

ORIGINAL ARTICLE

# Comparison of Discharge Functional Status After Rehabilitation in Skilled Nursing, Home Health, and Medical Rehabilitation Settings for Patients After Hip Fracture Repair



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## Abstract

**Objective:** To examine differences in rehabilitation outcomes across 3 post-acute care (PAC) rehabilitation settings for patients after hip fracture repair.

**Design:** Prospective, observational cohort study.

**Setting:** Six skilled nursing facilities (SNFs), 4 inpatient rehabilitation facilities (IRFs), and 8 home health agencies (HHAs) in 10 states.

**Participants:** Patients (N=181) receiving PAC rehabilitation following hip fracture with internal fixation (n=116) or total hip replacement (n=64), or no surgical intervention (n=1).

**Interventions:** Not applicable.

**Main Outcome Measure:** Self-care and mobility status at PAC discharge measured by the Inpatient Rehabilitation Facility Patient Assessment Instrument.

**Results:** IRF and HHA patients had lower self-care function at discharge relative to SNF patients controlling for patient characteristics, severity, comorbidities, and services. Adding length of stay (LOS) resulted in nonsignificant differences between IRFs and SNFs. In contrast, there was no setting-specific advantage in discharge mobility for patients with or without the addition of LOS. The average LOS of HHA patients was 2 weeks longer than that of SNF patients, whose average LOS was 9 days longer than that of IRF patients (average, 15d). IRF and SNF patients received about the same total minutes of therapy over their PAC stays (~2100min on average), whereas HHA patients received only approximately 25% as many minutes.

**Conclusions:** Setting-specific effects varied depending on whether self-care or mobility was the outcome of focus. It remains unclear to what extent rehabilitation intensity or natural recovery effects changes in functional status for patients with hip fracture. This study points to important directions for PAC setting comparative effectiveness studies in the future, including uniform measurement, limited consensus on factors affecting recovery, accounting for selection bias, and using end-point data collection that is at the same follow-up time periods for all settings.

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Hip fracture is a common and serious event among older adults. There were more than 264,000 hospital discharges for hip fractures among adults 65 years and older in 2007<sup>1</sup>; 13.5% died within 6 months and 12.8% needed total assistance.<sup>2</sup> Although hip fracture rates and subsequent mortality are declining in the United States,<sup>3,4</sup> levels of disability remain high.<sup>5</sup> Patients with hip fracture are high users of post-acute care (PAC) services. In 2008, 95.4% of those receiving hip or femur procedures (exclusive of

joint replacement procedures) received PAC services.<sup>6</sup> On average, patients made 3.5 care transitions among PAC providers after acute hospital discharge.<sup>7</sup> Yet evidence supporting which PAC rehabilitation services maximize functional outcomes for which patients following hip fracture repair remains limited.

Where patients with hip fracture receive rehabilitation services depends on multiple factors including the availability of providers, hospital relations, bed availability, physician referral patterns, patient preferences, and availability of family support.<sup>8</sup> Most patients with hip fracture have access to skilled nursing facility (SNF) and home health agency (HHA) services, and many live in areas with access to inpatient rehabilitation facilities (IRFs).<sup>9</sup> All PAC settings provide rehabilitation services but with varying therapy intensity and degrees of medical support.

There is limited evidence regarding the comparative effectiveness of PAC settings for these patients. Studies completed before the implementation of the Prospective Payment System found no advantage for patients with hip fracture admitted to IRFs versus SNFs in function at discharge<sup>10</sup> or the number of daily activities recovered at 6 months<sup>11</sup> but did find an advantage for IRF and HHA patients compared with SNF patients for function at 6 weeks postdischarge.<sup>12</sup>

Studies are also equivocal after the implementation of PAC Prospective Payment System. Munin et al<sup>13-15</sup> reported an advantage in recovery of function for patients admitted to IRFs versus SNFs. However, 2 of these studies were small and conducted at a single provider. A study using Medicare data<sup>8</sup> found an advantage for SNF patients compared with IRF patients for mortality and return to the community but did not examine functional status. An analysis of patients with a joint replacement following hip fracture<sup>16</sup> compared function over the entire PAC episode for patients who initiated care in an IRF or SNF; investigators found a disadvantage for all SNF-initiated and IRF+SNF patterns of services versus IRF+HHA. However, this study did not examine episodes that started with HHA.

