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Recovery of Functional Status After Stroke in a Tri-Ethnic Population

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Abstract

Objective—To examine recovery of functional status for white, black, and Hispanic patients who have had a stroke from the time of admission to inpatient medical rehabilitation to 12 months after discharge.

Design—A longitudinal study that used information from the Stroke Recovery in Underserved Population database, a prospective observational study of persons with stroke who received inpatient medical rehabilitation services during 2005-2006.

Setting—Eleven inpatient rehabilitation facilities located across diverse regions of the United States, including California, Florida, Iowa, Illinois, Kentucky, New Jersey, New York (2), Texas (2), and Washington, DC.

Participants—A total of 990 adults aged 55 years or older who had a stroke and were admitted to 1 of 11 inpatient medical rehabilitation facilities in the United States were interviewed at 4 time points, including admission to and discharge from an inpatient medical rehabilitation facility and 3 and 12 months after discharge.

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Interventions—Not applicable.

Main Outcome Measure—Functional status as measured by the Functional Independence Measure (FIM).

Results—For the total sample, FIM ratings increased from admission to discharge and from discharge to 3-month follow-up, with little recovery occurring between 3 and 12 months. In random effects mixed models, at 3-month follow-up, both black and Hispanic patients had lower FIM ratings than did white patients. At 12-month follow-up, black and white patients were similar; however, Hispanic patients continued to have lower FIM ratings compared with white patients. Racial/ethnic group, age, length of stay, and medical comorbidities were significant predictors of total FIM ratings over the 4 time points.

Conclusions—Persons 55 years and older who have had a stroke, regardless of race/ethnicity, appear to benefit from inpatient medical rehabilitation. Most functional status gains occur during inpatient medical rehabilitation and continue in the first few months after discharge, with little change afterward.

INTRODUCTION

Stroke is primarily a disease of older people and disproportionately affects ethnic minority groups. Of the more than 5.7 million stroke survivors, nearly half are left functionally dependent after hospitalization [1]. The projected shift in demographics toward older age groups along with declining stroke mortality rates suggest that the number of functionally dependent persons with stroke will likely increase in the coming decades [1,2].

Black and Hispanic persons are 2 and 1.7 times, respectively, more likely to experience a stroke than are white persons [1]. Research further suggests that older black and Hispanic persons who have experienced a stroke recover functional status more slowly than do older white persons and that these differences are not simply the result of greater stroke severity. In a large tri-ethnic study of older adults who received inpatient medical rehabilitation after having their first stroke, Ottenbacher et al [3] found that black and Hispanic subjects had lower admission and discharge functional status ratings compared with white subjects. In a study of 171 patients admitted to a medical rehabilitation facility, Chiou-Tan et al [4] found that although older Hispanic patients had lower functional status ratings at admission when compared with older black patients, they had larger functional status gains during the inpatient stay, and by discharge both groups had similar functional status ratings. To date, it is not clear whether recovery of functional status continues after discharge or whether patterns of recovery are similar for older white, black, and Hispanic subjects.

A goal of the current investigation was to assess functional status at 4 poststroke time points, including admission to and discharge from an inpatient medical rehabilitation facility and 3 and 12 months after discharge. Functional recovery in persons who have had a stroke beyond inpatient medical rehabilitation has been investigated in few studies, and it is not evident whether gains in function continue beyond the first few months after discharge [5]. We hypothesized that gains in functional status would continue into the first few months after discharge but would moderate or plateau thereafter. A second goal of the investigation was to examine racial/ethnic differences in functional status at the 4 time points. Because of established racial/ethnic disparities in health care and health outcomes, we hypothesized that white patients 55 years and older who had a stroke would show greater gains in functional status than would black and Hispanic patients 55 years and older who had a stroke during a 12-month follow-up.

