Effects of Race and Poverty on the Process and Outcome of Inpatient Rehabilitation Services Among Stroke Patients

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Background and Purpose—The greater mortality and residual physical impairments among black stroke patients may be attributable to differential utilization of rehabilitation services. This report examines, within an equal-access healthcare system, racial differences in time to initiation of stroke rehabilitation services and in the trajectory of physical function recovery.

Methods—This study was a secondary analysis of data from an inception cohort of 1073 stroke patients hospitalized between April 1995 and March 1997 and followed up for up to 1 year. Inpatient data came from medical record reviews; follow-up data came from telephone interviews at 1, 6, and 12 months after stroke. The study included consecutive acute ischemic or intracerebral hemorrhagic stroke patients from 9 VA medical centers. The main outcome measures were time to initiation of inpatient rehabilitation services and ability to perform activities of daily living.

Results—There were no racial differences in receipt of inpatient rehabilitation services (blacks, 76%; whites, 70%) or in the proportion of patients referred within 3 days of admission (blacks, 43.5%; whites, 42.0%). Among patients who experienced delay in initiation of rehabilitation, only low-income blacks experienced worse functional recovery over 12 months.

Conclusions—Low-income black stroke patients who experience delay in initiation of inpatient rehabilitation have a worse trajectory of functional recovery in the first year after stroke. Poverty-associated factors in the postdischarge setting may explain this phenomenon. (Stroke. 2003;34:1027-1031.)

Key Words: outcome ■ rehabilitation ■ stroke

Blacks experience not only a higher stroke incidence than whites but also higher stroke mortality and, among stroke survivors, worse residual physical impairment.1,2 Recent evidence indicates that greater stroke severity cannot fully account for these racial differences in stroke outcomes.3 However, differential access to timely acute and postacute stroke services may play a role. Stroke patients who receive prompt care in stroke rehabilitation units, for example, experience lower mortality and better recovery of physical function in the immediate term and for at least 10 years after stroke onset.4 Because few studies have examined racial differences in utilization of stroke rehabilitation services,5–7 it is unclear whether differential utilization of services accounts for observed racial differences in stroke recovery. This report presents evidence regarding racial differences in the process and outcomes of stroke rehabilitation services within an equal-access healthcare system.

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The views expressed in this report are those of the authors and do not necessarily reflect the views of either the Department of Veterans Affairs or the United States Government.

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1027
Patient Population

For this report, the original cohort was restricted to the 738 patients (69 of the 1073 patients) who were either black or white and were referred to inpatient rehabilitation (inpatient cohort). Blacks were as likely as whites to be referred to rehabilitation after adjustment for stroke severity and cognitive impairment (adjusted odds ratio [OR], 1.28; P = 0.13).

To assess the trajectory of physical function recovery, the inpatient cohort was further restricted to the 598 patients (81% of the 738 patients) who had at least 2 assessments of physical function: baseline (ie, discharge) and ≥1 follow-up periods (follow-up cohort). Attrition occurred for a number of reasons: we were unable to contact the patient before the interview date had passed; the patient was unable to communicate and had no proxy informant; or the patient died. Attrition was not significantly associated with the patient’s race.

Primary Outcomes

For analysis of the inpatient rehabilitation process, the primary outcome was elapsed time in days between hospital admission and initial contact by rehabilitation service personnel (eg, physician, physical therapist, occupational therapist, speech therapist, kinesiotherapist, or recreational therapist).

The primary outcome for analysis of physical function recovery was performance of activities of daily living (ADL) during the initial year after stroke onset. Performance of ADL was measured by the Rankin Scale score at the time of discharge and by the Barthel Index score at the last point of follow-up.

Primary Independent Variable and Covariates

Self-reported racial group dichotomized as black or white was the primary independent variable. When self-reported race was missing, race as recorded in the medical record was used. Covariates included age, sex, marital status, living situation at discharge (alone, with others, or nursing home or institution), income level (with low-income status being US$10 000 or less in annual household income), stroke type and severity, cognitive function, and whether the patient’s care was directed primarily by a neurologist. We also included a variable indicating the time in days from stroke onset to admission because time to referral to rehabilitation may be affected by how soon after stroke onset the patient presents for care.

