Characteristics and Circumstances of Falls in a Hospital Setting

A Prospective Analysis

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OBJECTIVE: **To describe the epidemiology of hospital inpatient falls, including characteristics of patients who fall, circumstances of falls, and fall-related injuries.**

DESIGN: **Prospective descriptive study of inpatient falls. Data on patient characteristics, fall circumstances, and injury were collected through interviews with patients and/or nurses and review of adverse event reports and medical records. Fall rates and nurse staffing levels were compared by service.**

SETTING: **A 1,300-bed urban academic hospital over 13 weeks.**

PATIENTS: **All inpatient falls reported for medicine, cardiology, neurology, orthopedics, surgery, oncology, and women and infants services during the study period were included. Falls in the psychiatry service and falls during physical therapy sessions were excluded.**

MEASUREMENTS AND MAIN RESULTS: **A total of 183 patients fell during the study period. The average age of patients who fell was 63.4 years (range 17 to 96). Many falls were unassisted (79%) and occurred in the patient's room (85%), during the evening/overnight (59%), and during ambulation (19%). Half of the falls (50%) were elimination related, which was more common in patients over 65 years old (83% vs 48%; $P < .001$). Elimination-related falls increased the risk of fall-related injury (adjusted odds ratio, 2.4; 95% confidence interval 1.1 to 5.3). The medicine and neurology services had the highest fall rates (both were 6.12 falls per 1,000 patient-days), and the highest patient to nurse ratios (6.5 and 5.3, respectively).**

CONCLUSIONS: **Falls in the hospital affect young as well as older patients, are often unassisted, and involve elimination-related activities. Further studies are necessary to prevent hospital falls and reduce fall injury rates.**

KEY WORDS: **accidental falls; hospital; injury; risk factors; epidemiology.**
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Falls among hospital inpatients are common, generally ranging from 2.3 to 7 falls per 1,000 patient-days.[1–4] Approximately 30% of inpatient falls result in injury, with 4% to 6% resulting in serious injury.[5,6] These serious fall-related injuries can include fractures, subdural hematomas, excessive bleeding, and even death. Injuries due to falls also increase health care costs. Patients who fall and sustain injury are reported to have hospital charges over $4,200 higher than patients who do not fall.[7] Prevention of falls in the hospital setting is therefore an important patient safety and public health issue. Unfortunately, there is relatively little reported evidence on factors contributing to inpatient falls or the effectiveness of hospital fall prevention programs.[8–10]

Most literature on falls focuses on elderly adults residing in the community or long-term care facilities. Some previous research has identified risk factors for falling in the hospital, several similar to those identified in nursing home and community studies, such as impaired balance or gait, altered mobility, history of falling, increasing age, impaired cognition, depression, dizziness or vertigo, orthostatic hypotension, visual impairment, and use of certain medications such as benzodiazepines, antipsychotics, and sedatives.[1,5,10–15] Studies also document altered elimination patterns and specific diagnoses as fall risk factors in the hospital.[1,5,10,13–15]

Risk factors for injurious falls may differ from risk factors for falling, and little research has been performed to identify predictors of injurious falls in hospitals. Studies performed in community, long-term care, and rehabilitation hospital settings have documented a wide variety of patient-related risk factors for suffering a serious fall-related injury. These include female gender, white race, cognitive impairment, gait or balance impairment, low body mass index, presence of two or more chronic conditions, and a previous fall with fracture.[16–18] One study has evaluated the predictors of serious fall-related injury among inpatients in an acute care hospital, and found confusion and comorbidities to be significant risk factors.[7] Limitations of this study include its small sample size, that it was a single-center study, that it assessed falls from only three services (medicine, surgery, and obstetrics/gynecology), and use of a comparison group that included patients who did not fall.

The few studies that have addressed the epidemiology of inpatient falls have used a variety of types of study design, patient populations, definitions, and data collection methods. The majority of inpatient fall studies are retrospective

and rely solely on data from medical records or incident reports. Information from risk management databases is often incomplete and may not identify potential causal factors for falls. Finally, prior studies often focused only on fall risk factors and did not examine contributing factors or circumstances of the falls (e.g., what triggered the fall), knowledge of which is necessary in the development of fall intervention programs.

