursing facility (SNF) subacute rehabilitation programs.

**Methods**—Clinical data were linked with Medicare claims for 58 724 Medicare beneficiaries with a recent stroke who completed treatment in 1996 or 1997 in IRFs and subacute rehabilitation SNFs that subscribed to the Uniform Data System for Medical Rehabilitation. Outcome measures were discharge destination, discharge FIM ratings and Medicare Part A reimbursement during the institutional stay.

**Results**—IRF patients that were more likely to have a community-based discharge, compared with rehabilitation SNF patients, were patients with mild motor disabilities and FIM cognitive ratings of 23 or greater (adjusted odds ratio [AOR]=2.19; 95% CI: 1.52 to 3.14), patients with moderate motor disabilities (AOR=1.98; 95% CI: 1.49 to 2.61), patients with significant motor disabilities (AOR=1.26; 95% CI: 1.01 to 1.57) and patients younger than 82 with severe motor disabilities (AOR=1.43; 95% CI: 1.25 to 1.64). IRF patients with significant and severe motor disabilities achieved greater motor function of 2 or more FIM units compared with rehabilitation SNF patients. Medicare Part A payments for IRFs were higher than rehabilitation SNF payments across all subgroups.

**Conclusions**—For most patients, poststroke rehabilitation in the more costly and intensive IRFs resulted in higher functional outcomes compared with care in a SNF-based rehabilitation program. IRF and SNF outcomes were similar for patients with minimal motor disabilities and patients with mild motor disabilities and significant cognitive disabilities. Cost-effectiveness analyses require considering the costs of the full episode of care. (*Stroke*. 2006;37:1477-1482.)

**Key Words:** cerebrovascular accident ■ outcomes ■ rehabilitation

The delivery of health services for patients with stroke has changed dramatically during the past 20 years in the United States. Medicare's inpatient prospective payment system (PPS), the growth of managed care, and medical and technological advances have led to a decrease in the average acute hospital stay for patients with stroke, from 12.2 days in 1982<sup>1</sup> to 5.3 days in 2002,<sup>2</sup> with a concomitant increase in the use of postacute rehabilitation services.<sup>3</sup> In 2001, approximately half of stroke survivors discharged from acute care hospitals were admitted to institutional postacute care settings, including 18% admitted to inpatient rehabilitation

facilities (IRFs) and 30% admitted to skilled nursing facilities (SNFs).<sup>4</sup>

IRFs provide intensive rehabilitation therapy in a hospital-based setting, and ≈10% of SNFs offer subacute rehabilitation programs,<sup>5</sup> which typically provide less intense rehabilitation therapy services. Experts recommend the selection of a rehabilitation setting should be primarily based on a patient's motor and cognitive function, physical activity endurance and social support,<sup>6,7</sup> yet there is little research examining these recommendations. Kane<sup>8</sup> stratified patients into 2 subgroups based on prestroke functioning (healthy or

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From the Department of Rehabilitation Medicine (C.V.G., J.P.N.), School of Medicine and Biomedical Sciences, University at Buffalo, The State University of New York and Uniform Data System for Medical Rehabilitation, Amherst, NY; the Department of Physical Medicine and Rehabilitation (A.W.H.), Feinberg School of Medicine, Northwestern University and Center for Rehabilitation Outcomes Research, Rehabilitation Institute of Chicago, Chicago, IL; Academic Affairs (R.C.F.), D'Youville College, Buffalo, NY; National Rehabilitation Hospital Research (G.D.), National Rehabilitation Hospital, Department of Rehabilitation Medicine, Georgetown University School of Medicine, Washington, DC; Health Services Research and Policy (R.L.K.), University of Minnesota, Minneapolis, MN; the University of Texas Medical Branch (K.J.O.), Galveston, TX; and the School of Public Health and Health Professions (M.T.), University at Buffalo, The State University of New York, Buffalo, NY.