Data Analysis

Ordinary least-squares regression analysis was used to test the baseline association between racial status and length of time to initial contact by rehabilitation service personnel in the hospital, controlling for relevant covariates. Mixed-model analysis was used to assess the longitudinal effects of race, socioeconomic status, and delay in initiation of rehabilitation on functional recovery.

Results

Patient Characteristics

Characteristics of patients in the inpatient and follow-up cohorts are shown in Table 1.

Race and Time to Initiation of Rehabilitation

The median time to initiation of rehabilitation was 3 days for patients regardless of race. The average time was approximately one-half day longer for blacks than whites (3.8 versus 4.4 days, respectively; P < 0.05), a result of the racial difference in the proportion of patients referred to rehabilitation (2 of 10 days after admission (8% of black patients [n = 17] and 4% of white patients [n = 18]). There was no racial difference in total number of in-hospital contacts with rehabilitation personnel.

Delay in Rehabilitation and Functional Recovery

On average, black patients recovered physical function during the first year after stroke at a significantly slower rate than whites (Table 2, model 1). This effect was associated with time to initiation of inpatient rehabilitation so that delay had a greater negative affect on poststroke recovery among blacks than whites (Table 2, model 2). Examination of improvement in physical function, defined as a change of 25 percentage points, among patients who began rehabilitation within 3 days after stroke was significantly worse for blacks than for whites, and the racial difference was 0.13, a result of the racial difference in the proportion of patients referred to rehabilitation.
of admission showed that 26% of whites and blacks experienced substantial improvement \((P/H11005 0.97)\). However, among those who began rehabilitation after 3 days, 35% of whites compared with 16% of blacks experienced substantial improvement \((P/H11005 0.007)\). These patterns held after the exclusion of patients who had initiated rehabilitation \(\geq 10\) days after admission.

Modifying Effect of Low Income on Use and Outcome of Inpatient Rehabilitation

Low-income black patients had a greater likelihood of beginning inpatient rehabilitation beyond the recommended 3 days (47.0% versus 27.3% for low- versus higher-income black patients, respectively; OR, 2.36; \(P<0.04\)). However, no such association existed among white patients (41.8% versus 40.5%; OR, 0.95; \(P=0.80\)). Functional recovery was impaired only for low-income blacks experiencing delay in initiation of inpatient rehabilitation (Table 3). That is, among patients experiencing delay in initiation of rehabilitation, substantial improvement in physical function occurred for only 9.1% of low-income blacks compared with 35.7% of higher-income blacks \((P=0.02)\). Again, these patterns held after the exclusion of patients who had initiated rehabilitation \(\geq 10\) days after admission.

**Discussion**

This report is the first to document the existence of a significant racial difference in the association between the process of rehabilitative care and subsequent outcomes among stroke patients. Low-income black stroke patients—those who were delayed in the initiation of stroke rehabilitation—experienced relatively worse poststroke physical function recovery after adjustment for important clinical factors such as stroke severity and type. There was no racial difference in either the proportion of stroke patients who were referred to inpatient rehabilitation or the intensity of rehabilitation.

It is unlikely that delay in initiation of inpatient rehabilitation is directly responsible for the worse functional recovery among poor black stroke patients after discharge. If that were the case, relatively worse recovery should have occurred among all stroke patients or, at least, among poor whites who

