Risk Management and Healthcare Policy

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ORIGINAL RESEARCH

Risk Factors and Profiles of Falls Among Inpatients in Vietnam: A Multicenter Nested Case–Control Study

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Purpose: Falls among inpatients represent a significant global health concern and are among the leading causes of accidental death. However, hospital falls are context- and population dependent. This study aimed to investigate the risk factors contributing to falls and the fall profiles among Vietnamese inpatients.

Methods: A nested case–control study was conducted at nine public hospitals in Ho Chi Minh City. For every fall identified through the medical fall incident reporting system, four controls (ie, nonfall patients) were also selected from medical records within the same department and timeframe. Medical records were extracted, which included detailed information about the falls.

Results: Among 101 fall cases and 404 nonfall controls, several risk factors for falls were found, including reduced strength and mobility (OR=3.08, 95% 1.30–7.30), nocturia (OR=9.08, 95% CI 4.04–20.45), having more than two diseases (OR=2.76, 95% CI 1.53–4.98), using walking aids (OR=23.26, 95% CI 10.20–53.03), using medical devices (OR=3.44, 95% CI 1.92–6.15) and using antiepileptics (OR=3.94, 95% CI 1.22–12.77). About 19.8% of the falls occurred within the first 24 hours from admission and the most common time of falls was from 0:00 am to 5:59 am (44.6%). The patient bed and bathroom were the most frequent locations for falls, accounting for 44.55% and 37.62% of the cases, respectively. More than 40% of the falls occurred when the patients were with their personal caregivers.

Conclusion: Although intervention programs can use these risk factors to target those who have a high risk of falling, to optimize resources, such programs should consider the fall patterns found in our study.

Keywords: falls, associated factors, inpatients, profile, Vietnam

Introduction

Falls represent a significant global health concern and are the second leading cause of accidental death worldwide. Annually, approximately 684,000 individuals die due to injuries from falls, with 80% of these fatalities occurring in low- and middle-income countries, especially prevalent in the Western Pacific and Southeast Asian regions.[1] This alarming statistic underscores a critical global health disparity and emphasizes the need for targeted fall prevention strategies in these regions.

Hospital falls, a subset of this broader issue, merit particular attention. Recognized by the Joint Commission International as one of the six pivotal areas necessitating proactive prevention, hospital falls are not merely accidents.[2] Instead, they are often indicative of broader systemic issues within healthcare facilities. In the United States, falls are the third leading cause of hospital-related incidents. The Agency for Healthcare Research and Quality reports an estimated 700,000–1,000,000 hospital fall incidents annually.[3] This trend is mirrored in the United Kingdom, where the National Health Service records nearly 209,000 reported fall cases in hospitals yearly, with approximately 61,000 cases resulting in varying degrees of injury. Importantly, falls are the principal cause of injury-related hospital admissions among

Received: 2 April 2024
Accepted: 11 September 2024
Published: 18 September 2024

individuals over 65 years old, incurring significant costs of about 2.3 billion pounds annually.[4] This demographic trend highlights the vulnerability of the aging population and the consequential strain on healthcare resources.

Although Vietnam, along with countries like Cambodia, Indonesia, and Myanmar, has some of the highest mortality-to-incidence ratios for falls in Southeast Asia,[5] fall-related data in the country, especially within healthcare facilities, are notably scarce. One plausible explanation is that medical incidents, particularly falls, are sensitive issues that have the potential to impact the reputation and credibility of healthcare facilities. Consequently, it is not that data on falls is entirely absent, but rather that healthcare facilities may be reluctant to disclose or report such data. An estimate of about 1.5–1.9 million people over 65 years old experience falls annually in the community, but the incidence rate in healthcare settings remains largely unquantified. Despite the Ministry of Health recognizing falls as a critical patient safety issue, more intensive research on fall prevention within the hospital management paradigm in Vietnam is needed.