Prospective and intensive examinations of patients who fall and circumstances surrounding falls are required to gain a full understanding of the epidemiology of hospital falls. The main objectives of this prospective observational study were to 1) identify and analyze characteristics of patients who fall, the types and circumstances of their falls, factors contributing to patient falls, fall rates by service, and staffing patterns; and 2) measure the extent of serious injury resulting from inpatient falls and analyze risk factors for injury among those who fall.

METHODS

This study was conducted at Barnes-Jewish Hospital, a 1,300-bed academic teaching hospital affiliated with Washington University School of Medicine in St. Louis, Mo. A prospective evaluation of 200 consecutive patient falls was performed from October 22, 2002 through January 25, 2003. All inpatient falls reported for medicine, cardiology, neurology, orthopedics, surgery, oncology, and women and infants services during the study period were included. Falls during physical therapy sessions were excluded because such sessions encourage patients to engage in activities that could cause postural instability, which often results in the physical therapist lowering a patient to the floor without bodily harm. Falls reported from the psychiatry service were also excluded due to the unique risk factors present in these patients.

Patient falls were identified by the data collectors after they were reported by hospital staff into the hospital's secure online adverse event reporting system. A fall is defined within the adverse event reporting system as a sudden unexpected descent from a standing, sitting, or horizontal position, including slipping from a chair to the floor, a patient found on the floor, and an assisted fall. In 2002, the rate of reported falls was 3.29 falls per 1,000 patient-days at Barnes-Jewish Hospital. The fall rate for the time of this study period was 3.38 falls per 1,000 patient-days.

A detailed fall data collection tool was developed based on an extensive review of the literature to identify possible factors contributing to falls and fall-related injuries (Table 1). Two researchers, a health systems engineer (EBH) and a registered nurse (PAN), collected data on 200 consecutive falls using this tool. For each event, several data sources were used to collect information including the adverse event database, the electronic nursing charting system (Emtek, Eclipsys Corporation, Boca Raton, Fla), the patient's paper medical record, and an interview with the patient or family member and nurse. The adverse event database included several variables (Table 1) as well as a description of the fall. The electronic nursing charting system was used to determine health status, medications, and fall risk-level information. If the patient had not yet been discharged, the data collector interviewed the patient and current nurse and reviewed the patient's medical record. The patient or a family member was interviewed for 21% of the cases

Table 1. Variables on Fall Data Collection Instrument

Patient information
Patient demographics*
Admitting diagnosis*
Health status variables†§
Mental condition at time of fall†
Medications taken within 24 hours prior to the fall†‖
History of falls†
Fall risk level (assigned by nurse at admission)†
Fall prevention in place at time of fall†
Details of fall
Date/time of fall*
Location of fall*
Discovery type*
Assist type*
Activity trying to perform at time of fall‡
Reason for activity‡
Fall type‡
Mechanisms of fall‡
Other factors contributing to fall
Staffing level¶
Call light location and usage*
Side-rail and bed position*
Furniture/equipment/assistive device involved in the fall‡
Floor type and problems‡
Patient footwear and clothing‡
Visibility‡
(if applicable, information on the following)
Bathroom‡
Exit alarm‡
Restraint ordered and/or in place*
Bedside commode‡
Foley catheter†
Result of fall/action taken postfall
Type of injury*
Severity of injury*
Fall prevention information postfall†
Documentation of fall†

* *Variables contained in the hospital's adverse event reporting system.*

† *Variables contained in the patient's electronic chart.*

‡ *Variables obtained by either talking with the patient, family member, nurse, observing the environment, or by extracting information from the narrative description of the fall in the adverse event reporting system.*

§ *Muscle weakness, gait deficit, balance deficit, use of assistive device (hospital and home), cognitive impairment/dementia, impaired memory, visually impaired, hearing impaired, fainting/syncope, orthostatic hypotension, urinary frequency, urgency, and/or incontinence, arthritis, osteoporosis, lower extremity problems, diabetes, drug/alcohol abuse, depression, receiving physical therapy.*

