Factors Associated With Severity of Falls In Adult Hospital Patients: A Retrospective Audit

Manonita Ghosh (✉ m.ghosh@ecu.edu.au)

Edith Cowan University

Beverly O'Connell

Edith Cowan University

Eben Afrifa-Yamoah

Edith Cowan University

Sue Kitchen

Sir Charles Gairdner Hospital

Linda Coventry

Edith Cowan University

Research Article

Keywords: Clinical Incident Management, Hospital injury, Injurious falls, Nursing, Severity assessment code.

Posted Date: November 30th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-1112336/v1>

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Abstract

Background: Injurious falls in hospital patients are threat to patient safety which can result in a financial burden on the patient's family and health care services. Both patient specific and environmental and organisational factors are associated with injurious hospital falls. It is important to continuously analyse the factors associated with the severity of falls which can inform the implementation of any fall preventive strategies. This study aims to identify risk factors associated with the severity of falls in hospitalised adult patients in Western Australia.

Methods: This study involved a retrospective analysis of hospital inpatient falls records extracted from the hospital's Clinical Incident Database. Falls clinical incidents were reviewed and analysed from May 2014 to April 2019.

Results: There were 3705 complete reported cases of falls with the average age of the patients was 68.5 ± 17.0 years, with 40.2% identified as female. Gender, activity at time of fall and height of fall were associated with the level of severity of the fall. The risk of falling at a higher level of severity increased by approximately 20% (65-74 years), 29% (75-84 years) and 39% (>84 years) respectively compared with patients age <50 years. Females were 15.1% more likely to fall at higher severity condition compared to males ($AOR = 1.151$, 95% $CI: 1.063, 1.247$, $p < 0.001$). Toileting and showering activities were 14.5% more likely to cause falling in higher level of severity ($AOR = 1.145$, 95% $CI: 1.022, 1.284$, $p = 0.020$) compared with attempting to sit or stand. A fall in a communal area was approximately 26% more likely to resulted in higher level of severity ($AOR = 1.257$, 95% $CI: 1.003, 1.576$, $p = 0.047$).

Conclusions: Identification of underlying risk factors associated with the severity of falls provides information which can inform the implementation of fall prevention strategies that mitigate the risk of injurious falls.

Background

Injurious falls in hospitalised patients are a serious concern for patient care. The incidence of inpatient falls ranges from 1.7 to 16.9 per 1000 patient-days [1-4]. The incidence rates for fall-related injuries range from 6.8%–72.1% for mild and 0.7%–30% for severe injuries [5]. These severe injuries can include fracture, subdural hematomas, excessive bleeding, cranial trauma, loss of independence and death [5-7]. Hence, injurious falls are threat to patient safety and quality of life, and responsible for prolonged hospital stay, economic burden on patient family and health care costs [3, 8]. Patients with fall-related injuries in the US were reported to have hospital charges more than \$4200 higher than patients who did not fall [6, 9]. Considering the adverse impact, strategies to prevent injurious falls have been the growing research focus. Yet, patient falls remain steady adverse events in acute care [10-12].

In Australia, falls were reported causing 37% of all injury deaths, and more than 34,000 hospitalisations (3.2 per 1,000 hospitalisations) reported a fall over ten-year trends [13]. The total hospital cost of inpatient falls in six Australian hospitals was \$9.8 million, with \$6.4 million attributed to non-injurious

falls and \$3.4 million to injurious falls [14]. Each fall was associated with increased additional hospital stay (more than eight days) and incurred over \$6669 additional hospital costs [14]. In WA, there were 336 falls-related death reported during a 12-month time in 2016 equating to 11.5 death per 100,000 population, and 26,338 fall-related hospitalisations, an age-standardised rate of 960.7 per 100,000 population in 2017 [15]. Australia has a national standard on monitoring and reporting patient incident system to support falls prevention in hospitals [16].

Recognising the risk factors for severity of falls is critical prior to the establishment of preventive interventions. Studies have reported that inpatient falls are multifaceted involving intrinsic factors and extrinsic factors [3, 17]. Intrinsic factors include patient age, gender, medical condition, mobility impairment, whereas extrinsic factors include organisational structures and environmental factors [5]. Identifying the complex relationship of the underlying risk factors and establishing a profile may contribute to the design of effective prevention, improvement and implementing strategies to eliminate or reduce the risk of injurious falls. While there have been several studies on falls prevalence and falls risk factors, little research is published with specific focus on the variables associated with the severity of the fall. This is the first study to examine multivariable factors associated with severity of falls in adult patients in an acute metropolitan tertiary hospital in Western Australia (WA).

Methods

Design and Data source

This study involved a retrospective analysis of hospital inpatient falls record from the Clinical Incident Management System (CIMS) – an electronic online system implemented by the Department of Health WA (DOHWA) to capture and manage clinical incidents occurred within the WA health system. Reporting falls is mandatory through the CIMS database for monitoring and improving patient safety and evaluating the impact of interventions [18]. Data was collected from one of Australia's leading teaching hospital in WA, handling over 76,000 admissions annually with more than 600 beds and employs about 5500 staff treating over 420,000 adult patients each year.