Correspondence to Anne Deutsch, PhD, RN, CRRN, Center for Rehabilitation Outcomes Research, Rehabilitation Institute of Chicago, Department of Physical Medicine and Rehabilitation, Feinberg School of Medicine, Northwestern University, 345 East Superior St, Chicago, IL 60611-2654. E-mail a-deutsch@northwestern.edu

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sick) and found that in both subgroups IRF patients achieved more functional improvement relative to rehabilitation SNF patients and traditional SNF patients. Kramer<sup>9</sup> also found that IRF patients with stroke had improved functional skills relative to SNF patients across all 5 subgroups stratified by presence of a caregiver, cognitive skills, and participation in recreation. These studies provide some evidence about the effectiveness of IRFs and SNF-based rehabilitation programs for patients with stroke; however, uncertainty regarding the clinical and demographic characteristics of patients who would benefit from rehabilitation treatment in a more costly IRF<sup>3,6</sup> versus rehabilitation SNF remain.

This study compares the outcomes and reimbursement for care provided in IRFs and SNF-based subacute rehabilitation programs for subgroups of patients with stroke in the traditional Medicare program. The research questions were: Within subgroups, (1) do the percentages of patients discharged to the community differ for IRFs versus SNF-based rehabilitation programs? (2) do the short-term functional outcomes of patients treated in IRFs differ from those achieved by patients treated in SNF-based rehabilitation programs? (3) do Medicare payments for patients treated in IRFs differ from Medicare payments for SNF-based rehabilitation care?

## Materials and Methods

After the project was approved by the Institutional Review Board at the University at Buffalo, data from IRFs and rehabilitation SNFs for calendar years 1996 and 1997 were obtained from the Uniform Data System for Medical Rehabilitation (UDSMR), a national rehabilitation outcomes measurement system. The study facilities comprise a self-selected group that voluntarily subscribed to UDSMR in order to benchmark their performance relative to their peers. The SNFs in this study are likely more committed to rehabilitation than nonparticipating SNFs. UDSMR's patient records include sociodemographic, diagnostic, stay and admission and discharge functional assessment data. Functional assessment data were the 13 motor and 5 cognitive items that comprise the FIM instrument. Each item is rated on a 7-level scale with "7" signifying Complete Independence, and "1" indicating Total Assistance.<sup>10</sup> UDSMR patient records were selected if the primary payer was Medicare (nonmanaged care) and the primary impairment was stroke or the etiologic diagnosis was one of the International Classification of Diseases – 9th edition – Clinical Modification (ICD-9-CM) codes for stroke (430, 431, 432.0 to 432.9, 433.00 to 433.91, 434.00 to 434.91, 436, 437.0 to 437.9, 438).

The Centers for Medicare and Medicaid Services (CMS) provided Medicare Provider and Analysis and Review (MedPAR) files for IRFs and SNFs for the years 1996 and 1997. MedPAR files contained stay-level data for Medicare fee-for-service beneficiaries and included demographic, diagnostic, stay, and financial data. MedPAR records were selected if the admission diagnosis or one of the first 2 listed medical diagnoses was one of the stroke ICD-9-CM codes (listed above) or 342.9 (hemiplegia).

The UDSMR and MedPAR data were linked using a staged probabilistic matching algorithm,<sup>11</sup> because no common patient identifier was available in the 2 data sources. Within matched facilities, record pairs from the 2 sources were linked based on the agreement of information reported for 6 variables: admission date, discharge date, age, ZIP code, sex, and race/ethnicity. A median of 76.1% of IRF records and 82.5% of SNF records were linked. Linked records included a primary impairment of stroke or a stroke ICD-9-CM code (UDSMR data) and a stroke or hemiplegia ICD-9-CM code (MedPAR). Details of the linking processes are described elsewhere.<sup>12</sup>

The dependent variables in the 3 sets of analyses were: (1) the patient's discharge destination reported in the UDSMR data, either

community or noncommunity residence, (2) the patient's discharge motor functional status, the sum of the 13 discharge FIM motor ratings, and (3) the Medicare Part A payment to each facility.

The treatment variable was the type of rehabilitation setting, either an IRF or a SNF-based subacute rehabilitation program.

Covariates, which may affect outcomes,<sup>12,13</sup> included in all the regression models were: time from stroke onset to the rehabilitation admission, admission FIM motor rating, admission FIM cognitive rating, age, hemorrhagic versus nonhemorrhagic stroke, presence of left-sided, right-sided, or bilateral paresis, presence of a tiered comorbidity,<sup>14</sup> visual field deficits, living alone, median household income (assigned based on ZIP code), sex, race (white, black or other), rural and geographic region.