‖ *See Table 2 for medication categories.*

¶ *Obtained from nurse staffing records.*

and a nurse was interviewed for 9% of the cases. Medical records and adverse event reports were consulted for all of the falls. Through interviewing the patient, family, or witness of the fall, or consulting the narrative in the adverse event report, the data collector was able to identify some fall circumstances from a predefined list of possibilities, including the mechanism that triggered the fall (e.g., slipped, tripped, fainted, lost balance), the activity conducted at the time of the fall (e.g., ambulating, getting out of bed, using the toilet), and fall type (e.g., collapse, lowered to floor, fell from height) for some falls. The medical record offered detailed information on the patient's medical history. For example, a patient was considered confused or disoriented if the nurse documented the patient as not being alert to person, place, and time at the time of their fall. Some medical history variables were also obtained by talking with the patient. For example, muscle weakness was assessed by either documentation in the patient's chart or by asking the patient. Impaired memory was assessed by finding documentation of this impairment in the patient's chart as diagnosed by a physical therapist or assessed by the nurse, or by asking the patient or a family member. The data collector also assessed the patient's environment and fall location. Staffing data was collected from nursing staffing records. Fall prevention measures were obtained by consulting the patient's electronic chart or the adverse event report, which includes documentation of such strategies as a special room, bed exit alarm, sitter, toileting schedule, and restraints.

Several weeks after the fall, x-ray and CT scan results were reviewed to collect information about injuries discovered after the initial data collection phase. Based on the scale used in the hospital's adverse event reporting system, injury severity was then classified as:

1. No injury;
2. Minor: minor cuts, minor bleeding, skin abrasions, swelling, pain, minor contusions;
3. Moderate: excessive bleeding, lacerations requiring sutures, temporary loss of consciousness, moderate head trauma;
4. Severe: fractures, subdural hematomas, other major head trauma, cardiac arrest, and death.

The Washington University Institutional Review Board approved this study. The need for written informed consent from patients was waived because this study was part of a hospital-based quality improvement project and posed no risk to patients. Data were double-entered into a Microsoft Access database (Microsoft Corporation, Redmond, Wash), cleaned, and transferred to SPSS for Windows, version 11.0 (SPSS Inc., Chicago, Ill) for analysis. Pearson χ^2 test was used to compare characteristics of patients who fell and circumstances of the fall for categorical variables. Student's t test, ANOVA, and the Kruskal-Wallis test were used to compare continuous variables as appropriate. All tests were two-tailed with $P < .05$ considered statistically significant. Logistic regression was used to calculate both crude and adjusted odds ratios with 95% confidence intervals for predictors of suffering a fall-related injury.

RESULTS

Demographics and Characteristics of Inpatients Who Fell

The characteristics of inpatients who fell are displayed in Table 2. A total of 200 falls occurred during the study period; 183 different patients fell, 168 (92%) of whom fell only once during the study period, 13 (7%) of whom fell

Table 2. Demographics and Characteristics of Inpatients Who Fell

Patient Characteristic	Inpatients Who Fell (*N* = 183) *n* (%)
Mean age, y (range)	63.4 (17 to 96)
Gender	
Male	86 (47.0)
Female	97 (53.0)
Mental status	
Alert and oriented to person, place, and time	99 (54.1)
Confused at times or disoriented	81 (44.3)
Unconscious	1 (0.5)
Unknown	2 (1.1)
Body mass index	
Underweight (<18.5)	11 (6.0)
Normal (18.5–24.9)	66 (63.1)
Overweight (25.0–29.9)	40 (21.9)
Obese (≥30.0)	37 (20.2)
Unknown	29 (15.8)
Hospital fall risk assessment at time of fall*	
High	100 (54.6)
Low	78 (42.6)
Not documented	5 (2.7)
Muscle weakness†	148 (80.9)
Urinary frequency, urgency, or incontinence	66 (36.1)
Lower extremity problems	70 (38.3)
History of falls in previous 3 months	41 (22.4)
Impaired memory‡	58 (31.7)
Medications administered within 24 hours prior to fall	106 (57.9)
Central nervous system acting agents§	102 (55.7)
Vasoactive/blood pressure agents‖	63 (34.4)
Anticoagulants	53 (29.0)
Nonnarcotic analgesics	19 (10.4)
Unknown	

