Race/Ethnicity and Outcomes Following Inpatient Rehabilitation for Hip Fracture

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Background. Hip fracture results in severe and often permanent reductions in overall health and quality of life for many older adults. As the U.S. population grows older and more diverse, there is an increasing need to assess and improve outcomes across racial/ethnic cohorts of older hip fracture patients.

Methods. We examined data from 42,479 patients receiving inpatient rehabilitation for hip fracture who were discharged in 2003 from 825 facilities across the United States. Outcomes of interest included length of stay, discharge setting, and functional status at discharge and 3- to 6-month follow-up.

Results. Mean age was 80.2 (standard deviation [SD] = 8.0) years. A majority of the sample was non-Hispanic white (91%), followed by non-Hispanic black (4%), Hispanic (4%), and Asian (1%). After controlling for sociodemographic factors and case severity, significant ($p < .05$) differences between the non-Hispanic white and minority groups were observed for predicted lengths of stay in days (Asian: 1.1; 95% confidence interval [CI], 0.5–1.7; non-Hispanic black: 0.8; 95% CI, 0.6–1.1), odds of home discharge (Asian: 2.1; 95% CI, 1.6–2.8; non-Hispanic black: 2.0; 95% CI, 1.8–2.3; Hispanic: 1.9; 95% CI, 1.6–2.2), lower discharge Functional Independence Measure (FIM) ratings (non-Hispanic black: 3.6; 95% CI, 3.0–4.2; Hispanic: 1.6; 95% CI, 0.9–2.2 points lower), and lower follow-up FIM ratings (Hispanic: 4.4; 95% CI, 2.8–5.9).

Conclusions. Race/ethnicity differences in outcomes were present in a national sample of hip fracture patients following inpatient rehabilitation. Recognizing these differences is the first step toward identifying and understanding potential mechanisms underlying the relationship between race/ethnicity and outcomes. These mechanisms may then be addressed to improve hip fracture care for all patients.

Key Words: Hip fractures—Rehabilitation—Outcomes—Ethnic groups.

Hip fracture is the most common fall-related reason for hospitalization in older persons and the most costly fracture to treat (1). From 1984 through 1994, Medicare payments for hip fracture doubled (2). It is anticipated that hip fractures that occurred 10 years ago (1997) will ultimately cost the U.S. health care system $25 billion; this value is projected to climb to $47 billion by 2040 (3). More importantly, hip fracture dramatically and permanently affects the overall health and quality of life of many older adults (4,5). While the age-adjusted incidence rate of hip fracture decreased 14% from 1993 through 2003, the total number of hip fractures increased 19% over that time (6). As the population continues to age at an unprecedented rate, the number of older persons experiencing a hip fracture is projected to increase substantially in the coming decades (7–9). Based on these population estimates and the dire consequences of this injury, emphasis needs to be placed on assessing and improving outcomes in hip fracture care (10,11).

Within this framework of improving hip fracture outcomes it is important to consider the potential for differences based on race/ethnicity. The increase in the U.S. minority population will continue to affect the number of minorities experiencing hip fracture. For example, the proportion of total hip fractures in Hispanics and Asians living in California doubled from 1983 to 2000 (12). However, hip fracture research has primarily focused on the experiences of non-Hispanic whites as this injury is most prevalent in whites (13) and the enormous costs associated with hip fracture (1) may preclude disadvantaged individuals from getting appropriate care.

The purpose of this study was to evaluate inpatient rehabilitation outcomes following hip fracture among racial/ethnic groups. Outcomes included rehabilitation length of stay (LOS) and discharge setting, which convey the relative efficiency and overall success, respectively, in establishing functional independence following hip fracture. In addition, we were interested in recorded functional status at discharge and 3–6 months postdischarge from inpatient rehabilitation.