METHODS

Source of Data

Data came from the Stroke Recovery in Underserved Populations database, an observational follow-up study of persons who had a stroke and received inpatient medical rehabilitation services during 2005-2006. Of 20 facilities that were invited to participate and were sent information describing the goals of the study, 16 agreed to participate in the study. Five facilities that were located in the Gulf Coast region and were affected by hurricanes that occurred in 2005 subsequently were removed from the study. The 11 remaining facilities were located across diverse regions of the United States, including California, Florida, Iowa, Illinois, Kentucky, New Jersey, New York (n = 2), Texas (n = 2), and Washington, DC. Operating bed sizes ranged from 12 to 155 (median bed size, 78); all 11 facilities were accredited by the Joint Commission on Accreditation of Healthcare Organizations, and all but one facility was accredited by the Commission on Accreditation of Rehabilitation Facilities.

Data Collection

Sociodemographic characteristics and clinical measures were collected at 4 time points: within 72 hours of admission to and 72 hours of discharge from an inpatient medical rehabilitation facility and at 3 and 12 months after discharge. Inhospital interviews were conducted by nursing staff at the inpatient medical rehabilitation facility with use of a structured interview format. Follow-up information was collected by trained nurse researchers by telephone interview. The inter-rater reliability and stability of the follow-up information collected via the use of phone interviews has been established, with intraclass correlation values for functional assessments ranging from 0.86-0.99 [6,7]. In-hospital and follow-up interviews were conducted in Spanish or English.

Study Population

Persons eligible for inclusion in the current study were admitted to an inpatient medical rehabilitation facility with a diagnosis of stroke (ICD-9 codes 436-439), were age 55 years or older, were of either gender, and were self-reported as white, black, or Hispanic. A total of 990 patients (783 white, 150 black, and 57 Hispanic) were interviewed at admission and discharge from an in-patient medical rehabilitation facility. Of these, at the follow-up interviews, 89 had died, 170 could not be contacted, 39 refused to be interviewed, and 4 were missing data on functional status (n = 301). At the 3-month follow up, the total sample was 864 patients (679 white, 135, black, and 50 Hispanic). At the 12-month followup, the total sample was 689 (545 white, 113 black, and 31 Hispanic). To evaluate the potential bias of those lost to follow-up, we tested for significant differences across various sociodemographic and health-related measures. After reviewing these measures, we did not identify any potential sociodemographic confounders with known or suspected associations with functional status. Central and local ethical committee approval was sought and obtained. Consent was obtained in person at the time of the initial interview.

Outcome Measure

Functional status was assessed by the Inpatient Rehabilitation Facilities-Patient Assessment Instrument (IRF-PAI). The IRF-PAI is a 54-item instrument used to assign medical rehabilitation inpatients to a case-mix group. The case-mix group determines prospective reimbursement for medical rehabilitation by the Centers for Medicare Services [8-10]. The functional status items in the IRF-PAI are from the Functional Independence Measure (FIM), a standardized measure including 18 items and covering 6 domains: selfcare, sphincter control, transfer, locomotion, communication, and social cognition. All 18 items

are scored into 1 of 7 levels of function, ranging from complete dependence (level 1) to complete independence (level 7). Total FIM ratings have a potential range of 18 to 126, where higher scores indicate greater functional independence. The reliability, validity, and responsiveness of the FIM instrument have been widely investigated [11,12]. The reliability (intraclass correlation coefficient) of the Total FIM and of its domains has consistently been found to be >0.85 [11-13].

Covariates

Sociodemographic and clinical measures were included as covariates in the statistical models described later in this article. We selected these covariates on the basis of their association with stroke outcomes [1]. Sociodemographic measures included continuous age (< 55 years), gender, marital status, (married versus unmarried), and education (years of school completed). Clinical measures included a summary comorbidities index (heart attack, diabetes, kidney disease, and cancer), length of hospital stay (calculated in days from inpatient admission to discharge), postdischarge therapy (outpatient, home-based, long-term care, or day treatment), and stroke type (ischemic, hemorrhagic, or other).

Data Analysis

Descriptive statistics were reported as means (and standard deviations) for continuous measures and as percentages for categorical measures for the total sample and by ethnicity (white, black, and Hispanic). Random effects mixed models were used to compare functional status at 4 time points by racial/ethnic group. To assess the factors associated with race/ethnic differences on functional recovery, 2 models were built. The first model adjusted for patient sociodemographic characteristics, including age, gender, marital status (married versus unmarried), and years of education (<12 years versus >12). A second model added clinical measures including length of stay, stroke type, and comorbidities index score (>1). For all models, testing was 2-sided, and an α of .05 was used. All analyses were performed with SAS software, version 9.1.3 (SAS Institute, Cary, NC).

