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Melissa J. Krauss
Washington University School of Medicine in St. Louis

Sheila L. Nguyen
Washington University School of Medicine in St. Louis

Wm. Claiborne Dunagan
Washington University School of Medicine in St. Louis

Stanley Birge
Washington University School of Medicine in St. Louis

Eileen Costantinou
Barnes-Jewish Hospital

See next page for additional authors

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Author(s): Melissa J. Krauss , MPH, Sheila L. Nguyen , MPH, Wm. Claiborne Dunagan , MD, Stanley Birge , MD, Eileen Costantinou , MSN, RN, Shirley Johnson , RN, MS, MBA, Barbara Caleca , RN, Victoria J. Fraser , MD
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ORIGINAL ARTICLE

Circumstances of Patient Falls and Injuries In 9 Hospitals In a Midwestern Healthcare System

Melissa J. Krauss, MPH; Sheila L. Nguyen, MPH; Wm. Claiborne Dunagan, MD; Stanley Birge, MD; Eileen Costantinou, MSN, RN; Shirley Johnson, RN, MS, MBA; Barbara Caleca, RN; Victoria J. Fraser, MD

OBJECTIVE. Preventing hospital falls and injuries requires knowledge of fall and injury circumstances. Our objectives were to determine whether reported fall circumstances differ among hospitals and to identify predictors of fall-related injury.

DESIGN. Retrospective cohort study. Adverse event data on falls were compared according to hospital characteristics. Logistic regression was used to determine adjusted odds ratios (aORs) with 95% confidence intervals (CIs) for risk factors for fall-related injury.

SETTING. Nine hospitals in a Midwestern healthcare system.

PATIENTS. Inpatients who fell during 2001-2003.

RESULTS. The 9 hospitals reported 8,974 falls that occurred in patient care areas, involving 7,082 patients; 7,082 falls were included in our analysis. Assisted falls (which accounted for 13.3% of falls in the academic hospital and 9.8% of falls in the nonacademic hospitals; $P < .001$) and serious fall-related injuries (which accounted for 3.7% of fall-related injuries in the academic hospital and 2.2% of fall-related injuries in the nonacademic hospitals; $P < .001$) differed by hospital type. In multivariate analysis for the academic hospital, increased age (aOR, 1.006 [95% CI, 1.000-1.012]), falls in locations other than patient rooms (aOR, 1.53 [95% CI, 1.03-2.27]), and unassisted falls (aOR, 1.70 [95% CI, 1.23-2.36]) were associated with increased injury risk. Altered mental status was associated with a decreased injury risk (aOR, 0.72 [95% CI, 0.58-0.89]). In multivariate analysis for the nonacademic hospitals, increased age (aOR, 1.007 [95% CI, 1.002-1.013]), falls in the bathroom (aOR, 1.46 [95% CI, 1.06-2.01]), and unassisted falls (aOR, 1.83 [95% CI, 1.37-2.43]) were associated with injury. Female sex (aOR, 0.83 [95% CI, 0.71-0.97]) was associated with a decreased risk of injury.

CONCLUSION. Some fall characteristics differed by hospital type. Further research is necessary to determine whether differences reflect true differences or merely differences in reporting practices. Fall prevention programs should target falls involving older patients, unassisted falls, and falls that occur in the patient's bathroom and in patient care areas outside of the patient's room to reduce injuries.

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Patient falls are a leading cause of adverse events and injury in hospitals.[1] Approximately 42% of falls result in some form of injury, and 8% result in serious injury.[2] Falls can result in increased length of hospital stay, discharge to a long-term care facility, and increased costs.[3,4] In a retrospective, case-control study of hospital falls, patients with serious fall-related injury had charges that were $4,233 higher than those for patients who did not fall.[3] In addition to the physical harm that may result, falls may also contribute to emotional injury and decreased quality of life.[5-9]

Fall prevention can be facilitated by examining the circumstances of falls. For example, 82% of hospital falls occur in the patient's room, 85% are unassisted, and 47% are associated with toileting-related activities.[10] Closer examination of falls that result in patient injury is especially pertinent. However, this may be difficult, because there are few hospital studies that identify circumstances or risk factors for fall-related injury.

