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Analysis of Inpatient Hospital Falls with Serious Injury

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Abstract

Fall-related serious injuries pose risks to patients and healthcare organizations. This retrospective, single-hospital study used a 38 variable instrument to understand characteristics of those who sustained a fall with serious injury. Analyses included descriptive statistics, frequency, and Chi-square tests of associations between key variables and outcomes of moderate versus major injury. Age range 25–91 years, predominantly 60–69 years (23.3%), and mostly male (50.9%). Highest percentage occurred between 0:00 and 06:59 (39.6%), and on Oncology service (28.3%). Fallers were in the room, (81.1%), sustained major injury (73.6%), fractured a major bone (43.4%), had altered mobility prior to the fall (67.9%), and had received at least one narcotic dose within 24 hours before the fall (43.2%). The associations between injury severity and age, gender, altered mobility, fall risk assessment pre-fall, and unit service line are not statistically significant, however have small-to-moderate clinical significance. This study adds to the literature in identifying characteristics of patients who sustain a fall-related serious injury.

Keywords

serious injury, falls with injury, falls with serious injury, hospital inpatient

Introduction

Patients who sustain a serious injury when they fall are important safety concerns for hospitals. Experiencing a serious injury from a fall can have a lifelong impact on a patient's psychological well-being due to loss of independence and disability. Hospitals are not reimbursed for direct costs of diagnosing and treating patients' fall-related injuries. Recently, studies have sought to characterize these patients, however there is a paucity of evidence fully describing these high-risk patients and the circumstances surrounding serious injuries (Anderson et al., 2015; Capone et al., 2013; Daoust et al., 2018; Hester et al., 2016; Mion et al., 2012). While some type of fall risk assessment (FRA) is routinely used in hospitals, fall injury risk assessments are not as common (Quigley, 2016b; Sheth et al., 2013; Soncrant et al., 2020; Toyabe, 2014). Interventions to prevent injuries from falls have not been adequately studied in hospitals (Hester, 2015; Quigley, 2016a). The purpose of this study was to utilize an available data collection instrument to better understand patient and environmental characteristics of those who sustained a fall-related serious injury at a hospital. This study used The Injurious Fall Data Collection Tool to describe patients who were seriously injured by a fall and determine associations between key variables and moderate versus major severity levels of serious injury. This study did not seek to compare fallers with minor injuries, nor attempt to validate the data collection instrument.

Background and Significance

A patient fall is defined as "an unplanned descent to the floor with or without injury to the patient" (National Quality Forum, 2015, p. 141). A serious injury has three severity levels, classified as moderate, major, or death. These levels are defined by the National Database of Nursing Quality Indicators (NDNQI) and endorsed by the NQF (2015) as follows:

> Moderate - resulted in suturing, application of steri-strips/skin glue, splinting, or muscle/joint strain;
>
> Major - resulted in surgery, casting, traction, required consultation for neurological (basilar skull fracture, small subdural hematoma) or internal injury (rib fracture, small liver laceration) or patients with coagulopathy who receive blood products as a result of a fall;
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> Death - the patient died as a result of injuries sustained from the fall (not from physiologic events causing the fall). (p.138)

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Between 3 to 20 percent of inpatients fall at least once during their hospital stay and 30 to 51 percent of those suffer an injury. Of these, 6 to 44 percent are serious injuries that increase the risk of death (Boushon et al., 2012). Studies of data obtained from the NDNQI from 2006-2008 and from 2009 to 2010 report mean fall rates of 3.56 to 4.1 per 1,000 patient-days and mean injury rates of 0.93 to 0.9 per 1,000 patient-days, respectively (Bouldin et al., 2013; Staggs et al., 2015). The Joint Commission (TJC) plans to add a fall with serious injury, using the NDNQI definitions, to the list of sentinel events (The Joint Commission, 2020). Our conceptual framework for this study is based on the post-fall management guidelines in TJC's Targeted Solutions Tool.

Incidence of serious injury in five single-hospital studies varied widely, however operational definitions of injury level and the types of patients studied were not consistent. In those studies that used non-standardized definitions of injury level, 5%, 1.2%, and 9.8% of injuries, respectively, were serious (Brown et al., 2013; Kobayashi et al., 2017; Waters et al., 2013). Incidence of serious injury in those studies using standardized NDNQI injury level definitions was 8% and 18%, respectively (Anderson et al., 2015; Mion et al., 2012). Kobayashi et al. (2017) studied all patients, but others included only medical-surgical patients (Anderson et al., 2015; Mion et al., 2012; Waters et al., 2013) or trauma patients (Brown et al., 2013). Two recent studies of major injury only (Soncrant et al., 2020; Young-Xu et al., 2020) used different definitions for major injury and included hospital and long-term care patients.