RESULTS

Table 1 shows sociodemographic and clinical characteristics of the total sample stratified by race/ethnicity. The mean age for the overall sample was $73.0 (\pm 9.6)$. The most prevalent type of stroke was ischemic (75.2%). The majority of white patients were significantly older (73.9 ± 9.5 years), married (55.9%), and had a high school education of 12 years or more (80.8%). No significant differences were found between racial/ethnic groups with regard to gender ($P = .50$), number of comorbidities ($P = .73$), length of stay ($P = .44$), or stroke type ($P = .09$).

Table 2 shows the unadjusted total FIM ratings calculated for the total sample at 4 time points, including admission to and discharge from inpatient medical rehabilitation and 3 and 12 months after discharge. The mean Total FIM rating at admission was 55.0 points, and this rating increased to 79.5 points by the discharge date. At 3-month follow-up, the Total FIM rating increased a further 22.2 points to 101.7. At the 12-month follow-up, the Total FIM rating had increased by 3.8 points to 105.5. Black patients had the highest Total FIM rating at admission (58.1 points), and white patients had the lowest Total FIM rating (54.4 points). Total FIM ratings increased for all 3 ethnic groups, and by the discharge date, Hispanic, black, and white patients had Total FIM ratings of 80.3, 82.9, and 78.8, respectively. Total FIM ratings continued to increase during the first 3 months after discharge for each ethnic group (92.0, 101.9, and 102.3, respectively), but showed little gain afterward.

Table 3 shows multivariate repeated random effect mixed models predicting Total FIM ratings from admission to 12-month follow-up. Model 1 indicates a significant gain in Total FIM rating over the 4 interview time points. Race/ethnic group and age also were significant predictors of Total FIM rating. However, gender, marital status, and level of education were not significantly associated with the Total FIM rating over time. Model 2 added length of stay, type of stroke (ischemic stroke), comorbidities, and therapy to the analysis. Of the 4 clinical measures, longer length of stay ($P = <.0001$) and greater number of comorbidities ($P = .05$) were significantly associated with Total FIM ratings.

Table 4 shows adjusted mean differences of total FIM ratings stratified by race/ethnicity at the 4 interview time points. Mean scores (and 95% confidence interval) were adjusted for all measures included in Table 2 (model 2). Black patients had a mean Total FIM rating that was 0.08 points higher than that of white patients at admission, whereas Hispanic patients had a mean Total FIM rating that was 0.38 points higher than that of white patients. By the time of the discharge interview, black patients had a mean Total FIM rating that was 0.29 points higher than that of white patients, and Hispanic patients had a mean Total FIM rating that was -0.31 points lower than that of white patients. At the 3-month follow-up interview, black patients had a mean Total FIM rating that was significantly lower than that of white patients (by 4.02 points), and Hispanic patients had a mean Total FIM rating that was significantly lower than that of white patients (by 11.50 points). At the 12-month follow-up interview, black and Hispanic patients relative to white patients had lower mean Total FIM ratings of 1.60 and 9.87 points, respectively. The difference was only significant between Hispanic and white patients.

DISCUSSION

The current study examined recovery of functional status for patients aged 55 years or older after stroke at 4 interview time points. The 4 time points included admission to and discharge from inpatient medical rehabilitation, as well as 3 and 12 months after discharge. Our results showed that patients with stroke can recover functional status; however, functional status gains appear to be limited over time. After discharge, white and black patients showed significantly greater improvement in functional status than did older Hispanic patients after adjustment for relevant risk factors. In the 3 months after discharge, white patients improved functional status by 28.5% (23.2/81.3 points), black patients by 26.1% (21.3/81.6 points), and Hispanic patients by 16.8% (13.6/80.9 points). At the 12-month follow-up, functional status had increased marginally for white, black, and Hispanic subjects.

