

Frequently Observed Risk Factors for Fall-Related Injuries and Effective Preventive Interventions

A Multihospital Survey of Nurses' Perceptions

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There is an urgent need to prioritize the risk factors for injurious falls and effective interventions in nursing practice. Registered nurses perceived that the most frequently observed risk factors were confusion, gait problems, Alzheimer disease, disorientation, and inability to follow safety instructions. The most effective interventions were keeping hospital bed brakes locked, keeping floor surfaces clean/dry, using appropriate footwear for patients, maintaining a call light within reach, and reducing tripping hazards. **Key words:** *fall, fall-related injuries, hospital, nursing care, risk factors, safety*

FALLS are among the most common and costly sources of hospital-acquired injuries in adult inpatients.^{1,2} It is estimated that 25% (not all) of these fall injuries can be prevented.^{1,3} It is well known that nurses have a unique body of knowledge and awareness of risk factors for patient falls, injurious falls, and near misses, as well as knowledge of the effectiveness of related interventions in inpatient care settings. Teams of nurses are in a position to make valuable observa-

tions because they are present at the bedside 24 hours a day and 7 days a week. However, their observations are often missing from fall incident reports. Their unique body of knowledge about the prevalence of risk factors for falls and interventions to prevent falls is rarely reflected in the literature,^{4,5} because most studies have used data abstracted from medical records and fall incident reports. These data are subject to limited documentation and omissions for details. Therefore, there is an urgent need to identify and prioritize risk factors for injurious falls and preventive interventions from the perspective of nurses in practice. Multihospital studies are needed to systematically analyze, from the perspectives of nurses, risk factors and interventions identified in the literature and other guidelines.^{6,7}

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PURPOSE OF THE STUDY

This multisite, descriptive, cross-sectional survey identified nurses' perceptions of the frequency of specific risk factors for injurious

falls and the potential for their prevention, and the frequency of use and effectiveness of preventive interventions for injurious falls in adult inpatients. The 4 principal research questions were: what are the top-20 most (1) frequently observed risk factors for injurious falls, (2) preventable risk factors, (3) frequently adopted interventions for preventing injurious falls, and (4) effective interventions?

This study was conceptualized on the basis of Donabedian's⁸ structure, process, and outcome model for health care organizations. Nurses' perceptions of the frequency of specific risk factors for injurious falls and the potential for their prevention for adult inpatients were conceptualized as the structure-related indicators. The frequency of use and effectiveness of specific preventive interventions for injurious falls in adult inpatients were conceptualized as the process-related indicators. Successful prevention of injurious falls for adult inpatients in acute care settings was conceptualized as the outcome indicator. This study was not meant to investigate the relationships among the structure, process, and outcome indicators. The structure and process indicators described earlier were the focus of this study.

BACKGROUND

The National Quality Forum⁹ emphasized that improving patient safety saves lives and helps avoid unnecessary complications (eg, fall injuries). Establishing evidence-based strategies for preventing injuries due to falls has been challenging.¹ Tzeng and Yin¹⁰ found that most of the fall prevention interventions identified by registered nurses (RNs) and nurse assistants during interviews were related to unsafe care environments and inadequate caregiver communication. Shever and associates¹¹ studied fall prevention practices in adult medical-surgical nursing units, as described by nurse managers, and found that the most common interventions were bed alarms, rounds, and sitters, as well as the strategy of relocating patients closer to the nurses' station. Efforts to reduce falls and fall injuries often

focus on increasing safe mobility, risk assessment, and interdisciplinary and multifactorial protocols for fall prevention.¹ Schwendimann and associates¹² stated that priority should be placed on identifying patients at risk of falling and implementing strategies for preventing falls according to patient characteristics.

Cumbler and Likosky¹³ suggested that to reduce the burden of falls and their consequences, systematic approaches should be used to identify modifiable risk factors for falls and apply fall prevention measures designed to remove or compensate for these risk factors. On the basis of previous research, Cumbler and Likosky¹³ concluded that in hospital inpatient care settings, the combination of multifaceted risk factors, including acute illness, patient vulnerability, and environmental factors, could determine the likelihood of falling. They emphasized that clinicians need to be aware of the potential underlying risks in each patient and strategies to mitigate those risks.¹³ The National Quality Forum⁹ suggested that organizations must evaluate their fall reduction programs on a regular basis to determine their effectiveness. Raeder and associates¹⁴ found that implementation of guidelines for fall prevention was associated with a statistically significant reduction in the frequency of fall-related injuries. This is encouraging. However, there is still a need to prioritize the risk factors for injurious falls and to assess the effectiveness of such preventive interventions.