In a community setting, quality indicators and specific recommendations for multifactorial assessment of risk factors and implementation of interventions are recommended based on their effectiveness in preventing falls in community-dwelling elderly persons.[11,12] Less is known about how to effectively reduce falls in the hospital. Most studies that have examined the circumstances of fall-related injuries have focused on elderly persons living in a community or in long-term care facilities.[13-18] Such injury indicators (eg, female sex, low body mass index, cognitive impairment, functional independence, presence of 2 or more chronic conditions, and/or gait impairments), though relevant for community or long-term care populations, are of less clear importance for acute care hospital patients. One study in a tertiary care hospital identified

From the Department of Internal Medicine, Washington University School of Medicine (M.J.K., S.L.N., W.C.D., S.B., V.J.F.), BJC HealthCare (W.C.D., B.C.), and Barnes-Jewish Hospital (E.C., S.J.), St. Louis, Missouri.

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confusion and comorbidity as correlates of falls with serious injury.[3] We recently found that patients in an acute care hospital who were over the age of 75 and geriatric psychiatry patients were more likely to sustain serious injuries from falls.[19] However, further research on hospital fall–related injuries is necessary.

Because there are no large-scale multicenter studies examining fall-related injuries in acute care hospitals, we conducted a study of reported falls in 9 hospitals in a single healthcare system over 3 years. The objectives of this study were to describe the potential variation in fall rates and circumstances among different types of hospitals, identify risk factors associated with experiencing any type of fall-related injury, and identify risk factors associated with serious fall-related injury.

METHODS

This study was conducted in facilities belonging to BJC HealthCare, a not-for-profit organization providing healthcare services to residents in the greater St. Louis, mid-Missouri, and southern Illinois region. Thirteen BJC hospitals use the same online adverse event reporting system; 9 were included in this study.

From January 1, 2001 through December 31, 2003, the 9 hospitals submitted 9,733 fall reports, which included all inpatient falls reported at the study hospitals. Duplicate entries were removed, as were falls involving outpatients, visitors, and employees. Falls that occurred during physical therapy were excluded because these patients are often exposed to situations in which they are more likely to fall but also likely to be assisted safely to the ground. Falls that did not take place in patient care areas (eg, those that occurred on the sidewalk, in the parking lot, in the gym, or on the grounds) were also excluded. This left 8,974 falls involving 7,082 patients. All 8,974 falls were included in the analysis of fall rates. For analyses of patient demographic characteristics, fall circumstances, and risk factors associated with injury, the falls of patients who fell only once and the first fall of patients who fell multiple times during the study period were included, yielding 7,082 eligible falls.

All falls were reported using an adverse event and incident tracking system that is used by all 9 study hospitals. Fall-related data captured by this system include the hospital and the reporting department; the birth date, sex, and mental status of the patient before the fall; the date, and location of the fall; whether the fall was assisted; the type and severity of the injury; and a narrative account of the event. The narrative account of the event was used to manually code whether a fall was toileting-related (ie, a fall that occurred during an activity related to toileting needs, such as ambulating to or from the bathroom or bedside commode, reaching for toilet tissue, exiting a soiled bed, and/or using the toilet or bedside commode). Falls that were definitely toileting-related were coded as "yes." Falls that could not be definitely identified as toileting-related were coded as "no/unknown."

Definitions of injury severity were as follows. "None" indicated that the injury caused no significant discomfort, had no effect on clinical course, and did not result in an increased length of stay. "Minor" indicated that the injury had minimal impact on patient care, though it might have involved some clinical intervention, and it had no lasting impact on patient outcome (eg, the fall caused minor cuts, minor bleeding, swelling, pain, and/or minor contusions). "Moderate" indicated that the injury had moderate impact on patient care and involved some clinical intervention and/or a lengthened stay or rehospitalization; moderate injuries also had some lasting impact on the patient's outcome (eg, the fall caused excessive bleeding, lacerations requiring sutures, loss of consciousness, and/or moderate head trauma). "Major" indicated that the injury had a severe impact on patient care, involved major clinical intervention, or resulted in lengthened stay or rehospitalization, and had a major impact on the patient's outcome (eg, the fall caused fractures, subdural hematomas, other major head trauma, and/or cardiac arrest, or the patient's death was attributed to the fall).

