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Clinical and non-clinical factors that predict discharge disposition after a fall

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ABSTRACT

Background: Falls can result in injuries that require rehabilitation and long-term care after hospital discharge. Identifying factors that contribute to prediction of discharge disposition is crucial for efficient resource utilization and reducing cost. Several factors may influence discharge location after hospitalization for a fall. The aim of this study was to examine clinical and non-clinical factors that may predict discharge disposition after a fall. We hypothesized that age, injury type, insurance type, and functional status would affect discharge location.

Methods: This two-year retrospective study was performed at an urban, adult level-1 trauma center. Fall patients who were discharged home or to a facility after hospital admission were included in the study. Data was obtained from the trauma registry and electronic medical records. Logistic regression modeling was used to assess independent predictors.

Results: A total of 1,121 fallers were included in the study. 621 (55.4%) were discharged home and 500 (44.6%) to inpatient rehabilitation (IRF)/skilled nursing facility (SNF). The median age was 64 years (IQR: 49–79) and 48.4% (543) were male. The median length of hospital stay was 5 days (IQR: 2.5–8). Increasing age ($p < 0.001$), length of stay in the ICU ($p < 0.001$), injury severity ($p < 0.001$), number of comorbidities ($p = 0.038$), having Medicare insurance ($p = 0.025$), having a fracture at any body region ($p < 0.001$), and ambulation status ($p = 0.025$) significantly increased the odds of being discharged to IRF/SNF compared to home. The removal of injury severity score and ICU length of stay from the "late/regular discharge" model, to create an "early discharge" model, decreased the accuracy of the prediction rate from 78.5% to 74.9% ($p < 0.001$).

Conclusion: A combination of demographic, clinical, social, economic, and functional factors can together predict discharge disposition after a fall. The majority of these factors can be assessed early in the hospital stay, which may facilitate a timely discharge plan and shorter stays in the hospital.

Introduction

Falls are the leading mechanism of injury and fatality in trauma patients and may be attributed to many different risk factors [1]. Poor vision, home environment, osteoporosis, comorbidities, lack of muscle strength, exercise, and medications can all increase the risk of falling [2–6]. Additionally, studies suggest that if you fall once, the chances of falling again are doubled and if you are older than 65, the risk is even higher [7–9]. In the US, millions of people are treated each year for fall-related injuries [10]. One out of three elderly individuals fall annually and one out of every five falls leads to a serious bone fracture or head injury [8]. Accordingly, fallers over 65 years of age are more likely to be admitted to a long term care facility for a year or longer for these injuries [11,12]. Younger fallers also sustain injuries that require rehabilitation after hospitalization, though to a lesser extent.

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The cost of hospitalization and the need for further care post-hospital discharge both contribute to the rising cost of treating falls [10,13]. In 2012, the direct medical cost was $30 billion for non-fatal and $616 million for fatal falls, two thirds of which accounted for hospital costs [13]. One contributing factor is length of stay in the hospital, which is often extended due to a delay in discharge planning. Early determination of hospital discharge disposition may help formulate an appropriate discharge plan and shorten the time spent in the hospital [14]. Moreover, identifying factors that contribute to accurately predicting discharge disposition may shorten recovery time and reduce cost.

Only a few studies have explored prediction models of discharge planning for trauma patients. Beaulieu and colleagues reported that data available shortly after admission accurately predicted discharge disposition of trauma patients at a similar rate to data available at the completion of the hospital stay [15]. Lim and colleagues reported that older fallers with an injury to the face, neck, thorax or abdomen are less likely to be discharged to a nursing home or rehabilitation facility than to home when compared to having injuries of the upper or lower extremities. Injuries that involved the spine were more likely to result in discharge to a rehabilitation facility than to home [11]. Another study by Ayoung-Chee and colleagues reported that elderly fallers with poor functional and cognitive status were discharged to a skilled nursing facility (SNF) and did not qualify for discharge home or to an inpatient rehabilitation facility (IRF) [12]. These studies suggest that discharge disposition can be predicted and that early discharge planning is possible.

