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J Rush Pierce Jr

M Shirley

E F. Johnson

H Kang



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# Narcotic administration and fall-related injury in the hospital: Implications for patient safety programs and providers

J. Rush Pierce[a,*], Michael Shirley[a], Emma F. Johnson[a] and Huining Kang[b]
[a]*Department of Internal Medicine, Division of Hospital Medicine, University of New Mexico School of Medicine, Albuquerque, NM, USA*
[b]*Department of Internal Medicine, Division of Epidemiology, University of New Mexico School of Medicine, Albuquerque, NM, USA*

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**Abstract.**
**OBJECTIVE:** Identify factors that predict fall-related injury in hospitalized adults.
**DESIGN:** Retrospective records review.
**SETTING:** 435-bed university hospital.
**PARTICIPANTS:** Inpatients with reported falls in 2010.
**RESULTS:** Medical records were available for 286/293 (98%) of reported falls in 251 patients. 25% (63/286) of falls were associated with injury, 4% (11/286) with serious injury. Compared to all fallers, patients with injury did not differ by gender or age. In univariate analysis, patients who reported hitting their head, had pre-fall confusion, or who received narcotics within 24 hours before falling were more likely to suffer injury (estimated odds ratios 6.04, 2.00 and 5.1, respectfully). In multivariate analysis, receiving a narcotic prior to falling was the strongest predictor of injury (estimated odds ratio 5.38; 95% confidence intervals 2.07–13.98, $p < 0.001$).
**CONCLUSIONS:** In this single-institution study, 25% of patients who fell suffered injury and 4% serious injury. Neither age nor gender predicted fall-related injury. Recent narcotic administration was the strongest predictor of injury. Strategies to prevent fall-related injury in the hospital should target patients receiving narcotics. When evaluating inpatients who have fallen, providers should be especially vigilant about injury in patients who have pre-fall confusion, hit their head, or have received recent narcotics.

Keywords: Falls, hospital, injury, narcotics, patient safety



## 1. Background

Falls occur frequently in hospitalized patients, with recent studies reporting 2–4 falls/1,000 hospital days [1–4]. Inpatient falls have serious medical and legal consequences, as 2–6% of falls result in serious injury [1–5]. Previous studies have demonstrated falls are more common on medical and psychiatric than

*Address for correspondence: J. Rush Pierce Jr., MD, MPH, Department of Internal Medicine, MSC 10 5550, 1 University of New Mexico, Albuquerque, NM 87131-0001, New Mexico, USA. Tel.: +1 505 925 0660; Fax: +1 505 925 0680; E-mail: jrpierce@salud.unm.edu.

surgical units [1–5], and approximately 40% are associated with toileting [1, 2]. Compared to non-fallers, patients who fall in the hospital have longer hospital stays and higher hospital costs [6]. Though there are many tools to assess inpatients for risk of falling, these tools have low predictive value [7, 8]. Patient education, intensive exercise, bed alarms, and multimodality programs designed to prevent inpatient falls have had limited success [9–12]. Despite objections from experts that inpatient falls are poorly predictable and fall-related injury is unpreventable, the Centers of Medicare and Medicaid of the United States of America (USA) have recently imposed financial penalties on hospitals when their patients fall and suffer injury [13, 14].

A number of studies have examined factors associated with inpatient hospital falls, but few have looked at clinical factors that predict fall-related injury. Inconsistent associations of fall-related injury have been reported with increased age [2, 15], falls in a location other than the patient's room [2], unassisted falls [2], pre-fall ambulatory status [16], and administration of certain medications [17]. Previous authors have concluded that fall-related injury in the hospital is "largely unpredictable and more research is needed to determine how injury can be prevented in patients at risk of falls" [18]. This study was designed to (a) identify demographic and/or clinical factors which predict fall-related injury among hospitalized adults, and (b) judge the adequacy of physician documentation related to adult patients who fell in the hospital.

## 2. Methods

This study was conducted at the University of New Mexico Hospital, a 435-bed tertiary-care academic hospital in a large urban city in the southwestern region of the USA. It is the only Level 1 trauma center in a state with a population of just over two million. A large majority of patients are admitted through the emergency department. Patients with psychiatric diagnoses are admitted directly to an adjacent psychiatric hospital unless they have acute medical illness or drug overdose. The hospital uses an electronic health record and computerized provider order entry for all clinical encounters. Nursing staff are required to report all hospital falls through the hospital's computerized Patient Safety Network (PSN). At the time of this study, the hospital was gathering baseline data for a falls prevention program. There was much emphasis on complete and prompt reporting, and nurse managers were instructed to review all falls within 24 hours to ensure that a PSN report had been entered for falls that met the World Health Organization definition of a medical fall ("an event which results in a person coming to rest inadvertently on the ground or floor or other lower level") [19].