Failure to study fall risk factors and fall descriptions can lead to increased morbidity, mortality, and healthcare costs, particularly among vulnerable populations like older adults and stroke survivors. Moreover, without a clear understanding of these risk factors, healthcare systems, especially in low- and middle-income regions like Southeast Asia, may become overwhelmed by the growing burden of fall-related injuries.[5] In contrast, in-depth knowledge about falls can support the development of effective, tailored interventions, which could prevent falls and improve quality of life. Moreover, as the characteristics and contributing factors of falls may vary across different settings and populations, it is crucial to expand research in diverse environments and prioritize the development of effective fall prevention strategies tailored to these specific contexts.[6] Therefore, this study aimed to investigate the risk factors contributing to falls and the fall profiles among Vietnamese inpatients. This research seeks to fill a crucial gap in the existing literature and contribute to the formulation of effective fall prevention strategies within the Vietnamese healthcare context and other similar settings.

Materials and Methods

Setting and Participants

A multicenter nested case–control study was conducted by selecting fall and non-fall cases at multiple hospitals, with retrospective data collection from medical records. This study was conducted at nine public general hospitals in Ho Chi Minh City, Vietnam. The selection encompassed a diverse range of hospital types to ensure a comprehensive representation of the healthcare landscape in the city. This included one University hospital, renowned for its academic and research focus; two tertiary hospitals operating under the direct supervision of the Ministry of Health, known for their high patient influx and complex case profiles; five city hospitals governed by the Department of Health, reflecting the more typical healthcare settings in the city; and one military hospital under the Ministry of Defense, providing insights into the healthcare services for military personnel and their families. These hospitals collectively represent nearly half of the public general hospitals in Ho Chi Minh City and thus our multicenter approach was to improve representativeness and generalizability of the study findings.

This study focused on inpatients over 18 years old admitted to the selected hospitals between January 1, 2019, and December 31, 2022. Patients admitted to obstetrics, pediatrics, or psychiatric departments were excluded because of the unique nature of these departments, where patients are generally at an extremely lower risk of falls because of the high level of care and monitoring they receive. In addition, the obstetrics and pediatrics departments have specific dynamics and risk factors that might skew the general understanding of fall incidents in general hospital settings.

Study Procedures

In this study, sample size calculation was based on the formula for case–control studies.[7] With a 76% exposure rate (ie, individuals aged 65 years or older) among fall cases,[8] an odds ratio of 2.55 (ie, the odds of falling in the advanced age group compared to the non-advanced age group),[8] and a case-to-control ratio of 1:4, a minimum of 83 fall cases and 332 non-fall cases were required. All cases of falls were identified using the medical incident reporting system implemented in the study hospitals. Due to the limited number of falls, for every patient who experienced a fall, we also selected four patients from the same department and within the same admission period to form a control group (Figure 1). This