METHODS

Data Source and Description

Data were obtained from the Uniform Data System for Medical Rehabilitation (UDSMR). The UDSMR is the largest nongovernmental registry of comprehensive medical rehabilitation records in the United States (14,15). Follow-up information was collected by MedTel Outcomes over the phone 80–180 days postdischarge and then integrated with the UDSMR inpatient records. Essential data for the current...
study included patient demographic information, marital status, pre- and posthospitalization living situation, payment source, time to admission, LOS, medical diagnosis and comorbidities, case severity, and functional status. We limited our analysis to patients 60 years old or older who received inpatient rehabilitation for hip or femur fracture and who were discharged in 2003. Inpatient rehabilitation refers to the intensive rehabilitation services provided to inpatients in rehabilitation hospital units or freestanding rehabilitation facilities. Qualifying etiologies included hip and femur (shaft) fractures relating to UDSMR Impairment Group Codes 08.11, 08.12, and 08.2. There were 47,324 patients with the specified Impairment Group Codes with admission, discharge, and follow-up data. The final sample, after removal for missing key data (n = 894) and age restrictions (n = 3951), contained 42,479 patient records from 825 inpatient rehabilitation facilities across the United States.

Follow-up information is not required by the Centers for Medicare and Medicaid Services (CMS) so not all facilities contributing data to the UDSMR collect it. Approximately 16% (n = 6970) of the hip fracture cases in 2003 contained follow-up information. The mean ± standard deviation (SD) duration from discharge to follow-up was 104.4 ± 29.6 days. Baseline demographic and health characteristics of patients with follow-up data versus those without follow-up data were similar; no significant differences were noted.

Variables

Demographic information.—Patient age in years was used as a continuous variable. Gender was coded dichotomously. Self-reported race/ethnicity was limited to Asian, Hispanic, non-Hispanic black, and non-Hispanic white categories. Other self-reported race/ethnic groups were too small to be included in the analyses. The race/ethnic groups were dummy coded (0,1: reference = non-Hispanic white) for entry in the regression models.

Living situation.—Self-reported living arrangement (alone vs not alone) and living setting (home vs not home) were coded dichotomously and recorded for pre- and posthospitalization as well as for 3- to 6-month follow-up.

Payment source.—Primary payer information was coded dichotomously: Medicare versus non-Medicare. Under the prospective payment system for inpatient rehabilitation facilities, which was implemented in 2002, facilities receive predetermined reimbursements from Medicare based on algorithms using a patient’s status (age, functioning, medical condition, and comorbidities) at admission to rehabilitation, rather than the actual resources used or LOS (i.e., fee-for-services system). By aligning payment with predicted healthcare needs, this system was designed to provide equality (re: access to and care provided) in inpatient rehabilitation facilities for patients regardless of their health and/or functional status and projected costs to treat (16).

Duration and LOS.—Duration, from fracture date to admission to rehabilitation, and LOS, from rehabilitation admission to discharge, were determined in days.

Comorbidities.—A summary score was calculated for the total number of additional health conditions (range: 0–10) beyond the primary diagnosis. Specifically, this variable included any and all International Statistical Classification of Diseases and Related Health Problems, Ninth Revision (ICD-9) codes (maximum of 10) recorded in each patient’s medical record.

Case severity.—Case mix group (CMG) and tier level were used to determine estimated resource utilization. CMGs group patients according to expected rehabilitation needs and are the basis for the reimbursement that inpatient rehabilitation facilities will receive from CMS for a particular patient. Tier levels represent certain comorbidities that the CMS recognize as confounding patient care within particular impairment categories. Thus, expected costs of care and corresponding reimbursements are adjusted according to the tier level (17). CMGs relevant to hip fracture were originally recorded on a five-level scale (0701, 0702, 0703, 0704, 0705: least to most severe), and tier levels were recorded on a four-level scale (none, tier 3, tier 2, tier 1: least to most costly). Both variables were coded dichotomously as most severe/costly versus other: CMG 0705 versus other and Tier 1 versus other.

Functional status.—Functional status data were obtained using the Functional Independence Measure (FIM) at admission, discharge, and 3–6 months postdischarge. The FIM is a standardized measure of disability severity within the Inpatient Rehabilitation Facility Patient Assessment Instrument (IRF-PAC) (17). The FIM contains 18 items covering six domains of functioning: self-care (activities of daily living), sphincter control, transfers, locomotion, communication, and social cognition. Each item is scored on a 7-point scale (1–7) (19).

