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Does Post-Acute Care Site Matter? A longitudinal study assessing functional recovery after a stroke

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Abstract

Objective—To determine the impact of post acute care site on stroke outcomes. Following a stroke, patients may receive post acute care in a number of different sites: inpatient rehabilitation (IRF), skilled nursing facility (SNF), and home health care/outpatient (HH/OP). We hypothesized that patients who received IRF would have better six-month functional outcomes than those who received care in other settings after controlling for patient characteristics.

Design—Prospective Cohort Study.

Setting—Four Northern California hospitals which are part of a single health maintenance organization.

Participants—222 patients with stroke enrolled between February 2008 and July 2010.

Intervention—Not Applicable.

Main Outcome Measure—Baseline and 6 month assessments were performed using the Activity Measure for Post Acute Care (AM-PACTM), a test of self-reported function in three domains: Basic Mobility, Daily Activities, and Applied Cognition.

Results—Of the 222 patients analyzed, 36% went home with no treatment, 22% received HH/OP care, 30% included IRF in their care trajectory, and 13% included SNF (but not IRF) in their care trajectory. At six months, after controlling for important variables such as age, functional status at acute care discharge, and total hours of rehabilitation, patients who went to an IRF had functional scores that were at least 8 points higher (twice the minimally detectable change for the AM-PAC) than those who went to a SNF in all 3 domains and in two out of three functional domains compared to those who received HH/OP care.

Conclusions—Patients with stroke may make more functional gains if their post-acute care includes an IRF. This finding may have important implications as post-acute care delivery is reshaped through health care reform.

Keywords

stroke outcome; stroke assessment; disability evaluation; rehabilitation

Stroke is one of the most common causes of disability, and stroke rehabilitation places an enormous burden on healthcare systems worldwide.¹ In the US, 800,000 people experience a stroke annually,² and many require post-acute care after an initial hospitalization.³ Currently, post-acute care treatment patterns and settings of care for patients with stroke vary and there are no consistently applied guidelines for determining whether a patient should receive therapy in home health care (HH), outpatient (OP) or institutional settings (skilled nursing facility (SNF) or inpatient rehabilitation (IRF)).⁴⁻⁹

The lack of clinical consensus about post-stroke rehabilitation is concerning given two health care reform related issues: bundling of acute and post acute care payments, and the “minimal essential coverage” that will be provided to new patients covered under the Patient Protection and Affordable Care Act (PPACA) of 2010. The changes which are mandated in PPACA could radically alter, and perhaps decrease, patient access to a number of post-acute care treatment sites.¹⁰ This may occur for two reasons. First, as new Accountable Care

Organizations take on additional patients, they may alter traditional patient post acute care referral patterns. Second, the details of “minimal essential coverage” for patients has yet to be decided and may or may not include a number of post acute care options.

To help inform clinicians and policymakers about post-acute care following a stroke, we performed a prospective cohort study which compared six-month functional outcomes for patients with stroke whose trajectories of post acute care included an IRF, versus those whose care trajectory included a SNF, HH/OP, or no treatment. Previous research has suggested that post-acute care following a stroke that includes IRF has been related to improved functional recovery compared with care provided in other settings.^{11–13} However, these studies have been limited by the lack of functional outcome measures, long term follow-up or diagnostic specificity. Our hypothesis was that patients with stroke who received IRF care, which offers more rehabilitation services, would have better six-month functional outcomes than those who received post acute care in other settings after controlling for patients’ severity of illness, baseline functional status, and other important variables.

Methods

We performed a prospective, longitudinal cohort study, analyzing data from 222 patients following a stroke. These patients were enrolled from February 2008 to March of 2010, and came from four acute care hospitals that are part of the Kaiser Permanente Health Care System in northern California (Roseville, Sacramento, Walnut Creek, and Vallejo). Kaiser Permanente was chosen because the health plan provides complete coverage for all post-acute stroke care, allowing us to merge functional assessments with data from a single electronic medical record.