* *"Low" if patient had one or none of the following; "high" if the patient had two or more of the following: history of falls, impaired mobility, confused/disoriented, age over 65, incontinence (bowel or bladder), dizziness/vertigo/postural hypotension, sensory deficit, functional dependence.*

† *As documented by patient's medical record or admitted by patient.*

‡ *As diagnosed by physical therapy, admitted by patient or family member, or assessed by nurse.*

§ *Includes anticonvulsants, antidepressants, antipsychotic agents, benzodiazepines, narcotic analgesics, sedative hypnotics.*

‖ *Includes angiotensin-converting enzyme inhibitors, beta-blockers, calcium channel blockers, diuretics, and vasodilators.*

twice, and two (1%) of whom fell three times. The only significant difference between patients who fell once and patients who fell repeatedly was gender. Men were more likely to experience multiple falls during the study period than women (11/86 [13%] vs 4/97 [4%]; $P = .03$). We report on the first falls of all patients who fell ($N = 183$). Second and third falls were excluded to reduce bias for patient characteristics and because multiple fallers tend to repeat the type and location of the fall on successive falls.[19]

The mean age of the 183 patients who fell was 63.4 years (range 17 to 96 years); 47% were under the age of 65. A large proportion (81/183; 44%) of patients were confused or disoriented at the time of the fall. General muscle weakness was very prevalent among the patients who fell (148/183; 81%), and many patients had diabetes (71/183; 39%), urinary frequency (66/183; 36%), or lower extremity problems (70/183; 38%) including weakness, loss of sensation, swelling, or missing limbs.

In addition to the high prevalence of physical and cognitive problems, patients who fell were also on many medications that could have contributed to a fall. Many patients were administered agents with central nervous system activity (106/183; 58%) or vasoactive/blood pressure agents (102/183; 56%) in the 24-hour period prior to the fall; 12% (22/183) of patients received a sedative-hypnotic. Significantly more of the patients who received a sedative-hypnotic fell during the evening and night (7:00 PM to 6:59 AM) than those who did not receive a sedative-hypnotic (18/22 [82%] vs 82/142 [58%]; $P = .03$). An anticoagulant was administered to nearly 35% (63/183) of patients within 24 hours prior to their fall. Among those who fell, there was no significant relationship between urinary problems and elimination-related falls or between the use of a diuretic within the 24-hour period prior to the fall and elimination-related falls.

Description of Falls

The largest proportions of patients fell in the evening or at night (107/183; 59%), in the patient's room (155/183; 85%), and had an unassisted fall (145/183; 79%; Table 3). Lost balance was the most common mechanism of the fall mentioned by patients or documented in the adverse event reporting system (22/183; 12%). Half of falls were elimination related (92/183; 50%). Elimination-related falls were defined as a fall that occurred during an activity related to elimination, such as ambulating to or from the bathroom or bedside commode, reaching for toilet tissue, exiting a soiled bed, etc. Only 19% of elimination-related falls actually occurred in the patient's bathroom. Among patients who fell, those 65 years or older were more likely to have an elimination-related fall than those less than 65 years old (60/72 [83%] vs 32/66 [48%]; $P < .001$).

The most common activity performed at the time of the fall was ambulation (35/183; 19%). Of those who fell during ambulation, the most frequent destinations were: bed to bathroom (37%), bedside commode to bed (11%), and bed

Table 3. Circumstances of First Falls ($N = 183$)