Data Analysis

Demographic information, functional status, and other characteristics were stratified by race/ethnicity category to evaluate unadjusted differences between groups. Univariate statistics (analysis of variance) were used for continuous variables, and contingency tables (chi-square) were used for categorical data. A series of multiple regression models were performed to assess potential differences among the race/ethnicity groups in LOS, discharge FIM, and follow-up FIM. Logistic regression models were used to examine differences among the racial/ethnic groups in discharge.
setting (home vs not home). Subsequent models controlled for sociodemographic information (gender, age, marital status, and Medicare coverage), case severity (sum of comorbidities, CMG tier level, FIM, and LOS), and prehospitalization living setting, respectively. Alpha was set to 0.05 with Bonferroni corrections for multiple comparisons. SPSS v.14 software (Chicago, IL) was used for all statistical analysis.

RESULTS

Sample Characteristics (Covariates)

Patient characteristics by race/ethnicity are presented in Table 1. The total sample with inpatient data (n = 42,479) consisted of 91% non-Hispanic white, 4% non-Hispanic black, 4% Hispanic, and 1% Asian individuals. Overall, the non-Hispanic black, Hispanic, and Asian groups were younger and exhibited fewer comorbidities than did the non-Hispanic white cohort.

Relative to the non-Hispanic white group, non-Hispanic blacks and Hispanics were more likely to be classified in the most severe CMG category. Conversely, they were less likely to be married, live alone before and after rehabilitation, and have Medicare coverage. Non-Hispanic blacks were also less likely to be women. Individuals in the Asian group were more likely to be married and less likely to live alone before and after rehabilitation, receive the costliest tier rating, and have Medicare coverage compared to the non-Hispanic white group.

Inpatient Rehabilitation Outcomes

LOS by race/ethnicity is shown in Table 1. FIM ratings at admission, discharge, and 3–6 months following inpatient rehabilitation are presented in Figure 1. Figure 2 displays the percentage of patients living at home before, after, and 3–6 months following inpatient rehabilitation.

Table 2 shows the association between race/ethnicity and expected LOS as well as discharge and follow-up FIM.

After adjusting for sociodemographic factors and case severity, non-Hispanic black and Asian race/ethnicity were associated with longer LOS relative to the non-Hispanic white cohort. Non-Hispanic black and Hispanic race/ethnicity were associated with lower discharge FIM ratings relative to the non-Hispanic white group after adjusting for sociodemographic factors, case severity, and LOS. At follow-up, only the predicted FIM scores for the Hispanic group remained significantly lower than those for the non-Hispanic white group.

The odds of being discharged home versus not home relative to race/ethnicity are displayed in Table 3. All three nonreference groups demonstrated higher odds of home discharge compared with the non-Hispanic white group after adjusting for sociodemographic factors, case severity, LOS, and pre-admission living setting.

DISCUSSION

There is a compelling body of literature regarding race/ethnicity-based differences in risk factors for and prevalence of various health conditions as well as health care service utilization in the United States (20–22). Similarly, numerous works address health- and medical-related factors affecting hip fracture outcomes (7,10,23,24). Relatively little information is available concerning health outcome differences among race/ethnic groups within specific diagnostic categories, e.g., hip fracture (25,26). We found differences for non-Hispanic black, Hispanic, and Asian hip fracture patients compared to non-Hispanic white patients in outcomes including LOS, functional status, and discharge setting following inpatient rehabilitation.

