Hospital readmission of persons with hip fracture following medical rehabilitation

Kenneth J. Ottenbacher a,*, Pam M. Smith b, Sandra B. Illig b, M. Kristen Peek c, Roger C. Fiedler d, Carl V. Granger e

a Center on Aging, University of Texas Medical Branch, 301 University Boulevard, Galveston, TX 77555-1137, USA
b National Follow-Up Services, 6500 Main Street, Suite 3, Buffalo, NY 14221, USA
c Department of Preventive Medicine and Community Health, University of Texas Medical Branch, 301 University Boulevard, Galveston, TX 1153, USA
d Graduate Studies, D’Youville College, One D’Youville Square, 320 Porter Avenue, Buffalo, NY 14201, USA
e Center for Functional Assessment Research, State University of New York at Buffalo, 232 Parker Hall, 3435 Main St., Buffalo, NY 14214, USA

Received 17 December 2001; received in revised form 19 April 2002; accepted 6 June 2002

Abstract

A significant percentage of older adults hospitalized and treated for hip fracture are readmitted to a hospital within six months. We analyzed information from a national database, the Uniform Data System for Medical Rehabilitation. Records for 8236 patients (1994–98) who received inpatient medical rehabilitation following treatment for hip fracture were examined. Mean age was 76.51 years (S.D. = 12.48) with 71% female and 79% non-Hispanic White. The primary outcome measure was incidence of hospital readmission 0–180 days post-discharge. The hospital readmission rate was 16.7%. A Cox regression model predicting rehospitalization included the following variables (p < 0.05): basic daily living skills, age, length of stay, ethnicity, and gender. There was a statistically significant difference in the percent of male versus female patients rehospitalized for Hispanic subjects but not for non-Hispanic White or African American subjects. The greatest variability occurred among male patients. A total of 18.1% of non-Hispanic White males and 16.8% of African American males were rehospitalized. In contrast, only 10.1% of Hispanic males were rehospitalized. Basic daily living skills, length of hospital stay, age, ethnicity and gender were variables

* Corresponding author. Tel.: +1-409-772-3001; fax: +1-409-747-1623
E-mail address: kottenba@utmb.edu (K.J. Ottenbacher).
associated with hospital readmission following medical rehabilitation in persons with hip fracture. These variables should be considered in developing intervention programs to reduce the risk of hospital readmission.

© 2002 Elsevier Science Ireland Ltd. All rights reserved.

Keywords: Health outcomes; Aging

1. Introduction

The incidence of hip fractures is projected to increase by more than 250% in the next twenty-five years as the world population ages (Gullberg et al., 1997). The occurrence of hip fracture is significantly related to subsequent rehospitalization, increased number of hospital days, and total hospital costs (Milne and Clarke, 1990; Victor and Jefferies, 1990; Wolinsky et al., 1997). Sloan et al. (1999) reported a 167% increase in Medicare payments for hospital readmission in the United States from 1984 to 1994 for patients with hip fracture. The occurrence of unplanned hospital readmission among older adults with hip fracture is a significant concern as length of stay decreases and hospital readmission is increasingly used as an indicator of health care quality (Gooding and Jette, 1985; Jones, 1986; Lohr and Schorder, 1990; Chan et al., 1997; Smith et al., 2000).

We examined variables associated with hospital readmission in a large sample of patients who experienced a hip fracture from 1994 to 1998. Our goal was to identify demographic and patient characteristics associated with increased risk of hospital readmission. Intervention programs to reduce hospital readmission can be developed if factors associated with increased risk for rehospitalization are objectively identified (Tierney and Worth, 1995; Ashton and Wray, 1996).