METHODS

Design

This descriptive, cross-sectional survey study was conducted at 5 health care systems, from July 2011 to February 2012. It included 68 critical care, step-down, and noncritical acute care units for adult inpatients. Medical, surgical, combined medical-surgical, telemetry, oncology, orthopedics, cardiac, behavioral, women's health/delivery, rehabilitation, and geriatric units were included. This study was approved by each hospital's institutional review board.

Sample and procedures

All participants met the following inclusion criteria: (1) aged 21 years or older, (2) employed as a staff nurse for at least 12 months in the study unit, (3) working an average of at least 20 hours per week, (4) providing direct patient care, and (5) having at least an RN license in the state of Michigan. The exclusion criterion was working as a contingent or travel nurse. Invitations to participate in the study were placed in the mailboxes of all eligible staff nurses at the study units. The survey package included the survey tool, a consent form, and an energy bar as a token gift. The institutional review boards waived documentation of consent. Participation was voluntary and anonymous. No personal information or identifiers were recorded or tracked.

A total of 2170 RNs met the inclusion criteria, of whom 560 completed the surveys and were included in the analyses, for an overall response rate of 25.81%. The response rates for 5 Michigan nonprofit health systems (designated as A through E) follow: (a) a regional medical center with 400 beds (1 study unit), 7 (36.84%) of 19 RNs completed surveys; (b) a teaching medical center with 304 beds (8 study units), 92 (33.21%) of 277 RNs completed surveys; (c) a regional teaching medical center with 443 beds (12 study units), 39 (9.85%) of 396 RNs completed surveys; (d) a regional medical center with 436 beds (13 study units), 142 (31.35%) of 453 RNs completed surveys; and (e) a health system with 916 beds, including 4 teaching hospitals (all 4 hospitals participated in this survey study, 34 study units), 280 (27.3%) of 1025 RNs completed surveys.

Measurement

The survey tool used in this study was developed by the authors. Its development was based on previous studies and guidelines related to fall prevention.^{4,6,10,11,15-17} We sought input from 11 clinical or content area experts on the initial survey tool to ensure that the list of included risk factors and interventions was complete and that word us-

age was appropriate. Experts included 5 nurse managers, 1 staff nurse in acute care rehabilitation, 1 nursing practitioner in mental health care, 1 clinical pharmacist, and 3 master's-prepared medical-surgical nursing instructors. Additional items were added. Some wordings were changed for clarity. The survey took approximately 15 to 40 minutes to complete.

After the expert content review was completed, the survey tool was pretested in an adult acute care rehabilitation unit of one of the health care systems (HR-A) in September 2011. Nineteen RNs met the inclusion criteria and were invited to participate in the study, and 7 RNs completed the survey. No wording was changed after pretesting. The data from this pretest were included in the analysis.

The survey includes 3 parts. Part I includes 81 potential factors that may lead to an injurious fall in adult inpatients (aged 21 years or older). Participants were asked to rate these factors using 5-point scales, based on their experience in their current unit. This part has 2 columns. In the "Frequency" column, participants rated each risk factor on the basis of how often a patient with this specific risk factor will experience an injurious fall in their practice (1 = rarely, 5 = always). In the "Effective Preventability" column, participants rated each risk factor on the basis of how effective the appropriate intervention(s) are in preventing an injurious fall for a patient with this risk factor (1 = never, 5 = always). The first 2 research questions were answered using the responses in these 2 columns.