This study builds on previous research by examining changes in self-care and mobility following rehabilitation across 3 PAC settings and includes geographically diverse providers. The goal was to examine differences in outcomes across 3 PAC settings for patients with hip fracture. Study questions were as follows:

1. How do patients with hip fracture vary on key demographic and clinical factors at admission across PAC settings?
2. How are self-care and mobility function at discharge related to the type of PAC provider, after controlling for patient demographic, function, and clinical characteristics at baseline, and time from surgery?

## Methods

### Study design

We recruited 4 IRFs, 6 SNFs, and 8 HHAs for this prospective cohort study. We recruited patients from December 2005 through

#### *List of abbreviations:*

<b>HHA</b>	home health agency
<b>IRF</b>	inpatient rehabilitation facility
<b>LOS</b>	length of stay
<b>OT</b>	occupational therapy
<b>PAC</b>	post-acute care
<b>SNF</b>	skilled nursing facility

March 2010. The institutional review boards of Northwestern University and each of the providers approved the study. A study nurse obtained consent from patients; next of kin or a legally authorized representative provided consent for patients with cognitive impairments. We described the facilities, patient selection, and data collection procedures in an earlier report.<sup>17</sup>

### Facilities

We recruited facilities from Listserv postings and referrals from colleagues. Facilities were mostly in Eastern and Midwestern regions. We sought facilities that had sufficient volume to complete data collection in a timely manner.

### Patient selection

Eligibility criteria were as follows: 1) admission to PAC following surgery for a hip fracture including both open-reduction internal fixation or total joint replacement, 2) age 65 years or older, 3) Medicare fee-for-service as the primary insurance, 4) admission directly from an acute care hospital, and 5) receipt of rehabilitation services including at least physical therapy or occupational therapy (OT). Two additional criteria—6) receipt of PAC services since acute care hospital discharge and 7) Medicare managed care as a primary payer—were also added to facilitate patient recruitment. Our revised criteria included HHA patients who received care at an IRF or SNF after acute care discharge. We recruited 191 patients. Two patients were excluded because of incorrect procedures, and 8 subjects were readmitted to acute care for more than 48 hours (SNF:5; HHA:3). A final sample of 181 patients is reported (SNF:69; IRF:78; HHA:34).

### Patient characteristics

We extracted information on demographics (sex, race, and age), social support (marital status, living location, and living situation), time from surgery, type of surgical repair, number of comorbidities, and bowel and bladder continence. We documented specific comorbidities that may affect patients' ability to engage in and benefit from rehabilitation, specifically, obesity, visual impairment, anemia,<sup>18</sup> diabetes,<sup>19</sup> pressure ulcers,<sup>20</sup> mood disorders,<sup>21</sup> and cognitive skills (short- and long-term memory, daily decision making) using the Minimum Data Set 2.0 items. We recoded memory items dichotomously, indicating the presence or absence of memory problems. We also dichotomized decision making and bowel and bladder continence as independent or not. Nurses extracted up to 10 comorbidities from the medical record.

### Therapy measures

Nurses documented the PAC length of stay (LOS), the number of minutes of each therapy documented in the medical record, and discharge destination. We calculated days from surgery as the number of days from acute hospital admission to PAC admission. We collected data on the receipt of OT, physical therapy, speech language pathology, psychology, and other disciplines. *Number of therapy days* is the number of days a patient received therapy from that discipline. *Total therapy minutes* is the sum of therapy minutes received from all disciplines. *Discipline intensity* is defined as discipline-specific therapy minutes divided by the number of days on which that therapy occurred. We calculated an

indicator of the intensity of therapy across all disciplines for the entire stay, *overall therapy intensity*, as total therapy minutes divided by the LOS.

### Functional status

Functional status was collected by nurses to avoid rater severity differences between nurses and therapists.<sup>22</sup> Nurses recorded the most dependent functional performance in the first 48 hours and the last 48 hours of each PAC stay using the Inpatient Rehabilitation Facility Patient Assessment Instrument/FIM instrument. The Inpatient Rehabilitation Facility Patient Assessment Instrument includes 18 FIM items, rated on a 7-point rating scale, which describe the level of assistance in self-care, sphincter control, mobility, communication, and social cognition. We used Rasch analysis<sup>23,24</sup> to obtain separate self-care and mobility measures<sup>17,25</sup> using Winsteps software v. 3.6.9.<sup>a</sup> Rasch measures were transformed to match the raw score range to enhance interpretability; self-care Rasch measures range from 6 to 42, and the mobility Rasch measures range from 7 to 49.