<p>| TABLE 2. Effect of Key Variables on the Trajectory of Ability to Perform ADL After Stroke: Mixed-Model Multiple Regression, Repeated-Measures Analysis |</p>
<table>
<thead>
<tr>
<th>Model Parameter</th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effect of race over time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time (log function)</td>
<td>5.87 ‡</td>
<td>4.57 ‡</td>
</tr>
<tr>
<td>Black</td>
<td>6.32</td>
<td>-1.35</td>
</tr>
<tr>
<td>Black × time</td>
<td>-1.41 †</td>
<td>0.42</td>
</tr>
<tr>
<td>Interaction effects of race by days to rehabilitation over time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Days to rehabilitation initiation</td>
<td>-1.79 ‡</td>
<td>0.55</td>
</tr>
<tr>
<td>Days to rehabilitation × time</td>
<td>0.31 ‡</td>
<td>0.11</td>
</tr>
<tr>
<td>Black × days to rehabilitation</td>
<td>1.93</td>
<td>1.01</td>
</tr>
<tr>
<td>Black × days to rehabilitation × time</td>
<td>-0.43 *</td>
<td>0.19</td>
</tr>
<tr>
<td>Clinical and sociodemographic covariates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stroke severity</td>
<td>-4.45 ‡</td>
<td>0.40</td>
</tr>
<tr>
<td>Discharge to nursing home or other institution</td>
<td>-31.34 ‡</td>
<td>3.03</td>
</tr>
<tr>
<td>Inpatient treatment by a neurologist</td>
<td>6.13 ‡</td>
<td>1.84</td>
</tr>
<tr>
<td>Age</td>
<td>-0.33 ‡</td>
<td>0.10</td>
</tr>
<tr>
<td>Lives alone</td>
<td>6.78 †</td>
<td>2.46</td>
</tr>
<tr>
<td>Low income</td>
<td>-3.37</td>
<td>2.03</td>
</tr>
<tr>
<td>Control for missing data on income</td>
<td>-4.22</td>
<td>2.83</td>
</tr>
<tr>
<td>Covariates tested in model but not selected at (P&lt;0.15)</td>
<td></td>
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<tr>
<td>Male vs female</td>
<td></td>
<td></td>
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<tr>
<td>Single vs married</td>
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<tr>
<td>Stroke type and subtype</td>
<td></td>
<td></td>
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<tr>
<td>Cognitive impairment</td>
<td></td>
<td></td>
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<tr>
<td>Days from stroke event to hospital admission</td>
<td></td>
<td></td>
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<tr>
<td>Model fit statistics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>1488</td>
<td>1488</td>
</tr>
<tr>
<td>-2 Residual log likelihood</td>
<td>13 507.70</td>
<td>13 137.70</td>
</tr>
<tr>
<td>Null model likelihood ratio test, (\chi^2) with 1 df</td>
<td>756.86 ‡</td>
<td>478.81 ‡</td>
</tr>
</tbody>
</table>

* \(P<0.05; † P<0.01; ‡ P<0.001\).
experienced delay. This did not occur. The trajectory of physical function recovery among the black patients who were higher income, although relatively few in number, and whites with low income was similar to that of whites with higher income. Moreover, the average level of function was similar among all race-income groups at discharge. Hence, it appears that circumstances in the posthospital environment differentially affect recovery from stroke for poor blacks vis-à-vis poor whites and patients of higher incomes.

An explanation for this phenomenon may be found in the fact that patients were clinically managed in the VA healthcare system, which, in principle, provides equal access to care for its eligible patient population. This suggests that ability to pay for outpatient rehabilitative care is probably not a major factor. The pace of recovery from stroke is more likely inhibited by other aspects of poverty, such as the absence of supportive social resources (eg, transportation to outpatient rehabilitation services or access to supplemental in-home rehabilitation services) that may help sustain or enhance the benefits of therapy over time. This hypothesis derives from work suggesting that early supported discharge with an emphasis on rehabilitation in the home yields improved functional recovery after discharge.16 If the hypothesis holds, race must be associated with an accentuation of these poverty-related factors that impede stroke recovery so that being black and having low income combine to yield a more negative health outcome than might be associated with low income alone.

Further research is needed to determine specifically the rehabilitation services and processes experienced by patients of different races or ethnicities and incomes. It is important to explore the postdischarge context to identify those factors associated with further improvement (or impediment) in achieved therapeutic benefits at discharge.

**Acknowledgments**

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**References**


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