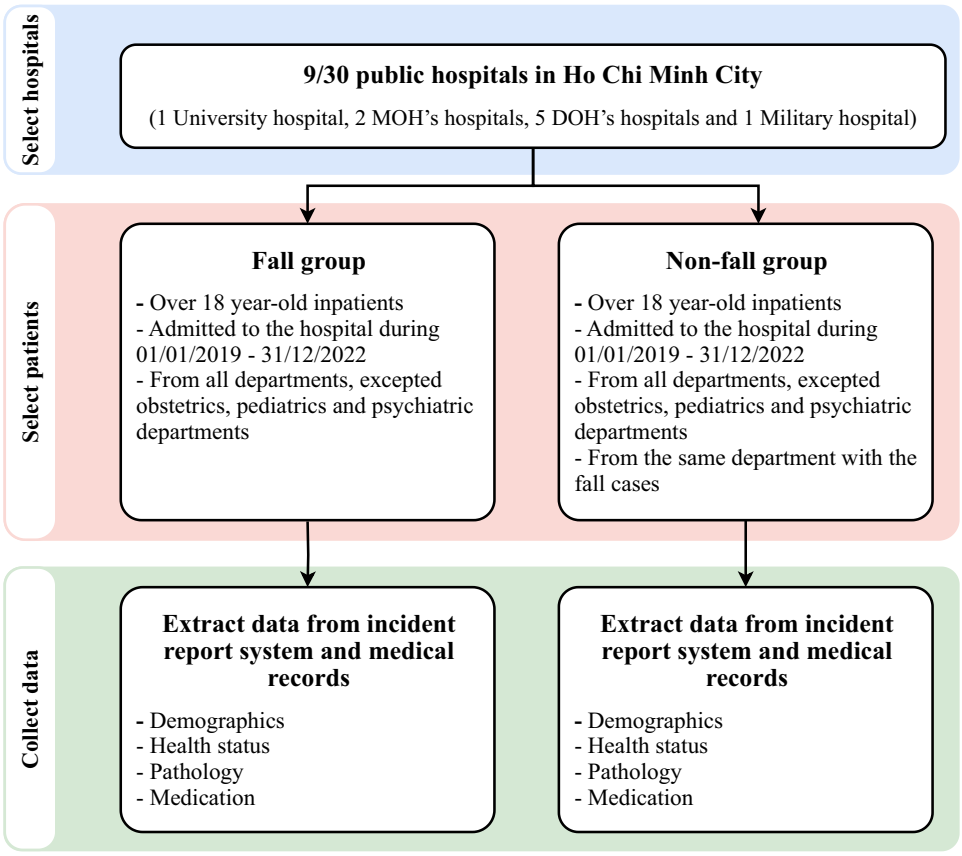

Figure 1 Participants selection flowchart.

approach ensured that the data was accurate and reliable. During the study period, 114 fall incidents were identified using medical incident reporting systems. However, 13 fall incidents were excluded because of their occurrence in pediatric patients (n = 8), outpatient falls (n = 2), or insufficient data collection (n = 4). With 101 fall incidents (88.6%) included in this study, 404 non-fall patients were also included, serving as a control group. This sample size was expected to have a statistical power of at least 80% to detect risk factors with an effect size of at least 2.0 given the prevalence of risk factors ranging from 0.25 to 0.30.

All patient data were extracted from medical records. This study was reviewed and approved by the Institutional Ethics Committees of the University Medical Center at Ho Chi Minh City. Because of the retrospective nature of this study and that data collection was only based on electronic medical records, written informed consent was waived. The data were anonymized and maintained with confidentiality in accordance with the Declaration of Helsinki.

Measurements

Variables included demographic characteristics, health status, pathological features, and medication usage. Demographic characteristics of the patients encompassed variables such as gender, age, presence of a caregiver during hospitalization, and body mass index (BMI). The BMI of patients was calculated using their weight and height, based on the formula: BMI = weight (kg) / height (m^2). The BMI was classified according to the standards of IDI and WPRO, with underweight defined as a BMI <18.5 and overweight or obese as a BMI ≥ 23. Based on a meta-analysis of 32 cohort studies,[9] the BMI classification for patients over 65 years old included underweight (BMI < 23), normal (BMI 24–30), and overweight (BMI > 30). Variables such as history of falls, hypertension, limitations/disorders in mobility, and frequent nocturia were recorded based on patient information at the time of hospital admission. Hypertension was defined as having a systolic blood pressure (SBP) of 140 mmHg or higher or a diastolic blood pressure (DBP) of 90 mmHg or higher. Information about limitations/disorders in mobility was recorded based on observations and assessments by healthcare staff when

evaluating the risk of falls for patients. For pathological and medication usage features, we collected information closest to the time of fall occurrence. The pathological characteristics were recorded as per the physician's notes in the treatment sheet of the medical record, including variables such as pathological condition at admission, comorbidities, surgical indications, use of mobility aids, use of accompanying medical devices, restricted mobility indications, bed bath indications, and physical therapy indications. Regarding medication information, we also based our data on prescribed medication. Drug groups related to falls included anticonvulsants, antidepressants, sedatives, addictive substances, diabetic drugs, and diuretics. The degree of injury of all cases was recorded and classified into almost no, mild, moderate, and severe based on guidelines from Vietnam Ministry of Health.[10]