Economic status is also an important factor to take into account when planning discharge [16–18]. Patients are often recommended to post-acute care services that they can afford or as approved by their managed care insurance. This limits the ability of a healthcare provider to recommend a patient to a location that would benefit them the most. Living arrangements, lack of family caregivers, and prior physical functioning are also important factors that may influence discharge location [19–21]. The discharge location should provide a safe environment for the patient and minimize the risk of a second fall or readmission to the hospital.

In this retrospective study, both clinical and non-clinical factors that may predict discharge disposition after hospitalization for a fall were examined. Data routinely obtained shortly after admission as well as data obtained at the end of the hospital stay were included in the prediction models. Given that little research exists on predicting discharge location after hospitalization for a fall, this retrospective study may be of benefit in constructing effective models to shorten hospital stay, expedite rehabilitation, and reduce cost.

Methods

Study design

This two-year retrospective study was performed at an urban, adult level one trauma center. All adult fall patients who were trauma activations or had a surgical consult were included in the study. Data was obtained from the trauma registry and electronic medical records. Patients were grouped and analyzed based on discharge location. This study was approved by the Institutional Review Board; patient consent was not required.

Setting

This study was conducted at a Level-1 trauma center, which has three tiers of trauma activations. Tier 1-falls are more serious and require fallers to have poor vital signs, an open/depressed skull fracture, paralysis or suspected spinal cord injury, an unstable pelvic fracture, two or more proximal long bone fractures, or a penetrating injury to the head, neck, torso, or extremities proximal to the elbow/knee. Falls are categorized as tier 2 activations if they are from a height of >20 feet for adults, >10 feet for children, 3X the height of the faller, or from any height if the faller is on anticoagulation medications. Tier 3-falls are for injuries not classifiable as tier 1 or 2, but require a trauma consult within 30 min of an injury being identified by an ED physician. For falls not categorized as trauma activations, a consultation by other surgical specialties (Orthopedics, Neurosurgery, Thoracic, etc.) may be needed depending on the injury.

Inclusion/exclusion criteria

Adult trauma activation patients who were admitted to the hospital after a fall were included in the study. Patients who did not meet criteria for trauma activation but had a surgical consultation from any surgical sub-specialty were also included. Patients with isolated hip fractures were included in the dataset. Patients were excluded if they were under 18 years of age, if they were not admitted to the hospital, and if the fall was secondary to a medical condition such as cardiac arrest, stroke, or other mechanism such as being struck by a motor vehicle. Patients who left against medical advice, died, or were transferred to another hospital/facility were also excluded from data analysis.

Variables collected

The trauma registry and electronic medical records were utilized to collect several variables. Variables collected included: gender, race/ethnicity, BMI, alcohol/drug use, anticoagulation medications, fall height, fall location, comorbidities, hospital length of stay, intensive care unit (ICU) length of stay, intubation status, surgery status, discharge location, injury severity score (ISS), and injuries to specific body regions. The reference range for alcohol screening is 0.0–10.0 mg/dL, a blood alcohol level over 10 mg/dL is considered positive alcohol use. Drug use was defined as a positive drug test for opiates, cocaine, marijuana, or benzodiazepines.

Factors such as support system, living arrangements, level of prior physical functioning, use of assistive devices, primary caregiver, and economic resources were extracted from the social workers' assessments. At our institution, all in-patients and patients in observation that meet the high-risk screening criteria are assessed by a social worker within 24 h of admission, or on the next business day for patients admitted on the weekend. For urgent cases on the weekend, a nurse performs the assessment.

A fall was defined as inadvertently coming to rest on the ground or other lower level [7,19,22,23]. Indoor falls occurred inside a residential dwelling or non-residential building, while outdoor falls occurred outside a dwelling or building, including the driveway/yard and street. To determine factors that influence discharge location after a fall, patients were grouped into two discharge dispositions: home and in-patient rehabilitation/skilled nursing facility. Patients in the "Home" disposition group included patients discharged home with or without homecare services. All patients who required additional care after hospital discharge were grouped, that is, patients discharged to an in-patient rehabilitation facility (IRF) or a skilled nursing facility (SNF).

Data analysis

R version 3.4.2 [24] was used for all statistical analyses, and logistic regression modeling was performed using the *caret* package [25]. The ultimate goal of logistic regression modeling was to ascertain the subset of available predictors that could be

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