Since 2008, The Centers for Medicare and Medicaid Services (CMS) identified falls in hospitals that result in trauma as one of the preventable Hospital-Acquired Conditions (HAC). Costs associated with HAC are not covered for hospitals participating in the Inpatient Prospective Payment System (Centers for Medicare & Medicaid Services, 2015). Given the incidence of falls in hospitals resulting in trauma, this can result in a considerable financial impact on hospitals. The regulation implies falls with trauma are preventable, providing an opportunity to increase costs due to litigation. The Institute for Healthcare Improvement (IHI) reported that a fall without serious injury costs $3,500 while a serious injury increases costs by $27,000 (Boushon et al., 2012). A study by Wong et al. (2011) reported that serious injuries from falls in the hospital increase length of stay (LOS) an average of 6.3 days and cost an average of about $14,000 per injury. Of all fall-related serious injuries, the costs of treatments for major injuries, such as surgery or intensive care unit admission, far outweigh those for moderate injuries, such as suturing or splinting.

Evidence Base

Extensive database searches of peer-reviewed journals from 2008 to 2020 were conducted to identify studies of falls and injuries in adult hospitalized patients, yielding 23 articles most current and relevant to our study objective. Relevant studies were those that identified injury risk factors, described available injury risk assessment instruments, and evaluated injury prevention measures.

Injury risk factors. Risk factors for falls with injury are described in nine single-hospital studies (Anderson et al., 2015; Capone et al., 2013; Daoust et al., 2018; Kobayashi et al., 2017; Mandl et al., 2013; Mion et al., 2012; Pierce et al., 2013; Quigley et al., 2009; Tsai et al., 2014). Evidence suggests that patient age and gender may not be predictors of serious injury. Study data do not consistently show that older adults who fall are more likely to sustain serious injury than younger adults (Anderson et al., 2015; Mandl et al., 2013). Similarly, the conclusion that males are more likely to be seriously injured by a fall in one study (Anderson et al., 2015) is not supported in other studies (Mandl et al., 2013; Mion et al., 2012; Pierce et al., 2013). Limitations in these studies include study design, generalizability, and potential under-reporting of falls.

Evidence suggests that mental status, mobility, medications, and fall risk assessment (FRA) score may play a role in injurious falls. Pierce et al. (2013) found that patients who were confused prior to a fall were more likely to sustain an injury than those with normal mental status, $OR = 2.00$, 95% CI [1.08, 3.70], $p = .03$. In a sample of medical-surgical patients who were seriously injured by a fall, 36.4% had altered mental status and 68.2% had impaired mobility (Quigley et al., 2009). In a study comparing patients with and without cancer, impaired mobility was present in 12.5% of cancer patients and 39% of non-cancer patients who were seriously injured by a fall (Capone et al., 2013). In a Taiwan study, gait impairment was associated with fall injury, $OR = 2.24$, 95% CI [1.08, 3.70], $p = .03$ (Tsai et al., 2014). Medications that may increase risk of a fall with injury include anticoagulants (Quigley et al., 2009), selective serotonin reuptake inhibitor (SSRI) antidepressants, some antipsychotics, opiates, and some diuretics (Mion et al., 2012). Receiving a narcotic within 24 hours before a fall was a strong predictor of injury in one study, $OR = 5.38$, 95% CI [2.07, 13.98], $p < .001$ (Pierce et al., 2013), and hospitalized older adults who used opioids during a two-week period prior to a fall in the community were 58% more likely than non-users to die in the hospital (Daoust et al., 2018). Two studies reported that a composite high FRA score (multiple fall risk factors) significantly increased the likelihood of a fall injury, $OR = 1.77$, 95% CI [1.16, 2.71], $p < .01$ (Tsai et al., 2014), and the incidence of serious fall injury (Kobayashi et al., 2017).

Injury risk assessment instruments. The fall literature has extensively addressed risk factors for falls. However, there is scant literature on injury risk assessment or screening instruments. Quigley et al. (2009) identified four major groups of patients at risk for serious injury from a fall—Age over

85 years, Bone disorders such as osteoporosis, Coagulopathy, and recent Surgery with abdominal, thoracic, or lower-limb amputation wounds, described as ABCs. The ABCs screening method has been used in a case-control study (Sheth et al., 2013), but no randomized controlled trials. Toyabe (2014) used two validated assessments—the STRATIFY (St. Thomas Risk Assessment Tool in Falling Elderly Inpatients), comprised of five fall risk factors, and the FRAX™ that includes seven osteoporosis risk factors—in a retrospective review of hospitalized patients in Japan. An instrument developed by VISN 8 is designed to retrospectively review an institution's patient falls that resulted in serious injury (Quigley, 2012). The Injurious Fall Data Collection Tool requires that the reviewer use the medical record to quantify multiple variables, describe the documented "story" of the fall event, and reflect on the appropriateness of preventive measures used or omitted. No published studies utilizing this instrument were found.