The authors performed a retrospective chart review of all PSN reported falls that occurred during 2010. Patients younger than18 years, pregnant women, and prisoners were excluded. We used a chart extraction tool to record for each patient the following characteristics: age, gender, platelet count, and international normalized ratio (INR); if the fall was witnessed; if the patient was observed or reported to have hit their head or had loss of consciousness; if within 24 hours before falling the patient had abnormal mental status or had received narcotics, benzodiazepine, antihistamines or zolpidem; if the patient had Foley catheterization at the time of the fall; if the fall was related to toileting; if there was injury and severity of injury; and whether there was a post-fall evaluation documented by a physician in progress notes or discharge summary. Severity of injury was assigned as none, mild (bruising, skin tear, laceration not requiring closure) or serious (laceration requiring closure, fracture, intracranial bleeding or death). The chart review abstraction technique was standardized and rehearsed. 10% of charts were reviewed by two reviewers and no inconsistencies were noted. The degree of injury for all patients with injury was independently reviewed by two reviewers and no differences in assigning degree of injury were found.

This study was granted exempt status by the Human Research Protections Office of the University of New Mexico Health Sciences Center.

Since there were some repeated observations on the same patients (some patients fell more than once), we used logistic regression with repeated measure solved by the generalized estimating equation (GEE). Using this equation, we calculated odds ratios, their 95% confidence intervals and the corresponding *p*-values to assess the association between fall with injury and each of the demographic and clinical characteristics of patients. In an attempt to understand if predictor variables were independent predictors of injury, we retained those variables with $p$-value <0.05 for multivariate analysis. We eliminated one of these predictor variables (if the patient was observed or reported to have hit their head or had loss of consciousness) because in a very large number of observations (198/286) the medical notes did not record whether or not the patient was observed or reported to have hit their head or had loss of consciousness. Including the small number of observations for which the data was available severely limited the power of the multivariate analysis. The retained two variables were tested for independent significance after adjusting for the effect of each other using a multivariate logistic GEE model.

## 3. Results

Medical records were available for 286/293 (98%) of PSN-reported falls in 251 eligible patients. Fall rate was 3.25 falls/1,000 patient days. Falls occurred in 152 males (61%), and 99 females (39%). 48% of falls occurred while toileting. 25% (63/286) of falls were associated with injury, and 4% (11/286) with serious injury (laceration requiring closure or fracture). There were no fall-related deaths. Compared to all fallers, patients with injury did not differ by gender (males 38/152 vs. females 25/99, $p = 0.96$). Patients older than 64 years who fell were no more likely to suffer injury that younger adults (13/64 vs. 50/187, $p = 0.31$). In univariate analysis (Table 1), patients who reported hitting their head, patients with pre-fall confusion, and patients who received narcotics within 24 hours before falling were more likely to suffer injury (estimated odds ratios 6.04, 2.00 and 5.1, respectfully). In multivariate analysis (Table 2), receiving a narcotic within 24 hours before falling was the strongest predictor of injury (estimated odds ratio 5.38, 95% confidence intervals 2.07–13.98, $p < 0.001$). 33% (21/63) of falls with injury had no physician documentation of the fall or a post-fall evaluation in the hospital record, and only 21% (13/63) of falls with injury were mentioned in the discharge summary.

## 4. Discussion

The results of our study include several new findings with regard to inpatient falls. Mion and coauthors [17] previously reported an association of fall-related injury with use of narcotics and psychiatric medications, but the effect size was small. The current study demonstrated that receiving narcotics was a strong predictor of fall-related injury in the hospital and suggests that reducing inpatient narcotic use might be an effective strategy to prevent hospital fall-related injury. Interestingly, hip fracture has been associated with narcotic use in community dwelling elderly adults [20]. A recent study from a large University hospital in Japan showed that hypnotics and opioid narcotics were associated with inpatient falls, although fall-related injury was not specifically studied [21]. Our study failed to demonstrate that benzodiazepines, antihistamines or zolpidem were associated with injury. It may be that these medications are less likely than narcotics to be associated with fall-related injury, or patients who receive narcotics may differ from patients receiving these other medications in ways that our study did not identify.

