Racial and Ethnic Differences in Postacute Rehabilitation Outcomes After Stroke in the United States

Kenneth J. Ottenbacher, PhD; Joanna Campbell, PhD; Yong-Fang Kuo, PhD; Anne Deutsch, CRRN, PhD, RN; Glenn V. Ostir, PhD; Carl V. Granger, MD

Background and Purpose—Incidence, prevalence, and mortality for stroke vary by race and ethnicity with higher rates for blacks compared with non-Hispanic whites. Little information is available regarding differences in postacute care outcomes for racial and ethnic groups after a stroke.

Methods—A retrospective analysis was conducted of 161,692 patients from the Uniform Data System for Medical Rehabilitation who received inpatient medical rehabilitation after a first stroke in 2002 and 2003. Multivariable models examined the effects of race and ethnicity on length of stay, functional status, rehabilitation efficiency, and discharge setting.

Results—The mean age was 70.97 years (SD=12.87), 53% were female, and 76% were non-Hispanic white. Mean length of stay was similar for all groups ranging from 17.39 days (SD=10.86) to 17.93 (SD=10.59). Non-Hispanic white patients had higher admission and discharge functional status ratings compared with patients in the minority groups (P<0.01). Differences in functional status across racial/ethnic groups were related to age (F=20.49, P<0.001); the older the comparison group, the greater the difference in functional status. Non-Hispanic whites were discharged home less often than blacks (OR=0.64, 95% CI=0.62 to 0.66), Hispanics (OR=0.58, 95% CI=0.55 to 0.62), or other minority groups (OR=0.67, 95% CI=0.57 to 0.67).

Conclusions—The findings suggest racial and ethnic disparities exist in postacute care outcomes for persons with stroke. (Stroke. 2008;39:1514-1519.)

Key Words: cerebrovascular accident • ethnic groups • treatment outcome

Blacks are twice as likely to experience a stroke as non-Hispanic whites and are twice as likely to die from a first stroke.1–3 Hispanic Americans also have a higher incidence of first-time stroke than non-Hispanic whites (1.7 times greater) and are more likely to experience a hemorrhagic stroke.4 Recent data indicate age-adjusted incidence of first ischemic stroke per 100,000 persons is approximately 90 for non-Hispanic whites, 150 for Hispanics, and 190 for blacks.2

The effectiveness of postacute rehabilitation programs to reduce long-term disability is influenced by age, severity and type of stroke, early initiation of treatment, and educational level.5 Because there are racial and ethnic differences in the incidence, type, and severity of stroke, it is logical to assume that there may be racial and ethnic differences in postacute care outcomes.3,6

The purpose of our study is to examine poststroke outcomes across different racial and ethnic groups. We hypothesize that non-Hispanic white racial status will be an independent predictor of functional independence and that functional status will be higher in non-Hispanic whites than other racial/ethnic groups after controlling for relevant co-variates. Based on access to health care and other resources, we also hypothesize that discharge setting (home versus not home) will vary across racial and ethnic groups with non-Hispanic whites discharged home more frequently.

Methods

Source of Data

Data are from the Uniform Data System for Medical Rehabilitation (UDSMR). The UDSMR is the largest nongovernmental national registry of standardized information on rehabilitation inpatients in the United States7 and includes sociodemographic variables from the medical record, International Classification of Diseases, 9th Revision, Clinical Modification codes, facility characteristics, patient prehospital living arrangements and marital status, predisability employment, discharge disposition, length of stay (LOS), source of payment, and hospital charges. In addition, scores on a standardized measure of basic daily living skills, the Functional Independence Measure (FIM Instrument), are recorded at admission and discharge. All FIM instrument items are scored into one of 7 levels of function ranging from complete dependence (level 1) to complete independence (level 7). Total ratings range from 18 to 126 and are reported as Motor FIM (self-care, sphincter control, transfers, locomotion—13 items) and Cognitive FIM (communication, social cognition—5 items).8–11

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Facilities administer FIM items according to a protocol required by the Centers for Medicare and Medicaid Services. The interrater and test–retest reliability of the data collection process and FIM items has been examined by independent researchers and consistently produced intraclass correlation coefficients between 0.86 and 0.99. The study was reviewed and approved by the Institutional Review Board.