Descriptors	*n* (%)
Location	
Patient room	155 (84.7)
Patient bathroom	20 (10.9)
Other*	8 (4.4)
Time of day	
7:00 AM–6:59 PM	76 (41.5)
7:00 PM–6:59 AM	107 (58.5)
Discovery type	
Found on floor	140 (76.5)
Witnessed	35 (19.1)
Self-reported	8 (4.4)
Assist type at time of fall	
Unassisted	145 (79.2)
Assist by employee, visitor, or device	15 (8.2)
Unknown	23 (12.6)
Fall type	
Collapsed	62 (33.9)
Slid to floor	42 (23.0)
Fell from height	12 (6.6)
Unknown	67 (36.6)
Fall mechanism	
Lost balance	22 (12.0)
Slipped or tripped	18 (9.8)
Dizziness or fainted	14 (7.7)
Muscle weakness	9 (4.9)
Hip, leg, or knee gave out	8 (4.4)
Used bad support	7 (3.8)
Other†	6 (3.3)
Asleep or sedated	2 (1.1)
Unknown	97 (53.0)
Activity at time of fall	
Ambulating	35 (19.1)
Getting out of bed	20 (10.9)
Sitting down or standing up	17 (9.3)
Using bedside commode	4 (2.2)
Using toilet	4 (2.2)
Standing or sitting (not trying other action)	7 (3.8)
Reaching for object	6 (3.3)
Sleeping or repositioning in bed	4 (2.2)
Getting into bed	2 (1.1)
Using bathtub	1 (0.5)
Dressing or undressing	1 (0.5)
Unknown	61 (33.3)
Reason for activity	
Definitely elimination related‡	92 (50.3)
Not elimination related	46 (25.1)
Unknown	45 (24.6)
Intervention ordered and/or in place	
Special room§	11 (6.0)
Restraints	8 (4.4)
Sitter	8 (4.4)
Toileting schedule	3 (1.6)
Bed exit alarm	3 (1.6)
Special bed: veil or low-boy	1 (0.5)

* *Hallway (3), nurses station (2), exam room (1), elevator (1), sidewalk (1).*

† *Rolled out of bed, prosthesis gave out, missed chair, intentional fall, slid out of chair, forgot paraplegia, stiff muscles.*

‡ *Defined as fall occurring during an activity involving elimination (e.g., ambulation to/from bathroom, reaching for toilet tissue from bedside commode, exiting a soiled bed, etc.).*

§ *Close to nurses' station or video surveillance.*

to bedside commode (6%). While at least 29% (53/183) of patients who fell in the hospital reported using an assistive device on a regular basis at home, fewer than 6% (3/53) of those patients reported using one at the time of their in-hospital fall.

Interventions to prevent falls were inconsistently used before or at the time of the fall. The most commonly used fall interventions among patients who fell were assignment to special rooms (i.e., video surveillance or placement close to the nurses' station; 11/183; 6%), sitters (8/183; 4%), and restraints (8/183; 4%). Of the 8 patients with restraints, including vests and lower and upper limb soft restraints, 6 had restraints ordered to prevent a fall and 2 removed their restraints prior to the fall. (The use of restraints are currently discouraged as a fall prevention strategy at this hospital. Vest restraints, primarily used as a fall prevention strategy in the past, have been eliminated since the time of this study.)

Environment and Additional Circumstances of Falls

Environmental circumstances were either documented in the adverse event reporting system (e.g., side-rail use and call light use), assessed by observing the patient's environment, interviewing the patient, or extracting information from the narrative of the fall in the adverse event reporting system. Approximately 4% of the patients had one or no side-rails raised, 67% had two or three side-rails raised, and 10% had all four side-rails up at the time of the fall. (Having all four side-rails elevated is currently considered a restraint and is discouraged as a fall prevention strategy at this hospital.) The call light was reportedly used immediately prior to the fall in only 3% of cases. At least 24% (15/62) of those who did not use the call light felt they did not need assistance.

The floor was wet due to urine or water for at least 14 (8%) of the falls and accounted for the majority of slips. Issues with environmental obstacles, such as tripping over or the misuse or malfunction of furniture, devices, or equipment, were identified as contributing to the fall in 15 (8%) falls. In 4 of 21 (19%) falls occurring in the bathroom, an assistant who had helped the patient to the toilet was waiting for the patient outside the bathroom door. Eight of 27 (30%) falls involving a bedside commode occurred when the patient was left after being assisted to the bedside commode.