Although the health of ethnic minority groups has improved in recent years, disparities in health care and health outcomes still persist [12]. However, the current findings provide some encouraging results on narrowing the ethnic disparity gap. During inpatient rehabilitation, nonwhite patients had slightly higher functional status ratings at admission and were able to match functional status gains made by white patients. This finding is also consistent with recent reports indicating some improvement in the area of access and quality of care for ethnic minorities (ie, black, Hispanic, Asian, and American Indian/Alaska Native individuals)[14,15].

Our findings suggest that differences in functional recovery over time between various race/ethnic minority groups who have had a stroke may be to the result of factors associated with postrehabilitation. It is not entirely apparent what these factors may be or why white subjects were able to show a significantly greater ability to recover functional status than were nonwhite subjects after discharge. Identifying variables that contribute to an increased risk for one group and a decline in the other will require more in-depth assessment. Nevertheless,

our data demonstrated nonsignificant differences across sociodemographic characteristics between white and nonwhite subjects and between those who received home health services and those who did not receive such services during follow-up.

It also is unlikely that measurement error played a role in observed differences in FIM rating scores after discharge [13]. This finding suggests a need to identify factors by which this difference occurs. According to the Institute of Medicine report *Unequal Treatment: Confronting Racial and Ethnic Disparities in Healthcare*, better understanding the causes of ethnic disparities in health care requires broadening the focus from traditional factors surrounding the illness or disability [16]. Future research focused on identifying less traditional factors associated with recovery of functional status, such as social support, emotional wellbeing, and availability of and access to community-based resources, may prove beneficial in understanding existing disparities [12].

The observed differences in the recovery of functional status between white and other minority ethnic groups have relevance to rehabilitation medicine and its focus on restoring physical and cognitive capabilities. In several studies, researchers have equated increased FIM points with minutes per day of help required from another person to complete basic daily living tasks. According to Granger et al [17], each increase of 1 FIM point in persons who have had a stroke corresponds to approximately 2.2 minutes of less assistance required by another person in performing activities of daily living. In the current study, we found an 11.5-point difference in total FIM rating between white and Hispanic patients, which equates to a difference of approximately 25 minutes per day of extra caregiver assistance for Hispanic patients. In terms of increased independence and quality of life for the older patient who has had a stroke, this finding is noteworthy. The finding is also potentially noteworthy in relation to caregiver burden, resource use, and cost. A number of reports specific to stroke research indicate the high prevalence of caregiver stress and burden [18,19] and the negative impact this can have on the caregiver and on the person receiving care.

Our study has a number of strengths, including a large sample size, use of the International Classification for Disease 9 codes, reliable and valid measurement instruments, and data obtained from rehabilitation facilities accredited by the Joint Commission on Accreditation of Healthcare Organizations and Commission on Accreditation of Rehabilitation Facilities, which set guidelines and standards for care for medical rehabilitation. However, our analysis is not without some limitations. First, as in all longitudinal studies, biases might have been introduced by missing data or unbalanced representation of the population. Second, although our data were collected across diverse geographic regions in the United States, the study participants were not randomly selected and may not be representative of all persons who have had a stroke. We also had a very small sample size in the Hispanic group. Third, because interhospital variability exists with regard to the type and quality of care delivered by inpatient medical rehabilitation facilities in the United States, facilities participating in this study may not adequately reflect the rehabilitation experience at other facilities. Fourth, because of a lack of data, we were not able to control for stroke severity in the statistical analyses. Another possible limitation of the study is the potential ceiling effect of the FIM instrument, in which subtle gains in function may not have been detected in patients who reached the maximum score.

CONCLUSIONS

Persons 55 years and older who have had a stroke, regardless of race/ethnicity, appear to benefit from inpatient medical rehabilitation. The present study demonstrated that the majority of functional status gains occur during rehabilitation and continue in the first few months after discharge. Recovery of functional status appeared to plateau between 3 and 12

months after discharge. In our sample, at the 3-month follow-up, both black and Hispanic patients had lower FIM ratings than did white patients. At the 12-month follow-up, black and white patients were similar; however, Hispanic patients continued to have lower FIM ratings compared with white patients. Our results suggest that knowledge of the postdischarge environment is required to fully understand what may account for these differences. The association of ethnicity to recovery of function after stroke requires further exploration.