A total of 72 753 patient records were linked to include both clinical (UDSMR) and payment (MedPAR) data. Because this study focused on the outcomes of care, atypical and incomplete stays were excluded. A significantly higher percent of SNF than IRF records were excluded because patients: (1) did not reside in the community (3.7% versus 3.0%), (2) were admitted >60 days poststroke (3.3% versus 2.6%), (3) were admitted from another rehabilitation facility (11.0% versus 3.8%), (4) had a rehabilitation length of stay (LOS) <3 days, (3.2% and 2.4%), (5) were discharged to an acute care unit (9.6% versus 5.7%), (6) died during the stay (4.0% versus 0.4%), and (7) had a program interruption (4.5% versus 3.7%). Additional exclusion criteria, which were similar for the 2 settings, were patients with a long rehabilitation LOS (>3 standard deviations above mean of the logarithm of the LOS) and with missing FIM data in records.

After applying the exclusion criteria, 54 914 (81.8%) of the IRF records and 3810 (67.8%) of the SNF records remained.

Descriptive statistics were used to characterize the sample. Regression analyses estimated the effect of the rehabilitation setting on patient outcomes, controlling for covariates. Logistic regression tested whether the community discharge percentages were different for IRFs and SNFs, and multiple linear regression tested whether patients' discharge functional status was different for IRFs and SNFs. For this study, differences of 2 or more FIM motor units were considered to be clinically important.<sup>12</sup>

Significant interactions between the admission FIM ratings (motor and cognitive), age and the rehabilitation setting, but not living

**TABLE 1. Characteristics of Patients With Stroke, 1996 and 1997**

Characteristic	Inpatient Rehabilitation Facility (n=54 914)	Skilled Nursing Facility Rehabilitation (n=3810)
Mean (SD) age, y	76.0 (8.5)	79.0 (8.4)
Male, %	44.8	40.4
Race: nonwhite, %	16.3	10.5
Married, %	48.3	40.6
Lived alone, %	31.5	36.4
Mean (SD) days from onset to rehabilitation admission	9.0 (8.0)	11.7 (10.8)
Comorbidities/complications, %*		
Tier 1 (most severe)	0.5	0.4
Tier 2 (moderately severe)	1.9	1.8
Tier 3 (mild)	9.1	9.0
None of listed comorbidities	88.5	88.8
Mean (SD) admission FIM motor rating	41.8 (14.6)	39.7 (16.7)
Mean (SD) admission FIM cognitive rating**	22.6 (8.4)	22.1 (9.5)

Significance levels determined using *t* tests and  $\chi^2$  tests.  $P < 0.001$  except \* $P = 0.749$ , \*\* $P = 0.079$ .

alone, led to the records being stratified into subgroups using the case-mix group (CMG) classification system.<sup>14</sup> Patients with stroke are assigned into one of 14 CMGs based on the sum of the ratings for 12 FIM motor items (lower scores reflect greater dependence), the sum of the ratings for the 5 cognitive items and age. Some CMGs were combined so that statistical power was 0.80 for detecting a 5% difference in community discharge percentages. Patients assigned to CMG 104 (minimal motor deficits) were separated based on FIM cognitive ratings because cognitive function and setting produced a significant interaction term within that CMG.

Medicare payment data were converted to 1997 US Dollars, and facility-specific modifications (ie, wage, indirect medical education, share of low-income patients, and rural location) were removed.<sup>12</sup> Logarithm-transformed Medicare Part A payments made to IRFs and SNFs were compared across subgroups using *t* tests. Analyses used 2-sided testing and an  $\alpha$  of 0.05.

**Results**

The final sample included 58 724 patient records: 93.5% (n=54 914) were from 631 IRFs, and 6.5% (n=3810) were from 239 rehabilitation SNFs.

Patients with stroke treated in IRFs, when compared with SNF patients (Table 1), were younger, more likely to be male, more likely to be nonwhite and more likely to be married. IRF patients had higher admission FIM motor ratings, indicating fewer motor disabilities. Admission FIM cognitive ratings for the 2 settings were similar.