Study Population

Potential study participants were screened and enrolled from February, 2008 through July, 2010. Through a chart review of 1244 consecutive patients suspected of having a hemorrhagic or ischemic stroke, a convenience sample of 287 participants were consented into the study during their acute hospital stay one at one of the four study hospitals. These individuals were identified through information obtained from review of medical records, the daily hospital census, and conducting rounds with the stroke teams. Those individuals with transient ischemic attack, brain tumor/abscess, significant brain trauma, under age 18, survival prognosis of less than 6 months, or non-Kaiser health plan patients were excluded from the study.

Of the original 287 consented patients, 23 cases were dropped from the sample for administrative reasons: 2 left the Kaiser health system during the study period and 21 were determined not to have had a stroke at the time of their acute care discharge (International Classification of Disease-9 codes (430.00–434.99). Of the 264 remaining patients, 16% were lost to follow-up. Five of these patients were discharged before we could obtain a baseline functional assessment and 20 died before their six month assessment. Of those who died, 6 were in the IRF group, 4 in SNF, 4 in HH/OP, 4 in the home with no services group, and 2 patients expired during their acute stay. Seventeen patients also withdrew from the study. Of these, 3 withdrew during their initial acute hospitalization and before they had been assigned to a post-acute care group, 3 were in the IRF group, 1 in SNF, 4 in HH/OP, and 6 in the home with no services group. After accounting for deaths and withdrawals, we obtained a final cohort of 222 participants for analysis.

Outcome Measures

To assess function over time, we utilized the Boston University Activity Measure for Post Acute Care (AM-PACTM). The AM-PAC was designed to measure functional status in adults in all post-acute care settings. It contains three distinct functional domains: Basic Mobility (e.g., ambulation, transfers, lifting, bending, lifting, carrying), Daily Activities (e.g., feeding, grooming, dressing, meal preparation), and Applied Cognitive functioning (e.g., using a phone, following complex instructions, reading print material).¹⁴ Respondents assign a difficulty rating (no difficulty, a little difficulty, a lot of difficulty, cannot/unable to do) to functional tasks and activities. The AM-PAC has been validated in post-acute care patients with major neurological, orthopedic, and major medical conditions.^{15–19} The AM-PAC standardized scale is built around a mean of 50 with 10 points as the standard deviation. A 4 point change in AMPAC scores has been shown to reflect the minimal detectable change (MDC) for the mobility and daily activity AMPAC domains,¹⁹ while a 7 point change reflects the MDC for the cognitive domain. The MDC is the minimum change in the AMPAC score that is needed to be considered statistically significant (i.e. the amount of change needed to exceed measurement variation/error).

In this study, the computer adaptive test version of the AM-PAC was employed. The AM-PAC was administered by a trained study coordinator. In this version of the AM-PAC, an iterative computer program uses information from a subject's previous responses to determine subsequent questions, thereby eliminating questions that are too difficult or too easy. As a consequence, a small sample of questions from the instrument is administered to any one patient, thus reducing burden. However, all scores are generated on the same metric, regardless of the number or selection of items, facilitating comparison of function between care settings where care is delivered.

Patients who could understand the interview questions, sustain attention for 15 minutes, and give accurate and consistent responses to questions responded for themselves. Otherwise, a proxy respondent was selected by the study coordinator. If a patient was receiving care in an institution, the first proxy choice was a clinician. A family member was the first choice if the patient was living at home. Agreement between proxy and self responses for the AM-PAC has been found to be acceptable in patients with stroke²⁰ and in other post acute care patient groups.^{21,22}

Data

AM-PAC data were collected at discharge from the acute care facility and 6 months later. In addition to the AM-PAC scores, other data were collected from the patient's chart and electronic medical record including: socio-demographic characteristics (gender, age, race-ethnicity, education, combined family income, living situation, and marital status); health indices (stroke severity as measured by the modified NIH stroke scale (mNIHSS);²³ stroke type (hemorrhagic or ischemic); a modified Rankin (mRankin)²⁴ score as an indicator of pre-stroke functioning; height and weight; stroke history; smoking history; co-morbidities as measured by the modified Charlson Index (mCharlson, stroke removed);²⁵ and hospital readmission. We also estimated hours of post-acute care treatment at each site in the following manner: IRF treatment time per day was estimated at 3 hours a day, six days a week, since this is intensity is set at Kaiser. The SNF treatment time, 1.3 hours a day, five days a week, was set by Kaiser Foundation Health Plan contracts with facilities. Detailed data were available for home health and outpatient treatment encounters. Every encounter with a particular discipline on a given day was counted as an hour. PT, OT and speech therapies were counted. Cases with missing educational data (4%) were imputed using the mode value for eight age (26–59, 60–69, 70–79, 80–95) and gender (male, female) sub-groups.

