

ORIGINAL ARTICLE

Factors That Predict Acute Hospitalization Discharge Disposition for Adults With Moderate to Severe Traumatic Brain Injury

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ABSTRACT. Cuthbert JP, Corrigan JD, Harrison-Felix C, Coronado V, Dijkers MP, Heinemann AW, Whiteneck GG. Factors that predict acute hospitalization discharge disposition for adults with moderate to severe traumatic brain injury. *Arch Phys Med Rehabil* 2011;92:721-30.

Objective: To identify factors predicting acute hospital discharge disposition after moderate to severe traumatic brain injury (TBI).

Design: Secondary analysis of existing datasets.

Setting: Acute care hospitals.

Participants: Adults hospitalized with moderate to severe TBI included in 3 large sets of archival data: (1) Centers for Disease Control and Prevention Central Nervous System Injury Surveillance database (n=15,646); (2) the National Trauma Data Bank (n=52,012); and (3) the National Study on the Costs and Outcomes of Trauma (n=1286).

Interventions: None.

Main Outcome Measure: Discharge disposition from acute hospitalization to 1 of 3 postacute settings: (1) home, (2) inpatient rehabilitation, or (3) subacute settings, including nursing homes and similar facilities.

Results: The Glasgow Coma Scale (GCS) score and length of acute hospital length of stay (LOS) accounted for 35% to 44% of the variance in discharges to home versus not home,

while age and sex added from 5% to 8%, and race/ethnicity and hospitalization payment source added another 2% to 5%. When predicting discharge to rehabilitation versus subacute care for those not going home, GCS and LOS accounted for 2% to 4% of the variance, while age and sex added 7% to 31%, and race/ethnicity and payment source added 4% to 5%. Across the datasets, longer LOS, older age, and white race increased the likelihood of not being discharged home; the most consistent predictor of discharge to rehabilitation was younger age.

Conclusions: The decision to discharge to home a person with moderate to severe TBI appears to be based primarily on severity-related factors. In contrast, the decision to discharge to rehabilitation rather than to subacute care appears to reflect sociobiologic and socioeconomic factors; however, generalizability of these results is limited by the restricted range of potentially important variables available for analysis.

Key Words: Brain injuries; Healthcare disparities; Hospitalization; Nursing homes, Patient discharge; Rehabilitation; Rehabilitation centers.

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TRAUMATIC BRAIN INJURY is one of the leading causes of disability in the United States, and it is a contributing factor in approximately one-third of all injury-related deaths.¹ Each year at least 1.7 million Americans incur a TBI, and of these injuries, 275,000 are severe enough to require hospitalization.¹ Recently, hospitalizations related to TBI have risen sharply, with an increase of 19.5% from 2002 to 2006.¹

Health care providers, patients, and families must decide, on completion of acute medical care, which postacute care setting will maximize outcomes and minimize morbidity and mortality.² Potential settings include the patient's home (with or without outpatient or home health services), inpatient rehabilitation, and skilled or extended nursing care facilities, with the level and type

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List of Abbreviations

AIS	Abbreviated Injury Scale
CDC	Centers for Disease Control and Prevention
CNSIS	Central Nervous System Injury Surveillance
GCS	Glasgow Coma Scale
ICD-9-CM	International Classification of Diseases, 9th Revision, Clinical Modification
IRF	inpatient rehabilitation facility
LOS	length of stay
NSCOT	National Study on the Costs and Outcomes of Trauma
NTDB	National Trauma Data Bank
NTDS	National Trauma Data Standard
SCI	spinal cord injury
TBI	traumatic brain injury

of care varying across settings. In making the decision, acute care professionals must assess the severity of injury, the degree of recovery, ability to function independently in daily tasks with or without family support, and ability to actively participate in rehabilitation. Other factors also must be weighed, including familial and social supports, availability of funding, and the postacute discharge options available within the community.

Research examining the factors influencing postacute care discharge options for persons with TBI have suggested that decisions may be based on factors other than clinical criteria.²⁻⁵ While some investigations have suggested that discharge disposition is mostly related to indicators of premorbid functioning, overall injury severity and recovery, other studies have indicated possible disparities, with discharge destination related to demographic, biologic, and socioeconomic factors.³