Part II includes a list of 75 interventions for preventing injurious falls in adult inpatients. Participants were asked to rate these interventions using 5-point scales, based on their experience in their current unit. This part also has 2 columns. In the "Frequency of Use" column, participants rated each preventive intervention on the basis of how often the specific intervention would be used to prevent injurious falls in their practice (1 = rarely, 5 = always). In the "Effectiveness" column, participants rated each preventive intervention on the basis of how effective the intervention is in preventing injurious falls in

their practice (1 = never, 5 = always). The last 2 research questions were answered using the responses in these 2 columns. Part III includes 12 optional items (eg, primary working shift, the part of the fall prevention education that the participant felt most helpful for preventing injurious falls). The survey tool can be obtained from the corresponding author.

Data analysis

Collected data were processed using SPSS 19.0 statistical software for Windows (SPSS Inc, Chicago, Illinois). Data from completed or partially completed surveys were included in the analysis. Descriptive statistics (means and standard deviations) were calculated to answer the 4 research questions. Then, the mean values were ranked using Microsoft Excel.

RESULTS

Demographic characteristics

Among the 560 RNs, 514 (91.8%) were female; 359 (64.1%) were younger than 45 years, 198 (35.4%) were 45 years or older and younger than 65 years, and 3 (0.5%) were 65 years or older. Four (0.7%) of the participants were advanced nurse specialists or nurse practitioners, and the remainder ($n = 554$, 99.3%) were RN staff. A total of 216 (38.6%) participants worked primarily during the day shift; 135 (24.1%) worked a 12-hour day shift, 115 (20.5%) a 12-hour night shift, and 94 (16.8%) worked during the evening or night shift, or rotating shifts. Ninety-seven (17.3%) participants worked in critical units, 112 (20%) in step-down units, and 351 (62.7%) in noncritical acute care units. The average tenure in the study unit when the survey was completed was 8.33 years. All but 34 (6.1%) had not received fall prevention education in the past 12 months.

Descriptive analyses

As shown in Table 1, the top-5 most frequent risk factors for injurious falls were (1)

confusion, (2) gait problems, (3) Alzheimer disease, (4) disorientation, and (5) inability to follow safety instructions. The top-5 most preventable risk factors were (1) bed brakes not in locked position, (2) age younger than 25 years, (3) poor lighting, (4) age 25 years or older and younger than 45 years, and (5) inappropriate or no footwear worn by patients. In other words, the occurrences of injurious falls associated with unlocked bed brakes, poor lighting, and inappropriate footwear, as well as the identified patient age groups, could be minimized by introducing appropriate precautions. Among the identified top-20 risk factors, vertigo was the only risk factor that appeared in both the Frequency and Effective Preventability columns.

As seen in Table 2, the top-5 most frequently adopted interventions were (1) completing a fall risk assessment at admission, (2) keeping hospital bed brakes locked, (3) using a fall risk identification wristband, (4) placing patient beds in a low position, and (5) completing daily mental status assessments. The top-5 most effective interventions were (1) keeping hospital bed brakes locked, (2) keeping floor surfaces clean and dry, (3) using appropriate footwear for patients, (4) maintaining a call light within reach, and (5) reducing tripping hazards. Among the identified top-20 interventions, 9 appeared in both Frequency of Use and Effectiveness columns.

DISCUSSION

Risk factors for injurious falls

Answers to the 4 research questions are summarized in Tables 1 and 2. On the basis of previous studies,^{4,15,18} 17 of the top-20 most frequent risk factors for injurious falls can be categorized as intrinsic risk factors, defined as integral to each individual patient. Three of them (insufficient staffing, high workload due to admissions and discharges, and night shift) were extrinsic risk factors, defined as external to each individual patient and related to human resource management of the study

Table 1. Top-20 Most Frequently Observed and Most Preventable Risk Factors for Injurious Falls in Acute Care Settings

