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ORIGINAL RESEARCH

Factors Associated With Discharge to Home Versus Discharge to Institutional Care After Inpatient Stroke Rehabilitation

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Abstract

Objective: To examine sociodemographic and clinical characteristics independently associated with discharge home compared with discharge to a skilled nursing facility (SNF) after acute inpatient rehabilitation.

Design: Retrospective cohort study.

Setting: Three tertiary accredited acute care rehabilitation facilities.

Participants: Adult patients with stroke (N=2085).

Interventions: Not applicable.

Main Outcome Measures: Not applicable.

Results: Of 2085 patients with stroke treated at 3 centers over a 4-year period, 78.2% (n=1631) were discharged home and 21.8% (n=454) discharged to an SNF. Findings from a multivariable logistic regression analysis indicated that patients were less likely to be discharged home if they were older (odds ratio [OR], .98; 95% confidence interval [CI], .96–.99), separated or divorced (compared with married; OR, .61; 95% CI, .48–.79), or with Medicare health insurance (compared with private insurance; OR, .69; 95% CI, .55–.88), or had dysphagia (OR, .83; 95% CI, .71–.98) or cognitive deficits (OR, .79; 95% CI, .77–.81). The odds of being discharged home were higher for those admitted with a higher motor FIM score (OR, 1.10; 95% CI, 1.09–1.11). The following were not associated with discharge disposition: sex, race, prestroke vocational status, availability of secondary health insurance, number of days from stroke onset to rehabilitation facility admission, stroke type, impairment group, cognitive FIM on admission, other stroke deficits (aphasia, ataxia, neglect, or speech disturbance), stroke complications of hyponatremia or urinary tract infection, or comorbid conditions.

Conclusions: One in 5 patients with stroke were discharged to an SNF after inpatient rehabilitation. On admission, several sociodemographic and clinical characteristics were identified that could be considered as important factors in early discussions for discharge planning.

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The incidence of stroke has been relatively consistent at 795,000 new or recurrent strokes per year over the last decade.[1,2] In contrast, because of early, coordinated interventions, stroke survival has significantly improved and is now <130,000 deaths per year.[2,3] This reflects a 38.5% decrease in the relative rate of stroke deaths from 2000 to 2010.[1,3,4] Although this is a great success story, the downside is that more stroke survivors are living longer with disability. Stroke remains the leading cause of long-term disability in adults.[4] A close look at the stroke population with disability reveals minor impairment in 25%, moderate to severe impairment in 40%, and discharge to institutional care in 10%.[5]

In addition to the impairment caused to the patient, stroke is very costly. These costs include the burden of care placed on the family and caregivers. There are also financial costs that the individual stroke survivor and the society bear. These involve the loss of productivity as well as the cost of care provision. In 2010, the cost of stroke in the United States approached $73.7 billion, making stroke one of the most expensive chronic diseases.[1,6] The national burden is anticipated to reach $240 billion by 2030.[1] On an individual basis, Taylor et al[7] reported in 1996 that the average lifetime cost of stroke surpassed $100,000 with nursing

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home cost of care comprising 17.5% of the total. In 2009, this cost was further evaluated in a critical review of the literature by Luengo-Fernandez et al,[8] who reviewed 120 articles from 15 countries. When focusing only on the United States, they reported that the cost ranged from $7309 to $146,149. A 2012 Canadian study[9] reported similar levels of expenditure for Canadian stroke survivors, with an average annual cost of $107,883 for disabling strokes.

In light of the significant level of disability and the rising costs of care, discharging the patient home is highly desirable. Inpatient stroke-directed rehabilitation has been shown to positively affect the probability of home discharge.[10-12] It has been postulated that the improved effect is through a comprehensive interdisciplinary approach that minimizes medical complications, initiates neurocognitive stimulation, and optimizes training of the patient and caregivers.[10,11] In addition, from a personal preference perspective, patient surveys confirm that up to 85% of patients preferred to be discharged to their home environment.[13] Studies evaluating discharge disposition suggest that 54.2% to 64.1% of stroke survivors are discharged from acute care rehabilitation to another inpatient setting.[14-16] As suggested previously, admission to an acute stroke rehabilitation program can increase the probability of returning home after a stroke.[10-12] Studies of discharge disposition from acute inpatient rehabilitation settings report a wide range from 62% to 99% for home disposition.[12,17,18]

There is little information on which specific patient characteristics can be used to predict a home versus institution disposition from inpatient rehabilitation.[19-24] The purpose of this study was to examine sociodemographic and clinical characteristics independently associated with discharge home compared with discharge to a skilled nursing facility (SNF) after acute inpatient rehabilitation.