Longer stays in inpatient rehabilitation were observed for all three racial/ethnic groups relative to the non-Hispanic white group (Table 1). The non-Hispanic white group, on average, was older, had more comorbidities, and was more likely to have Medicare coverage than the other three groups (Table 1). These observations may help to explain why this group experienced shorter LOS; after the decision has been made, the patient is more likely to receive the most appropriate level of care.
made to continue care in an alternative setting, it is practical to shorten the duration of high-cost inpatient rehabilitative care. Table 2, however, shows that, after adjusting for sociodemographic factors and case severity, expected LOS were still greater than \( \frac{3}{4} \) of a day and a full day for the non-Hispanic black and Asian cohorts, respectively. Mean discharge FIM ratings were lower in the non-Hispanic black and Hispanic groups compared with the
non-Hispanic white group (Figure 1). Expected values, after adjusting for sociodemographic factors, case severity, and LOS, were 3.6 and 1.6 points lower for the non-Hispanic black and Hispanic groups, respectively (Table 2). The non-Hispanic black group experienced less improvement in FIM ratings during inpatient rehabilitation relative to the non-Hispanic white group (Table 1). Certain pre-existing medical conditions such as diabetes can reduce the functional improvements of hip fracture rehabilitation (27). Comorbidities were entered as a single summed variable in the predictive models of the current study, so it cannot be determined if differences in specific disease prevalence among racial/ethnic groups influenced the outcomes. A higher proportion of patients from the non-Hispanic black group than from the non-Hispanic white group were likely to receive uninterrupted acute care prior to admission, which could partly explain the smaller improvements observed during rehabilitation. We could not assess the quality of acute care from the current database. Mean duration from time of fracture to admission was approximately 1.5 days longer in the non-Hispanic black group compared to the non-Hispanic white group; this difference was not statistically significant (Table 1). We could not determine if this trend in delayed rehabilitation admission in the non-Hispanic black cohort was primarily pre- or postsurgical. The literature is mixed regarding a relationship between surgical delay and poor outcomes (24,28,29), whereas no reports were found concerning the impact of duration from surgery to rehabilitation admission on long-term outcomes. Differences between racial/ethnic groups in understanding of and trust in medical procedures may need to be considered when interpreting the current results. The demographic profile of orthopedic providers is not representative of the health care-seeking public in the United States. Whereas the proportion of combined minorities is approaching 40% of the total population, only 7% of orthopedic surgeons in 1999 were of African American, Latino, or Native American heritage (30). Non-Hispanic black (20,31) and Hispanic (20) patients are more apprehensive about and less likely to undergo joint replacement surgery compared to non-Hispanic white patients.

Table 2. Regression Coefficients (b) for Race/Ethnicity on Hip Fracture Outcomes

<table>
<thead>
<tr>
<th>Outcome by Race/Ethnicity</th>
<th>b (95% CI)</th>
<th>b (95% CI)</th>
<th>b (95% CI)</th>
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<tbody>
<tr>
<td></td>
<td>Model 1</td>
<td>Model 2</td>
<td>Model 3</td>
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<tr>
<td>Length of stay</td>
<td></td>
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<tr>
<td>Non-Hispanic black</td>
<td>1.13 (0.83, 1.43)</td>
<td>1.21 (0.91, 1.51)</td>
<td>0.84 (0.56, 1.12)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>0.67 (0.35, 0.99)</td>
<td>0.77 (0.45, 1.08)</td>
<td>0.12 (-0.17, 0.42)</td>
</tr>
<tr>
<td>Asian</td>
<td>0.82 (0.22, 1.43)</td>
<td>1.08 (0.48, 1.68)</td>
<td>1.09 (0.53, 1.65)</td>
</tr>
<tr>
<td>R²</td>
<td>0.00</td>
<td>0.03</td>
<td>0.16</td>
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<tr>
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<tr>
<td>Discharge FIM</td>
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<tr>
<td>Non-Hispanic black</td>
<td>-4.91 (-5.84, -3.98)</td>
<td>-5.85 (-6.75, -4.96)</td>
<td>-3.59 (-4.19, -2.99)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>-5.49 (-6.48, -4.51)</td>
<td>-6.04 (-6.99, -5.09)</td>
<td>-1.58 (-2.21, -0.94)</td>
</tr>
<tr>
<td>Asian</td>
<td>0.81 (-1.05, 2.67)</td>
<td>-0.21 (-2.00, 1.59)</td>
<td>0.82 (-2.02, 0.38)</td>
</tr>
<tr>
<td>R²</td>
<td>0.01</td>
<td>0.09</td>
<td>0.59</td>
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<tr>
<td>Follow-up FIM</td>
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<tr>
<td>Non-Hispanic black</td>
<td>-2.76 (-4.55, -0.97)</td>
<td>-3.32 (-5.08, -1.55)</td>
<td>-0.22 (-1.66, 1.21)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>-7.07 (-8.96, -5.18)</td>
<td>-7.37 (-9.23, -5.50)</td>
<td>-4.35 (-5.87, -2.84)</td>
</tr>
<tr>
<td>Asian</td>
<td>-2.12 (-5.71, 1.46)</td>
<td>-2.55 (-6.08, 0.97)</td>
<td>-2.04 (-4.90, 0.83)</td>
</tr>
<tr>
<td>R²</td>
<td>0.01</td>
<td>0.05</td>
<td>0.37</td>
</tr>
</tbody>
</table>