Rank ^a	Frequency of Specific Risk Factors ^b	Mean (SD)	Potential for Prevention ^c	Mean (SD)
1	Cognitive impairment: confusion	3.22 (1.13)	Bed brakes not in locked position	3.94 (0.84)
2	Altered gait problems	3.17 (1.07)	Age <25 y	3.90 (0.87)
3	Alzheimer disease	3.17 (1.36)	Poor lighting	3.89 (0.79)
4	Cognitive impairment: disorientation	3.16 (1.12)	Age ≥25 and <45 y	3.88 (0.81)
5	Inability to follow safety instructions	3.15 (1.12)	Inappropriate footwear worn by patients	3.88 (0.79)
6	Impaired balance	3.12 (1.08)	Bed not kept in the low position	3.86 (0.85)
7	Fall history	3.10 (1.13)	Slippery floor surfaces	3.86 (0.81)
8	Age ≥85 y	3.07 (1.09)	Improper use of side rails	3.85 (0.82)
9	Impulsiveness	3.05 (1.14)	Prolonged bleeding time	3.84 (0.81)
10	Impaired muscle strength	3.02 (1.09)	Tripping hazards	3.84 (0.79)
11	Insufficient staffing	2.98 (1.20)	Clutter	3.84 (0.78)
12	Comorbidity: stroke	2.96 (1.15)	Age ≥45 and <65 y	3.83 (0.75)
13	<i>Vertigo or dizziness</i>	2.93 (1.06)	Sex: female	3.82 (0.72)
14	Increased toileting needs	2.92 (1.09)	Walkers or canes not available	3.82 (0.81)
15	Comorbidity: syncope	2.91 (1.13)	Vitamin D deficiency	3.81 (0.87)
16	High workload	2.90 (1.19)	Comorbidity: diabetes	3.81 (0.83)
17	A desire for independence	2.88 (1.11)	Dehydration	3.81 (0.76)
18	Short-term memory loss	2.82 (1.12)	Use of anticoagulants	3.81 (0.84)
19	Have catheters and tubes	2.80 (1.14)	<i>Vertigo or dizziness</i>	3.81 (0.68)
20	Time of day: night	2.78 (1.15)	Medication use: insulin or oral hypoglycemics	3.80 (0.84)

^aThe item ranked 1 has the highest mean value.

^bScale of 1 (*rarely*) to 5 (*always*).

^cScale of 1 (*never*) to 5 (*always*). Italicized item appeared on both lists.

units (Table 1). In contrast, 9 of the top-20 preventable factors can be categorized as intrinsic risk factors, including age younger than 25 years, between 25 and 45 years, and between 45 and 65 years; prolonged bleeding time; female sex; vitamin D deficiency; diabetes; dehydration; and complaint of vertigo. In other words, all ages younger than 65 years were included in the top-20 preventable risk factors for injurious falls. Eleven of them can be categorized as extrinsic risk factors (Table 1).^{4,15,18}

In fact, patient age is not a “modifiable” patient characteristic for which RNs could in-

tervene. It is possible that RNs perceived patient age as a preventable risk factor because it could prompt them for choosing different preventive interventions. Findings suggested that RNs knew how to intervene to resolve risk factors by introducing appropriate interventions. As reflected in their responses to the survey (Table 1), the majority of the top-20 most frequently observed risk factors were patient related or associated with staffing levels. However, only 1 of the top-20 most frequently observed risk factors (vertigo) was also identified among the top-20 most preventable risk factors. In other words, the occurrences

Table 2. Top-20 Most Frequently Adopted and Most Effective Interventions to Prevent Injurious Falls in Acute Care Settings