**Community Discharges**

Before adjusting for covariates, the percentages of community-based discharges from IRFs and SNFs for each subgroup were compared (Table 2). IRF patients were more likely to be discharged to the community across all subgroups; the differ-

ences were statistically significant for all subgroups except patients with minimal disabilities (CMG 101). After adjusting for covariates, odds ratios showed IRF patients who were significantly more likely to have a community-based discharge were patients with mild motor and cognitive disabilities (CMGs 102 and 104 with cognitive scores  $\geq 23$ ; 2.19, 95% CI: 1.52 to 3.14), moderate motor disabilities (CMG 105; 1.98, 95% CI: 1.49 to 2.61), significant motor disabilities (CMGs 106 and 107; 1.26, 95% CI: 1.01 to 1.57), and severe disabilities younger than 82 (CMGs 109, 113 and 114; 1.43, 95% CI: 1.25 to 1.64). The community discharge percentages were similar for patients with minimal motor disabilities, mild motor and significant cognitive disabilities and severe motor disabilities who were 82 years of age or older (CMGs 101, 103, 108, 110 to 112 and patients in CMG 104 with cognitive scores  $< 23$ ).

**Functional Outcomes**

The mean discharge FIM motor ratings for IRF and SNF patients were compared for each subgroup, before adjusting for covariates (Table 2). For patients with minimal to mild motor disabilities (CMGs 101 through 104), mean discharge FIM motor ratings were similar ( $< \pm 2$  FIM units). Among patients with moderate to severe motor disabilities (CMGs 105 through 114), IRF patients achieved FIM motor ratings that were, on average, 2 or more FIM units higher than SNF rehabilitation patients. After adjusting for covariates, IRF patients had FIM motor ratings that were higher by an average of: 2.40 (95% CI: 1.56 to 3.24) for patients with significant motor disabilities (CMGs 106 and 107) 2.39 (95% CI: 1.45 to 3.32) for patients 82 years of age and older with

**TABLE 2. Percent of Patients Discharged to the Community, Adjusted Odds Ratio of Community Discharge, Unadjusted and Adjusted Mean Discharge FIM Motor Rating, 1996 and 1997**

Case-Mix/Cognition Group	Case-Mix/Cognition Group Assignment Criteria			No. of Patients		Percent Discharged to the Community		Adjusted Odds Ratio for Community Discharge (IRF=1) (95% CI)	Mean (SD) Discharge FIM-13 Motor Rating		Adjusted Mean Difference (IRF minus SNF) in Discharge FIM-13 Motor Rating (95% CI)
	FIM-12 Motor Rating	FIM Cognitive Rating	Age	IRF	SNF	IRF	SNF		IRF	SNF	
Minimal motor disabilities (101)	69 to 84	23 to 35	All	489	70	98.8	98.6	4.13 (0.20 to 86.03) <i>P</i> =0.361	86.4 (3.7)	85.0 (4.5)	1.03 (0.07 to 1.98) <i>P</i> =0.035
Mild motor and mild to no cognitive disabilities (102 and 104 with admit cognition rating $\geq 23$ )	53 to 68	23 to 35	All	7129	529	96.7	91.7	2.19 (1.52 to 3.14) <i>P</i> <0.001	79.2 (6.6)	78.3 (7.5)	1.04 (0.46 to 1.62) <i>P</i> <0.001
Mild to minimal motor and significant cognitive disabilities (103 and 104 with admit cognition rating $< 23$ )	53 to 84	5 to 22	All	2184	171	90.6	88.3	0.96 (0.57 to 1.62) <i>P</i> =0.878	77.5 (8.5)	77.5 (8.4)	-0.36 (-1.58 to 0.86) <i>P</i> =0.560
Moderate motor disabilities (105)	47 to 52	All	All	8474	513	92.3	84.2	1.98 (1.49 to 2.61) <i>P</i> <0.001	73.1 (8.1)	71.1 (9.1)	1.93 (1.19 to 2.66) <i>P</i> <0.001
Significant motor disabilities (106 and 107)	39 to 46	All	All	11 817	627	85.8	79.3	1.26 (1.01 to 1.57) <i>P</i> =0.038	67.1 (9.8)	64.9 (11.0)	2.40 (1.56 to 3.24) <i>P</i> <0.001
Severe motor disabilities among older patients (108, 110, 111, 112)	12 to 38	All	$\geq 82$	6997	775	54.6	49.4	1.00 (0.84 to 1.18) <i>P</i> =0.949	46.1 (16.4)	40.1 (18.6)	2.39 (1.45 to 3.32) <i>P</i> <0.001
Severe motor disabilities among younger patients (109, 113 and 114)	12 to 38	All	$\leq 81$	17 824	1125	66.4	52.0	1.43 (1.25 to 1.64) <i>P</i> <0.001	49.8 (16.7)	41.8 (18.1)	4.24 (3.45 to 5.03) <i>P</i> <0.001