Fall Information by Service

Thirty-four separate units from 7 services reported falls (Table 4). Fall rates differed significantly by service ($P < .001$), as did the average number of patients per nurse ($P < .001$). The medicine and neurology services had the highest fall rates (both were 6.12 falls per 1,000 patient-days), as well as the highest patient to nurse ratios (6.5 and 5.3, respectively). Length of stay prior to the fall was examined as a proxy-marker for illness severity and differed by service ($P = .004$). Women and infants and neurology services had the shortest lengths of stay prior to the fall (medians 1 and 2 days, respectively), while the surgery and oncology services had the highest (medians 8 and 7 days, respectively).

Table 4. Fall Information by Service

Service	Fall Rate Per 1,000 Patient-Days*	Average Number of Patients Per Nurse†	Number of Days in Hospital Prior to Fall	
			Median	Mean (Range)
Medicine	6.12	6.5	3	6.5 (0 to 42)
Neurology	6.12	5.3	2	5.1 (0 to 20)
Oncology	3.75	4.6	7	10.5 (1 to 38)
Cardiology	2.97	4.7	4	9.1 (1 to 92)
Surgery	2.18	5.1	8	8.9 (1 to 24)
Orthopedics	0.80	5.0	3	3.0 (2 to 4)
Women and Infants	0.83	2.7	1	0.7 (0 to 1)
Overall	3.38	5.4	4	7.4 (0 to 92)

* *Fall rate for November 2002 through January 2003.*
† *Average number of patients assigned to the nurses of patients who fell in these services.*

Injuries and Factors Associated with Injuries Sustained from Falls

Overall, 42% of the 183 first falls resulted in some type of injury (Table 5). Fourteen (8%) falls involved moderate/severe injury including 4 (2%) lacerations, 2 (1%) fractures, 2 (1%) subdural hematomas, 6 (3%) other head traumas, 1 (0.5%) loss of consciousness, and 1 (0.5%) cardiac arrest with death. Some significant associations between patient or fall characteristics and injury were found when comparing no injury to any type of injury (Table 6). In univariate analysis, factors that increased the risk of suffering a fall-related injury were female gender (crude odds ratio [cOR], 2.0; 95% confidence interval [CI], 1.1 to 3.7) and elimination-related falls (cOR, 2.5; 95% CI, 1.2 to 5.2). Patients who were confused or disoriented were less

Table 5. Injuries Sustained from Falls (*N* = 183)

Type of Injury	*n* (%)
Pain/swelling	34 (18.6)
Abrasion/skin tear	27 (14.8)
Bleeding	25 (13.7)
Contusion/hematoma*	23 (12.5)
Subdural hematoma	2 (1.1)
Laceration/perforation/puncture	5 (2.7)
Foley catheter pulled out	4 (2.2)
Decubitus/reddened area on skin	4 (2.2)
Fracture/dislocation*	2 (1.1)
Loss of consciousness	1 (0.5)
Cardiac/respiratory arrest	1 (0.5)

* *1 compression fracture of spine; 1 blowout of left orbit and fracture of left maxillary sinus.*

Table 6. Characteristics of First Falls Resulting in Injury (*N* = 183)