### Statistical analysis

We used Stata version 11.0<sup>b</sup> to compare patient characteristics across PAC settings; we examined differences in proportions of categorical variables with chi-square tests and continuous variables with analysis of variance. We used hierarchical linear regression<sup>26</sup> to examine the effect of setting on functional outcomes while controlling for demographic characteristics, function at admission, condition severity, and service utilization. We computed separate models for self-care and mobility. Our primary aim was to test for statistically significant differences in the post-acute rehabilitation setting coefficients. We include a number of demographic and health factors to control for selection differences in patients across settings that might have an impact on functional outcomes. However, because of the large number of variables in the models, the significance of the coefficients may be overstated. We therefore retested statistically significant PAC setting coefficients for significance using Bonferroni adjustments. Because LOS, total therapy minutes, and therapy intensity are factors that distinguish the PAC settings, controlling for these variables in our models could conceal some of the setting-specific differences we are aiming to detect. However, we report the additional effect of LOS (step 6) on the final model (step 5) for both the self-care and mobility regression models. We examined but do not report the additional effect of total number of therapy minutes on the final model, because it did not have a significant effect on the PAC setting coefficients.

We observed multicollinearity when self-care and mobility at admission were included in the same model. Consequently, we excluded admission mobility in the self-care models and admission self-care in the mobility models. We also examined the limitation of conducting this type of model, that is, including baseline self-care in models of self-care at discharge because of concerns with regression to the mean.<sup>27</sup> We found no difference in results between this or residualized gain score approaches, and so present the results of the more parsimonious hierarchical regression.

### Results

Table 1 presents the patient characteristics by PAC provider; 64% had surgery with internal fixation and 36% had a total hip

replacement. Most patients were white, female, and lived at home before admission to the acute care hospital. Across settings, patients were similar in demographic and health conditions. Key significant differences by setting at admission included the following: SNF patients were older on average and more likely to have pressure ulcers and cognitive limitations. IRF patients had the most comorbid conditions, particularly anemia. HHA patients were younger, had the fewest comorbid conditions, had few cognitive problems, and had higher levels of self-care and mobility function.

Table 2 presents patients' service utilization, LOS, therapy minutes, and discharge location by provider type. Time from surgery until PAC admission was highest for HHA patients, but this is due to our decision to relax inclusion criteria for this setting; half of the HHA patients had received PAC before the use of HHA care. For patients admitted directly to HHA care, the average time from surgery was 6.5 days and for those with prior PAC use, the average time from surgery was 17.2 days. IRF patients had a significantly shorter LOS ( $15 \pm 5$ d) than did both SNF ( $28 \pm 14$ d) and HHA ( $32 \pm 19$ d) patients. SNF and IRF patients received significantly more total therapy minutes than did HHA patients. Consequently, IRF patients had the greatest therapy intensity ( $139 \pm 23$ min/d) compared with SNF patients ( $79 \pm 23$ min/d) and HHA patients ( $17 \pm 7$ min/d). All patients received physical therapy; 9 SNF (13%) and 15 IRF (19%) patients received speech-language therapy. All IRF and SNF patients received OT, but only 15 (44%) HHA patients did. SNF and IRF patients received therapy services on most days of the stay. HHA patients received therapy on less than a third of the days.

For both the SNF and IRF settings, 73% of the patients were discharged home. Of the 50 SNF patients discharged home, 45 received additional PAC services while 55 of 57 IRF patients discharged home received additional PAC services including HHA and outpatient services. For HHAs, 11 (32%) patients went on to use outpatient services and almost all of these had received PAC services before the HHA stay. Of the SNF patients, 11 (16%) were discharged to a nursing facility; no IRF or HHA patient was discharged to a nursing facility.