Methods

Design and setting

This retrospective observational study includes patients treated at 3 inpatient acute care rehabilitation centers in southeastern United States. The 3 centers are part of a self-supporting, public, not-for-profit health care provider system with a network of almost 800 care locations including academic medical centers, hospitals, physician practices, surgical and rehabilitation centers, home health agencies, nursing homes, and hospice and palliative care. The study was approved by the institutional review board of the provider organization and the data coordinating center.

Participants

There are 85 impairment group codes that represent conditions requiring rehabilitation. The impairment group codes are used to generate rehabilitation impairment categories (RICs).[25] RIC codes are the first level of classification in inpatient rehabilitation facilities for payment based on case mix. An RIC code of 1 indicates stroke cases with a diagnosis of cerebral ischemia due to vascular thrombosis, embolism, or hemorrhage. Patients with an RIC code of 1 were selected for this retrospective study. A total of 2695 patients with an RIC code of 1 were admitted over a 4-year period (2008–2011) at 1 of the 3 acute inpatient rehabilitation facilities (fig 1). The stroke volume per site remained constant for each of the 4 years.

List of abbreviations:

CI	confidence interval
OR	odds ratio
RIC	rehabilitation impairment category
SNF	skilled nursing facility

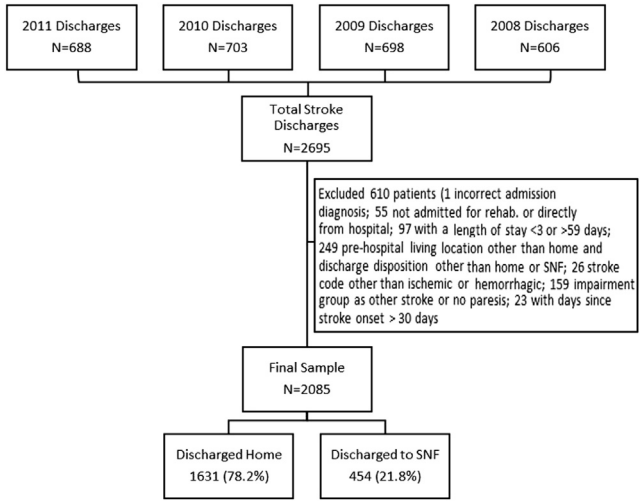

Fig 1 Study sample of the stroke population.

The 3 facilities—2 urban and 1 rural in location—belonged to the same stroke rehabilitation program and conformed to a uniform set of stroke rehabilitation practice guidelines and data documentation. Preliminary analysis revealed that there was no difference in discharge disposition by site for all 4 years or by year. The site, location of care (urban vs rural), and year of patient discharge were not included as variables in further analyses.

Data collection

Data were collected retrospectively through abstraction of data from eRehabData.[a] eRehabData is an inpatient rehabilitation outcomes software system that serves as an online patient assessment approach offered to inpatient rehabilitation providers by the American Medical Rehabilitation Providers Association.[26]

The patient sociodemographic and clinical variables were selected on the basis of the literature, preliminary screen, and clinical expertise. A review of the literature revealed the following variables that could assist in predicting disposition: the FIM, particularly the motor FIM[27-31]; stroke severity, most often measured by the National Institutes of Health Stroke Scale[32-34]; racial background[22-24,35]; age at stroke onset[17,36]; marital status[30]; and insurance.[37] The team of clinicians and researchers further evaluated the data available for variable selection. Stroke physiatrists, resident physicians, research scientists, research coordinators, research assistants, and biostatisticians met face to face and held asynchronous discussions to examine the value of each variable for this study.

Sociodemographic variables selected for this study included age, sex, race, marital status, prestroke living arrangement, employment status, and health insurance. Clinical variables selected included preexisting comorbidities, number of days from stroke onset to inpatient rehabilitation facility admission, stroke type, impairment on rehabilitation admission, motor and cognitive

function on admission, complications experienced during hospitalization, and stroke deficits.