FIM-13 motor rating refers to the sum of all 13 of the motor item ratings, and FIM-12 motor rating refers to the sum of 12 of the ratings, transfer to tub/shower is excluded.

Model fit: Receiver operating curve values for the logistic regression models were 0.965, 0.742, 0.699, 0.749, 0.724, 0.727 and 0.737. The adjusted *r*<sup>2</sup> values for the multiple linear regression models were 0.173, 0.131, 0.254, 0.099, 0.138, 0.503, 0.438.

severe motor disabilities (CMGs 108 and 110 to 112), and 4.24 (95% CI: 3.45 to 5.03) for patients younger than 82 with severe motor disabilities (CMGs 109, 113 and 114).

For most patients, discharge cognitive FIM ratings were similar ( $\pm 1$  U). Among older patients with severe disabilities, those treated in IRFs had FIM cognitive ratings that were higher than SNF patients (adjusted mean difference=1.36, 95% CI: 1.08 to 1.64).

**Medicare Part A Payments**

The unadjusted median Medicare Part A payment per patient was \$12 320 (1997 US Dollars) for IRFs, almost double the \$6215 payment for SNF-based rehabilitation programs. The adjusted Medicare Part A payments for IRFs remained significantly higher across all subgroups (Figure 1) with differences between the median IRF and SNF payments becoming more disparate as CMG severity increased; \$2106 for patients in CMG 101 and \$8733 for patients in CMGs 109, 113 and 114. There were no Medicare payments for  $\approx 10\%$  of patients across all subgroups in both settings attributable to the Medicare Secondary Payer provisions.

Although IRF payments were higher than SNF payments, the median IRF LOS was significantly shorter than the median SNF stay (Figure 2) across most subgroups.

**Discussion**

This study examined the outcomes and reimbursement for Medicare fee-for-service beneficiaries with stroke who completed typical stays in an IRF or SNF-based subacute rehabilitation program. IRFs provide intensive rehabilitation treat-

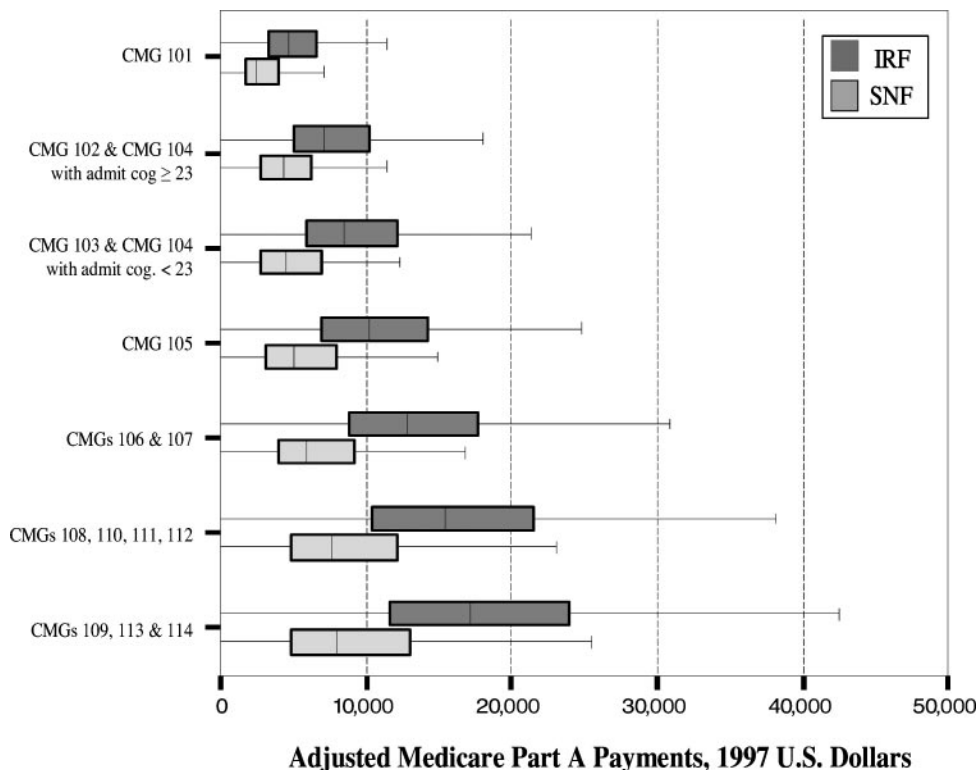
ments to patients during a short stay, whereas the subacute rehabilitation programs provided varying levels of treatments typically over a longer period of time.