Data Analysis

The statistical analysis was conducted using Pearson's Chi-squared tests and Fisher's exact tests to compare the differences in qualitative variables between the two groups. For quantitative variables, *t*-tests and Mann–Whitney tests were used when appropriate. Univariate and multiple logistic regression analysis was used to identify independent risk factors. Statistically significant variables from univariate analysis (ie p-value < 0.05) were entered in multiple logistic regression. The final model was fitted based on guidelines provided by Kleinbaum et al.[11] The results of logistic regression were reported in the form of Odds Ratio (OR) and its 95% confidence interval. All data analyses were conducted using Stata version 17.

Results

Risk Factors of Falls Among Inpatients

The percentage of patients at least 65 years old in the fall group was 68.3%, which was more than 2.4 times as high as that in the non-fall group (28.7%) (p<0.001) (Table 1). Patients in the fall group had a significantly higher percentage of all health status indicators including underweight, history of fall, hypertension, mobility disorder and nocturia. Similarly, a statistically higher percentage was found in almost all pathological characteristics and medication used, except for surgical conditions and analgesic drug use.

Table 1 Characteristics of Inpatients in the Two Groups

Variables	Fall (n=*101*)	Non-Fall (n=*404*)	p
	n (%)	n (%)	
Demographic characteristics			
Gender			
Female	47 (46.5)	195 (48.3)	0.755
Male	54 (53.5)	209 (51.7)	
Age category (years)			
< 65	32 (31.7)	288 (71.3)	**<0.001**
≥ 65	69 (68.3)	116 (28.7)	
Having a caregiver	74 (73.3)	274 (67.8)	0.290
Health status			
Body mass index (kg/m^2)			
Underweight	49 (48.5)	100 (24.8)	**<0.001**
Normal	41 (40.6)	182 (45.0)	
Overweight/obese	11 (10.9)	122 (30.2)	
History of fall	25 (24.7)	14 (3.5)	**<0.001**
Hypertension	46 (45.5)	112 (27.7)	**0.001**
Reduced strength and mobility	16 (15.8)	23 (5.7)	**0.001**
Nocturia	28 (27.7)	16 (3.9)	**<0.001**

(*Continued*)

Table 1 (Continued).

Variables	Fall (n=*101*)	Non-Fall (n=*404*)	p
	n (%)	n (%)	
Pathological characteristics			
Neurological disorder	30 (29.7)	114 (28.2)	0.849
Comorbidity	46 (45.5)	112 (27.7)	**0.001**
Surgical condition	31 (30.7)	87 (21.5)	0.065
More than two diseases	65 (64.4)	149 (36.9)	**<0.001**
Using walking aids	40 (39.6)	10 (2.5)	**<0.001**
Using medical devices	55 (54.5)	103 (25.5)	**<0.001**
Mobility restriction indication	41 (40.6)	29 (7.2)	**<0.001**
Bed hygiene indication	28 (27.7)	15 (3.7)	**<0.001**
Physical therapy indication	28 (27.7)	19 (4.7)	**<0.001**
Medication used			
Sedative	14 (13.9)	29 (7.2)	**0.044**
Antiepileptics	9 (8.9)	9 (2.2)	**0.004**
Antidepressant	6 (5.9)	5 (1.2)	**0.011**
Addictive substances	8 (7.9)	11 (2.7)	**0.034**
Analgesic	49 (48.5)	175 (43.3)	0.371
Diabetic drugs	21 (20.8)	37 (9.2)	**0.003**
Diuretics	11 (10.9)	6 (1.5)	**<0.001**

Note: Bold values denote statistical significance at the $p < 0.05$ level.