Rank ^a	Frequency of Use ^b	Mean (SD)	Effectiveness ^c	Mean (SD)
1	<i>Complete a fall risk assessment at admission</i>	4.70 (0.69)	<i>Keep hospital bed brakes locked</i>	4.17 (0.74)
2	<i>Keep hospital bed brakes locked</i>	4.52 (0.80)	<i>Keep floor surfaces clean and dry</i>	4.15 (0.67)
3	Fall risk identification wristband	4.45 (0.85)	<i>Use appropriate footwear for patients</i>	4.14 (0.68)
4	<i>Place patient beds in the low position</i>	4.40 (0.85)	<i>Maintain a call light within reach</i>	4.13 (0.70)
5	Conduct daily mental status assessments	4.40 (0.98)	<i>Reduce tripping hazards</i>	4.12 (0.67)
6	<i>Maintain a call light within reach</i>	4.39 (0.76)	Keep equipment out of patient's pathway	4.10 (0.68)
7	Complete a fall risk assessment after a fall	4.39 (0.99)	One-on-one support in the bathroom	4.10 (0.69)
8	Complete a fall risk assessment once a day	4.34 (1.07)	<i>Place patient beds in the low position</i>	4.10 (0.75)
9	<i>Clean and dry floor</i>	4.31 (0.74)	Reduce clutter	4.08 (0.69)
10	<i>Use nonslip, well-fitted footwear for patients</i>	4.31 (0.75)	<i>Assess and modify environment as needed</i>	4.07 (0.71)
11	Monitor the fall and injurious fall rates	4.28 (0.91)	Personal possessions within reach	4.07 (0.69)
12	A visual identification system for patients at risk of falling	4.22 (1.00)	<i>Adjust the lights for daily activities</i>	4.06 (0.68)
13	Visual observation of patient's mobility	4.19 (0.91)	Assist transfers	4.03 (0.74)
14	<i>Reduce tripping hazards</i>	4.18 (0.81)	Use night light	4.03 (0.69)
15	Staff understand fall prevention policies	4.18 (0.86)	Use of patient's regular assistive device	4.02 (0.69)
16	Provide supportive chairs with armrests	4.18 (0.93)	Increased observation and surveillance	4.02 (0.68)
17	<i>Assess and modify environment as needed</i>	4.16 (0.85)	Patients demonstrate call light use	4.02 (0.74)
18	<i>Adjust the lights for daily activities</i>	4.15 (0.81)	Walker/cane available	4.02 (0.68)
19	<i>Have sturdy and unobstructed handrails</i>	4.15 (0.90)	<i>Complete fall risk assessment at admission</i>	4.02 (0.82)
20	Yearly in-service requirements	4.15 (1.06)	Have sturdy and unobstructed handrails	4.01 (0.77)

^aThe item ranked 1 has the highest mean value.

^bScale of 1 (*rarely*) to 5 (*always*).

^cScale of 1 (*never*) to 5 (*always*). Italicized items (9 items) appeared on both lists.

of injurious falls associated with vertigo are frequently observed in practice and could be minimized by introducing appropriate precautions.

Injurious fall prevention

Nine of the top-20 most frequently adopted and effective interventions appeared in both the Frequency of Use and Effectiveness columns (Table 2). Among these 9 fall prevention interventions, 7 were related to modifying the physical environment of patient rooms: keeping hospital bed brakes locked, keeping patient beds in the low position, maintaining a call light within reach, keeping floor surfaces clean and dry, reducing tripping hazards, assessing and modifying the environment as needed, adjusting the lights to daily activities, and having sturdy and unobstructed handrails. This is consistent with the findings of the study conducted by Tzeng and Yin,¹⁰ in which fall prevention strategies often addressed an unsafe care environment and inadequate caregiver communication. The remaining 2 preventive interventions were completing a fall risk assessment at admission and using nonslip, well-fitted footwear for patients. We also noted that among the top-5 interventions in either column, only the intervention of keeping hospital bed brakes locked appeared in both columns as the most frequently adopted and the most effective intervention.

Inconsistencies and lessons learned

Findings of this study concluded that RNs' perceptions about the most frequent and preventable/modifiable risk factors for injurious falls, as well as the most frequently adopted and most effective interventions, were inconsistent. We assume that with timely and proper training, agreement between RNs' *perceptions* and their *prior knowledge* (gained via fall prevention-related training) could be established through observation and clinical experience. The inconsistencies could be due to lacking an understanding of modifiable risk factors for injurious falls (eg, the risks included in the daily fall risk assessment) and

lacking awareness of feasible and available fall prevention measures. These inconsistencies could also be linked to the disagreement between RNs' *perceptions* and their *prior knowledge*.

Understanding RNs' perceptions of the potential for preventing specific risk factors and the frequency of specific interventions could be helpful in eliciting their action when a patient is identified as being at high risk for fall-related injuries. In education and practice settings, we have observed that putting into practice the professional knowledge learned through formal education or on-the-job-training includes 6 steps ("6Rs process cycle"): (1) retaining prior knowledge (eg, learning the risk factors for injurious falls via formal and continuous education); (2) recognizing previously studied scenarios in practical settings (eg, identifying frequent risk factors for falling); (3) retaining know-how (eg, knowing how to implement fall prevention interventions); (4) reinforcement via on-the-job training and regulations (eg, establishing hospital policies related to fall prevention); (5) realizing prior knowledge by doing ("To-Do") (eg, being able to identify risk factors and acting accordingly as a form of translating research-based knowledge to practice, also called evidence-based practice); and (6) results (eg, decreased rates of injurious falls). When new knowledge related to fall prevention is established (eg, a new fall risk assessment methodology) or a gap in evidence-based practice is identified (eg, lacking an optimal design for the bathroom of patient rooms to effectively prevent injurious falls in bathrooms in acute care settings), the entire process or part of it should be repeated until the expected results have been achieved. This 6Rs process cycle needs to be validated to improve our understanding of the process of putting professional knowledge into practice.