Notes: Model 1: race/ethnicity only. Model 2: adjusted for sociodemographic factors (gender, age, married, Medicare coverage). Model 3: adjusted for sociodemographic factors and case severity (sum of comorbidities, case mix group (CMG) tier, admission or discharge Functional Independence Measure (FIM), and length of stay (LOS) (except for model with LOS as dependent variable).

Reference group: non-Hispanic white.
CI = confidence interval.

Table 3. Odds Ratios (OR) for Home Discharge Based on Race/Ethnicity

<table>
<thead>
<tr>
<th>Outcome by Race/Ethnicity</th>
<th>OR (95% CI)</th>
<th>OR (95% CI)</th>
<th>OR (95% CI)</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model 1</td>
<td>Model 2</td>
<td>Model 3</td>
<td>Model 4</td>
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<tr>
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<tr>
<td>Non-Hispanic black</td>
<td>1.22 (1.10, 1.36)</td>
<td>1.22 (1.09, 1.36)</td>
<td>2.16 (1.89, 2.46)</td>
<td>2.02 (1.77, 2.32)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1.16 (1.04, 1.30)</td>
<td>1.13 (1.00, 1.26)</td>
<td>2.00 (1.74, 2.32)</td>
<td>1.90 (1.64, 2.19)</td>
</tr>
<tr>
<td>Asian</td>
<td>1.86 (1.47, 2.35)</td>
<td>1.64 (1.29, 2.09)</td>
<td>2.06 (1.55, 2.73)</td>
<td>2.07 (1.55, 2.78)</td>
</tr>
<tr>
<td>R²</td>
<td>0.00</td>
<td>0.10</td>
<td>0.40</td>
<td>0.44</td>
</tr>
</tbody>
</table>

Notes: Model 1: race/ethnicity only. Model 2: adjusted for sociodemographic factors (gender, age, married, Medicare). Model 3: adjusted for sociodemographic factors and case severity (sum of comorbidities, case mix group tier, discharge Functional Independence Measure, and length of stay. Model 4: adjusted for sociodemographic factors, case severity, and prehospitalization living setting (home vs not home).

Reference group: non-Hispanic white.
CI = confidence interval.
patients with similar clinical conditions. Thus, cultural and/or personal concerns regarding medical intervention may not only reduce prefracture care, but also confound the complex postfracture repair and rehabilitation processes. Additional studies are needed to determine how patient-provider interactions (32) and differences in prerehabilitative care influence hip fracture rehabilitation outcomes.

Regarding FIM ratings at follow-up, the non-Hispanic black and Hispanic groups were still lower, whereas the Asian cohort demonstrated comparable scores at all three assessments relative to the non-Hispanic white group (see Figure 1). Longer term ethnicity-based outcome differences are not unique to orthopedic patients. Hispanic patients with traumatic brain injury, for example, experience worse long-term (1-year follow-up) functional outcomes compared to non-Hispanic whites after controlling for age, LOS, injury severity, admission functional scores, and education (33).

Compared to the non-Hispanic white group, all three nonreference groups were more likely to be discharged home (see Figure 2). Although the non-Hispanic white group had shorter LOS and higher FIM ratings at discharge compared to the other groups, this group was also older, had more comorbidities, and was more likely to have Medicare coverage. This could explain why the non-Hispanic white group was less likely to be discharged home; that is, they demonstrated greater need and coverage for additional (transitional) care. Table 3, however, shows that, after controlling for these factors and prior living setting, all three nonreference groups were still twice as likely to be discharged home compared with those in the non-Hispanic white group.