Patients with stroke admitted to IRFs were significantly more likely to be discharged to the community compared with patients treated in SNFs for 4 of the 7 subgroups, after controlling for covariates. This included patients with mild motor disabilities and mild to no cognitive disabilities, patients with moderate and significant motor disabilities and older patients with severe disabilities. Discharge motor function improved by  $\geq 2$  FIM motor units for patients with significant and severe disabilities (CMGs 106 through 114).

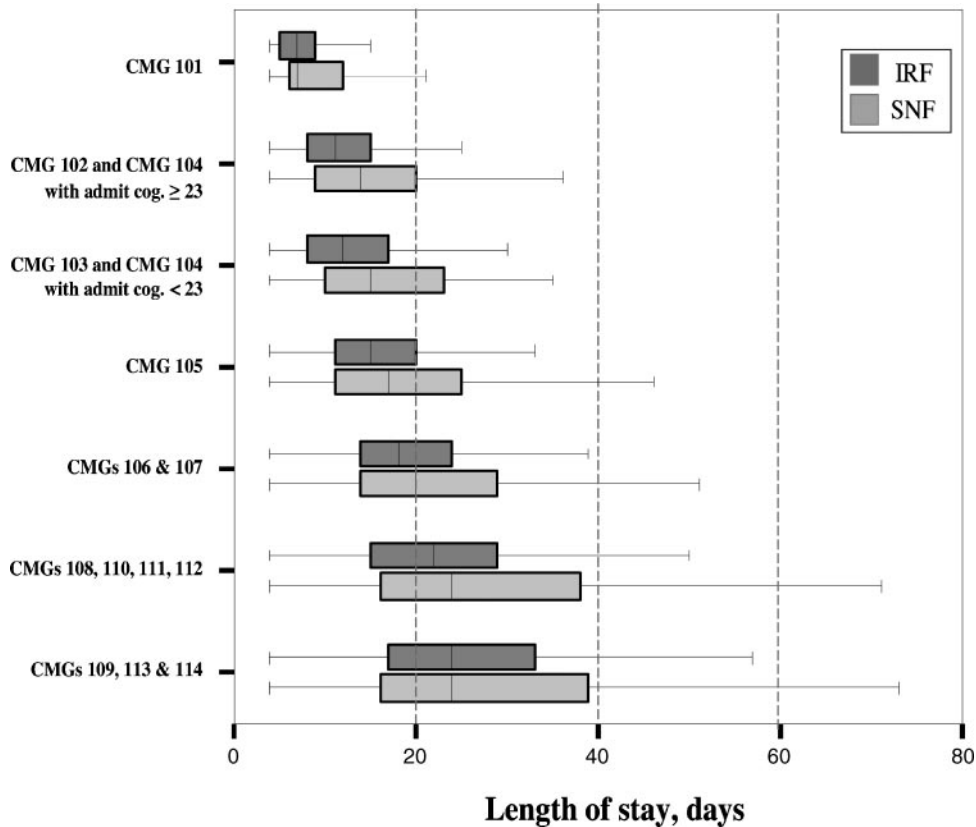
Results support expert recommendations that motor and cognitive disabilities should be considered when selecting a setting for poststroke rehabilitation. Patients treated in IRFs had better outcomes, either a higher likelihood of a community discharge or a higher level of motor function, for 5 of the 7 subgroups. These subgroups included patients with mild motor disabilities and mild to no cognitive disabilities, and patients with moderate, significant and severe motor disabilities.