In the multivariate logistic regression, six factors about health status, pathological characteristics and medication use were associated with fall (Table 2). Regarding health status, patients who had reduced strength and mobility and nocturia were more likely to experience fall, with OR = 3.08, 95% CI 1.30–7.30 and OR = 9.08, 95% CI 4.04–20.45, respectively. Regarding pathological characteristics, falls were significantly associated with having more than two diseases (OR = 2.76

Table 2 Factors Associated with Fall Among Inpatients in Vietnam

	Univariate Logistic Regression			Multivariate Logistic Regression		
	OR	95% CI	p	OR	95% CI	p
Demographic characteristics						
Age category (≥ 65 years)	5.35	3.34–8.58	<0.001			
Health status						
Body mass index (kg/m^2)						
Normal	1					
Underweight	2.18	1.34–3.52	0.002			
Overweight-Obesity	0.40	0.20–0.81	0.011			
History of fall	9.16	4.56–18.43	<0.001			
Hypertension	2.18	1.39–3.41	0.001			
Reduced strength and mobility	3.12	1.58–6.15	0.001	3.08	1.30–7.30	0.011
Nocturia	9.30	4.79–18.05	<0.001	9.08	4.04–20.45	<0.001
Pathological characteristics						
Comorbidity	2.19	1.15–4.17	0.018			
More than two diseases	3.09	1.96–4.87	<0.001	2.76	1.53–4.98	0.001
Using walking aids	25.84	12.28–54.34	<0.001	23.26	10.20–53.03	<0.001
Using medical devices	3.49	2.23–5.49	<0.001	3.44	1.92–6.15	<0.001

(*Continued*)

Table 2 (Continued).

	Univariate Logistic Regression			Multivariate Logistic Regression		
	OR	**95% CI**	**p**	**OR**	**95% CI**	**p**
Mobility restriction indication	8.84	5.11–15.29	<0.001			
Bed hygiene indication	9.95	5.06–19.54	<0.001			
Physical therapy indication	7.77	4.12–14.65	<0.001			
Medication used						
Sedative	2.08	1.06–4.10	0.034			
Antiepileptics	4.29	1.66–11.12	0.003	3.94	1.22–12.77	0.022
Antidepressant	5.04	1.51–16.86	0.009			
Addictive substances	3.07	1.20–7.85	0.019			
Diabetic drugs	2.60	1.45–4.69	0.001			
Diuretics	8.11	2.92–22.50	<0.001			

95% CI 1.53–4.98), using walking aids (OR = 23.26 95% CI 10.20–53.03) and using medical devices (OR = 3.44 95% CI 1.92–6.15). Moreover, patients who used antiepileptics had a significantly higher odds of falling (OR = 3.94 95% CI 1.22–12.77).

Profiles of Falls Among Inpatients

Of the 101 fall cases, 17.8% had not been identified as having a risk of fall at admission and nearly half had been identified as having a high risk of fall at admission (Table 3). Regarding the timing of falls, 19.8% occurred within the first 24 hours from admission, 29.7% within the next 24 hours, and over 50% occurred after 48 hours of admission. The most common time of falls was from 0:00 am to 5:59 am (44.6%), followed by 6:00 am to 11:59 am (22.8%). The patient bed and bathroom were the most frequent locations for falls, accounting for 44.55% and 37.62% of the cases,

Table 3 Profiles of the Fall Incidents (n = 101)

	n	**%**
Fall risk identification at admission		
Not identified	18	17.8
Low	33	32.7
High	50	49.5
Time of fall since admission (hours)		
< 24	20	19.8
24 - < 48	30	29.7
48 - < 72	22	21.8
≥ 72	29	28.7
Time of fall		
6:00 am - 11:59 am	23	22.8
12:00 am - 5:59 pm	17	16.8
6:00 pm - 11:59 pm	16	15.8
0:00 am - 5:59 am	45	44.6
Fall location		
Bed	45	44.6
Restroom	38	37.6
Patient room	16	15.8
Hallway/corridor	2	2.0