Table 3 presents the unadjusted mean mobility and self-care measures at discharge by setting and the unadjusted functional change from admission to discharge. There were significant differences among settings for self-care function at admission ( $F_{2,178} = 21.8$ ;  $P < .001$ ) and discharge ( $F_{2,178} = 5.4$ ;  $P < .005$ ) and for mobility function at admission ( $F_{2,178} = 27.5$ ;  $P < .001$ ) and discharge ( $F_{2,178} = 13.6$ ;  $P < .001$ ). In each of these analyses, HHA patients were significantly more independent than were SNF and IRF patients (Tukey's honestly significant difference).

For the hierarchical regression self-care model (table 4), setting alone, without adjustment for covariates, explains 6% of the variance, with patients in HHA settings having significantly better self-care at discharge than did those in the SNF setting. Adding demographic characteristics accounts for little additional variance. In the final model, short-term memory problems and diabetes are associated with worse self-care function at discharge. In the final model (step 5), both the IRF and HHA setting indicators are significant and negative relative to SNF, indicating lower self-care function at discharge. After controlling for LOS (step 6), the IRF setting indicator is nonsignificant relative to the SNF setting while the HHA indicator remains significant and negative.

**Table 1** Demographic characteristics, health conditions, and functional status at admission

Type of PAC Facility	SNF (n=69)	IRF (n=78)	HHA (n=34)
<b>Patient demographics</b>			
Sex			
Women	51 (73.9)	47 (60.3)	20 (58.8)
Men	18 (26.1)	31 (39.7)	14 (41.2)
Race			
White	68 (98.6)	77 (98.7)	34 (100.0)
Other	1 (1.5)	1 (1.3)	ND
Marital status			
Single	1 (1.5)	5 (6.4)	ND
Married/partnered	24 (34.8)	33 (42.3)	19 (55.9)
Widowed	38 (55.1)	32 (41.0)	14 (41.2)
Separated/divorced	5 (7.3)	6 (7.7)	1 (2.9)
Missing	1 (1.5)	2 (2.6)	ND
Living location before the episode			
Home	53 (76.8)	70 (89.7)	31 (91.2)
Board & care (assisted living)	9 (13.0)	6 (7.7)	2 (5.9)
Nursing home resident	3 (4.4)	ND	ND
Other	3 (4.4)	1 (1.3)	1 (2.9)
Missing	1 (1.5)	1 (1.3)	ND
Living situation			
Lives alone	35 (50.7)	32 (41.0)	11 (32.4)
Lives with others	34 (49.3)	46 (59.0)	23 (67.7)
Age (y)*	83.4±7.6	80.7±7.0	79.4±7.2
<b>Health conditions at admission</b>			
Type of surgery			
Hip fracture with internal fixation	41 (59.2)	50 (64.1)	25 (73.5)
Hip fracture with total joint replacement	28 (40.6)	28 (35.9)	8 (23.5)
No surgical intervention	ND	ND	1 (3.5)
No. of comorbid conditions*	6.9±2.4	8.6±2.2	4.0±2.0
Mood disorder	13 (18.8)	10 (12.8)	3 (8.8)
Diabetes mellitus	13 (18.8)	17 (21.8)	8 (23.5)
Pressure ulcer*	10 (14.5)	5 (6.4)	ND
Anemia*	20 (28.9)	40 (51.3)	2 (5.9)
Impaired vision, MDS 2.0	13 (18.8)	21 (26.9)	4 (11.8)
Cognition status,† MDS 2.0			
Problems with short-term memory*	25 (36.2)	10 (12.8)	6 (17.7)
Problems with long-term memory	8 (11.6)	3 (3.9)	5 (14.7)
Problems with daily decision making*	41 (59.4)	22 (28.2)	6 (17.7)
Bladder continence, MDS 2.0			
Incontinent	20 (29.0)	17 (21.8)	8 (23.5)
Bowel continence, MDS 2.0			
Incontinent	12 (17.4)	11 (14.1)	4 (11.8)
<b>Functional status at admission</b>			
Self-care, IRF-PAI*†	21.6±4.4	22.6±2.2	27.1±6.0
Mobility, IRF-PAI*†	15.2±2.8	15.4±3.1	20.2±5.1

NOTE. Values are expressed as n (%) or mean ± SD. Chi-square tests or analyses of variance are used for categorical and continuous variables, respectively.

Abbreviations: IRF-PAI, Inpatient Rehabilitation Facility Patient Assessment Instrument; MDS, Minimum Data Set; ND, no data.