Numerous studies have noted age as a significant predictor of mortality, morbidity, and recovery after TBI, with older persons at risk for less desirable outcomes.⁶⁻¹⁸ Older adults differ in their sex distribution (higher proportion of women to men) and insurance coverage (higher rates of public funded insurance) from younger adults.¹⁹ The older group has greater numbers of comorbidities at injury, often requiring longer and more complex medical treatment.^{8,20} These differences suggest that age may be a significant factor in determining discharge location. In a retrospective study of 1059 persons with TBI discharged from acute care between 1996 and 1997, Mellick et al⁵ found that persons older than 65 were more likely to be discharged to long-term care facilities; however, the role of age may have been confounded by insurance type. A population-based study of persons with TBI ages 65 years or older in 15 states revealed that 37% were discharged home with no or unskilled assistance.⁸ This percentage, however, decreased substantially with age. In contrast, the proportions of persons discharged to home with home health or outpatient rehabilitation services tended to increase with age. The proportion of those discharged to IRFs decreased with age. This study, however, did not take into account injury severity or insurance payer.⁸ Leblanc et al⁶ reported that older persons with moderate to severe TBI had higher rates of discharge to long-term care and lower rates of discharge to inpatient and outpatient rehabilitation, compared to young- and middle-aged groups matched on severity. In contrast, Mosenthal et al¹² found that people over age 60 with mild TBI were more likely to be discharged to inpatient rehabilitation than younger persons.

Recently published reviews suggest disparities by race and ethnicity after TBI, including differences in medical, functional, social, psychosocial, and reintegration outcomes³⁻⁴; however, similar effects are not as clear in regards to the effect of race and ethnicity on discharge disposition after acute medical care. A study of 344 patients (114 persons from minority backgrounds, 230 non-Hispanic whites) with severe TBI discharged from an urban trauma center found no ethnic differences in discharge setting; rather, differences in discharge disposition were related to insurance type, which is associated with age.²¹ A similar result was found in a study examining the effect of insurance type on discharge location for 5550 adults ages 18 to 65, with Medicaid-insured persons less likely to be discharged to inpatient rehabilitation, after accounting for other patient characteristics including age, sex, and race.²² Malec et al² conducted a prospective study of 230 adults with moderate to severe TBI and found no differences between ethnic groups in regards to discharge setting; however, age was a significant predictor of discharge disposition. The Mellick study⁵ found that TBI severity was the strongest predictor of discharge disposition; however, the study also found that minorities, as compared to nonminorities, were more likely to be discharged

home than to any other setting and once home, less likely to receive outpatient services.

The hypothesis motivating the current study was that injury severity was the predominant factor contributing to discharge from acute care for persons with moderate or severe TBI, and that persons discharged home were likely to have less severe injuries. If this hypothesis held true, the opportunity arises to determine what, if any, factors contribute to a specific nonhome discharge. Thus, the purpose of the current study was: (1) to determine if injury severity-related variables are the primary predictors of acute care discharge to home for persons with moderate and severe TBI and (2) to determine if, after controlling for injury severity, differences related to sociobiologic or socioeconomic factors exist for both home and nonhome discharge dispositions.

METHODS

Three sets of archival data were selected to address the study questions: (1) CDC CNSIS²³; (2) the NTDB²⁴; and (3) the NSCOT.²⁵ These datasets contain adequate data to: (1) identify hospitalized patients with moderate to severe TBI, and (2) categorize hospital discharge disposition. Because no national dataset of acute care for persons with TBI exists, these databases were selected because they are the only datasets that met the study criteria and were appropriate to address the study purpose. Each database was analyzed separately and results were compared across databases. If results determined across databases were found to converge, confidence in each increased, as each database was collected for different purposes and across different years. For the protection of participants included in these datasets, this study was reviewed and approved by the HealthOne Inc Institutional Review Board.

Data Sources

The CDC CNSIS was designed for TBI and SCI surveillance and is a multi-year, population-based dataset of standardized medical and injury-related variables from patients with TBI, SCI, and combination TBI and SCI injuries occurring in specific states. The CDC CNSIS includes persons of all ages. Core components are obtained from computerized ICD-9-CM²⁶ codes recorded from standard hospital discharge databases using ICD-9-CM codes for case identification. Extended component data are obtained via medical record review and abstraction from a sample of cases identified through the core component. Since its inception in 1995, the number of states reporting cases to the CDC with extended data has fluctuated between 4 and 12, with each state submitting information from a stratified sample of cases based on hospital size (small and large hospitals [<100 and ≥ 100 licensed beds for acute care, respectively]). Data from 1997 to 2003 were available for analysis; however, population-based weights were not available for all years. As a result, each case was treated as a single incidence, and we made no attempt to generalize results to a national level. Furthermore, only states with less than 40% missing data on any of the variables of interest were selected for analysis; these criteria limited the dataset to cases from Alaska, Colorado, Minnesota, South Carolina, and Utah.

Beginning in 2007, data submitted to the NTDB followed the guidelines of the NTDS, a data dictionary comprised of standardized variables and response categories. In 2007, the NTDB consisted of over 500,000 records with valid trauma codes. Data were submitted by 435 hospitals with American College of Surgeons designation as a Trauma Center. Most contributing hospitals (85%) were accredited as level I or level II, and represent two-thirds of the accredited trauma centers. Only data from the year 2007 were available.

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