2. Methods

Data from 9956 patients experiencing a hip fracture and receiving inpatient medical rehabilitation in 1994–98 were collected from 171 hospitals in 44 states submitting information to the Uniform Data System for Medical Rehabilitation (UDSMR) (Hamilton et al., 1987). The UDSMR is the largest national registry of standardized information on medical rehabilitation inpatients in the United States (Hamilton et al., 1987). Information in the database includes basic demographic variables, diagnoses (ICD-9 codes), length of stay (LOS), and ratings on a standardized measure of basic daily living skills, the FIM™ instrument (Guide, 1997). Hip fractures included intertrochanteric and other types of fractures listed in the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM), with the following ICD-9-CM codes: 820.00, 820.02–820.3, 820.8–820.13, 820.19–820.22 and 820.30–820.31.
2.1. Validity of the data set

The UDSMR database was reviewed extensively by the Health Care Financing Administration (HCFA) in its examination of Function Related Groups (FRGs) (Carter et al., 1997a,b). The FRGs system has been proposed as the analog to Diagnostic Related Groups (DRGs) in post-acute care (Carter et al., 1997a). HCFA compared the UDSMR database to the Medicare Provider Annual Review (MEDPAR) file and the Health Care Provider Cost Report Information System (HCRIS) (Carter et al., 1997b) and concluded that patient demographics, hospital characteristics, and resources used by disabled Medicare beneficiaries ‘are represented well by the UDSMR database’ (Carter et al., 1997b). Detailed information regarding reliability and validity of the data collection system has been reported by independent researchers (Hamilton et al., 1994; Stineman et al., 1994; Ottenbacher et al., 1996; Carter et al., 1997a,b; Guide, 1997).

Complete admission, discharge and follow-up information including incidence of hospital readmission was available for 9956 patients with hip fracture receiving inpatient rehabilitation for the study period. We used criteria developed in research on FRGs to exclude 1720 patients whose rehabilitation was atypical (Stineman et al., 1994; Carter et al., 1997b). The remaining 8236 patients represented 82.7% of the usable patient records from the original sample.

2.2. Measures

Information on patient functional status was obtained using the FIM instrument. The FIM instrument is a standardized assessment widely used in medical rehabilitation (Guide, 1997). It includes 18 basic self-care items rated on a seven-point scale with higher scores indicating better functional status. The clinical reliability, validity and responsiveness of the assessment have been demonstrated (Hamilton et al., 1994; Ottenbacher et al., 1996). The FIM instrument was carefully examined by HCFA as a method of measuring basic self-care function in the development of the FRG system (Carter et al., 1997a,b).

Information on rehospitalization was obtained between 80 and 180 days post discharge by telephone interviews conducted by trained registered nurses with clinical experience in rehabilitation. A specific protocol was followed to gather information on current living situation and whether the former patient experienced a hospital readmission since discharge. Any new medical diagnosis since discharge was also recorded. The statistical consistency of soliciting this information by telephone interview has been established (Smith et al., 1996).

2.3. Data analysis

We used a Cox regression model with a time dependent variable (rehospitalization) to examine the effect of patient demographics and characteristics on readmission. We included the following possible explanatory variables: age, gender, martial status, ethnicity, length of stay, ICD-9 code and FIM instrument ratings.
The level of significance was set to 0.05. Differences in time to hospital readmission were presented graphically with Kaplan–Meier curves and examined with log-rank tests (Zeger and Liang, 1986).

3. Results

The mean age for the 8236 patients was 76.51 years (S.D. = 12.48) with 71% female and 79% non-Hispanic White. The percentage of patients who experienced a hospital readmission from 0 to 180 days post-discharge was 16.7%. The mean length of stay for patients who were rehospitalized was 17.16 days (S.D. = 12.05) compared to 14.91 days (S.D. = 10.59) for patients not rehospitalized ($t = 7.62$, $p < 0.001$). A Cox regression analysis with backward selection procedure was performed, followed by stepwise selection, including interaction between variables. The results are presented in Table 1. Total FIM instrument scores, length of stay, age, ethnicity (coded as white vs. non-white) and gender were included in the model. A statistically significant interaction effect was found between ethnicity and gender ($p = 0.023$).

Kaplan–Meier curves (Fig. 1) show the estimated probability of staying free of hospital readmission (0–180 days post-discharge) as a function of gender and ethnicity. We included only the three major ethnic groups (African American, Hispanic, and non-Hispanic White) in this analysis to maintain adequate sample sizes for all subgroup analyses. The probability of rehospitalization was lower for Hispanic patients (13.7%) compared to non-Hispanic White (17.8%) or African American (16.5%) patients. The Kaplan–Meier curves show the effect of the interaction and reveal that 18.1% of non-Hispanic White male patients were rehospitalized and 16.8% of African–American male patients were rehospitalized. In contrast, 10.1% of Hispanic male patients were rehospitalized within 180 days following discharge. 17.5% of the female non-Hispanic White patients; 16.3% of African–American females, and 15.1% of Hispanic females were rehospitalized during the follow-up period. Fig. 2 depicts the difference in percent of males versus female patients rehospitalized across the three ethnic groups. There was a