Injury prevention measures. Conducting an injury risk assessment is a key step in creating a prevention plan (Soncrant et al., 2020; Quigley, 2016b). Potential injury prevention measures most frequently tested across eight articles were bed alarms, low beds, floor mats, and hip protectors (Anderson et al., 2012; Barker et al., 2013; Bowers et al., 2008; Crandall et al., 2016; Cuttler et al., 2017; Hester, 2015; Quigley et al., 2014; Shorr et al., 2012). Bed alarms alone have not been shown to reduce injuries (Anderson et al., 2012; Shorr et al., 2012), however their use combined with risk-specific interventions and patient education in a study by Cuttler et al. (2017) reduced serious injury by 85%. Similarly, a low bed combined with a floor mat can greatly reduce serious head injury (Bowers et al., 2008). Serious injuries were reduced when hospital resources were sufficient to provide one low bed for no more than every three standard beds (Barker et al., 2013). Hip protectors, when combined with floor mats, could also benefit patients at high risk for hip fracture (Hester, 2015; Quigley et al., 2014), however may pose compliance issues (Crandall et al., 2016). Recent recommendations focus on leadership, staffing, and ensuring interventions are proactively in place and based on an individual's injury risk assessment. Unit leader rounding and increased analysis of fall events along with 1:1 observation have been suggested (Ambutas et al., 2017; Soncrant et al., 2020), along with information technology driven, risk factor-specific care planning and auditing (HD Nursing, 2020).

Methods

Study Design and Setting

This retrospective case series was conducted in a not-for-profit, Magnet-designated, 1,200-bed urban acute care adult hospital within a large Midwest health system. All medical record data were collected retrospectively to the patient's admission, without direct patient contact, and de-identified when reported. The study was conducted from 2015 to 2017. During the last quarter of each year, medical records of inpatients who fell and sustained a serious injury between January and August 2015, January and August 2016, and January and September 2017 were reviewed. Funding for the medical record reviews was given during the last quarter of each year and had been extended during 2017, allowing more reviews than during previous years. We followed the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Case Series when designing and reporting the study (Moola et al., 2017).

Participants and Sampling

The study used a purposive, convenience sample of patients who were confirmed to have fallen and sustained a serious injury based on the hospital's fall reporting policy. After a fall event is entered by a clinician electronically into the hospital's Safety Event Management System (SEMS), a hospital fall prevention subject matter expert (SME), who is also an NDNQI site coordinator experienced in defining falls and fall-related injuries, reviews the SEMS report and medical record of the faller. The SME validates the accuracy of the report, including the injury severity level classification, and confers with involved hospital staff to resolve discrepancies. Inclusion criteria were patients with a validated serious fall-related injury on a SEMS report and admitted to an inpatient unit prior to the fall. Exclusion criteria were patients who experienced a fall as an outpatient or in the Emergency Department. To ensure accuracy of medical record selection, the medical record number (MRN) associated with each SEMS report was compared to the MRN of each participant. A total of 53 medical records were reviewed.

Data Collection

Data were collected for this study using a hospital-specific adapted version of the Injurious Fall Data Collection Tool (Appendix A) (Quigley, 2012). Adaptations were made to the original instrument for clarification and identification of previously recognized characteristics specific to the study hospital. The adapted study instrument included 38 independent variables of demographic, physiologic, situational, environmental, behavioral, and preventive factors. Injury severity level, as defined by NDNQI/NQF, was matched to the validated SEMS report. The "story" of each fall was documented by completing categories on the instrument that describe details about the fall, injuries sustained, and patient and staff activity at the time of the fall. Additionally, reflections were recorded on the instrument about why the patient fell and sustained injury despite preventive efforts such as bed alarms or low beds, being in place. Reflections were also based on notes taken by the SME during post fall debriefs typically held within 2 weeks after each fall with serious injury.

Table 1. Descriptive Statistics of Demographic Variables of Sample.