The intensive IRF services did not result in better outcomes for patients with minimal motor disabilities; almost all these patients returned to the community, regardless of the rehabilitation setting. Patients with mild motor disabilities and cognitive limitations may not have benefited from the intensive IRF services because rehabilitation involves learning, which would have been affected by memory and problem solving disabilities.

Improved motor function was not consistently associated with a greater likelihood of community discharge; other



**Figure 1.** Adjusted Medicare Part A payments for patients with stroke. Box plots show lower and upper quartiles (left and right ends of the rectangle), median (perpendicular line inside the rectangle) and 10th and 90th percentiles (end of the lines extending from the rectangle).



**Figure 2.** Rehabilitation LOS for IRFs and rehabilitation SNFs for patients with stroke. Box plots show lower and upper quartiles (left and right ends of the rectangle), median (perpendicular line inside the rectangle) and 10th and 90th percentiles (end of the lines extending from the rectangle).

factors, like informal support and home accessibility play major roles in the ability to go home. This study's large sample permitted comparisons of more subgroups than previous studies,<sup>8,9</sup> and found most patients benefit from IRFs.

Limitations of this observational study must be considered when interpreting results. First, the study included  $\approx 60\%$  of the IRFs in the US,<sup>15</sup> but only about 11% of SNFs that provided subacute rehabilitation services.<sup>5</sup> The characteristics of IRF and SNF patients were similar to those reported by Kane and Kramer.<sup>8,9</sup> However, SNFs ordinarily do not collect FIM data and to do so beyond other reporting requirements suggests a high level of specialization to rehabilitation. The FIM instrument is more indigenous to the IRF industry and its use in IRFs is widespread—facilitated, in part, by rehabilitation accreditation requirements that do not apply to SNFs unless they voluntarily submit to the same accreditation process. If SNFs included in this study represent the “best of breed,” then the performance differentials between IRFs and SNFs may be even greater in favor of IRFs than study findings indicate.

Second, data were collected before the implementation of Medicare PPSs in SNFs and IRFs. Clinical practices likely changed with new PPS-related incentives, with unknown changes in patient outcomes. Under PPS, SNF patients may be receiving less rehabilitation therapy,<sup>16</sup> and IRF patients may have shorter stays.<sup>17</sup> The current study results may be used as a reference for patient outcomes before the implementation of major Medicare postacute care policy changes.

This study used administrative data, and thus included only Medicare fee-for-service beneficiaries and focused on only 1 phase (ie, the inpatient rehabilitation services component) of patients' recovery after a stroke. Although many covariates were included in analyses, data for other factors (eg, social support, nutritional status) were not available.

Only Medicare Part A payments were included in this study; Medicare Part B payments were not considered. Part B physician payments, which would be expected to be higher for IRFs than for SNFs, and payments for ancillary services billed to Medicare Part B for care provided in SNFs, were not available. Lui,<sup>18</sup> in analyzing 1990 Medicare claims, found that the mean charges to Medicare Part B during SNF stays was  $\approx \$1460$ . The cost information addresses only the immediate postacute period; the full episode of care was not examined.

As researchers examine the specific aspects of a rehabilitation program (eg, nature and intensity of treatments) that lead to optimal patient outcomes,<sup>19</sup> policymakers and health insurance executives are faced with setting policies that may influence access to rehabilitation services. Additional observational studies using more recent data would determine whether recent policy changes have affected patient outcomes.

### Summary

Study results indicate that for most Medicare fee-for-service beneficiaries needing institutional poststroke rehabilitation, treatment in the more costly IRF results in better outcomes

compared with treatment in a SNF-based rehabilitation program.

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Legal Statement: FIM is a trademark of Uniform Data System for Medical Rehabilitation, a division of UB Foundation Activities, Inc.

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