\* Significant values ( $P < .05$ ).

† Self-care and mobility data are from the IRF-PAI: Self-care (6 items: eat, groom, bath, toilet, upper body, lower body dressing), mobility (7 items: bed transfer, toilet transfer, stairs, tub transfer, shower transfer, walking, wheeling). Rasch analysis was used to convert raw self-care and mobility scores to interval-level measures. Rasch measures were set to match the raw score range for each scale; therefore, self-care measures range from 6 to 42 and mobility measures from 7 to 49, with higher scores indicating more independent function. Cognitive function and bladder/bowel continence data are from the MDS 2.0.

For mobility at discharge (table 5), setting alone explains 14% of the variance. In the final model (step 5), PAC setting indicators are not significant. In step 6, after the addition of

LOS, the model coefficients remained essentially unchanged. PAC setting coefficients remained significant after Bonferroni adjustments for multiple tests.

**Table 2** Service utilization, therapy minutes, therapy intensity, and discharge location

Type of PAC Facility	SNF (n=69)	IRF (n=78)	HHA (n=34)			
<b>Service utilization</b>						
Prior PAC use (%)	ND	ND	19 (55.9)			
Time from onset (d)	6.3 (5.3)	6.4 (4.5)	13.2 (9.3)			
LOS (d)	27.7 (13.8)	15.1 (5.4)	31.7 (18.7)			
<b>Number of therapy days</b>						
		n	n	n		
OT	19.4 (9.7)	69	11.8 (4.8)	78	5.2 (3.9)	15
PT	21.1 (10.3)	69	12.3 (4.6)	78	9.3 (6.2)	34
SLP	9.4 (6.2)	9	8.8 (6.1)	15	ND	0
Resp.	5.5 (4.5)	2	11.9 (5.0)	14	ND	0
Psych.	1.0 (-)	1	1.3 (1.0)	31	ND	0
Other	1.7 (1.2)	3	1.0 (0.0)	3	ND	0
<b>Therapy minutes</b>						
		n		n		n
OT	914.3 (480.7)	69	888.0 (343.4)	78	268.6 (215.1)	15
PT	1,084.5 (555.0)	69	1,006.2 (374.8)	78	448.4 (318.7)	34
SLP	883.9 (512.3)	9	496.0 (383.4)	15	ND	0
Resp.	322.5 (413.7)	2	399.6 (272.8)	14	ND	0
Psych.	60.0 (-)	1	73.6 (33.8)	31	ND	0
Other	30.0 (26.0)	3	25.0 (8.7)	3	ND	0
Total	2,125.5 (1246.1)	69	2,091.4 (824.0)	78	566.9 (469.9)	34
<b>Discipline intensity (minutes per therapy day)</b>						
OT	47.8 (14.2)	69	77.1 (12.7)	78	50.2 (8.5)	15
PT	54.7 (32.2)	69	83.2 (17.1)	78	47.5 (8.2)	34
SLP	87.9 (148.6)	9	53.3 (15.0)	15	ND	0
Resp.	41.7 (37.7)	2	31.1 (13.9)	14	ND	0
Psych.	60.0 (-)	1	30.5 (8.2)	31	ND	0
Other	16.7 (2.9)	3	25.0 (8.7)	3	ND	0
<b>Overall therapy intensity (total therapy min/LOS)</b>						
Overall	79.0 (22.8)	69	139.0 (22.6)	78	16.7 (6.9)	34
<b>Discharge location</b>						
Home without therapy	5 (7.3)		2 (2.6)		22 (64.7)	
Home with HHA	40 (58.0)		47 (60.3)		1 (2.9)	
Home with outpatient	5 (7.3)		8 (10.3)		11 (32.4)	
Board & Care/assisted living	3 (4.4)		1 (1.3)		ND	
Board & Care/transitional care	2 (2.9)		1 (1.3)		ND	
Nursing home	11 (15.9)		- (-)		ND	
SNF/subacute unit	3 (4.4)		17 (21.8)		ND	
Acute unit	0 (0.0)		1 (1.3)		ND	
Other	0 (0.0)		1 (1.3)		ND	

NOTE. Values are expressed as n (%).