Fall reports obtained from BJC HealthCare were transferred to SPSS version 12.0 (SPSS) for analysis. Mean fall rates (the mean number of falls per 100 beds) were compared with respect to intrinsic hospital characteristics, such as hospital size, type (nonacademic or academic), and location. Fall rates had a normal distribution; therefore, the Student t test (two-tailed) was used to compare them; a P value less than .05 was considered significant.

Patient characteristics and the circumstances surrounding the falls were compared across hospital characteristics using the Pearson χ^2 test. The Mann-Whitney U test was used to compare age, because it was not normally distributed. Associations between hospital and patient characteristics and fall circumstances were corrected for multiple comparisons

TABLE 1. Rates of Patient Falls per 100 Beds at 9 Hospitals, by Hospital Class and Year

Hospital class	No. of hospitals	Mean no. of falls per 100 beds, by year			
		2001-2003	2001	2002	2003
Type					
Academic	1	113.7	94.5	108.8	137.9
Nonacademic	8	95.0	92.3	96.6	96.0
Size[a]					
Small (<250 beds)	5	73.6	69.1	77.1	74.5
Large (≥250 beds)	4	126.4	121.8	124.0	133.4
Location[a,b]					
Rural	3	53.7	46.8	63.1	51.3
Urban or suburban	6	118.7	115.4	115.3	125.4

[a] For all 3 years combined (2001-2003), rates differed significantly according to size ($P < .001$) and location ($P < .001$)

[b] Rates differed significantly according to location in 2001 ($P = .015$), 2002 ($P = .040$), and 2003 ($P = .011$).

TABLE 2. Characteristics of Patients and Circumstances of Patient Falls at 9 Hospitals During 2001–2003, According to Hospital Class

	Hospital type			Hospital size[a]			Hospital location		
Variable	Nonacademic (n = 4,563)	Academic (n = 2,519)	P	Small (n = 869)	Large (n = 6,213)	P	Rural (n = 480)	Urban or suburban (n = 6,602)	P
No. of hospitals	8 (88.9)	1 (11.1)	…	5 (55.6)	4 (44.4)	…	3 (33.3)	6 (66.7)	…
Sex			.090			.152			.408
Male	2,137 (46.9)	1,234 (49.0)		392 (45.4)	2,979 (48.0)		237 (49.5)	3,134 (47.5)	
Female	2,419 (53.1)	1,284 (51.0)		472 (54.6)	3,231 (52.0)		242 (50.5)	3,461 (52.5)	
Mental status prior to the fall			**<.001**			**<.001**			**<.001**
Normal	1,874 (56.3)	1,367 (63.2)		316 (52.4)	2,925 (59.8)		121 (42.0)	3,120 (59.9)	
Altered	1,457 (43.7)	796 (36.8)		287 (47.6)	1,966 (40.2)		167 (58.0)	2,086 (40.1)	
Mean age, years	70.2	62.3	**<.001**	71.0	66.9	**<.001**	71.8	67.1	**<.001**
Fall type			**<.001**			.651			.004
Unassisted	4,114 (90.2)	2,185 (86.7)		769 (88.5)	5,530 (89.0)		446 (92.9)	5,853 (88.7)	
Assisted	449 (9.8)	334 (13.3)		100 (11.5)	683 (11.0)		34 (7.1)	749 (11.3)	
Location of fall			.002			.592			.006
Patient's room	1,766 (80.3)	1,077 (78.3)		308 (77.6)	2,535 (79.7)		139 (82.7)	2,704 (79.3)	
Patient's bathroom	254 (11.5)	140 (10.2)		47 (11.8)	347 (10.9)		7 (4.2)	387 (11.4)	
Other[b]	180 (8.2)	159 (11.6)		42 (10.6)	297 (9.3)		22 (13.1)	317 (9.3)	
Shift when fall occurred[c]			.220			.334			.602
Day	2,216 (48.6)	1,185 (47.0)		404 (46.5)	2,997 (48.2)		225 (46.9)	3,176 (48.1)	
Evening/night	2,347 (51.4)	1,334 (53.0)		465 (53.5)	3,216 (51.8)		255 (53.1)	3,426 (51.9)	
Toileting-related fall			.042			.988			.002
Yes	1,782 (39.1)	922 (36.6)		332 (38.2)	2,372 (38.2)		151 (31.5)	2,553 (38.7)	
Fall-related Injury			.009			.262			.543
Any type of injury	1,248 (31.5)	620 (28.3)		254 (32.1)	1,614 (30.1)		138 (31.7)	1,730 (30.3)	
Serious fall-related injury			**<.001**			.222			.767
No injury or minor injury	3,875 (97.8)	2,109 (96.3)		765 (96.6)	5,219 (97.4)		425 (97.5)	5,559 (97.2)	
Moderate or major injury	87 (2.2)	82 (3.7)		27 (3.4)	142 (2.6)		11 (2.5)	158 (2.8)	