At Kaiser Permanente, multiple post-acute care options were possible, including home without services, HH, OP, admission to a SNF or IRF, as well as combinations of these options. For the purposes of this study, all post-acute care trajectories were aggregated into four distinct groups: those who received no post acute care, those who received only HH/OP, those whose care trajectory included an IRF (regardless of whether they received other post-acute care), and those whose post-acute care included SNF care without an IRF admission. These categories were chosen so that subjects were grouped by the most intensive care setting in their trajectory. This study was approved by an institutional review committee and all subjects gave informed consent.

Statistical Analyses

Socio-demographic characteristics, health indices, and treatment characteristics were compared across the four post-acute care groups using ANOVA with post-hoc Dunnett tests (all groups compared to the IRF group) or chi-square tests. Linear regression analyses were used to predict actual 6 month functional outcome (AMPAC) scores in each domain across post-acute care groups while controlling for age (continuous variable), BMI (≥ 30 ; <30), baseline functional status for that domain (acute care visit), mRankin scores, history of previous stroke, and mCharlson Index at baseline. These variables were selected for inclusion in the models because they were significant predictors of the outcomes, and when included in the models, explained additional overall model variance. We omitted variables that did not meet these criteria (including driving distance and time, in miles and minutes, from home to facility). Readmission status (no readmissions, stroke-related readmissions, and non-stroke related readmissions) and total time of post-acute care treatment in hours were significant predictors of the outcomes and explained overall model variance. It can be argued that these variables represent key factors differentiating PAC sites and should be omitted from the models to avoid masking differences in outcomes attributable to PAC site. It can also be argued that these variables represent proxies for overall severity of illness and, since we measured them, they should be included in the models to better characterize these effects. To best address both concerns, we present two sets of models; one with readmission status and treatment time included and one with these variables omitted. In cases where independent variables were highly correlated, for instance mNIHSS score and baseline AM-PAC score, we included the variable that had the strongest association with the outcome variable (i.e. most predictive power). Since 9 of the 66 participants in the IRF group also spent time in a SNF as part of their trajectory, we performed sensitivity analyses to determine if the exclusion of these participants from the IRF group affected modeling results. The threshold for statistical significance for all statistical tests was $p < 0.05$. SAS System for Windows (release 9.3; SAS Institute Inc, Cary, NC) was used for statistical analyses. Standard errors were reported in parentheses unless otherwise indicated. Potential bias due to exclusion of adults from the analytical sample because of withdrawal (death or loss to follow-up) was explored by comparing gender, race-ethnicity, living situation, education, age, mNIHSS, mRankin, and mCharlson scores in the 222 participants in the analytic sample and 42 participants who were lost to follow-up using chi-square or 2-sample t-tests.

Results

In this cohort of 222 patients, 36% of the patients went home with no treatment, 22% received only HH/OP, 30% had a trajectory that included an IRF, and 13% had a trajectory that included a SNF without an IRF admission. At the acute care hospitalization, 35% required a proxy respondent, while at the 6-month assessment, 25% required a proxy respondent.

Tables 1 and 2 show patient demographics as well as health and treatment characteristics by post acute care group. There were significant differences among the post acute care groups in the age distributions (those in SNFs about 10 years were older), occurrence of a second stroke during the study period, mNIHSS, mRankin, and mCharlson. Those in the IRF group were the most functionally impaired after their stroke. In addition, those who went to an IRF received on average, 29 more hours of therapy than those who went to a SNF and 67 hours more than those in the HH/OP group. Those in the HH/OP, IRF and SNF groups had similar stroke re-hospitalization rates over the six month time frame (6–8%), while the stroke related re-hospitalization rate for those who went home with no services was <1.5%.