Abbreviations: ND, no data; Psych., psychology services; PT, physical therapy; Resp., respiratory therapy; SLP, speech language pathology.

## Discussion

The results suggest that the 3 PAC rehabilitation settings may be treating patients with hip fracture with different rehabilitation and medical needs. SNF patients appeared to be more chronically ill and frail because they were more likely to have pressure ulcers and cognitive limitations. IRF patients were more acutely ill because they had the most comorbid conditions. HHA patients had, on average, higher levels of self-care and mobility functional status at the start of the PAC episode and few comorbid conditions, and were generally younger. This variation in medical needs across settings is consistent with the different levels of medical services furnished by these types of providers.

IRF and HHA patients had lower self-care function at discharge relative to SNF patients after controlling for all the covariates except LOS. The inclusion of LOS resulted in nonsignificant differences

between IRFs and SNFs for self-care at discharge. Longer LOS may be necessary for patients to obtain the benefits of the therapy; that is, beyond a given number of minutes per day, greater therapy intensity is not productive. Alternatively, IRF patients may have had higher self-care function had their measurements occurred at the same number of days after PAC admission as SNF patients. In contrast to self-care, there was no setting-specific advantage in discharge mobility function. Most of the variance associated with discharge mobility is explained by mobility function at admission. The coefficients for IRF and HHA settings remained nonsignificant after controlling for LOS. This suggests that with the exception of baseline functional status and short-term memory, covariates such as condition severity, prior PAC use, and LOS had little relation with recovery of mobility function in these patients. It is challenging to interpret these findings in the absence of other information such as minimally clinically important differences in mobility. Because IRF and SNF

**Table 3** Unadjusted functional status at discharge and functional change from admission to discharge

Type of PAC Facility	SNF (n=69)	IRF (n=78)	HHA (n=34)
Functional status at discharge			
Self-care	29.1±6.3	28.4±4.0	32.2±7.5
Mobility	23.0±5.1	22.8±5.1	28.5±7.3
Functional change			
Self-care	7.5±4.7	5.8±3.1	5.1±5.0
Mobility	7.8±4.4	7.4±3.8	8.2±5.7

NOTE. Values expressed as mean ± SD.

patients, on average, started with the same baseline level of mobility function, what discharge level of mobility is reasonable to expect in PAC patients with hip fracture? SNF, IRF, and HHA patients all averaged about 7 to 8 Rasch units of gain in mobility function. However, the average LOS of HHA patients was 2 weeks longer than that of SNF patients, whose average LOS, in turn, was 9 days longer than that of IRF patients. IRF and SNF patients receive about the

same total minutes of therapy, while HHA patients receive only approximately 25% as many minutes.

Much has changed about PAC services following the implementation of PAC Prospective Payment Systems including reductions in LOS, different patterns of service utilization, increases in average patient severity, and changes in the PAC settings to which patients with different diagnoses are admitted. In many cases, these changes reflect not only provider response to payment incentives but also provider response to changing patient needs. For example, in the early PAC comparison studies, the average LOS for SNF patients was 23 to 33 days and for IRF patients was 16 to 19 days, while for later studies, LOS remained relatively stable for SNF patients (21–25d) but declined to around 13 to 14 days for IRF patients; these numbers are similar to those reported by Medicare Payment Advisory Commission during the same period.<sup>9</sup> While payment incentives encourage IRFs to reduce LOS, IRFs have also seen an increase in patient average admission severity. IRF LOS has stabilized as providers learn to manage patients' needs more efficiently; yet, fewer patients are discharged to the community.<sup>9</sup> SNFs have increased use of ultrahigh and very high resource utilization groups, which now account for about 76% of all patient days.<sup>9</sup> The ultrahigh category indicates that