NOTE. Data are no. (%) of patients with data available, unless otherwise indicated. Denominators vary because missing data are excluded from analyses. Using the Bonferroni correction for multiple comparison, a P value less than .0017 was considered significant. Boldface type indicates statistical significance.

[a] Small hospitals had fewer than 250 beds, large hospitals had 250 beds or more.

[b] In a patient care area other than the patient's room or bathroom (eg, hallway, exam or treatment room, or nurses' station).

[c] Day shift defined as 7 AM-7 PM. Evening/night shift defined as 7 PM-7 PM.

using the Bonferroni correction. Therefore, for these tests, a P value less than .0017 was considered significant.

For this study, we examined 2 types of fall injury outcomes: any type of fall-related injury (minor, moderate, or major) and serious fall-related injury (moderate or major). Risk factors associated with injury were considered separately for the academic hospital and the nonacademic hospitals because differences were seen in injury severity according to this variable. Logistic regression was used to calculate crude odds ratios (cORs) to approximate the relative risk, and adjusted odds ratios (aORs) and 95% confidence intervals (CIs) for potential risk factors associated with experiencing any fall-related injury as well as those associated with experiencing moderate or major fall-related injury. Multivariable models were constructed via forward manual stepwise regression for the 2 outcomes of interest stated above. Variables that were significant or borderline significant in multivariate analysis were included in the final models. Effect modification among the predictor variables was tested. The Hosmer-Lemeshow statistic and the C statistic were used to test for goodness of fit. The final models were also run with a random effect for hospital (to account for any intraclass correlation among subjects from the same hospital) using the GLIMMIX macro in SAS version 9.00 (SAS Institute). The results did not change; therefore, the models are presented without the random effect variable for hospital.

RESULTS

Patient Fall Rates

A total of 8,974 falls were reported during the study period: 2,810 (31.3%) were reported in 2001; 2,961 (33.0%) in 2002; and 3,203 (35.7%) in 2003. Table 1 presents the hospital characteristics and fall rates (the mean number of falls per 100 beds) for the 9 acute care study hospitals during the 3 years of the study period. For all 3 years combined, the mean number of falls per 100 beds differed significantly by hospital size ($P < .001$) and by hospital location ($P < .001$), but not by hospital type ($P = .473$).

Demographic Characteristics and Fall Circumstances

The 8,974 falls reported as occurring in patient care areas involved 7,082 patients. Of those patients, 5,841 (82.5%) fell once during the study period and 1,241 (17.5%) fell more than once, either during the same hospitalization or during multiple hospitalizations; 877 (70.7%) fell twice, 215 (17.3%)

fell 3 times, 94 (7.6%) fell 4 times, and 55 (4.4%) fell 5 or more times.

Comparisons of patient characteristics and fall circumstances by hospital type, size, and location are presented in Table 2. Patients who fell in the academic hospital, large hospitals, urban hospitals, or suburban hospitals were younger, and more patients were of normal mental status when they fell, compared with patients in the nonacademic hospitals, small hospitals, or rural hospitals. More falls in the academic hospital were assisted and more falls resulted in serious injury, compared with the nonacademic hospitals. Comparisons by hospital size and hospital location were also performed excluding the academic hospital to determine whether results were disproportionately influenced by this hospital, and results were only marginally different.