(*Continued*)

Table 3 (Continued).

	n	%
Fall-inducing behavior/action		
Using the restroom	36	35.6
Getting down from the bed	21	20.8
Walking out	15	14.9
Rolling off without rails	10	9.9
Sitting on bed	8	7.9
Getting on to the bed	7	6.9
Others	4	4.0
Staying with a caregiver when fall occurs		
No	58	57.4
Yes	43	42.6
Level of injury severity		
Almost no	27	26.7
Mild	37	36.6
Moderate	36	35.7
Severe	1	1.0

respectively. The leading fall-inducing behaviors/actions were found to be using the restroom (35.6%) and getting down from the bed (20.8%). More than 40% of the falls occurred when the patients were with their personal caregivers. Based on the classification of injury severity, more than one-third of falls were moderate (35.7%) and severe (1.0%).

Discussion

Our study is among the first to identify risk factors and profiles of fall cases among inpatients across multiple hospitals in Vietnam. In the search for risk factors of falls, in addition to demographic characteristics, potential risk factors reported in previous studies were also included such as health status, pathological characteristics and medication use. Among these, we found that falls were associated with reduced strength and mobility, nocturia, having more than two diseases, using walking aids, using medical devices, and using antiepileptics. We also found the pattern of falls among inpatients.

Regarding health status, consistent with other studies, we also found decreased mobility function and nocturia associated with falls among inpatients.[12–15] Decreased mobility function increases the risk of falls through a series of impacts related to muscle health and balance maintenance. As muscle strength diminishes, patients encounter difficulties maintaining stability while standing or moving, leading to a higher risk of imbalance. This reduction in mobility also affects the ability to coordinate movements, making it challenging to adjust body position as needed, and may even cause issues in quickly responding to sudden changes in the environment, such as avoiding obstacles, thereby increasing the risk of falls. Similarly, nocturia and urinary frequency increase the risk of falls by necessitating patients to wake up and move to the bathroom multiple times, especially at night. In darkness or dim light, reduced visibility combined with fatigue and sleepiness can decrease reflexes and alertness, leading to a higher risk of tripping or slipping. Furthermore, the need to move quickly can increase the risk of imbalance, especially when patients try to avoid disturbing others at night or to reach the bathroom in time. Therefore, nocturia and urinary frequency not only cause inconvenience but also pose a hidden risk of serious fall-related issues, particularly in the unsafe environments of some hospitals. Our finding underscores the critical role of addressing underlying health issues in fall prevention strategies, as impaired physical functioning and frequent movement, particularly at night, significantly exacerbate fall risks.

Regarding pathological conditions, as expected, individuals with two or more diseases and those using walking aids or medical devices had increased fall risks. Multimorbidity is a well-documented factor that impairs physical functioning and reduces balance, making patients more susceptible to falls.[16,17] The use of walking aids or medical devices, while necessary for mobility, introduces additional challenges, such as difficulty navigating narrow spaces or uneven surfaces,

which increases dependence on hospital infrastructure. For some patients, these conditions are unavoidable and thus, fall prevention relies strongly on the available infrastructure at hospitals. However, due to the inadequate physical infrastructure in some hospitals in Vietnam, these conditions among inpatients can easily result in tripping hazards during patient movement. This finding emphasizes the urgent need for personalized fall-prevention strategies, especially for patients with multimorbidity or those who rely on walking aids or medical devices.

Moreover, a large body of literature indicates that medication use also significantly impacts fall risks. Previous studies suggest that sedatives and antidepressants increase the risk of falls in patients.[18] Many studies have indicated that medications such as anticholinergics and central nervous system drugs (including anxiolytics, hypnotics, sedatives, antipsychotics, opioids, antiepileptics, and antidepressants) can cause inpatient fall incidents.[12–14,19–22] Medication side effects, such as orthostatic hypotension from antihypertensive drugs or hypoglycemia from diabetes medications, also increase fall risk. In our study, the use of antiepileptics was significantly associated with patient falls. This finding suggests the importance of regular medication reviews, especially for those who had a high risk of fall. Adjusting dosages, exploring alternative treatments and close supervision could help mitigate the risks associated with these drugs.