Previous research³ has demonstrated that the use of a quality improvement (QI) model to develop a multidisciplinary fall prevention program could be an effective process to implement strategies to reduce injurious falls in

inpatient acute care settings. Also, in the process of developing an institutional-based or unit-based fall prevention program, it is essential to understand the association between risk factors for injurious falls and a certain type of falls before identifying and testing possible effective fall prevention interventions. For example, the study conducted by Ferrari and associates¹⁹ explored the risk factors for falls that may contribute to the occurrences of impulsivity related falls for older adult inpatients 65 years and older in a community hospital. They found that cognitive impairment and inattention predicted impulsivity-related falls. They emphasized that identification of the unique risk factors (cognitive impairment and inattention) of these falls could assist in applying appropriate fall prevention measures in a timely manner that could lead to fewer falls.¹⁹

To continuously prevent inpatient injurious falls, nursing leaders and managers need to identify frequently observed risk factors in adult inpatient care units on a regular basis (eg, once a year), as patient characteristics may change over time.^{9,12} Using a tool such as the one developed for this study is one way to collect such information. Nurse leaders and managers need to communicate these findings with RNs in a systematic way to effectively prevent injurious falls. Identifying the top-20 frequently observed risk factors, matching them with fall prevention strategies, and cross-checking with the frequency of use and perceived effectiveness of these interventions could be one approach to identify opportunities for on-the-job refresher courses.

Study limitations

The scope of this study is limited to the study hospitals and units of the 5 participating health care systems located in the Midwest area of the United States, reducing the generalizability of the findings to other institutions. Each health care system may have similar fall prevention protocols but different emphasis on fall prevention strategies. To minimize the length of time required to complete the surveys, we did not include additional structure,

process, and outcome-related indicators (eg, assessment of the safety culture in each study unit and assessment of the emphasis on implementation of fall prevention strategies).

CONCLUSION AND FUTURE RESEARCH

Falls did occur, and it would be unrealistic to consider all falls to be preventable.³ Still, systematic approaches are needed to identify modifiable risk factors for injurious falls and fall prevention measures, which may compensate for these risk factors.¹³ In this study, we used a systematic approach to assess the agreement between RNs' prior knowledge and their perceptions of the frequency of specific risk factors and effectiveness of specific interventions. This study concluded that RNs' perceptions about the most frequent and preventable risk factors for injurious falls, as well as the most frequently adopted and most effective interventions, were inconsistent. Such inconsistencies may be due to RNs being unable to recognize the importance of some risk factors and fall prevention interventions. Offering education on a routine basis about an institution's fall prevention policies, procedures, and prevention measures to RNs, nurse assistants, and other members of the health care team is warranted.

As for future research directions, additional analyses of the data collected in this study are needed, for example, to understand differences in RN perceptions between unit specialties and acuity levels. Additional practical insights could be gained by grouping risk factors for fall-related injuries and preventive interventions and by mapping the risk factors with relevant fall prevention strategies. More research is also needed to understand how RNs put their professional knowledge into practice (eg, preventing fall-related injuries).

In summary, both licensed and unlicensed staff members on the health care team need to understand the underlying risks for injurious falls for the patients for whom they care and be aware of strategies to mitigate those risks. Nurturing a practice environment that

promotes patient safety and assists clinicians putting into practice the knowledge learned through formal education or on-the-job education is key to preventing injurious falls. Use of a QI model to address risks for injurious falls

is one of the approaches to help clinicians identify feasible and effective interventions. The ultimate goal is to assist clinicians putting into practice their knowledge related to fall prevention.

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