Characteristic	No Injury *N* = 107 *N* (%)	Minor Injury *N* = 62 *N* (%)	Moderate/ Severe Injury *N* = 14 *N* (%)
Age			
Below 50	26 (24.3)	15 (24.2)	2 (14.3)
50–59	13 (12.1)	9 (14.5)	0 (0.0)
60–69	26 (24.3)	14 (22.6)	4 (28.6)
70–79	25 (23.4)	10 (16.1)	4 (28.6)
80 and above	17 (15.9)	14 (22.6)	4 (28.6)
Gender			
Male	58 (54.2)	21 (33.9)	7 (50.0)
Female	49 (45.8)	41 (66.1)	7 (50.0)
Mental status			
Alert/oriented to person, place, and time	51 (47.7)	38 (61.3)	10 (71.4)
Confused at times/ disoriented	54 (50.5)	23 (37.1)	4 (28.6)
Unconscious	0 (0.0)	1 (1.6)	0 (0.0)
Unknown	2 (1.9)	0 (0.0)	0 (0.0)
Service			
Medicine	41 (38.3)	23 (37.1)	6 (42.9)
Cardiology	22 (20.6)	11 (17.7)	2 (14.3)
Neurology	19 (17.8)	9 (14.5)	3 (21.4)
Surgery	14 (13.1)	7 (11.3)	1 (7.1)
Oncology	5 (4.7)	12 (19.4)	2 (14.3)
Women and infants	4 (3.7)	0 (0.0)	0 (0.0)
Orthopedics	2 (1.9)	0 (0.0)	0 (0.0)
Elimination-related falls			
Definitely elimination related	42 (39.3)	42 (67.7)	8 (57.1)
Not elimination related	31 (29.0)	13 (21.0)	2 (14.3)
Unknown	34 (31.8)	7 (11.3)	4 (28.6)

likely to be injured than alert and oriented patients (cOR, 0.5; 95% CI, 0.3 to 0.98). In multivariate analysis, only elimination-related falls remained a significant predictor of being injured from a fall (adjusted odds ratio [aOR], 2.4; 95% CI, 1.1 to 5.3).

When comparing none/minor injury to moderate/severe injury, a fall involving a bedside commode was a risk factor for serious injury (cOR, 3.7; 95% CI, 1.1 to 12.1). Age 65 or above was of borderline significance as a risk factor for serious injury (cOR, 3.5; 95% CI, 0.95 to 13.1). The low number of serious injuries in our sample precluded the calculation of adjusted odds ratios. Although most falls and fall-related injuries occurred on the medicine service, the oncology service had the highest rate of injury with 74% of first falls resulting in injury, and the highest rate of major injury with 11% of first falls resulting in moderate/severe injury.

DISCUSSION

Inpatient falls are a persistent problem in hospitals across the country, and our study suggests that many complex patient characteristics, circumstances, and activities may contribute to these falls. While we could not determine risk factors for falling due to the lack of a control group, patient characteristics that have been identified as risk factors for falling, such as weakness, poor cognitive status, and being on medications that could contribute to falling,[5,10,20] were prevalent in patients who fell in our study. Our study can provide insight into common circumstances surrounding patient falls. Patients attempting to perform activities unassisted, especially elimination-related activities, accounted for a large proportion of inpatient falls.

While many of the hospital patients in our study were getting out of bed when they fell, as has been reported in previous studies,[2,6,21] more were ambulating at the time of their fall, usually unassisted. One fourth of the patients used ambulatory aids at home, yet only three used one in the hospital at the time of the fall. Two thirds of patients who fell had physical therapy sessions during their hospital stay; yet walkers are often not left in the room following the session for the patient's use. Increased scheduled assistance from hospital staff could help reduce the number of patients getting out of bed unassisted. Physical therapy sessions could be incorporated into hospital fall prevention programs to increase access to walkers and canes that can be left for use at the bedside. Furthermore, families should be encouraged to bring the patient's walker or assistive device from home for use in the hospital.

In addition to the limited availability of assistive devices for patients, other barriers that emphasize the difficulty of preventing hospital falls surfaced in our results. For example, many patients did not use the call light because they believed that they did not need assistance. Perhaps patients need to be better educated on the effects that a new environment, decreased activity, medications, tests, and treatments can have on patients' energy and ability to ambulate safely. Another example demonstrating the difficulty in preventing falls is that some patients fell despite the fact that they received assistance to the bedside commode or toilet prior to their fall.

The finding that elimination-related falls were quite common is consistent with previous studies that have found altered elimination to be a risk factor for hospital falls.[10,13,14] We also found that elimination-related falls increased the risk of suffering a fall-related injury, even after controlling for gender and mental status. Although urinary problems and diuretics surprisingly were not associated with elimination-related falls, age above 65 was. Interventions for high-risk elderly patients should include toileting schedules and specific interventions to facilitate safely using the bathroom and bedside commode.