Study Sample
Admission, discharge, and follow-up data were reviewed for 178,055 patients receiving inpatient medical rehabilitation after a first stroke in 2002 and 2003 (International Classification of Diseases, 9th Revision, Clinical Modification codes 430, 430.1, 431.0 to 434.9, 436.0 to 438.99). The data were from 828 hospitals in 50 states. We used clinical criteria developed in previous research on case mix groups to exclude patients whose rehabilitation was atypical. We excluded patients with missing or out of range values including a logarithm of LOS that was 3 SDs or more above the mean for the impairment group (n = 3577) and cases with incorrect rehabilitation impairment categories or International Classification of Diseases, 9th Revision codes (n = 641). In addition, we excluded patients who were younger than 30 years of age (n = 1602), were readmissions or transfers from another rehabilitation facility (n = 4011), or were admitted for evaluation only (n = 1181). Patients not living at home at time of stroke onset were not included in the sample (n = 5351). The remaining 161,692 patients comprised the sample and represented 90.8% of the usable patient records from the original sample.

Independent Variable
Race/Ethnicity
Race/ethnicity was obtained from the medical record and coded as Non-Hispanic white, black, Hispanic, and others. The racial/ethnic status was confirmed by the hospital staff member completing the FIM instrument items. Due to small numbers for Asians, American Indians, Hawaiians and Pacific Islanders, and Alaskan Natives, they were collapsed into one category.

Dependent Variables
Functional Status
Functional status was based on ratings from the 18 FIM instrument items described previously. The rehabilitation facilities routinely administer the FIM instrument at admission and discharge.

Length of Stay
LOS was calculated as the total number of inpatient rehabilitation days. This did not include any rehabilitation days from the acute care hospital stay. According to Centers for Medicare and Medicaid Services criteria, a single admission includes patients who are transferred from inpatient rehabilitation to acute care and then back to inpatient rehabilitation within 3 days. If the readmission to acute care occurred after 3 days, the case was considered a new admission and excluded from the sample (see criteria for patient exclusion previously).

Efficiency
Efficiency was defined as the change in functional status (total FIM rating) from admission to discharge divided by the LOS; the shorter the LOS for a given change in FIM rating, the higher the efficiency rating.

Discharge Setting
Living setting was coded as home, board and care, transitional living, intermediate care, skilled nursing facility, hospital, rehabilitation facility, and other. These categories were collapsed to home and not home for statistical analyses.

Covariates
Covariates included gender, age, marital status (married versus not married), and primary payment source (Medicare, Medicaid, and commercial insurance). Case severity was assessed using admission FIM instrument ratings and the number of comorbidities. Additional covariates were type of stroke (hemorrhagic or nonhemorrhagic) and the time from stroke onset to rehabilitation admission in days. LOS was a covariate in statistical models in which LOS was not the dependent variable. We selected these covariates based on their established relationship with stroke outcomes and our previous research using the UDSMR database.

Statistical Analysis
We used descriptive statistics to examine sociodemographic and patient characteristics. We assessed bivariate differences for continuous and categorical variables using one-way analyses of variance with post hoc tests and χ² tests, respectively. Hierarchical multivariable linear regression was used to estimate the effects of race/ethnicity on FIM ratings at discharge, inpatient LOS, and FIM efficiency. Interaction terms for age and race/ethnicity were included in the model. We examined the effects of race/ethnicity on discharge setting using logistic regression. Regression diagnostics were computed and collinearity among variables examined. Bivariate comparisons used a significance level of P < 0.01, and adjustments were made using a modified Bonferroni correction. All statistical tests were conducted using SAS (version 9.0) or SPSS (version 14.0) software.