Variables	2015 (n = 15)	2016 (n = 18)	2017 (n = 20)	Total sample (N = 53)	p-value*
Age (yr) mean ± SD				62.23 ± 15.8	
Age group – no. (%)					.986
18–49	4 (7.5)	3 (5.7)	4 (7.5)	11 (20.8)	
50–59	3 (5.7)	4 (7.5)	3 (5.7)	10 (18.9)	
60–69	3 (5.7)	6 (11.3)	6 (11.3)	15 (28.3)	
70–79	2 (3.8)	3 (5.7)	3 (5.7)	8 (15.1)	
80–99	3 (5.7)	2 (3.8)	4 (7.5)	9 (17.0)	
Gender – no. (%)					.874
Female	8 (15.1)	8 (15.1)	10 (18.9)	26 (49.1)	
Male	7 (13.2)	10 (18.9)	10 (18.9)	27 (50.9)	

Note. *Significance at $p \leq .05$.

Debriefs were coordinated and attended by the Risk Management department and participants included the SME, leadership of the unit where the fall occurred, and staff involved in the fall event. Additional participants often included the department director, unit educators, clinical nurse specialists, and physician staff. Efforts were made to address potential sources of bias in data entry. Record reviews were conducted by two registered nurses trained on use of the data collection instrument by the SME. Data were collected from the same electronic medical record system over the three-year study period.

Data Analysis

All quantitative data collected on the study instrument were included in the reported results. Reflective qualitative data, including preventive measures and individual variances, were grouped into themes by the SME. The demographic variables of age, age group, and gender were also summarized using descriptive statistics. Frequency was tabulated for categorical variables. Chi-square tests were performed to examine the relationship between outcomes of moderate versus major injury severity level and the nominal variables of age group, gender, FRA category, altered mobility, and unit service line. All analyses were conducted using a significance level of .05. Statistical analyses were performed using SPSS software version 25.0 (IBM Corp., 2017).

Results

The total sample (n=53) included patients who sustained a serious injury from a fall in 2015 (n=15), 2016 (n=18), and 2017 (n=20). Participant characteristics of the sample are shown in Table 1. The total sample ranged in age from 25 to 91 years, was predominantly age 60-69 years (28.3%, n=15), and 50.9% were male. There was no statistically significant difference between the yearly samples for age group, χ^2 (4) = 1.84, p = .986, or gender, χ2 (1) = .27, p = .874.

Occurrence of falls with serious injury were examined with regard to day of the week, time of day, and length of stay at the time of the fall. The highest percentage of falls during the study months were on Mondays (24.5%) and Saturdays (20.8%), between 0:00 and 06:59 (39.6%). The lowest percentage of falls were on Tuesdays (7.5%) and Fridays (9.4%), between 07:00 and 11:59 (13.2%). The mean and median length of time between admission and the fall was 10.34 days and 6 days, respectively (range: 0–41).

Statistics of the additional independent variables for the total sample are shown in Table 2. The highest percentages of falls with serious injury involved oncology patients (28.3%), medicine patients (20.8%), and heart/vascular patients (24.5%). The lowest involved neurology patients (5.7%) and psychiatry patients (5.7%). Analysis of falls per 1,000 patient-days shows highest rates on oncology (0.11), heart/vascular (0.1), and surgery (0.9). The highest percentage of falls during the study months were in January (15.1%) and July (15.1%). The highest fall rates were also in those 2 months. Most frequently, patients fell in their hospital room but outside the bathroom (81.1%), sustained a major versus moderate level injury (73.6%), and fractured a major bone (43.4%). Seven fallers had multiple types of injuries due to a single fall. These fallers were categorized into an injury severity level consistent with their most serious injury. Patient characteristics of antihypertensive or narcotic medication use, altered mobility prior to the fall, and a high or moderate FRA category (per Johns Hopkins Fall Risk Assessment tool) were most frequently noted. Either noncompliance with the fall risk plan or alteration in physiologic status, such as dizziness, were factors present in about half of the patients. Falls occurred in 25% of the patients while using the bedside commode or urinal. Most patients (88.7%) had fall prevention interventions in place and about half (56.6%) had injury prevention interventions, such as a low bed or floor mat, in place prior to their fall. Hourly rounding was documented in 98.1% of the records and only 9.4% of the patients called out prior to the fall.

Table 2. Characteristics of Fallers with Serious Injury and Preventive Strategies Pre-fall.