Community and long-term care studies generally have been limited to elderly patients and have found that age above 80 years increases the risk of falling.[22–24] However, approximately half of inpatients who fell in our study were younger than 65 years old. This finding may reasonably suggest that other fall risk factors commonly associated with age and falling (such as cognitive impairment and

impaired mobility) are present in today's very ill patient population regardless of age. Regarding injury, patients under the age of 65 were just as likely to suffer a fall-related injury as patients 65 or older. Although age 65 or above was of borderline significance as a risk factor for serious injury, low numbers of patients suffering a serious injury precluded multivariate analysis. However, a previous study in a rehabilitation hospital found increased age to be an independent risk factor for suffering fall-related fracture after adjusting for confounders.[25] Therefore, it may be beneficial to extend research on prevention strategies specific for serious fall-related injury, such as hip protectors, to elderly hospital patients who also have other risk factors for falling.

An interesting finding was that reported fall rates were generally higher in those services with higher patient to nurse staffing ratios. Recent studies have highlighted associations between nurse staffing levels and adverse outcomes,[26,27] including fall rates.[28–30] Patients in the services with higher fall rates in this study may also have greater illness severity or greater prevalence of balance and weakness problems that could account for higher fall rates. Studies should be undertaken to determine whether lower patient to nurse staffing ratios are associated with lower fall rates after accounting for patient acuity.

Alert and oriented fallers were more likely to suffer an injury in univariate analysis, contrary to previous hospital, community, and long-term care studies that found patients with impaired mental status to be more likely to fall[10,13,14,20,31–34] and more likely to suffer an injury.[17] The association we found in univariate analysis may be due to chance or to bias. Alert and oriented patients may be more likely to report minor injuries than confused/disoriented patients simply because they are more aware. This could lead to a false association between being alert/oriented and sustaining an injury. Furthermore, nurses' assessment of mental status (i.e., orientation to person, place, and time) is not necessarily administered uniformly to patients and is not a validated measure of cognitive impairment. This could have caused misclassification of some patients' mental status. In any case, this factor was no longer significant after adjusting for gender and elimination-related falls in multivariate analysis.

Our data suggest that rates of serious injuries resulting from patient falls are slightly higher than in previous reports.[35] This may be due to increased severity of illness of patients now being hospitalized. Oncology patients, who had the highest rate of injury, may be more prone to fall-related injuries due to anemia, thrombocytopenia, and risk for pathologic fracture. Although a majority of falls still result in no injury, predictors of injury should be considered as well as predictors of patient fall risk when developing fall prevention programs.

Results from this study should be interpreted with caution due to certain limitations. A control group was not studied, so the data cannot be used to quantitatively identify predictors of patients at risk for falling. Although reporting of falls is mandatory, it is not known how accurate fall rates in the hospital are. It is possible that falls that do not result in injury are less likely to be reported than falls that do result in injury. Follow-up record reviews could not always be completed before the patients were discharged, resulting in missing values for several variables. Some variables were not always assessed in an objective manner, but rather by asking the patient about his/her health status. At times information collected from various sources was conflicting, and the data collector's best judgment was used. Collecting data from different sources also introduced bias. In addition, many patients were confused or disoriented and their recall of the circumstances of their fall was not reliable. Even if the patients were alert and oriented, patient recall of events is often not accurate because patients will often make associations in order to explain the occurrence of a fall.

Finally, our results suggest that modifiable activities and characteristics of the patient could be contributing to hospital falls. Given that falls occurred when patients were unassisted and ambulating and were often elimination related, prevention efforts that focus on increasing staff assistance with ambulation and providing supervised or assisted toileting schedules may be helpful. Many patients who needed an ambulatory assistive device were not provided one; therefore, attempts to provide walkers and canes for bedside use after physical therapy sessions or encouraging patients and families to bring an assistive device from home for use in the hospital could help prevent some falls. It is also important to target the prevention strategies to patients at high risk for falling. Further research using a comparison group of patients who did not fall at this hospital will determine the specific independent risk factors for falling. Prevention efforts can then be targeted to patients at high risk and address the known activities leading to falls and the characteristics lending patients to be at higher risk.

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