Figure 1 shows the unadjusted functional scores across the groups for all three domains: Basic Mobility, Applied Cognitive, and Daily Activities, at acute hospital discharge and at the 6-month follow-up. Every group achieved at least a minimal detectable functional improvement over the six-month timeframe in Basic Mobility and Daily Activities. However, only the IRF group achieved a minimal detectable change (7 points) in the Applied Cognitive domain. Those patients receiving inpatient rehabilitation also had the largest gains in all three functional domains, while those going to a SNF had the smallest improvements.

Adjusted Scores

Table 3 shows the results of our regression analyses. Six months after a stroke, those patients who went to an IRF had at least an 8 point higher functional improvement in all 3 domains compared to those patients who went to a SNF (Panel A), after controlling for age, BMI, function at acute hospital discharge, history of previous stroke, mRankin, mCharlson, re-hospitalization status, and total hours of rehabilitation treatment time during the 6 month period ($p<0.0001$ for Basic Mobility and Applied Cognition; $p=0.007$ for Daily Activities). Those who went to an IRF also had statistically significant improvements in Applied Cognitive function ($p<0.02$) compared to those who received only HH/OP. There was no difference in adjusted functional scores at 6 months comparing those who went to IRF and those who went home with no stroke-related services. Overall, our models predicted 60% of the variance in Basic Mobility, 51% in Daily Activities, and 45% in the Applied Cognitive domains. Post-acute care treatment site alone accounted for 3%, 2%, and 5% of the variance respectively. Omission of treatment time and readmission status from the models lessened the differences in 6-month scores between the IRF and SNF trajectories (Panel B). Outcomes were either equivalent to IRF or significantly better for the home health/out-patient and no PAC trajectories when treatment time and readmission status were included.

Comparisons of the 264 participants who were enrolled in the study vs. the 222 analyzed was examined by socio-demographic and health characteristics to explore potential bias due to differential loss to follow up. There were no differences between the 222 participants in the analytic sample and the 42 who were lost to follow-up except those lost to follow-up were significantly older (mean=73 years) than the analytic group (mean =70 years).

Discussion

Our results suggest that patients with a stroke whose post-acute care trajectory included IRF achieved greater functional gains in mobility, daily activity and applied cognition than those who received treatment in a SNF. Furthermore, those who went to an IRF also had statistically significant improvements in applied cognitive function compared to those who received only HH/OP services. These differences were statistically significant, were evident six months after the stroke, and persisted even after controlling for important patient characteristics such as age, stroke severity, pre-stroke function, the burden of co-morbid illnesses, as well as treatment hours. Differences between IRF and SNF were, for the most

part, maintained when treatment time and readmission status were omitted from the models, while HH/OP and no PAC groups appeared better than IRF in some instances. If these factors are thought of as proxies for severity of illness, then one would expect inclusion in the models to have the effects we observed.

This is one of the first studies that has tracked patients with stroke over a six-month period of time using a single functional assessment instrument across multiple post acute care sites. Our results are consistent with the work of Kramer, Gage, and Kane and others who found better outcomes for patients treated in IRFs compared to SNFs.^{11–13,26–28} We were able to expand on the findings of others because our study is one of the first to prospectively follow a group of stroke patients with a single, sophisticated functional assessment instrument for 6 months, and to be able to control for some very important variables such as stroke severity and treatment hours.