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CME Question

According to this study, which ethnic/race groups showed similar functional gains one year after their stroke?

- a. Hispanic and white
- b. white and black
- c. black and Hispanic
- d. Asian and white

Answer online at me.aapmr.org

Table 1
Sociodemographic and clinical characteristics of patients with stroke at admission to inpatient medical rehabilitation facility stratified by race/ethnicity (N = 990)

Patient Characteristic	Total (N = 990)	White (n = 783)	Black (n = 150)	Hispanic (n = 57)	P Value
Age, y; mean (SD)	73.0 (9.6)	73.9 (9.5)	69.2 (9.0)	71.3 (9.8)	<.0001
Women, n (%)	508 (51.3)	398 (50.8)	83 (55.3)	27 (47.3)	.50
Married, n (%)	516 (52.1)	438 (55.9)	53 (35.3)	25 (43.9)	<.0001
Education, >12 y, n (%)	711 (78.7)	573 (80.8)	115 (79.3)	23 (46.9)	<.0001
Comorbidities, >1, n (%)	686 (69.3)	546 (69.7)	103 (68.7)	37 (64.9)	.73
Length of stay, mean, SD	20.1 (10.1)	20.3 (10.4)	19.2 (8.9)	20.0 (9.1)	.44
Stroke type, ischemic, n (%)	744 (75.2)	577 (73.7)	123 (82.0)	44 (77.2)	.09

SD = standard deviation.

Table 2
Unadjusted FIM ratings at admission, discharge, 3 months, and 12 months after discharge by race/ethnic group (N = 990)

	N*	FIM Scores Mean, SD						P Value
		Total	n	White	Black	n	Hispanic	
Admission	990	55.0 (19.5)	783	54.4 (19.7)	58.1 (18.7)	57	55.4 (18.2)	.09
Discharge	990	79.5 (24.1)	783	78.8 (24.2)	82.9 (23.6)	57	80.3 (23.9)	.15
3-month follow-up	864	101.7 (23.4)	679	102.3 (22.9)	101.9 (22.6)	50	92.0 (28.2)	.01
12-month follow-up	689	105.5 (21.7)	545	105.9 (21.2)	105.0 (21.9)	31	98.7 (29.6)	.18

FIM = Functional Independence Measure.

* Sample sizes vary from admission to the 12-month follow-up.

Table 3
Comparisons of total FIM ratings from admission to 12-month follow-up for selected sociodemographic and clinical measures (N = 990)

Measure	df	Model 1		Model 2	
		F Value	P Value	F Value	P Value
Time	3	43.5	<.0001	26.8	<.0001
Ethnicity	6	6.1	<.0001	5.8	<.0001
Age, y	3	4.8	<.002	4.4	.004
Women	3	0.2	.92	0.3	.81
Married	3	1.	.29	1.3	.26
Education, >12 y	3	0.99	.99	1.1	.36
Length of stay, days	3			21.5	<.0001
Stroke type, ischemic	3			1.7	.17
Comorbidities, >1	3			2.6	.05
Therapy, postdischarge, yes/no	3			0.4	.70

FIM = Functional Independence Measure.

Table 4

Adjusted mean difference of total FIM scores stratified by ethnic group over the 4 interview time points (N = 990)

Time	Ethnicity*	Mean	95% CI
Admission	Black	0.08	(-3.72, 3.89)
	Hispanic	0.38	(-5.60, 6.37)
Discharge	Black	0.29	(-3.50, 4.10)
	Hispanic	-0.31	(-6.30, 5.67)
3-month follow-up	Black	-4.02	(-7.83, -0.21)
	Hispanic	-11.50	(-17.49, -5.50)
1-year follow-up	Black	-1.60	(-5.57, 2.37)
	Hispanic	-9.87	(-16.48, -3.25)

CI = confidence interval; FIM = Functional Independence Measure.

* White is the reference category.