Fall-Related Injuries

Of the 7,082 eligible falls, 4,285 (60.5%) were reported as resulting in no physical injury to the patient, 1,699 (24.0%) resulted in minor injury, 87 (1.2%) resulted in moderate injury, 82 (1.2%) resulted in major injury; 929 (13.1%) of the falls were documented in reports that did not specify injury severity. Therefore, overall, 1,868 (26.4%) of the falls resulted in some type of injury, and 169 (2.4%) of the falls resulted in serious injury (moderate or major injury).

Table 3 presents cORs and 95% CIs for potential risk factors associated with experiencing any type of fall-related injury (minor, moderate, or major), stratified by hospital type. Results of multivariate analyses of independent risk factors associated with experiencing any type of fall-related injury in the academic hospital and the nonacademic hospitals were similar and are presented in Table 4. For the academic hospital, falls in a patient care area other than the patient's room or patient's bathroom (eg, the hallway, an exam or treatment room, or the nurses' station) and unassisted falls were associated with an increased risk of experiencing fall-related injury. Increased age and falling in the patient's bathroom were of borderline significance. Altered mental status was associated with a decreased risk of fall-related injury. For the nonacademic hospitals, increased age, falls in the bathroom, and unassisted falls were associated with increased risk of experiencing fall-related injury. Female sex was associated with a decreased risk of experiencing fall-related injury. Altered mental status was of borderline significance in decreasing the risk of injury.

Table 5 shows cORs and 95% CIs for potential risk factors associated with experiencing serious fall-related injury (mod-

TABLE 3. Crude Odds Ratios (cORs) of Potential Risk Factors Associated With Experiencing Fall-Related Injury, Stratified by Hospital Type

	Academic hospital			Nonacademic hospitals		
Risk factor	No injury (n = 1,571)	Injury (n = 620)	cOR (95% CI)	No injury (n = 2,714)	Injury (n = 1,248)	cOR (95% CI)
Sex						
Male	762 (48.5)	327 (52.7)	1.0	1,259 (46.4)	626 (50.2)	1.0
Female	808 (51.4)	293 (47.3)	0.85 (0.70-1.0)	1,452 (53.5)	620 (49.7)	**0.86 (0.75-0.98)**
Unknown	1 (0.1)	0 (0)	…	3 (0.1)	2 (0.2)	…
Mental status prior to the fall						
Normal	874 (55.6)	356 (57.4)	1.0	1,128 (41.6)	548 (43.9)	1.0
Altered	548 (34.9)	164 (26.5)	**0.74 (0.59-0.91)**	893 (32.9)	410 (32.9)	0.95 (0.81-1.10)
Unknown	149 (9.5)	100 (16.1)	…	693 (25.5)	290 (23.2)	…
Age, mean ± SD, years	62.0 ± 17.8	63.3 ± 18.3	1.004 (0.999-1.009)	70.3 ± 16.3	71.3 ± 16.7	1.004 (1.000-1.008)
Fall type						
Assisted	233 (14.8)	60 (9.7)	1.0	318 (11.7)	87 (7.0)	1.0
Unassisted	1,338 (85.2)	560 (90.3)	**1.63 (1.20-2.20)**	2396 (88.3)	1,161 (93.0)	**1.77 (1.38-2.27)**
Location of fall						
Patient's room	723 (46.0)	247 (39.8)	1.0	1149 (42.3)	499 (40.0)	1.0
Patient's bathroom	82 (5.2)	44 (7.1)	**1.57 (1.06-2.33)**	140 (5.2)	88 (7.1)	**1.45 (1.09-1.93)**
Other[a]	95 (6.0)	47 (7.6)	1.45 (0.99-2.11)	109 (4.0)	51 (4.1)	1.08 (0.76-1.53)
Unknown	671 (42.7)	282 (45.5)	…	1,316 (48.5)	610 (48.9)	…
Toileting-related fall						
No/unknown	1,011 (64.3)	371 (59.8)	1.0	1,677 (61.8)	727 (58.3)	1.0
Yes	560 (35.6)	249 (40.2)	1.21 (1.00 –1.47)	1,037 (32.2)	521 (41.7)	**1.16 (1.01-1.33)**
Shift when fall occurred[b]						
Day	758 (48.2)	274 (44.2)	1.0	1,325 (48.8)	587 (47.0)	1.0
Evening/night	813 (51.8)	346 (55.8)	1.18 (0.98-1.42)	1,389 (51.2)	661 (53.0)	1.07 (0.94-1.23)

NOTE. Data are no. (%) of patients, unless otherwise indicated. Boldface type indicates statistical significance.