There are a number of theoretical reasons why patients with stroke may experience more improvement in an IRF than a SNF. Compared to patients in a SNF, patients in IRFs likely have greater access to physicians, registered nurses, a higher intensity of rehabilitation treatment, and are often physically integrated in the acute care setting. This may give IRFs greater access to diagnostic and treatment technologies than those in a SNF. In addition, there are likely other differences in care coordination, patient/family education, and discharge planning between IRF and SNF facilities that may affect outcomes.²⁹

Study Limitations

Since all the PAC sites in our study were part of a single integrated health system in Northern California (and included only one IRF), our findings may not be generalizable to a broader range of post acute care facilities. The amount of therapy in the IRF under study may have been more than is available in other IRFs as Medicare only requires five days of therapy rather than the six received by the patients in this cohort.²⁹ We were not able to control for the content or quality of therapy, although Kaiser has guidelines and highly standardized approaches to the care of patients with strokes. Because of our sample size, we collapsed all possible care trajectories into 4 separate groups. We chose to include those patients who had received both IRF and SNF care (n=9) in the IRF group. Given our hypothesis, that IRF care is better than SNF care, we felt that including these individuals in the IRF group was a more conservative approach. In addition, the results of our sensitivity analysis examining the impact of those individuals whose trajectory included both SNF and IRF did not change our overall conclusions. We only examined patients with stroke. While stroke may be one of the more common diagnoses requiring post-acute care, our results may not be applicable to other common conditions requiring rehabilitation such as hip and knee replacements. We had a 16% loss to follow up in our cohort and this could have affected our results. However, nearly half of the loss to follow up was attributable to deaths in the cohort, a known post-stroke event. These deaths were equally distributed across groups, as were overall withdrawals. In our statistical examination of the loss to follow up group, we found no differences between those who withdrew and those in the analytic group with the exception of age, suggesting that differential loss to follow-up did not substantively influence our results. Finally, since the patients in this cohort study were not randomized to groups, unmeasured variation among subjects may account for some of the differences in functional scores at 6 months. Indeed, the explanatory power of our models, while greater than that reported by others,¹¹ still indicates a large amount of unexplained variance. While baseline functional status, patient demographics, and, to a lesser extent, post acute care site are important predictors, we were not able to assess important patho-physiological variables such as size and location of brain lesion that are certain to drive stroke outcomes.

Our findings have two significant policy implications. The fact that patients with a stroke may make more gains in an IRF than in other post-acute care settings is important since we may be on the cusp of major changes in access to post-acute care. The field of health care financing has been moving toward bundled payments for many years.³⁰ The movement to bundle payments was accelerated with the passage of PPACA in 2010 which created “Accountable Care Organizations (ACOs),” vertically integrated entities that are responsible for the entire episode care of the patients they manage. With bundling, there may be economic incentives for ACOs and others to provide stroke care in SNFs or with HH/OP therapy since they are less expensive options than IRFs. Our data suggests that this might come at a cost, as patients in our cohort who received care in an IRF following a stroke displayed greater recovery 6 months post stroke in nearly all domains compared with those discharged to other settings.

A second policy implication relates to the “minimal essential coverage” for the tens of millions of patients who will receive new or expanded insurance under the PPACA. While “rehabilitative services” are required by law to be included in any approved plan, the details of what constitutes “rehabilitation services” are not yet defined. It is likely it will be many years before this definition is adjudicated. Studies such as ours can help inform this process.

Conclusions

Based on the findings from this observational study, patients with a stroke may make more functional gains if they receive some of their post-acute care in an IRF compared to other sites. This finding may have important implications as post-acute care delivery is reshaped through health care reform.

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List of Abbreviations

HH	Home Health Care
OP	Outpatient
SNF	Skilled Nursing Facility
IRF	Inpatient Rehabilitation Facility
PPACA	Patient Protection and Affordable Care Act of 2010
AM-PACTM	Activity Measure for Post Acute Care
MDC	Minimal Detectable Change
mNIHSS	Modified NIH Stroke Scale
mRankin	Modified Rankin
mCharlson	Modified Charlson
CMS	Centers for Medicare and Medicaid Services
PAC	Post Acute Care
ACO	Accountable Care Organization

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Figure 1. Unadjusted scores across PAC groups at discharge from acute care and at the 6-month follow-up for the three AM-PAC domains.