Home discharge is generally considered a positive outcome and is often used as an indicator for quality of care. The finding of relative advantage for the minority groups compared to non-Hispanic whites was unique among the rehabilitation outcomes in the current study. Previous studies assessing discharge status from inpatient rehabilitation by race/ethnicity have yielded mixed results. Ottenbacher and colleagues (26) reported equivalent home discharge rates among patient racial/ethnic groups following hospitalization for hip fracture and lower extremity joint replacement. In separate single-facility outcome studies in patients with stroke, Chiu-Tan and colleagues (34) found no differences among non-Hispanic white, non-Hispanic black, and Hispanic patients, whereas Bhandari and colleagues (35) reported a 70% greater likelihood of home discharge for non-Hispanic black patients and no significant difference for Hispanic patients compared to non-Hispanic whites. It is clear that decisions underlying discharge destination are complex. The reasons for differences in health outcomes extend beyond objective clinical measures (36). Personal, family, and cultural values and/or preferences affect health status and care choices. It is possible that family and social support networks available to older adults are better established in certain minority groups compared to non-Hispanic whites (37,38) and therefore increase the likelihood for home discharge. Ottenbacher and colleagues (26) showed that, among patients discharged home from inpatient rehabilitation, non-Hispanic whites are most likely to be living alone and responsible for providing their own care. Conversely, Hispanics are most likely to have care provided by family members or other unpaid persons. Additional research is needed to elucidate these factors and to ascertain if this information could be used to expedite return home and decrease postrehabilitation costs for nonminority patients.

Nearly 25% of independent adults require nursing home care for at least 1 year following hip fracture (39). At follow-up, in the current study, the percentages of individuals living at home within the non-Hispanic black (95%), Asian (94%), non-Hispanic white (92%), and Hispanic (90%) groups were not significantly different.

The reasons for health differences are multifaceted and often difficult to identify (40). The lack of acute-care information is a limitation in this study. Although we accounted for functional status and number of comorbidities at admission to inpatient rehabilitation, it was not possible to adjust for differences in prerehabilitative care. Another potential limitation involves the use of self-reported data, including race/ethnicity. It has been suggested that race in health research is limited to skin color and more of a social construct than a biologic, cultural, or behavioral one (41). Race/ethnicity based on self-reported inclusion in social categories, however, is relevant to the objectives of the current study. We also did not control for types of comorbidity that may have been disproportionately prevalent across the racial/ethnic categories. Rather, we used a single value depicting the number of comorbidities that each patient had as a covariate. In addition, we did not ascertain qualitative information regarding familial or cultural attitudes toward caring for ailing older adults, which may affect likelihood of home discharge and possibly, rehabilitation LOS. Last, with <20% of facilities collecting follow-up data, care must be taken when generalizing our follow-up findings to the larger population. It is important to note, however, that the follow-up sample of nearly 7000 is of considerable size, and there were no statistical differences in baseline variables between those patients contributing follow-up information and those not.

Summary

This study provides evidence of race/ethnicity-based differences within all four outcomes of interest (LOS, functional status at discharge and follow-up, and discharge setting) across a large national sample of hip fracture patients. Compared to the non-Hispanic white group, the other three groups generally experienced longer stays in inpatient rehabilitation, achieved lower functional status, and were more likely to be discharged home. These differences persisted after controlling for certain known and possible confounding variables. Thus, it is apparent that there are additional factors related to race/ethnicity, which resulted in consistent differences in rehabilitation outcomes in the current study. Further study is needed to explore potential mechanisms underlying the association between race/ethnicity and rehabilitation outcomes. Recognition and understanding of these mechanisms can then lead to improved quality of rehabilitative care for all patients.
ACKNOWLEDGMENTS

This research was supported by funding from the National Institutes of Health (grants R01-AG17638 and K02-AG019736 to K. Ottenbacher). J. E. Graham was supported by a fellowship from the National Institute on Disability and Rehabilitation Research (H133P040003) from the U.S. Department of Education. The funding source had no role in the design of the study, collection, analysis or interpretation of the data, or in the decision to prepare and submit the manuscript for publication. The FIM instrument and UDSmR are trademarks of Uniform Data System for Medical Rehabilitation, a division of UB Foundation Activities, Inc.

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