Table 1
Univariate analysis of clinical characteristics predicting fall-related injury

| Odds ratio | 95% confidence interval | *p*-value | Clinical characteristic |
|---|---|---|---|
| 0.72 | 0.24–2.13 | 0.5482 | Witnessed fall |
| 0.73 | 0.37–1.45 | 0.3745 | Fall related to toileting |
| 1.19 | 0.62–2.30 | 0.5982 | Foley catheterization at time of fall |
| 6.04 | 1.95–18.73 | **0.0018** | Patient observed or reported hitting head |
| 2.55 | 0.40–16.37 | 0.3247 | Patient observed or reported to lose consciousness |
| 2.00 | 1.08–3.70 | **0.0273** | Patient observed to have pre-fall confusion |
| 0.91 | 0.34–2.44 | 0.8587 | Receiving anticoagulant or antiplatelet drugs |
| 1.28 | 0.65–2.52 | 0.4678 | Abnormal INR (>1.3) or thrombocytopenia (<149,000) |
| 5.12 | 1.96–13.41 | **0.0009** | Received narcotic prior to fall |
| 1.33 | 0.69–2.54 | 0.3931 | Received benzodiazapine prior to fall |
| 0.61 | 0.18–2.05 | 0.4226 | Received zolpidem prior to fall |
| 0.41 | 0.09–1.77 | 0.2318 | Received antihistamine prior to fall |

Table 2
Multivariate analysis of clinical characteristics predicting fall-related injury

| Variable | Odds ratio | 95% confidence iinterval | Z statistic | *p*-value |
|---|---|---|---|---|
| Pre-fall confusion | 2.08 | 1.11–3.91 | 2.28 | 0.0224 |
| Received narcotic | 5.38 | 2.07–13.98 | 3.46 | 0.0006 |



Many existing inpatient fall prevention programs are designed to assess all patients on admission for fall risk, and provide multimodality interventions throughout the hospitalization for patients at high risk [12]. The majority of these programs use screening instruments that include clinical factors associated with risk of falling in ambulatory adults such as previous fall, advanced age, gait disturbance, lower extremity weakness, and cognitive impairment [12]. Unfortunately, these screening instruments have been shown to have low predictive value for inpatient falls [7, 8]. Our study demonstrated that clinical factors used in most of these instruments were also not predictive of fall-related injury. Hospital fall prevention programs that focus on fall-related injury rather than prevention of all falls, screen for clinical factors associated with injury identified in this study (pre-fall confusion and narcotic use), and use daily screening for risk of fall-related injury might prove to be effective.

This study also demonstrated that in our hospital, physicians infrequently documented inpatient falls in the health record, resulting in potential gaps in clinical care and surveillance. Despite the fact that delayed recognition of fall-related injury has serious clinical and risk-management implications [14, 22], there is limited literature to guide providers when assessing hospitalized patients for fall-related injury; what has been published is primarily expert opinion rather than evidence-based [14, 23]. Our study suggests that when evaluating a patient who has fallen in the hospital, providers should be especially vigilant to the possibility of injury if the patient had pre-fall confusion, reported hitting their head, or had received narcotics in the previous 24 hours. We now use in our hospital, a multidisciplinary tool designed to aid provider evaluation and documentation of the inpatient who falls [24].

Our study is subject to several limitations. It is the experience of a single institution and the conclusions may not be generalizable to institutions with different patient populations and/or types of providers. It only studied falls reported to our PSN. At the time of this study, there was much emphasis on complete reporting, and though we believe that almost all falls were reported, the PSN may not have captured all inpatient falls, and ascertainment bias may have occurred. Pregnant women and prisoners were excluded; the results of this study may not apply to these types of patients. Also, patients admitted to the adjacent psychiatric facility were not included in this study; different results might have been found with the inclusion of these patients. This study was a retrospective chart review subject to limitations of completeness, accuracy, and human error. Finally, the study's small sample size limits the ability to do extensive hypothesis testing.

## 5. Conclusions

In this single-institution retrospective cohort study, 25% of inpatients who fell suffered injury and 4% serious injury. Compared to all fallers, patients with fall-related injury did not vary by gender or age. Receiving a narcotic within 24 hours before the fall was a strong predictor of injury. Strategies to prevent fall-related injury in the hospital should target patients receiving narcotics. In this study, physician documentation of inpatient falls was poor. Improved physician documentation of occurrence and evaluation of falls may improve patient care and surveillance by hospital systems improvement programs. Providers evaluating inpatients who have fallen should be especially vigilant about injury when patients had pre-fall confusion, hit their head, or have received recent narcotics.