Understanding the differences in associated factors of falls across various settings and populations is essential for developing targeted and effective interventions. For instance, while numerous studies have identified gender as a significant risk factor for falls,[21,23] our study did not find a statistically significant association between gender and the likelihood of falling. This discrepancy may be attributed to differences in the health conditions, physical activity levels, as well as gender-related cultural factors that influence risk differently. However, our finding is consistent with studies conducted in Switzerland and Norway, where gender was also not seen as a major risk factor for falls.[21,22] Similarly, although advanced age (ie ≥65 years) is widely recognized as a significant predictor of falls due to physical decline, balance issues, and the prevalence of chronic health conditions,[17,21,24,25] our study did not find a statistically significant association between advanced age and fall risk. This may be due to the influence of other factors, such as overall functional ability, comorbidities, or the use of assistive devices, which could have played a more prominent role in fall outcomes. These differences suggest that while some factors, such as age and gender, are important in one context, they may not be decisive predictors of fall risk in all populations, underscoring the need for more comprehensive and context-specific approaches to fall prevention.[5,6]

In addition to identifying risk factors of falls, it is extremely important to understand the patterns of falls to optimize the resources and to target prevention. For example, in our study, although patients with more than two diseases were at a significantly higher risk of fall, it is unknown from that finding where and when the falls would occur. In resource-limited settings such as Vietnam, it is impossible to monitor patients all the time. In our study, a significant proportion of falls occurred within 48 hours after hospital admission. In clinical practice, fall risk assessments are conducted at the time of hospital admission, but are not re-evaluated after the patient undergoes medical examination and is prescribed treatment. It is highly probable that the patient's risk factors may have increased during this period, and the absence of subsequent assessments means that preventive and supportive measures are not implemented, leading to an elevated fall risk. Moreover, most falls in our study occurred from midnight to early morning. This period is characterized by limited lighting conditions in patient rooms, restricting visibility and posing challenges for moving patients, especially for restroom use. Furthermore, the bedside and restroom areas are high risk locations for patient falls. In Vietnam, restroom facilities often lack safety measures, with the absence of handrails to assist patients in standing, sitting, or leaning, contributing to falls. Wet floors in restrooms are also a contributing factor. Due to budget constraints, most hospital beds are not equipped with height-adjustable features, making it difficult for patients, particularly those of shorter stature, to get on and off the bed. In addition, the bed design often lacks protective side rails, increasing the risk of patients rolling off. These findings align with similar research conducted by other authors globally.[25–27]

In some healthcare systems globally, having a personal caregiver continuously providing care and support during a patient's hospital stay is rare. However, this practice is common in Vietnam, where patients are often cared for by several family members. This phenomenon is partly related to Vietnamese culture, but primarily due to a shortage of healthcare staff in Vietnam, which compromises the provision of comprehensive care for patients. Typically, a patient will have one primary caregiver present during the morning and another taking over, usually during the night. Interestingly, in our study, among 101 fall incidents, the majority occurred between 0:00 am and 5:59 am (44.6%)

with the presence of a caregiver (42.6%). This result raises significant concerns regarding caregiver's capability and support. Health education for patients' caregivers is a mandatory activity in Vietnamese hospitals, covering from basic assistance such as mobility support, bathing, and dressing, to specific activities such as fall prevention, all communicated by hospital staff to family members in various forms. However, health education is typically conducted only once at the time of admission and for the primary caregiver only. The responsibility of disseminating this information to subsequent caregivers depends on whether the primary caregiver shares it, not on hospital staff. Therefore, based on the study's findings, we also recommend changes in health education for family members, with particular attention to secondary caregivers.