Data analysis

Patient characteristics and administrative variables were compared for patients with stroke discharged home and those discharged to an SNF. For each analysis, probability values were obtained using Pearson chi-square tests for categorical variables and Wilcoxon signed-rank tests for continuous/ordinal variables. The relation between covariates was examined, and marital status was found to be strongly associated with prestroke living arrangements. Clinically, we observed that marital status might be a better indication of possible support availability and an important consideration for discharge disposition. Therefore, we included marital status in the final model. All tests were 2-sided and performed by comparing only nonmissing values. The level of significance was set at $P<.05$.

The univariate odds of being discharge home were examined for each variable by using logistic regression. Stepwise multivariable logistic regression with generalized estimating equations to account for within-hospital clustering was performed to identify independent factors associated with discharge to home (vs SNF). Model discrimination was assessed by determining the C-index for each model. The C-index ranges from 0.5 to 1, where 1 corresponds to the model perfectly discriminating the response. SAS version 9.3[b] was used for all analyses.

Results

A total of 2695 patients with stroke were admitted over a 4-year period and treated at 3 acute inpatient rehabilitation facilities. Of these cases, 610 were excluded from analyses and 2085 patients admitted directly from an acute hospital and living at home before admission to an acute stroke rehabilitation program were included in the study (see fig 1).

Patients' age ranged from 19 to 98 years. There were 50.6% men compared with 49.4% women, 61.5% white (n=1281), 46.0% married (n=959), 72.4% living with family before stroke (n=1509), and 58.2% supported by Medicare (n=1213). Of the 2085 patients analyzed, 78.2% (n=1631) were successfully discharged to home and 21.8% (n=454) to an SNF (table 1). Univariate associations between each variable and discharge disposition are presented in table 1 for proportions and means and in table 2 for odds ratios (ORs).

Stepwise multivariable logistic regression analyses revealed that patients were more likely to discharged home if they were admitted with a higher motor FIM score (OR, 1.10; 95% confidence interval [CI], 1.09−1.11) (see table 2). Patients were less likely to be discharged home if they were older (OR, .98; 95% CI, .96−.99), separated or divorced (compared with married; OR, .61; 95% CI, .48−.79), or with Medicare health insurance (compared with private insurance; OR, .69; 95% CI, .55−.88), or had dysphagia (OR, .83; 95% CI, .71−.98) or cognitive deficits (OR, .79; 95% CI, .77−.81). The model discriminated well (C-index=.820).

Discussion

This study examined sociodemographic and clinical characteristics independently associated with discharge home compared with discharged to an SNF after acute inpatient rehabilitation for stroke. The results indicate that age, race, marital status, motor function on admission, and cognitive deficits were associated with discharge disposition after inpatient rehabilitation.

These findings confirm that there are certain variables that can guide the stroke rehabilitation team with regard to home versus SNF disposition. Feng et al[22] and Freburger[23] and colleagues reported that blacks were less likely to be discharged home from acute care rehabilitation. However, these studies addressed only populations who received acute care rehabilitation. Focusing further down the care spectrum on acute care rehabilitation, data on discharge disposition are conflicting. Chiou-Tan et al[24] asserted that neither race nor ethnicity was predictive of discharge disposition. In contrast, Bhandari et al[35] suggested that blacks were more likely to be discharged home. Present findings provide support that blacks compared with white stroke survivors are more likely to be discharged home after inpatient rehabilitation. Future analyses of racial disparities in outcomes including discharge disposition could examine living arrangements and caregiver availability. Prospective studies using survey research methods may be useful in obtaining patient and caregiver preferences regarding discharge planning and placement, given patients' health status.

Evaluating the FIM score as a predictor of disposition, Sandstrom et al[28] reported that patients who received acute care rehabilitation with higher admission and discharge motor FIM scores were more likely to be discharged home. The findings of Nguyen et al[30] were similar, which indicated that patients with an admission FIM score of $\leq$75 were more likely to be discharged to an SNF. Interestingly, if these patients with low FIM scores were married, they were significantly more likely to be discharged home.[30] The present results indicate that married patients and those with a higher admission motor FIM score were also more likely to be discharged home.

We report that age, marital status, cognitive deficits, and type of insurance are associated with discharge disposition. These findings suggest that patients with stroke who are older, separated or divorced, cognitively impaired, or with Medicare health insurance are less likely to be discharged home. With the exception of younger age[36] and being cognitively intact[38] in separate studies associated with home discharge, the data that directly address these factors for patients who received inpatient rehabilitation are sparse.