Variables		% of falls w/serious injury	*n*
Unit service line			53
(% of Total patient-days in 25 months of study)*	Fall w/ serious injury rate**		
Medicine (22.6)	0.07	20.8	
Oncology (19.6)	0.11	28.3	
Heart and vascular (19.4)	0.1	24.5	
Surgery (12.1)	0.09	15.1	
Neurology (11.2)	0.04	5.7	
Women and infants (8.1)	0	0	
Psychiatry (7.0)	0.06	5.7	
Month of fall			53
(% of Total patient-days in 25 months of study)*	Fall w/serious injury rate**		
January (12.1)	0.09	15.1	
February (11.3)	0.08	11.3	
March (12.1)	0.06	9.4	
April (11.8)	0.08	13.2	
May (12.2)	0.05	7.5	
June (11.9)	0.07	11.3	
July (12.4)	0.09	15.1	
August (12.3)	0.08	13.2	
September (3.9)	0.07	3.8	
Admitted to unit that does not customarily care for this type of patient			53
Yes		1.9	
No		98.1	
Location of fall			53
Room		81.1	
Bathroom		13.2	
Hallway		5.7	
Off-unit		0	
History of previous fall?			53
Yes		54.7	
No		45.3	
Medications			44
Anticoagulant		27.3	
Benzodiazepine		22.7	
Antihypertensive		36.4	
Anticonvulsant		0	
Narcotic		43.2	
Fall due to environmental issues (slip/trip)?			53
Yes		30.2	
No		69.8	
Was patient non-compliant with fall risk plan?			52
Yes		51.9	
No		48.1	
Fall due to patient physiological status?			53
Yes		50.9	
No		49.1	
Fall related to toileting?			53
Yes		50.9	
No		49.1	
Fall while from/to the patient bathroom?			52
Yes		26.9	
No		73.1	

(continued)

Table 2. (continued)

Variables	% of falls w/serious injury	*n*
Incontinent?		52
Yes	0	
No	100	
Fall while from/to BSC or while using urinal?		52
Yes	25	
No	75	
History of a coagulopathy?		39
Yes	46.2	
No	53.8	
History of osteoporosis?		20
Yes	0	
No	100	
Severity of fall		53
Moderate	26.4	
Major	73.6	
Death	0	
Altered mental status?		53
Yes	34.0	
No	66.0	
Altered mobility? (per PT/OT, fall risk, or N/S assessment)		53
Yes	67.9	
No	32.1	
Altered elimination status?		53
Yes	18.9	
No	81.1	
Impaired sensory status/function?		53
Yes	22.6	
No	77.4	
Malnourished or frail?		52
Yes	7.7	
No	92.3	
Fall risk assessment done?		53
Yes	100	
No	0	
Fall risk assessment p/t fall?		52
Low	11.5	
Moderate	40.4	
High	48.1	
Fall risk interventions in place p/t fall?		53
Yes	88.7	
No	11.3	
Injury prevention interventions in place p/t fall?		53
Yes	56.6	
No	43.4	
PT/OT saw patient within a week prior to fall?		53
Yes	54.7	
No	45.3	
Type of injury		53
Head laceration or digit fracture	35.8	
Major bone fracture	43.4	
Head bleed	28.3	
Other laceration	9.4	
Death	0	

(continued)

Table 2. (continued)

Variables	% of falls w/serious injury	*n*
Patient transferred to higher level of care d/t fall?		53
Yes	7.5	
No	92.5	
Did patient call out p/t fall?		53
Yes	9.4	
No	90.6	
Hourly round completed prior to fall?		53
Yes	98.1	
No	1.9	
Gait belt in use?		53
Yes	0	
No	100	
1 on 1 sitter used?		53
Yes	0	
No	100	

Note. BSC = bedside commode; PT = physical therapy; OT = occupational therapy; N/S = neurosensory; p/t = prior to; d/t = due to.
*Patient-days = daily patient census during study months (Jan–Aug 2015, Jan–Aug 2016, and Jan–Sept 2017).
**Number of falls with serious injury per 1,000 patient-days.

The associations between injury severity level and the variables of age group, gender, altered mobility, FRA category, and unit service line are shown in Table 3. Patients sustaining moderate injuries were most often 60–69 years of age, however major injuries were distributed relatively evenly among all age groups. Gender and mobility associations with injury severity were not statistically significant, $OR = 2.41$, 95% CI [0.86, 6.72] and $OR = 1.37$, 95% CI [0.89, 2.10], respectively. Most patients sustaining moderate injuries had been assessed to be in the moderate FRA category and most sustaining major injuries had been assessed to be in the high FRA category. Patients sustaining moderate injuries were somewhat evenly distributed across unit service lines, however major injuries were more frequent on the Oncology and Heart/Vascular services. While statistical significance was not established, the association of injury severity level to all variables in Table 3 demonstrated small-to-moderate clinical significance, per phi and Cramer's V measures of effect.