Table 1

Socio-demographic characteristics across post acute care groups

	Home, no treatment (n=79)	HH and/or OP ^{1,2} (n=48)	IRF ³ (n=66)	SNF ⁴ w/o IRF (n=29)	p-value ⁶
Percent ⁵					
Gender					0.30
Men	58.2	60.4	50.0	41.4	
Women	41.8	39.6	50.0	58.6	
Race-ethnicity					0.77
White	64.6	72.9	60.6	79.3	
Black	11.4	6.3	16.7	3.4	
Asian	5.1	6.3	9.1	3.4	
Hispanic	12.7	10.4	9.1	10.3	
Other	6.3	4.2	4.5	3.4	
Marital status					0.07
Single	7.6	4.2	16.7	3.4	
Married	64.6	68.8	54.5	44.8	
Divorced	11.4	6.3	6.1	13.8	
Widowed	16.5	20.8	22.7	37.9	
Living situation					0.08
Living alone	17.7	14.6	19.7	37.9	
Living with others	82.3	85.4	80.3	62.1	
Education					0.16
High school	26.6	25.0	36.4	48.3	
Some college	54.4	47.9	50.0	31.0	
Professional/graduate school	19.0	27.1	13.6	20.7	
Mean $\pm$ sd					
Age	67 (12.2)	69 (11.2)	67 (14.0)	79 (10.2)	p-value ² <0.0001

¹ HH=Home health² OP=Out patient

³IRF=Inpatient rehabilitation facility

⁴SNF=Skilled nursing facility

⁵Proportions may not add to 100% due to rounding

⁶p-value associated with Chi-square test if comparing proportions or ANOVA if comparing group means

Table 2

Health and treatment characteristics across post acute care groups

	Home, no treatment (n=79)	HH and/or OP ^{1,2} (n=48)	IRF ³ (n=66)	SNF ⁴ w/o IRF (n=29)	p-value ⁶
	Percent ⁵				
Smoking history					0.13
No	44.3	50.0	63.6	48.3	
Yes	55.7	50.0	36.4	51.7	
Stroke type					0.34
Ischemic	92.4	95.8	86.4	89.7	
Hemorrhagic	7.6	4.2	13.6	10.3	
Stroke history					0.83
No	74.7	72.9	68.2	69.0	
Yes	25.3	27.1	31.8	31.0	
BMI					0.84
30	40.5	37.5	39.4	31.0	
< 30	59.5	62.5	60.6	69.0	
Had second stroke during study	1.3	6.3	7.6	6.9	0.003
Readmission status					0.19
No readmissions	86.1	81.3	69.7	69.0	
Stroke related readmissions	1.3	6.3	7.6	6.9	
Non-stroke related readmissions	12.7	12.5	22.7	24.1	
	Mean $\pm$ sd				p-value ²
Modified NIH Stroke Scale score⁷	1.5 (2.0)	2.6 (2.8)	6.0 (4.5)	4.2 (3.4)	<0.0001
Modified Rankin Scale score⁷	0.2 (0.5)	0.5 (1.0)	0.5 (0.9)	0.9 (1.2)	0.001
Modified Charlson Index⁸	1.5 (1.5)	2.2 (1.9)	1.8 (1.6)	1.4 (1.3)	0.05
Total PAC¹⁰ length of stay (days)	0	11.6 (8.2)	45.2 (24.9)	38.1 (26.5)	<0.0001 ⁹
Total PAC treatment time (hours)	0	9.3 (7.1)	76.7 (38.6)	47.7 (33.3)	<0.0001 ⁹

¹ HH=Home health

- ² OP=Out patient
- ³ IRF=Inpatient rehabilitation facility
- ⁴ SNF=Skilled nursing facility
- ⁵ Proportions may not add to 100% due to rounding
- ⁶ p-value associated with Chi-square test if comparing proportions or ANOVA if comparing group means
- ⁷ Higher score represents worse outcome
- ⁸ Deyo modification of the Charlson Index
- ⁹ p-value unchanged when comparing all 4 groups or only the 3 groups that received post-acute care
- ¹⁰ PAC= post acute care

Table 3
Linear regression results examining 6-month functional outcome scores across post acute care groups