As discussed previously, there is an increasing rate of stroke survival concomitant with an increasing financial burden of stroke care. Predicting the outcome associated with various sociodemographic and clinical factors can assist the stroke team in planning the patient's disposition that best meets the patient's needs and minimize the cost. Furthermore, the information could be used to guide admission criteria for acute care rehabilitation. This ought to be addressed in future studies. Finally, as 85% of patients desire home discharge,[13] correctly prognosticating disposition is desirable.

Study limitations

A wide range of sociodemographic and clinical variables affecting discharge disposition were addressed. The study is limited by retrospective data from the medical records and does not address the strength of the prediction for each variable. Future studies may consider developing an algorithm to predict discharge disposition as an important patient-centered outcome.

Table 1 Sociodemographic variables affecting discharge disposition

Variable	Home (n=1631 [78.2%])	SNF (n=454 [21.8%])	*P*
Age (y)	63.7±13.9	69.9±12.5	<.001
Min, Max	19, 98	35, 94	
Sex: female	796 (48.8)	234 (51.5)	.302
Race			.009
White	976 (59.8)	305 (67.2)	
Black	589 (36.1)	129 (28.4)	
Other*	66 (4.1)	20 (4.4)	
Marital status			<.001
Married	800 (49.1)	159 (35.0)	
Never	357 (21.9)	108 (23.8)	
Separated or divorced	207 (12.7)	72 (15.9)	
Widowed	267 (16.4)	115 (25.3)	
Prestroke living arrangements			<.001
Alone	291 (17.8)	133 (29.3)	
Family or relatives	1221 (74.9)	288 (63.4)	
Other, friends, attendant	119 (7.3)	33 (7.3)	
Prestroke employment status			<.001
Retired for age	773 (47.4)	289 (63.7)	
Retired for disability	169 (10.4)	48 (10.6)	
Employed	387 (23.7)	58 (12.8)	
Not working, student, or homemaker	302 (18.5)	59 (13.0)	
Primary health insurance			<.001
Private†	466 (28.6)	63 (13.9)	
Medicare	876 (53.7)	337 (74.2)	
Medicaid	289 (17.7)	54 (11.9)	
Secondary health insurance	544 (33.4)	192 (42.3)	<.001
Medical information			
Days since stroke onset	9.8±10.5	11.9±12.4	<.001
Motor function on admission	37.2±12.4	24.8±9.9	<.001
Cognitive function on admission	19.7±7.1	15.4±6.8	<.001
Impairment on rehabilitation admission			.932
Left (right stroke)	744 (45.6)	206 (45.4)	
Right (left stroke)	783 (48.0)	221 (48.7)	
Bilateral	104 (6.4)	27 (6.0)	
Stroke type			.767
Hemorrhagic	260 (15.9)	75 (16.5)	
Ischemic	1371 (84.1)	379 (83.5)	
Comorbidities			
Atrial fibrillation	145 (8.9)	62 (13.7)	.003
Diabetes	258 (15.8)	71 (15.6)	.926
Kidney disease	229 (14.0)	73 (16.1)	.275
Hypertension	545 (33.4)	128 (28.2)	.035
Hyperlipidemia	409 (25.1)	71 (15.6)	<.001
Coronary artery disease	101 (6.2)	29 (6.4)	.879
Complications			
Hyponatremia	58 (3.6)	32 (7.1)	.001
Urinary tract infection	229 (14.0)	101 (22.3)	<.001
Deficits			
Dysphagia	169 (10.4)	87 (19.2)	<.001
Aphasia	70 (4.3)	36 (7.9)	.002
Speech disturbance	114 (7.0)	42 (9.3)	.105
Cognitive deficits	140 (8.6)	68 (15.0)	<.001
Neglect	38 (2.3)	20 (4.4)	.017
Ataxia	58 (3.6)	7 (1.5)	.029

NOTE. Values are mean ± SD or n (%). Probability values were obtained using Pearson χ^2 tests for categorical variables and Wilcoxon signed-rank tests for continuous/ordinal variables.

* Other race/ethnicity includes American Indian, Alaska Native, Asian, Hispanic/Latino, Native Hawaiian/Other Pacific Islander.

† Blue Cross; CHAMPUS; commercial; managed care; private payer.