[a] In a patient care area other than the patient's room or bathroom (eg, hallway, exam or treatment room, or nurses' station).

[b] Day shift defined as 7 AM-7 PM. Evening/night shift defined as 7 PM-7 AM.

TABLE 4. Multivariate Models of Risk Factors Associated With Experiencing Fall-Related Injury, by Hospital Type

Risk factor	aOR (95% CI)
Academic hospital[a]	
Mental status	
Normal	1.0
Altered	**0.72 (0.58-0.89)**
Age	1.006 (1.000-1.012)
Location of fall	
Patient's room	1.0
Patient's bathroom	1.45 (0.94-2.23)
Other[a]	**1.53 (1.03-2.27)**
Unknown	1.09 (0.88-1.36)
Fall type	
Assisted	1.0
Unassisted	**1.70 (1.23-2.36)**
Nonacademic hospitals[b]	
Sex	
Male	1.0
Female	**0.83 (0.71-0.97)**
Mental status	
Normal	1.0
Altered	0.87 (0.74-1.02)
Age	**1.007 (1.002-1.013)**
Location of fall	
Patient's room	1.0
Patient's bathroom	**1.46 (1.06-2.01)**
Other[c]	1.06 (0.71-1.58)
Unknown	1.15 (0.98-1.36)
Fall type	
Assisted	1.0
Unassisted	**1.83 (1.37-2.43)**

NOTE. Model for academic hospital: Hosmer-Lemeshow χ^2, 4.65; $P = .794$; C statistic, 0.58 (95% CI, 0.55-0.61). Model for nonacademic hospitals: Hosmer-Lemeshow χ^2, 10.99; $P = .203$; C statistic, 0.58 (95% CI, 0.56-0.60). Boldface type indicates statistical significance.

[a] A total of 1,410 patients with no injury, 518 patients with injury.

[b] A total of 2,011 patients with no injury and 948 patients with injury.

[c] In a patient care area other than the patient's room or bathroom (eg, hallway, exam or treatment room, or nurses' station).

erate or major), also stratified by hospital type. For the academic hospital, falling in an area other than the patient's room or bathroom (cOR, 2.05 [95% CI, 0.96-4.40]) was the only risk factor of borderline significance associated with increased risk of experiencing serious fall-related injury. Therefore, a multivariate model was not constructed for the academic hospital. In multivariate analysis for the nonacademic hospitals (in which 3,870 patients experienced either no injuries or minor injuries as a result of their falls, and 87 experienced moderate or major injuries), female sex (aOR, 1.75 [95% CI, 1.12-2.74]) was associated with increased risk of serious fall-related injury. Falling in the bathroom (aOR, 1.90 [95% CI, 0.90-4.03]) or in a location other than the patient's room or bathroom (aOR, 2.20 [95% CI, 0.96-5.07]) and unassisted falls (aOR, 2.58 [95% CI, 0.94-7.09]) were of borderline significance associated with an increased risk of serious injury (Hosmer-Lemeshow χ^2, 0.94; $P = .967$; C statistic, 0.62 [95% CI, 0.56-0.68]).

DISCUSSION

This study identified some differences among hospital classes with regard to fall rates, the characteristics of patients who fell, the circumstances of falls, and injury severity. Patients who fell in large, urban, and/or academic hospitals were younger and more alert than those who fell in small and/or rural hospitals. This difference could possibly be attributed to the general demographic characteristics of patients in the academic and large hospitals in urban areas, who generally have a lower median age than patients in rural locations.