Results
Descriptive Statistics
Table 1 reports significant differences by race/ethnicity in several sociodemographic variables. Blacks, Hispanics, and other minority groups were significantly younger than non-Hispanic white patients at admission. Non-Hispanic white patients were more likely to be married, less likely to have Medicaid insurance, and were less likely to have experienced a hemorrhagic stroke. Time from stroke onset to inpatient rehabilitation admission varied significantly across the groups with non-Hispanic whites having the shortest interval (mean = 10.35 days [SD = 12.18]) and Hispanics the longest (11.96 days [SD = 11.22]). This difference remained significant after adjusting for age and type of stroke. For example, the time from onset to rehabilitation for persons with hemorrhagic stroke varied across ethnic groups: 15.22 days (SD = 15.18) for non-Hispanic white patients, 16.85 days (SD = 16.19) for black patients, and 16.66 days (SD = 15.31) for Hispanic patients.

Continuous Outcome Measures
Average length of stay was similar for all patient groups ranging from 17.39 days (SD = 10.86) for non-Hispanic whites to 17.93 days (SD = 10.25) for other minority groups. The unadjusted admission FIM ratings were highest for non-Hispanic white patients with the largest difference between non-Hispanic whites (58.82 [SD = 20.16]) and Hispanic patients (55.82 [SD = 20.14]). Discharge FIM ratings were also significantly different between non-Hispanic whites (81.54 [SD = 24.52]) and Hispanics (79.43 [SD = 24.65]). Similar differences in FIM ratings were found between non-Hispanic whites and black patients at admission (58.01 [SD = 20.03]) and discharge (80.23 [SD = 25.13]).

Table 2 presents the hierarchical regression models for the 3 continuous dependent variables: LOS, FIM efficiency, and FIM discharge ratings. Each regression model was computed using a hierarchical method of variable entry in which sociodemographic and patient characteristics (gender, age, marital
status, hemorrhagic versus nonhemorrhagic stroke, and number of comorbidities) were entered followed by treatment-related covariates (insurance coverage, time from stroke onset to rehabilitation admission, and admission FIM rating). The final regression models were generated by adding the race/ethnicity variable to the equations. Nonrace/ethnicity variables included age, number of comorbidities, time from onset to rehabilitation admission, marital status, and admission FIM rating. LOS was a significant predictor for FIM efficiency and discharge FIM ratings. Race/ethnicity was a significant variable in the equations for efficiency ($R^2=0.21$) and discharge FIM ($R^2=0.68$) after adjustment for the covariates listed previously.

We further examined the relationship between race/ethnicity and age on functional status by analyzing mean admission and discharge FIM ratings across the age quartiles (see Table 3). The differences in admission and discharge FIM ratings were smallest between the racial/ethnic groups for patients in the youngest quartile (30 to 62 years) and increased across the age quartiles with the largest differences in the oldest quartile. This relationship did not change when covariates listed in Table 2 were included in the analysis (results not shown). There was a 7.83-point difference in discharge FIM ratings between non-Hispanic white patients (mean 76.93, SD=24.68) and Hispanic patients (mean 69.10, SD=25.29) in the oldest quartile. There was a similar difference (6.74 points) between non-Hispanic white and black patients in the oldest quartile. In contrast, the differences in discharge FIM ratings between non-Hispanic white and Hispanic patients and non-Hispanic white and black patients in the youngest quartiles were 1.68 points and 1.76 points, respectively.

### Categorical Outcome Measures

The unadjusted analyses revealed a significant difference in the percent of patients discharged to home with 66% of non-Hispanic white patients discharged home versus 74% for blacks, 74% for Hispanics, and 76% for other minority groups. These differences remained significant after adjusting for age, gender, marital status, insurance coverage, hemorrhagic versus nonhemorrhagic stroke, onset time from stroke onset to rehabilitation admission, marital status, and admission FIM rating. LOS was a significant predictor for FIM efficiency and discharge FIM ratings. Race/ethnicity was a significant variable in the equations for efficiency ($R^2=0.21$) and discharge FIM ($R^2=0.68$) after adjustment for the covariates listed previously.
to rehabilitation, LOS, admission FIM ratings, and number of comorbidities. Non-Hispanic whites are less likely to be discharged to home compared with other racial/ethnic groups. With non-Hispanic whites as the reference group, the adjusted ORs were 0.64 (95% CI = 0.57 to 0.67) for other minority groups.