Reflection on the data, preventive measures, and individual variances revealed several themes. General themes were (1) patient behaviors and characteristics, and (2) underutilization of preventive resources, including environmental controls. Patient factors ($n = 33$) were related to not using the call light or not waiting for staff (most common), overconfidence, physiologic status, and response to medication. Underutilization of preventive resources ($n = 21$), including environmental management, ($n = 21$) was related to not using all preventive measures indicated by the FRA (most common), not adjusting the care plan with a change in the patient's condition or supervision, such as when a visitor leaves, and underestimating the FRA score.

Discussion

This study identified specific characteristics of those who sustained a fall-related serious injury. This knowledge can inform patient specific and hospital wide measures to reduce falls and falls with serious injury. When considering measures to reduce falls and falls with serious injury, it is important to understand pertinent risk factors and where to focus preventive efforts.

While Zhao et al. (2018) identified falls with injury (all injury) were 8% more likely on surgical units, the results of our study focusing on serious injury indicate that Oncology units may be an area to investigate. Wildes et al. (2015) found that oncology patients pose unique risk factors for falls. Oncology patients in our study had the highest percentage of falls with serious injury (28.3%). This finding is not surprising due to their physiologic alterations such as low platelets, low bone density due to chemotherapy, steroid use, and radiation therapy (National Comprehensive Cancer Network, 2019), all of which place the patient at greater risk for serious injury. Oncology is a large service line and has the second highest percentage of patient-days at the study organization (19.6%), therefore may not be typical of other acute care hospitals. For a considerable percentage of all patients in the sample (43.2%), at least one narcotic dose was given within 24 hours before the fall which is a common treatment modality in many service lines. This supports the findings by Pierce et al. (2013) that hospital inpatients receiving a narcotic within 24 hours before a fall was a strong predictor of injury.

Whereas the 2016 average LOS in hospitals for adults 18 years of age and older was 4.8 days (Freeman et al., 2018),

Table 3. Relationship between Injury Severity and Selected Variables.

Variables	Moderate injury % (n = 14)	Major injury % (n = 39)	$\chi 2$(df)	Measure of effect	*p*-value*
Age group			2.518(4)	V = 0.218	.641
18–49	5.7	15.1			
50–59	3.8	15.1			
60–69	11.3	17.0			
70–79	1.9	13.2			
80–99	3.8	13.2			
Gender			3.195(1)	Φ = 0.246	.074
Female	7.5	41.5			
Male	18.9	32.1			
Altered mobility			2.806(1)	ϕ =−0.230	.094
Yes	13.2	54.7			
No	13.2	18.9			
Fall risk assessment pre-fall			2.080(2)	V = 0.200	.353
Low	3.8	7.7			
Moderate	13.5	26.9			
High	7.7	40.4			
Unit service line			6.617(5)	V = 0.353	.251
Medicine	5.7	15.1			
Oncology	7.5	20.8			
Heart and vascular	3.8	20.8			
Surgery	1.9	13.2			
Neurology	3.8	1.9			
Women and infants	0	0			
Psychiatry	3.8	1.9			

Note. *Significance at $p \leq .05$.

our study patients had been in the hospital an average of 10 days before sustaining a fall-related serious injury. A longer time in the hospital may increase the likelihood of falls, however a study of acute medical and surgical units identified that peak occurrence of injurious falls was between 1 and 4 days after admission (Francis-Coad et al., 2020). Regarding the findings related to month and day of week, the highest percentage of falls with serious injury during the study months were in January and July and more falls occurred on Mondays and Saturdays. At the study hospital, January and July are typically associated with an influx of new registered nurses and new resident physicians, implying less familiarity with fall prevention protocols. Further, weekend staffing ratios, weekends-only option, and lack of leadership support or oversight may explain these findings.

Two-thirds of the patients studied had mobility deficits and over half were seen by inpatient rehabilitation services (PT/OT) within a week prior to the fall. This supports findings in the literature that altered mobility is a significant risk factor for falls resulting in injury (Capone et al., 2013; Francis-Coad et al., 2020; Tsai et al., 2014). Interventions to mitigate this risk factor are essential in preventing falls and fall related injuries.