Urban and suburban hospitals had higher fall rates than rural hospitals. The academic hospital had more reported assisted falls and more serious fall-related injuries. These differences may be caused by disparities in the definition of falls and reporting practices. Although the 9 hospitals in this study share the same online adverse event reporting system, at the time of this study the hospitals were using different fall definitions. There are also differences in fall definitions in the literature. For example, Morris and Isaacs[20] define a fall as an "untoward event in which the patient came to rest unintentionally on the floor. This definition included patients slipping down from the chair on to the floor, and patients found lying on the floor unable to account for themselves"(p181). Some published definitions specifically include all falls, witnessed or unwitnessed; others may exclude falls due to stroke, fainting, or seizure; and some definitions specifically include assisted falls, or falls in which the patient comes to rest on any surface lower than the patient's original position.[21,22] Including or excluding certain falls can have a large effect on the recorded fall circumstances and rates for a hospital. Differences in fall rates and type of fall among hospitals could also be caused by differences in types of units among hospitals (eg, the presence of psychiatry or rehabilitation units might affect the rate and type of falls). Differences in injury rates could result from differences in injury follow-up. Some hospitals may not follow-up by examining patients' records after the fall to determine whether injuries are identified later with additional testing.

Although analyses were performed separately for the academic and nonacademic hospitals, risk factors associated with injury were similar. Age of 80 years or more was a risk factor associated with hip fracture in rehabilitation hospitals,[23] and we found that increased age was a risk factor for any type of fall-related injury in acute care facilities. In addition, falls that occurred in the bathroom or in patient care areas outside the patient's room and falls that were not assisted were associated with an increased risk of fall-related injuries in our study. Female sex has been associated with fall-related injury in the community setting.[24] Although in our study female sex was associated with a decreased risk of experiencing any type of injury, it was associated with an increased

TABLE 5. Crude Odds Ratios (cORs) of Potential Risk Factors Associated With Experiencing Moderate or Major Fall-Related Injury, Stratified by Hospital Type

	Academic hospital			Nonacademic hospitals		
Risk factor	No injury or minor injury (n = 2,109)	Moderate injury or major injury (n = 82)	cOR (95% CI)	No injury or minor injury (n = 3,875)	Moderate injury or major injury (n = 87)	cOR (95% CI)
Sex						
Male	1,051 (49.8)	38 (46.3)	1.0	1,855 (47.9)	30 (34.5)	1.0
Female	1,057 (50.1)	44 (53.7)	1.15 (0.74-1.79)	2,015 (52.0)	57 (65.5)	**1.75 (1.12-2.73)**
Unknown	1 (0.0)	0 (0.0)	…	5 (0.1)	0 (0.0)	…
Mental status prior to the fall						
Normal	1,182 (56.0)	48 (58.5)	1.0	1,630 (42.1)	46 (52.9)	1.0
Altered	684 (32.4)	28 (36.8)	1.01 (0.63-1.62)	1,277 (33.0)	26 (29.9)	0.72 (0.44-1.17)
Unknown	243 (11.5)	6 (7.3)	…	968 (25.0)	15 (17.2)	…
Age, mean ± SD, years	62.4 ± 18.0	62.6 ± 17.8	1.001 (0.988-1.013)	70.6 ± 16.4	73.1 ±17.7	1.010 (0.996-1.025)
Fall type						
Assisted	285 (13.5)	8 (9.8)	1.0	401 (10.3)	4 (4.6)	1.0
Unassisted	1,824 (86.5)	74 (90.2)	1.45 (0.69-3.03)	3,474 (89.7)	83 (95.4)	2.40 (0.87-6.56)
Location of fall						
Patient's room	939 (44.5)	31 (37.8)	1.0	1,614 (41.7)	34 (39.1)	1.0
Patient's bathroom	123 (5.8)	3 (3.7)	0.74 (0.22-2.45)	219 (5.7)	9 (10.3)	1.95 (0.92-4.12)
Other[a]	133 (6.3)	9 (11.0)	2.05 (0.96-4.40)	153 (3.9)	7 (8.0)	2.17 (0.95-4.98)
Unknown	914 (43.3)	39 (47.6)	…	1,889 (48.7)	37 (42.5)	…
Toileting-related fall						
No/unknown	1,326 (62.9)	56 (68.3)	1.0	2,352 (60.7)	52 (59.8)	1.0
Yes	783 (37.1)	26 (31.7)	0.79 (0.49-1.26)	1,523 (39.3)	35 (40.2)	1.04 (0.67-1.60)
Shift when fall occurred[b]						
Day	997 (47.3)	35 (42.7)	1.0	1,864 (48.1)	48 (55.2)	1.0
Evening/night	1,112 (52.7)	47 (57.3)	1.20 (0.77-1.88)	2,011 (51.9)	39 (44.8)	0.75 (0.49-1.15)

NOTE. Data are no. (%) of patients unless otherwise indicated. Boldface type indicates statistical significance.