### Discussion

Consistent with previous research, we found non-Hispanic whites who undergo rehabilitation for a stroke were older, less likely to have Medicaid, and less likely to have had a hemorrhagic stroke. As hypothesized, we found statistically significant differences in the functional independence of blacks and Hispanics when compared with non-Hispanic whites. These differences continued to exist at admission and discharge after adjustment for relevant covariates. The differences in functional independence were smallest between non-Hispanic white and the “other” minority groups. Age was an important mediating variable in the relationship between FIM discharge rating and racial/ethnic group. The differences increased significantly as the patients became older with the largest differences approaching 8 FIM points between non-Hispanic white and Hispanic patients in the oldest quartile. The rehabilitation (FIM instrument) efficiency was significantly larger for non-Hispanic white patients compared with black patients. Not only did non-Hispanic white patients enter medical rehabilitation with higher FIM instrument ratings, but they also made larger gains after adjusting for covariates (see Table 1).

Research on the clinical significance of changes in FIM ratings has demonstrated that each 1-point increase in the total FIM instrument rating is associated with an average of between 3 and 6 minutes of daily help required from another person. There is variation in the amount of help required based on whether the change occurs in the low or high end of the FIM scale. The amount of help required (minutes per change in FIM point) also varied based on severity and impairment type. These “burden of care” studies have been conducted involving patients with traumatic brain injury, spinal cord injury, multiple sclerosis, and stroke. If an average of 4 minutes per FIM point is assumed, the difference at discharge of 8 FIM points between non-Hispanic white and Hispanic patients translates to approximately 32 minutes per day or 224 minutes (3.7 hours) per week of additional help from another person. Over a period of 6 months, a person of Hispanic ethnicity would require 96 additional hours of assistance provided by another person.

An obvious question is why is there a difference in functional independence ratings occurred among the racial/ethnic groups after controlling for confounding factors such as age, gender, type of stroke, martial status, and number of comorbidities. Other uncontrolled factors such as socioeconomic status and educational level should have had little direct impact over the relatively short period of inpatient medical rehabilitation. Potential explanations that require further investigation include the type, duration, and intensity of rehabilitation therapy provided to patients. Little research has been done on this topic, but at least one investigation has

<table>
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<th>Variables</th>
<th>Quartile 1</th>
<th>Quartile 2</th>
<th>Quartile 3</th>
<th>Quartile 4</th>
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<tr>
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<td>30 to 62 Years</td>
<td>62 to 73 Years</td>
<td>73 to 80 Years</td>
<td>80 to 105 Years</td>
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<td>85.47 (3.67)</td>
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<td>57.07 (19.45)</td>
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<td>68.09 (2.97)</td>
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<td>83.28 (22.93)</td>
<td>77.99 (24.33)</td>
<td>72.47 (25.35)</td>
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*Highest age varied for racial/ethnic groups: non-Hispanic white=104 years, black=105 years, Hispanic=102 years, other minority groups=101 years.
†Other=Asian, Native American, Alaska Native, and Hawaiian and Pacific Islander.
reported variation in the type and amount of occupational and physical therapy provided to older adults based on racial/ethnic grouping after controlling for level of disability and medical diagnosis. Other studies, however, have found no racial/ethnic difference in the amount of rehabilitation therapy for older patients with stroke or found increases in types of therapy associated with more severe motor deficits. These studies involved smaller sample sizes or specialized patient populations (Veterans’ Administration hospitals). Other possible explanations include personality-related variables such as attitudes toward health services, incentive to engage in the demanding activities associated with medical rehabilitation, and compliance with treatment programs and exercises. Research on health locus of control suggests that members of minority populations (eg, blacks) are more likely to express an external locus of control related to health beliefs and behaviors, whereas internal locus of control has been identified as a predictor of rehabilitation motivation and treatment success. External locus of control has also been demonstrated to increase in old age. These areas of future research may begin to increase our understanding of difference in functional outcomes among racial and ethnic groups.