Table 2 Patient Characteristics independently associated with discharge home (N = 2085)

	Univariate			Multivariate[†]		
Characteristic	OR	95% CI	*P*	OR	95% CI	*P*
Age (y)	0.97	0.96–0.97	<.001	0.98	0.96–0.99	<.001
Sex: female	0.95	0.85–1.05	.302	NA	NA	NA
Race (reference = white)			.010	NA	NA	NA
Black	1.25	1.01–1.55	.038			
Other*	0.91	0.64–1.28	.575			
Marital status (reference = married)			<.001			<.001
Never married	1.02	0.84–1.23	.850	0.80	0.64–1.01	.056
Separated or divorced	0.89	0.71–1.10	.278	0.61	0.48–0.79	<.001
Widowed	0.72	0.59–0.86	<.001	1.07	0.84–1.35	.595
Prestroke employment status (reference = employed)			<.001	NA	NA	NA
Retired for age	0.63	0.54–0.74	<.001			
Retired for disability	0.83	0.64–1.08	.167			
Not working	1.21	0.95–1.53	.117			
Primary health insurance (reference = private)			<.001			.009
Medicaid	1.14	0.92–1.42	.230	1.16	0.90–1.51	.257
Medicare	0.56	0.48–0.65	<.001	0.69	0.55–0.88	.002
Secondary health insurance, none (does not have it)	0.83	0.74–0.92	<.001	NA	NA	NA
Days since stroke onset	0.99	0.98–0.99	<.001	NA	NA	NA
Motor function on admission	1.09	1.08–1.11	<.001	1.10	1.09–1.11	<.001
Cognitive function on admission	1.09	1.07–1.11	<.001	NA	NA	NA
Impairment on rehabilitation admission (reference = bilateral)			.932	NA	NA	NA
Left (right stroke)	0.99	0.82–1.18	.871			
Right (left stroke)	0.97	0.81–1.16	.709			
Stroke type, hemorrhagic (vs ischemic)	0.98	0.85–1.13	.765	NA	NA	NA
Comorbidities						
Atrial fibrillation	0.79	0.67–0.92	.003	NA	NA	NA
Coronary artery disease	0.98	0.79–1.22	.878	NA	NA	NA
Diabetes	1.01	0.87–1.16	.926	NA	NA	NA
Hyperlipidemia	1.34	1.17–1.54	<.001	NA	NA	NA
Hypertension	1.13	1.01–1.27	.036	NA	NA	NA
Kidney disease	0.92	0.80–1.07	.275	NA	NA	NA
Complications						
Hyponatremia	0.70	0.56–0.87	.001	NA	NA	NA
Urinary tract infection	0.76	0.66–0.86	<.001	NA	NA	NA
Deficits						
Aphasia	0.72	0.59–0.89	.002	NA	NA	NA
Ataxia	1.53	1.03–2.28	.034	NA	NA	NA
Cognitive deficits	0.73	0.63–0.85	<.001	0.79	0.77–0.81	.010
Dysphagia	0.70	0.61–0.80	<.001	0.83	0.71–0.98	.027
Neglect	0.72	0.55–0.95	.019	NA	NA	NA
Speech disturbance	0.86	0.71–1.03	.106	NA	NA	NA

Abbreviations: AIC, Akaike information criterion; NA, not applicable.

* Other race/ethnicity includes American Indian, Alaska Native, Asian, Hispanic/Latino, Native Hawaiian/Other Pacific Islander.

† C-index = 0.820; AIC = 1715.0.

Furthermore, studies are indicated to evaluate specific interventions that could be used to improve the probability of home discharge even among those patients known to be more likely to be discharged to an SNF.

Conclusions

The present results suggest an association between sociodemographic and clinical variables and home versus SNF discharge disposition. Younger patients and blacks were more likely to be discharged home. Patients who were married were more likely to be discharged home than were patients who were widowed. Patients who were widowed were more likely to be discharged home than were patients who were separated or divorced. Patients who were privately insured were more likely to return home than were patients with Medicare health insurance. Finally, patients with a higher admission motor FIM score and without dysphagia or cognitive deficits were more frequently discharged home. Future studies are needed to evaluate whether patient characteristics may be used to improve the prognostication of a

stroke patient and to optimize the management of their rehabilitation program.

Suppliers

a. American Medical Rehabilitation Providers Association.
b. SAS Institute Inc.

Keywords

Outcome assessment (health care); Rehabilitation; Stroke

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