Another important finding from our study is that 32.7% of patients were initially assessed as low fall risk upon hospital admission but eventually experienced falls, while 49.5% assessed as high risk failed to avoid fall. One possible explanation for this is the use of risk assessment tools. Commonly used adult fall risk assessment tools in Vietnam, such as the Morse and Johns Hopkins scales, have been validated and are widely applied globally. However, these tools were developed based on patient populations and healthcare systems that differ from Vietnam's and thus may not fully capture specific factors pertinent to Vietnamese patients, with caregivers being one example. Additionally, competency in risk assessment is another issue, as most assessments in hospitals are conducted by nursing staff who may lack specialized knowledge in certain medical conditions and medication, potentially affecting the accuracy of results. The occurrence of falls among high-risk individuals underscores the limitations in the effective implementation of preventive measures and programs in Vietnamese healthcare settings. Current programs mainly focus on health education, while specific intervention measures such as installing handrails in bathrooms, providing beds with suitable guardrails and adjustable heights, or supplying appropriate clothing and footwear for patients are often overlooked and underemphasized. Moreover, the subjective attitudes of patients and the embarrassment associated with receiving assistance for personal tasks, especially from caregivers of the opposite sex, can also hinder intervention programs and increase fall risk. Based on the issues raised, our study proposes the need to develop a fall risk assessment tool specifically tailored for Vietnamese patients and aligned with the professional competencies of nursing evaluators.

Several implications were found in our study. First, as risk factors of fall are context sensitive depending on multiple features of healthcare such as facility, patient condition, the identification of such risk factors should also be specific to population and context. While the risk factors found in our study should be used to identify those who are likely to fall, we encourage further studies in various settings and populations to optimize intervention and prevention. Second, in addition to identifying risk factors, the characteristics of every fall should be recorded and synthesized to understand the pattern of falls and thus target prevention and intervention. Third, health education alone, even for patients and caregivers might not be sufficient. Instead, systematic reform of health care system focusing more on infrastructure, might be more beneficial. However, in a resource limited setting such as Vietnam, such reform would pose more burden and challenge to the health care system.

Although our study is the first in Vietnam to systematically investigate patient falls in hospitals, there are still several limitations. First, the data used in this study were from medical records or the existing fall reporting system at each study hospital. This approach might introduce biases due to potential negative consequences for healthcare workers, as fall incidents could reflect on their performance or care quality. Second, our study primarily focused on the physical factors of patients and did not investigate their knowledge, attitudes, and behaviors towards fall prevention, especially when they identified themselves at high or low risk. These characteristics may also be important risk factors for fall. In addition, variation in intervention measures across different hospitals could influence outcomes. Due to the many variations at the study hospital, we did not add these in the data analysis. These limitations should be considered when interpreting our study results when conducting future studies.

Conclusion

In our study, several risk factors for fall among Vietnamese inpatients were found, including reduced strength and mobility, nocturia, having more than two diseases, use walking aids or medical devices and using antiepileptics. The fall profile provides critical insights, with most of falls occurring within the first 48 hours of admission, primarily during nighttime (from 0:00 am to 5:59 am), and most frequently in the patient's bed or restroom. These patterns highlight key

periods and locations where targeted prevention efforts should be concentrated. Although intervention programs can use these risk factors to target those who have a high-risk profile for fall, to optimize resources, such programs should consider the fall pattern found in our study. As fall among inpatients depends significantly on the context and populations, more studies are needed to tailor interventions.

Data Sharing Statement

Collected and analyzed data during the study are available from the corresponding author upon reasonable request.

Acknowledgment

The authors would like to thank all hospitals that participated in this study.

Funding

This study received financial support from the University of Medicine and Pharmacy at Ho Chi Minh City through Institutional Grant Theme.

Disclosure

The authors declare that they have no conflicts of interest in this work.

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