Half of the serious injury falls in this study were related to toileting and 39.6% occurred between midnight and 06:59. Although Francis-Coad et al. (2020) found that the time of injurious falls was proportionate throughout the day, Chari et al. (2017) found an increase in fall related head injury during the overnight hours. Toileting and time of fall demonstrate additional areas of focus. Possible causes of overnight falls could be due to limited staff during these hours, less frequent rounding, or rounding that excludes toileting in order to promote restful patient sleep. Although documentation of hourly rounding was present in nearly all cases, 9 out of 10 patients did not call for help prior to falling. Patients who toilet unassisted at night are typically subject to dark rooms and unfamiliar environments. Patient noncompliance with recommended interventions, identified in over half of the falls with serious injury in our study, may be due to overconfidence in their abilities (Twibell et al., 2020).

Mandl et al. (2013) studied orthopedic surgery patients who fell and reported an average age of 68 years. Anderson et al. (2015) identified age greater than 64 years and male gender as two predictors of a fall with serious injury. Similarly, the mean age of this study's sample was 62 years, but differences in the percentage of serious injuries for age group and gender were not statistically significant. Although injury severity impacts costs, studies of falls with serious injury have not differentiated between levels of injury. In this study, major injuries occurred more frequently than

moderate injuries across age groups and in both males and females.

A significant percentage of serious injuries occurred in the younger population and those identified as a moderate fall risk. This could be a result of inaccuracy of the hospital FRA tool in predicting fall risk, timeliness or underestimation of fall risk prior to the fall, or that patients who truly are at moderate risk have an almost equal chance of sustaining a serious fall related injury. The FRA often drives the selection of preventive measures. Bedside care providers may underutilize these measures for a variety of reasons such as giving the patient the benefit of the doubt, the inability to adjust the environment due to room size or clutter created by patient care related items or, as this study identified during reflection, simply not using all preventive measures indicated by the FRA.

While approximately 9 out of 10 patients studied had fall prevention measures in place, only slightly over half had fall injury prevention measures in place. Measures such as low beds and floor mats, while they may be effective at preventing injury, should be used for patients who are prone to falling from the bed. Rising from a low bed or standing on a foam floor mat may cause patients to fall off the mat if coupled with an impaired gait or balance (Hester, 2015; Quigley, 2016a). Bed/chair alarms, while not proven to reduce fall-related injuries, alert care providers of patient movement off the bed or chair; however, staff may be unavailable or too far away to intervene before the patient falls.

The study is strengthened by a comprehensive data collection instrument and consistent reviewer training by the SME. Selection bias was decreased by using NDNQI/NQF definitions and SME validation of injury severity level along with consecutively enrolling all eligible inpatients who fell and sustained a serious injury during the study period. In addition, the sample was not restricted to a specific service or type of patient. Data were enriched by post-fall information gathered shortly after the fall events. Qualitative reflection helped to identify trends among the fallers' individual circumstances.

Limitations of this study include potential information bias related to lack of reporting and inaccurate or incomplete medical record data including documentation of patient characteristics such as osteoporosis. The study instrument has not been validated. Although consistent training of the reviewers was provided, inter-rater reliability was not conducted. Falls with serious injury that occurred in the fourth quarter of each year were not reviewed. This study did not compare fallers with a serious injury to a control group of non-fallers or fallers with mild injuries, however that was not the intent of this study. This one site study limits generalizability. Factors not studied, such as organization-wide leadership or fall prevention program changes, may have influenced the number of falls and falls with injuries.

Application to Practice

This study adds to the literature describing characteristics of patients who sustained a fall-related serious injury and preventive measures in place prior to the fall. A wide range in length of time between admission and the fall supports the need to identify injury risks at admission and at regular intervals throughout the patient's hospital stay. Timely and accurate assessment of fall and/or injury risk remains important as the condition of the patient can potentially change quickly. Collaboration and communication between nursing and rehabilitation services regarding recommended level of assistance needed for toileting and ambulation, and type of assistive device is a vital component in developing individualized care plans to address mobility deficits. Risk-specific interventions, such as bed alarms, low beds, bedside floor mats, mobility aids, and rounding must be planned, implemented, and communicated to the patient, family and health care providers.

Patients at risk for injurious falls may benefit from interventions focused on toileting activities. Ways to mitigate these falls include purposeful rounding, instituting toileting regimens, or staff presence during toileting activities. Bedside commodes may increase risk due to tipping, improper height, and temptation for patients to use the commode independently. Additional interventions include adjusting the height of the bedside commode to allow firm placement of feet on the floor and removing the commode at night.