[a] In a patient care area other than the patient's room or bathroom (eg, hallway, exam or treatment room, or nurses' station).

[b] Day shift defined as 7 AM–7 PM. Evening/night shift defined as 7 PM–7 AM.

risk of serious injury. Therefore, to help decrease fall-related injury rates, hospitals should target prevention of falls involving older patients and female patients, as well as falls in the bathroom and falls in patient care areas other than the patient's bathroom and room. Furthermore, even if fall rates remain the same, increasing the proportion of falls that are assisted by a staff member could help decrease injury rates and injury severity.

Confusion or altered cognition has been documented as a risk factor for fall-related injuries in elderly people living in a community,[13] nursing home residents,[16-18] rehabilitation hospital patients,[23,25] and tertiary care hospital patients.[3] However, in our study, altered mental status was associated with a decreased risk of fall-related injury. This could be a result of patients with an altered mental state being less aware of injuries after a fall, or the fact that cognitive status was based on subjective assessment by nurses rather than assessment by standardized measures. Another possible explanation is that patients with altered mental status who fell were less likely to fall in areas other than their rooms, which could make them less likely to be injured (because falling in a patient care area other than the patient's room or bathroom was associated with an increased risk of fall-related injury).

There were several limitations to this study. The study was retrospective and relied solely on fall indicators reported in the adverse event reporting system. This reporting system includes a limited set of variables, and some variables are not required to be reported, leading to missing data for some data points. Medications were not included in the adverse event reporting data, which precluded analyzing their potential influence on fall-related injuries. We cannot determine what proportion of falls is not reported, nor which falls are more likely to go unreported. Patient-days were not available for all hospitals, which precluded the calculation of falls per 1,000 patient-days (the more widely accepted metric for calculating fall rates). Demographic information on hospitalized patients was not available for all hospitals in the study, preventing the reporting of rates adjusted by demographic differences. The lack of consistent long-term follow-up of these patients after their falls could lead to misclassification of patients' injury status. Finally, the service on which the falls occurred was not included in the analysis. Despite these lim-

itations, this study provides important new data on fall outcomes. It is, to our knowledge, the largest study of inpatient fall-related injuries to date, and it is the first multicenter study comparing risk factors and outcomes across hospitals.

Future research on fall-related injuries should include a more comprehensive list of specific risk factors for injury and should not depend solely on adverse event reporting. In general, adverse event reporting systems do not include all the information that would be useful in identifying risk factors for injury. However, fall reporting systems should have standardized definitions. The amount of additional data collected in these systems depends on the resources available and the purpose of the reporting system. At the very least, reporting systems should include the name of the patient, the service and/or hospital unit, location, the fall description, and injury outcome. Ideally, more comprehensive information should be tracked if hospitals want to study falls and implement interventions to prevent falls.

Further research is necessary to determine whether differences in fall circumstances and injuries among hospital classes are the result of differences in interpretations of fall definitions, reporting practices, and follow-up of injuries, or whether they reflect true differences in falls. It is of vital importance that fall definitions, reporting practices, and injury follow-up and classification be consistent within and among hospitals, so that fall and injury rates can be accurately calculated, trends identified, and rates compared to test and share successful methods of decreasing hospital falls and injuries.

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Address reprint requests to Victoria J. Fraser, MD, Washington University School of Medicine, Department of Internal Medicine, Division of Infectious Diseases, 660 South Euclid Avenue, Campus Box 8051, St. Louis, MO 63110 (vfraser@im.wustl.edu). Address correspondence to Melissa J. Krauss, MPH, Washington University School of Medicine, Department of Internal Medicine, Division of Infectious Diseases, 660 South Euclid Avenue, Campus Box 8051, St. Louis, MO 63110 (mkrauss@im.wustl.edu).

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