**Table 4** Results of regression analysis on self-care function at discharge

Model Covariates	Self-Care Function at Discharge						
	Step 1 β	Step 2 β	Step 3 β	Step 4 β	Step 5 β	Step 6 β	Step 6 95% CI
Setting							
IRF	-0.72	-1.09	-1.82*	-1.77*	-1.73*	-0.99	-2.57 to 0.58
HHA	3.38†	2.87*	-2.31*	-3.01†	-4.09†	-4.80†	-7.48 to -2.11
Demographics							
Age		-0.14*	-0.04	-0.01	-0.02	-0.04	-0.13 to 0.05
Sex		-0.08	0.28	1.05	0.80	0.71	-0.65 to 2.06
Function							
Self-care at admission			0.95‡	0.84‡	0.84‡	0.90‡	0.71–1.09
Condition severity							
Type of surgery				-0.64	-0.61	-0.39	-1.64 to 0.87
No. of comorbid conditions				-0.25	-0.28	-0.26	-0.55 to 0.03
Urinary incontinence				-0.71	-0.57	-0.59	-2.07 to 0.90
Fecal incontinence				0.35	0.54	0.62	-1.33 to 2.56
Vision				-1.55	-1.56	-1.41	-2.99 to 0.16
Daily decision making				0.78	0.74	1.02	-0.53 to 2.57
Short-term memory				-2.62†	-2.60†	-3.04†	-4.91 to -1.17
Mood disorder				0.33	0.40	0.54	-1.41 to 2.49
Diabetes mellitus				-5.92*	-5.76*	-6.04*	-10.80 to -1.28
Anemia				0.40	0.40	0.56	-0.80 to 1.92
Pressure ulcer				-1.80	-2.05	-2.10	-4.35 to 0.16
Utilization							
Time from onset to PAC admission					0.08	0.06	-0.05 to 0.17
Prior PAC usage					0.77	1.16	-1.96 to 4.29
PAC LOS							
LOS						0.07†	0.02–0.12
R <sup>2</sup>	0.07	0.10	0.49	0.57	0.58	0.60	
Adjusted R <sup>2</sup>	0.06	0.08	0.48	0.53	0.53	0.55	

NOTE. Base categories are setting: skilled nursing facilities; sex: female; type of surgery: internal fixation; urinary incontinence: continent at admission; fecal incontinence: continent at admission; vision: not impaired; daily decision making: not impaired; short-term memory: not impaired; mood disorder: no; diabetes mellitus: no; anemia: no; pressure ulcer: no at admission; prior PAC usage: no.

Abbreviation: CI, confidence interval.

\*  $P < .05$ .†  $P < .01$ .‡  $P < .001$ .

**Table 5** Results of regression analysis on mobility function at discharge

Model Covariates	Mobility Function at Discharge						
	Step 1 $\beta$	Step 2 $\beta$	Step 3 $\beta$	Step 4 $\beta$	Step 5 $\beta$	Step 6 $\beta$	Step 6 95% CI
<b>Setting</b>							
IRF	-0.17	-0.44	-0.55	-1.06	-1.05	0.21	-1.49 to 1.90
HHA	5.81*	5.45*	0.47	-0.19	0.83	-0.43	-3.26 to 2.41
<b>Demographics</b>							
Age		-0.10	-0.05	0.002	0.02	-0.01	-0.10 to 0.09
Sex		0.07	0.22	0.56	0.70	0.55	-0.88 to 1.99
<b>Function</b>							
Mobility at admission			0.96*	0.85*	0.89*	1.07*	0.84 to 1.29
<b>Condition severity</b>							
Type of surgery				-0.87	-0.97	-0.72	-2.04 to 0.60
No. of comorbid conditions				-0.15	-0.16	-0.13	-0.43 to 0.18
Urinary incontinence				-0.11	-0.08	-0.08	-1.65 to 1.49
Fecal incontinence				-0.27	-0.37	-0.23	-2.24 to 1.77
Vision				-1.34	-1.56	-1.50	-3.13 to 0.13
Daily decision making				-0.77	-0.79	-0.44	-2.06 to 1.17
Short-term memory				-2.16 <sup>†</sup>	-2.20 <sup>†</sup>	-2.94 <sup>‡</sup>	-4.90 to -0.97
Mood disorder				-0.62	-0.81	-0.58	-2.63 to 1.46
Diabetes mellitus				-2.09	-1.88	-1.81	-6.88 to 3.27
Anemia				0.67	0.65	0.87	-0.57 to 2.30
Pressure ulcer				-0.38	-0.54	-0.52	-2.91 to 1.87
<b>Utilization</b>							
Time from onset to PAC admission					0.04	0.01	-0.10 to 0.13
Prior PAC usage					-2.84	-2.67	-6.04 to 0.71
<b>PAC LOS</b>							
LOS						0.12*	0.06-0.18
$R^2$	0.15	0.16	0.45	0.51	0.52	0.56	
Adjusted $R^2$	0.14	0.14	0.43	0.46	0.46	0.51	

NOTE. Base categories are setting: skilled nursing facilities; sex: female; type of surgery: internal fixation; urinary incontinence: continent at admission; fecal incontinence: continent at admission; vision: not impaired; daily decision making: not impaired; short-term memory: not impaired; mood disorder: no; diabetes mellitus: no; anemia: no; pressure ulcer: no at admission; prior PAC usage: no.