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## References

[1] Fischer ID, Krauss MJ, Dunagan WC, et al. Patterns and predictors of inpatient falls and fall-related injuries in a large academic hospital. Infect Control Hosp Epidemiol 2005;26(10):822-7.
[2] Krauss MJ, Nguyen SL, Dunagen WC, et al. Circumstances of patient falls and injuries in 9 hospitals in a Midwestern healthcare system. Infect Control Hosp Epidemiol 2007;28(5):544-50.
[3] Schwendimann R, Buhler H, De Geest S, Milisen K. Characteristics of hospital inpatient falls across clinical departments. Gerontology 2008;54(6):342-8.
[4] Bouldin EL, Andresen EM, Dunton NE, et al. Falls among adult patients hospitalized in the United States: Prevalence and trends. J Patient Saf 2013;9(1):13-7.
[5] Healey F, Scobie S, Oliver D, Pryce A, Thomson R, Glampson B. Falls in English and Welsh hospitals: A national observational study based on retrospective analysis of 12 months of patient safety incident reports. Qual Saf Health Care 2008;17(6):424-30.
[6] Wong CA, Recktenwald AJ, Jones ML, Waterman BM, Bollini ML, Dunagan WC. The cost of serious fall-related injuries at three Midwestern hospitals. Jt Comm J Qual Patient Saf 2011;37(2):81-7.
[7] Webster J, Courtney M, Marsh N, et al. The STRATIFY tool and clinical judgment were poor predictors of falling in an acute hospital setting. J Clin Epidemiol 2010;63(1):109-13.

[8] da Costa BR, Rutjes AW, Mendy A, Freund-Heritage R, Vieira ER. Can falls risk prediction tools correctly identify fall-prone elderly rehabilitation inpatients? A systematic review and meta-analysis. PLoS One 2012;7(7):e41061.
[9] Coussement J, De Paepe L, Schwendimann R, Denhaerynck K, Dejaeger E, Milisen K. Interventions for preventing falls in acute- and chronic-care hospitals: A systematic review and meta-analysis. J Am Geriatr Soc 2008;56(1):29-36.
[10] Cameron ID, Gillespie LD, Robertson MC, et al. Interventions for preventing falls in older people in care facilities and hospitals. Cochrane Database Syst Rev 2012;12:CD005465.
[11] DiBardino D, Cohen ER, Didwania A. Meta-analysis: Multidisciplinary fall prevention strategies in the acute care inpatient population. J Hosp Med 2012;7(6):497-503.
[12] Hempel S, Newberry S, Wang Z, et al. Hospital fall prevention: A systematic review of implementation, components, adherence, and effectiveness. J Am Geriatr Soc 2013;61(4):483-94.
[13] Inouye SK, Brown CJ, Tinetti ME. Medicare nonpayment, hospital falls, and unintended consequences. N Engl J Med 2009;360(23):2390-3.
[14] Cumbler E, Likosky D. In-hospital falls: Evaluation and response. Continuum (Minneap Minn). 2011;17(5 Neurologic Consultation in the Hospital):1063-76.
[15] Clelly JE, Conroy L, Miller G, Marc N, Horne J, Hudson ME. Risk factors and injury associated with falls in elderly hospitalized patients in a community hospital. J Patient Saf 2008;4(3):178-83.
[16] Bradley SM, Karani R, McGinn T, Wisnivesky J. Predictors of serious injury among hospitalized patients evaluated for falls. J Hosp Med 2010;5(2):63-8.
[17] Mion LC, Chandler AM, Waters TM, et al. Is it possible to identify risks for injurious falls in hospitalized patients? Jt Comm J Qual Patient Saf 2012;38(9):408-13.
[18] Vassallo M, Vignaraja R, Sharma JC, Briggs R, Allen S. The relationship of falls to injury among hospital in-patients. Int J Clin Pract 2005;59(1):17-20.
[19] Aging and Life Course, Family and Community Health. WHO Global Report on Falls Prevention in Older Age. Geneva: World Health Organization Press, 2007. Available at http://www.who.int/ageing/publications/Falls_prevention7March.pdf Accessed 2013 July 15.
[20] Huang AR, Mallet L, Rochefort CM, Eguale T, Buckeridge DL, Tamblyn R. Medication-related falls in the elderly: Causative factors and preventive strategies. Drugs Aging 2012;29(5):359-76
[21] Obayashi K, Araki T, Nakamura K, et al. Risk of falling and hypnotic drugs: Retrospective study of inpatients. Drugs R D 2013;13(2):159-64.
[22] Oliver D, Killick S, Even T, Willmott M. Do falls and falls-injuries in hospital indicate negligent care – and how big is the risk? A retrospective analysis of the NHS Litigation Authority Database of clinical negligence claims, resulting from falls in hospitals in England 1995 to 2006. Qual Saf Health Care 2008;17(6):431-6.
[23] Healey F, Darowski A, Lamont T, Panesar S, Poulton S, Treml J, et al. Essential care after an inpatient fall: Summary of a safety report from the National Patient Safety Agency. BMJ 2011;342:d329.
[24] Pierce JR Jr, Kearney D, Cumbler E. Using a checklist to evaluate hospitalized patients who suffer a fall. POGOe - Portal of Geriatric Online Education; 2011. Available at: http://www.pogoe.org/sites/default/files/POGOe%20falls%20huddle%20checklist.pdf Accessed 15 July 2013.