We found significant differences in discharge to home versus not home across the racial and ethnic groups. Sixty-six percent of non-Hispanic white patients were discharged home compared with approximately 75% for all other (minority) groups. Discharge home is usually viewed as a positive outcome and is considered an indicator of quality of care. Discharge disposition is a complex variable with many potential mediating factors. It is possible that the family support and social network structure for blacks, Hispanics, and other minority groups is more extensive than for non-Hispanic whites and allows for increased home placement after stroke rehabilitation. Patient and family preferences play an important role in discharge planning and placement. Blacks and Hispanics tend to view nursing homes negatively and the percent of persons from these racial and ethnic groups in such facilities is low. Although discharge to home is considered a positive outcome, there may be cases in which it is not appropriate but alternatives are not available for a variety of reasons, including financial resources. In our sample, non-Hispanic whites were less likely to receive Medicaid insurance, which is one indicator of socioeconomic status. This is an area that requires additional research to understand how differences in discharge setting are related to functional independence, financial independence, and other social support factors.

**Study Strengths and Limitations**

The large national sample representing patients from more than 800 hospitals in the United States is a strength of our investigation. Another strength is the use of a standardized and validated measure of functional independence—the FIM instrument. However, as an observational study based on a large cohort of data analyzed retrospectively, our investigation has several limitations. Although the UDSMR data set has been extensively examined and compared with the Medicare claims files, selection bias remains a potential limitation, particularly for persons younger than 65 years of age not represented in the Medicare files. A related limitation is the small subsamples of persons from “other” minority populations that are not Hispanic or black. We combined persons from the other minority groups into one category, but this is a less than ideal solution. The “other” group was primarily Asian (2.1% of total sample) followed by Native Americans (0.5%), Hawaiian and Pacific Islanders (0.4%), and Alaskan Natives (0.1%). The data for the Asians appeared to be more like the non-Hispanic whites in regard to functional independence, whereas the other members of this group displayed outcomes similar to blacks and Hispanics. The numbers were too small to make statistical comparisons among these racial and ethnic groups, and this is an area in need of further investigation.

The UDSMR data set does not include information regarding the type, intensity, or duration of services received by patients during the acute medical hospitalization or their inpatient rehabilitation stay. This limitation reduced our ability to speculate about why patients from minority backgrounds had significantly longer times between the stroke event and admission to medical rehabilitation. This discrepancy existed both for patients with ischemic and hemorrhagic stroke across racial and ethnic groups. Although the time from event to rehabilitation admission differed across groups, it did not appear to impact LOS, which was similar across all groups. The differences in time from stroke onset and rehabilitation admission may be associated with other outcomes not examined in our study, and this is an important topic for future research.

A final limitation is the lack of information on the amount and type of follow-up services received by persons who have experienced a stroke and are also members of racial and ethnic minority groups. Follow-up data would be useful to determine if the disparity in discharge setting persists over time or if there are differences in downstream institutional placement or hospitalization readmission across racial/ethnic groups.

**Conclusion**

The Global Stroke Initiative states that, “Despite the enormous and growing burden of stroke...the disease does not receive the attention it deserves.” In the United States, very little attention has been devoted to poststroke outcomes in disadvantaged populations. In a recent review, Stansbury and colleagues summarized the evidence regarding ethnic disparities in stroke and concluded that unambiguous evidence exists for greater morbidity and mortality in blacks, but that evidence for disparities in postacute care across ethnic/racial groups is less conclusive. We found significant differences in rehabilitation outcomes across racial/ethnic groups.

In discussions of healthcare services provided to disadvantaged populations, the distinction is frequently made between differences in health care versus disparities. Differences may be related to the appropriateness or effectiveness of an intervention or patient preferences. Our investigation suggests the presence of disparities in poststroke outcomes for persons from minority populations. Additional research is required to confirm these disparities and begin exploring how they can be reduced or eliminated.
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Disclosures
C.V.G. is employed by the Uniform Data Services for Medical Rehabilitation, which is the largest nongovernmental national registry of standardized information on medical rehabilitation inpatients in the United States and has been used by rehabilitation facilities since 1987. The data used in this study were taken from the UDSMR database. FIM is a trademark owned by the UB Foundation Activities, Inc.

References
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