Patient noncompliance emphasizes the need for consistent, interdisciplinary, individualized patient/family engagement in preventing falls and fall injuries. Empowering patients with the knowledge of their fall and injury risk factors may help them understand the consequences of their behaviors. The importance of transparency with the patient and family about their risks and potential consequences is essential and promotes a patient-centered care approach. Transparency with health care providers is also important and supports the culture of safety necessary for high reliability organizations. It contributes to more effective post-fall analysis which aids in identifying patterns, opportunities, and barriers to success. Timely feedback to staff regarding post fall analysis findings is also important in maintaining a culture of safety.

Technological advances to address and mitigate falls with serious injury is an area that needs further exploration, development and research. New systems and products currently available, such as camera systems, protective head gear, hip air bags, and protective flooring, show promise however need more rigorous scientific research to demonstrate success in the acute care population. Health care providers are united by the concepts of non-maleficence (do no harm) and beneficence (act in the best interest of the patient). Falls with serious injury can be a life changing event for the patient, their loved ones, and the care providers involved in the fall event as well as an economic burden to the patient and the healthcare system.

Appendix A

Injurious Fall Data Collection Tool (Adapted)

Date of fall (MM/DD/YYYY)
Day of Week (Su, M, T, W, Th, F, Sa)
Time of Day in Military Notation (00:00–23:59)
Unit name
LOS at time of fall (admit date = 0)
Admitted to unit that does not customarily care for this type of patient (Y/N)
Location of Fall (R = Room, BR = Bathroom, H = Hallway, O = Off-unit)
Patient Age (in years)
Patient Sex (F, M)
History of previous fall? Y/N
Medications: AC = for anticoagulant, B = benzodiazepines, AH = antihypertensives, AV = anticonvulsants, N = narcotic
Fall due to environmental issues (slip/trip)? Y/N
Was patient non-compliant with fall risk plan? Y/N
Fall due to patient physiological status? Y/N
Fall related to toileting? Y/N
Fall while from/to the patient bathroom? Y/N
Incontinent? Y/N
Fall while from/to BSC or while using urinal? Y/N
History of a coagulopathy? Y/N
History of osteoporosis? Y/N
Severity of Fall (3, 4, 5: see below for definitions;)
Altered mental status? Y/N
Altered mobility? Y/N (per PT/OT, fall risk or N/S assessment)
Altered elimination status? Y/N
Impaired sensory status/function? Y/N
Malnourished or frail? Y/N
Fall Risk assessment done? Y/N
Fall Risk assessment p/t fall? L=Low; M=Moderate; H=High
Fall risk interventions in place p/t fall? Y/N
Injury prevention interventions in place p/t fall? Y/N
PT/OT saw patient within a week prior to fall? Y/N
Type of Injury (see code)
Patient transferred to higher level of care d/t fall? Y/N
Did patient call out p/t fall? Y/N
Hourly Round Completed prior to fall? Y/N
Gait belt in use? Y/N
1 on 1 (Sitter) used? Y/N
Provide the "story" of the fall: details of patient activity at time of fall, staff activity at time of fall, and details of the fall and injuries sustained
Reflection: Why do you think patient fell/sustained injury in spite of all preventive efforts in place?

Harm Definitions from NQF Nursing Sensitive Measures http://www.qualityforum.org/txNCFINAL.public.pdf

0 – Unknown
1 – No apparent injury
2 – Minor
3 – Moderate
4 – Major
5 - Death

Type of Injury

1 – Head laceration
1 – Fracture – digit
2 – Fracture – major bone
3 – Head bleed
4 – Laceration – other
5 - Death

Note: LOS: length of stay; BSC: bedside commode; PT: physical therapy; OT: occupational therapy; N/S: neurosensory; p/t: prior to; d/t: due to

Variables removed from original tool (individualized to available medical record data):

- Percent unit occupancy at time of injurious fall
- History of fracture
- Recent amputee
- Number of co-morbidities
- Admitting diagnosis
- Restraints used
- Injury risk assessment done
- Hours since last fall risk assessment
- Risk communicated at shift change
- Transfer and mobility aids (Gait belt, walker, etc) in use
- Patient assessed AT RISK to fall?
- Patient assessed NOT at risk to fall?
- Risk intervention implemented?
- Harm risk assessment done?
- Patient assessed AT RISK for injury?
- Patient assessed NOT at risk for injury?

Variables added to adapted tool:

- Unit name
- LOS at time of fall
- Medications: Narcotic
- Was patient non-compliant with fall risk plan?
- Fall while from/to the patient bathroom?
- Incontinent?
- Fall while from/to BSC or while using urinal?
- Malnourished or frail?
- PT/OT saw patient within a week prior to fall?
- Type of injury (see code)
- Patient transferred to higher level of care due to fall?
- Did patient call out p/t fall?

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