Abbreviation: CI, confidence interval.

\*  $P < .001$ .

<sup>†</sup>  $P < .05$ .

<sup>‡</sup>  $P < .01$ .

patients receive more than 720 minutes of therapy per day; the very high category indicates that patients receive 520 to 719 minutes per day. Consequently, SNFs may be delivering care more like IRFs with regard to the intensity of therapy services.<sup>9</sup> Use of HHA services has also increased in terms of both the number of beneficiaries and the number of episodes per beneficiary. Therapy services now make up 33% of all HHA visits.<sup>9</sup> While Medicare Payment Advisory Commission suggests that this is a response to payment incentives, it is equally plausible that patients are discharged from acute care sicker and more functionally impaired; therefore, more therapy may be needed.

Such changes raise questions about how rehabilitation can and should be provided to patients, to what extent setting-specific differences play a role, and directions for PAC setting comparative effectiveness research.<sup>28</sup> A major limitation with current studies, including this one, is that they do not account for selection bias.<sup>9</sup> While Buntin et al<sup>8</sup> attempted to correct for selection bias by controlling for unmeasured or unknown covariates that vary by settings, it is the correlation between those factors related to the outcome and selection of the sample that are unobserved that biases the estimates.<sup>29</sup> In addition, the development of a uniform patient assessment such as the Continuity Assessment Record and

Evaluation item set addresses the concern of measuring function equivalently across settings.<sup>30</sup> Our study suggests that modeling self-care and mobility as separate outcomes can reveal important differences. Future studies should include end-point data collection that is at the same time after PAC admission in each setting.

This is the first study to compare functional outcomes across PAC settings in which self-care and mobility outcomes are modeled separately. Although some HHA patients received prior PAC services, we attempted to control this factor in analyses. OT is not a qualifying service for HHA care. Despite the clear self-care disability in the patients in this study on admission to HHA, few received OT services, and HHA patients had lower discharge self-care function.

### Study limitations

Study limitations include a small sample. These data are from only 2 census areas and are not representative of the United States. Like other studies comparing rehabilitation outcomes, we recruited high-quality providers, which may have introduced selection bias. Although we noted the presence of comorbidities, we did not document comorbidity severity. A limit of 10

comorbidities may have created an artificial ceiling. We attempted to control for differences in patient characteristics across settings. To the extent we may not have measured the most relevant covariates, we may have over- or underestimated the effect of setting. In addition, because we included a large number of variables to account for patient characteristics, the significance of individual coefficients may be overstated.

## Conclusions

We found a stronger setting-specific effect when predicting self-care at discharge but a weaker impact when examining mobility at discharge. Controlling for LOS affected results for self-care at discharge but not for mobility. LOS, a defining structural feature of PAC settings, differed while IRF and SNF patients received about the same total minutes of therapy. While the PAC settings appear to address patients' differing medical issues, it remains unclear to which extent rehabilitation intensity, content of therapy, or natural recovery is affecting changes in functional status.

This study adds to the literature comparing the effectiveness of different PAC rehabilitation settings for patients with a hip fracture. The field of rehabilitation has limited, psychometrically robust, and comparable measures of functional status and medical severity across PAC settings, and minimally clinically important differences of these measures have not been established. In addition, there is limited evidence-based consensus for the factors influencing recovery that should be routinely included in prediction models or about how and when to measure them. If there is to be progress in comparative effectiveness studies of rehabilitation outcomes, these measurement limitations must be resolved.

## Suppliers

- a. Winsteps. Available at: [www.winsteps.com](http://www.winsteps.com).
- b. StataCorp LP, 4905 Lakeway Drive, College Station, TX 77845.

## Keywords

Hip fracture; Recovery of function; Rehabilitation; Skilled nursing facilities

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