<table>
<thead>
<tr>
<th>Variable</th>
<th>Beta</th>
<th>SEM</th>
<th>LR</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIM rating(a)</td>
<td>-0.825</td>
<td>0.293</td>
<td>4.86</td>
<td>0.005</td>
</tr>
<tr>
<td>LOS(b)</td>
<td>0.431</td>
<td>0.032</td>
<td>3.65</td>
<td>0.017</td>
</tr>
<tr>
<td>Age</td>
<td>0.943</td>
<td>0.374</td>
<td>3.51</td>
<td>0.015</td>
</tr>
<tr>
<td>Ethnicity × gender</td>
<td>0.012</td>
<td>0.005</td>
<td>2.54</td>
<td>0.032</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>-0.589</td>
<td>0.661</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Gender</td>
<td>0.001</td>
<td>0.003</td>
<td>0.10</td>
<td>0.744</td>
</tr>
</tbody>
</table>

Estimates and tests results (likelihood ratio test) for variables included in the model.
\(a\) FIM, functional independence measure.
\(b\) LOS, length of stay.
statistically significant ($p < 0.01$) difference in percent of patients rehospitalized between males and females for the Hispanic subjects, but no statistically significant differences between males and females for non-Hispanic Whites or African-Americans.

4. Discussion

Hip fracture is a common disabling condition among the elderly (Wolinsky et al., 1997; Sloan et al., 1999). Forty to 60% of older adults experiencing a hip fracture have reduced ambulation and increased health care use (Anderson and Poullier, 1999; Sloan et al., 1999). Recent research has demonstrated that even very old patients ($> 80$ years) can benefit from medical rehabilitation following hip fracture (Giaquinto et al., 2000). The benefits of rehabilitation are likely to be reduced or lost, however, if a patient is readmitted to a hospital within six months of discharge. A
substantial percent (16.7%) of patients in this sample were rehospitalized within 180 days following discharge from inpatient medical rehabilitation. We identified several variables associated with increased probability of hospital readmission: functional status in basic daily living skills, length of stay, age, gender and ethnicity. Patients with the highest risk of hospital readmission had deficits in basic activities of daily living, were older, and had longer length of stay. Patients with the lowest probability of rehospitalization in this sample were Hispanic males.

Further research is needed to identify factors such as family support, access to health care resources, or source of insurance/medical payer that may contribute to the lower rehospitalization rates for specific ethnic groups. More detailed information and analysis is also required to understand the role of living situation, gender, and cultural variations associated with ethnic status. For example, the ethnic category of Hispanic includes a variety of culturally diverse populations.

While the total sample size in this study was large ($N = 8236$), the actual number of persons rehospitalized at three to six month follow-up was small for some of the sub-analyses involving ethnic groups. The small percentage of patients rehospitalized in some ethnic groups (e.g. Native Americans) prevented us from conducting more detailed analyses for these patients. Other limitations in the analyses included the method of data collection for race/ethnicity. Ethnicity was recorded by personnel collecting demographic information as part of the hospital admission process. We had no way of independently verifying the ethnic status of the patients. We also did not attempt to analyze comorbidities associated with hip fracture in the current sample. The incidence of diabetes mellitus, for example, is known to be high in the Hispanic population (Markides et al., 1996). Investigation of potential interactions between comorbidities and ethnicity is particularly important given our findings and the fact that little research on these variables currently exists in the medical rehabilitation literature.
Hospital readmission in older adults is related to a number of negative consequences. Older adults who experience more than one hospitalization in a 12-month period are at significantly higher risk for increased morbidity and mortality (Tierney and Worth, 1995). Another negative result of hospital readmission is increased cost (Sloan et al., 1999). Continued investigation of factors contributing to risk of hospital readmission will assist clinicians, policy makers, and consumers to make informed decisions regarding the appropriate discharge time and destination for patients with hip fracture.

Acknowledgements

This research was supported by a grant from the National Institutes of Health, Department of Health and Human Services, R01-HD34622.

References