Panel A: WITH Readmission Status and Treatment Time in models						
	MOBILITY		SELF CARE		COGNITION	
	β (SE)	p-value	β (SE)	p-value	β (SE)	p-value
Post-Acute Care group						
IRF ²	---	---	---	---	---	---
SNF ³ without IRF	-10.1 (2.5)	<0.0001	-8.8 (3.2)	0.007	-8.7 (2.2)	<0.0001
HH/OP ^{4,5}	-5.2 (2.9)	0.07	-2.4 (3.6)	0.51	-5.6 (2.4)	0.02
Home, no treatment	-3.8 (3.0)	0.2	0.4 (3.8)	0.91	-4.2 (2.4)	0.08
Age (continuous)	-0.3 (0.06)	<0.0001	-0.2 (0.1)	0.03	-0.08 (0.05)	0.13
Body mass index						
30	-3.0 (1.4)	0.04	-2.3 (1.8)	0.21	-0.36 (1.2)	0.77
< 30	---	---	---	---	---	---
AM-PAC score at acute care (continuous)	0.2 (0.1)	0.003	0.5 (0.1)	<0.0001	0.5 (0.06)	<0.0001
Modified Rankin score at acute care (continuous)	-3.2 (0.8)	0.0002	-1.6 (1.1)	0.14	-0.8 (0.7)	0.29
History of previous stroke						
No	---	---	---	---	---	---
Yes	-4.3 (1.5)	0.005	-6.4 (2.0)	0.001	-5.3 (1.3)	0.0001
Charlson index at acute care ⁶ (continuous)	-0.3 (0.4)	0.49	-1.1 (0.6)	0.06	-0.3 (0.4)	0.38
Readmission status						
No readmissions	---	---	---	---	---	---
Stroke related readmissions	-6.4 (3.3)	0.05	-3.3 (4.2)	0.44	0.5 (2.8)	0.85
Non-stroke related readmissions	-4.5 (1.9)	0.02	0.1 (2.5)	0.97	-0.9 (1.6)	0.57
Total length of PAC ⁷ treatment in hours (continuous)	-0.2 (0.03)	<0.0001	-0.1 (0.04)	0.004	-0.07 (0.03)	0.006

Panel B: WITHOUT Readmission Status and Treatment Time in models				
	MOBILITY		SELF CARE	
	β (SE)	p-value	β (SE)	p-value
Post-Acute Care group				

Panel B: WITHOUT Readmission Status and Treatment Time in models						
	MOBILITY		SELF CARE		COGNITION	
	β (SE)	p-value	β (SE)	p-value	β (SE)	p-value
IRF ²	---	---	---	---	---	---
SNF ³ without IRF	-6.1 (2.6)	0.02	-6.1 (3.2)	0.06	-6.8 (2.1)	0.001
HH/OP ^{4, 5}	5.3 (2.5)	0.03	4.7 (2.8)	0.09	-0.8 (1.7)	0.63
Home, no treatment	7.7 (2.5)	0.003	8.5 (2.9)	0.004	1.0 (1.6)	0.52
Age (continuous)	-0.3 (0.1)	<0.0001	-0.2 (0.1)	0.03	-0.1 (0.1)	0.13
Body mass index						
30	-3.5 (1.6)	0.03	-2.6 (1.9)	0.17	-0.6 (1.3)	0.66
< 30	---	---	---	---	---	---
AM-PAC score at acute care (continuous)	0.3 (0.1)	0.0001	0.5 (0.1)	<0.0001	0.5 (0.1)	<0.0001
Modified Rankin score at acute care (continuous)	-2.9 (0.9)	0.002	-1.3 (1.1)	0.23	-0.7 (0.7)	0.37
History of previous stroke						
No	---	---	---	---	---	---
Yes	-3.4 (1.7)	0.045	-5.7 (2.0)	0.005	-4.7 (1.3)	0.0005
Charlson index at acute care ⁶ (continuous)	-0.7 (0.5)	0.13	-1.2 (0.6)	0.03	-0.5 (0.4)	0.21

¹ ---Reference group,

² IRF=Inpatient rehabilitation facility,

³ SNF=Skilled nursing facility,

⁴ HH=Home health,

⁵ OP=Out patient

⁶ Deyo modification of the Charlson Index,

⁷ PAC= post acute care.