Data analysis

In the CIMS each patient name was replaced with a Unique-Record-Number (URN) to de-identify them. De-identified records of patients ≥ 18 years who had falls during May 2014 – April 2019 were extracted from the database. Patients with no URN or were entered after April 2019 were excluded ($n = 4231$) from analysis. Intrinsic factors included patient age, gender, behavioural factors including dementia, depression and neurological condition, as well as mobility impairment such as poor balance, and severe foot problems. Extrinsic factors included environmental factors: activity at time of the fall, history of falls, and medication effects; and organisation factors: place of incident, height of fall and intervention in place at the time of the fall. Age was broken down into five groups <50, 50-64, 65-74, 75-84 and > 84 years. Activity at time of the fall was categorised as attempting to sit, stand, bend; getting in or out of bed; toiling or showering; walking or running; and unknown. Place of incident was reported as bathroom, bed,

allied health treatment area, and communal area such as dining room, waiting room, corridor, ground and carpark. As well height of fall was divided into low fall (<0.5m e.g., an ultra-low bed), medium fall (0.5m-1.0m, e.g. chair or stool), high fall (>1.0m, e.g. a high bed) and unknown.

In the CIMS, incidents were graded as three Severity Assessment Code (SAC) (level of severity): SAC 1 = high – defined as a clinical incident that caused serious harm or death; SAC 2 = medium – had or could have caused moderate harm or minor; SAC 3 = low – no harm [18]. Descriptive statistics were calculated for all baseline variables in terms of frequencies and percentages stratified by SAC. We fitted univariable and multivariable generalised ordinal logistic regression models to quantify the magnitude of effects of the variables on SAC and reported the odds ratios. In both univariable and multivariable models, the number of falls was used as an offset to correct for any bias in predicting severity of fall. Number of falls as an offset is addressing recurrence effect or time effect, that is, patients fall history may have some form of “maturity effect” on the outcome of severity that was measured for the most recent fall incident. Comparisons of demographic and clinical characteristics; risk factors; and common interventions with the severity level of the fall were conducted using Chi-square and Fishers Exact test. Missing data for each variable was identified and removed from the analysis. Removing missing data was safe to do so as all deleted rows belonged to SAC3 which was the dominant group. Two-sided p-values <0.05 of a 95% confidence interval (CI) was considered significant, and all analyses were performed using R v 4.1.1 [19] and package `oglmx` [20].

Results

There were 3705 complete reported cases of falls included in this analysis, of which, 3545 patients suffered low level severity, 142 suffered medium level severity and 18 suffered high level severity of falls (Table 1). Patients who had a low level of fall severity had no injuries and the fall did not increase the length of hospital stay; patients who had a medium level of fall severity might have a minor fracture and might require a minor treatment and the fall increased the length of hospital stay less than seven days. Patients who had a high level of falls severity, had a major surgery and length of hospital stay was more than seven days. The average age of the patients was 68.5 ± 17.0 years, with 40.2% identified female. The likelihood ratio and chi-square tests revealed that gender, activity at time of the fall and height of fall were associated with the severity of the fall.

Table 1 Comparison of demographic and clinical characteristics and the severity level of the fall

^aLikelihood Ratio test; ^bChi-square.

*Denotes significant association at 5% level of significance.

Variables associated with the severity level of the fall

In the multivariable model assessing the association of age and severity of fall, using age bracket (<50 years) as the reference group, the results indicated that individuals in the age brackets 65-74 years were

Variables	N = 3705	Level of severity			p-value
	n (%)	Low	Medium		
		High			
		(n=3545) (n=18)	(n=142)		
Age					0.216 ^a
< 50	508 (13.7)	482 (13.7)	25 (17.6)	1 (5.6)	
50-64	844 (22.8)	808 (22.7)	30 (21.1)	6 (33.3)	
65-74	801 (21.6)	722 (21.9)	25 (17.6)	4 (22.2)	
75-84	868 (23.4)	835 (23.5)	32 (22.5)	1 (5.6)	
> 84	684 (18.5)	648 (18.2)	30 (21.1)	6 (33.3)	
Gender					0.029 ^{b*}
Male	2216 (59.8)	2133 (60.1)	77 (54.2)	6 (33.3)	
Female	1489 (40.2)	1412 (39.9)	65 (45.8)	12 (66.7)	
Activity at the time of fall					0.042 ^{b*}
Attempting to sit/ stand/ Bending and reaching over	1350 (36.4)	1311 (35.0)	36 (25.4)	3 (16.7)	
Getting in/out of bed	685 (18.5)	652 (17.2)	31 (21.8)	2 (11.1)	
Toileting and showering	869 (23.5)	824 (21.8)	41 (28.9)	4 (22.2)	
Walking & running	676 (18.2)	648 (17.6)	21 (14.8)	7 (38.9)	
Unknown	98 (2.6)	83 (8.4)	13 (9.2)	2 (11.1)	
Place of incident					0.380 ^b

Bathroom	909 (24.5)	871 (24.5)	33 (25.4)	5 (31.3)
Bed	1301 (35.1)	1257 (35.3)	41 (31.5)	3 (18.8)
Allied health treatment area	1356 (36.6)	1301 (36.6)	49 (37.7)	6 (37.5)
Communal area	139 (3.8)	130 (3.7)	7 (5.4)	2 (12.5)
Height of fall				
				<0.001^{b*}
Low fall (< 0.5 m)	1460 (39.4)	1436 (37.6)	41 (28.9)	2 (11.1)
Medium fall (0.5 – 1.0 m)	1761 (47.5)	1716 (44.9)	67 (48.5)	12 (66.7)
High fall (> 1.0 m)	31 (0.8)	25 (0.7)	6 (7.2)	0 (0)
Unknown	453 (12.2)	404 (16.8)	12 (15.4)	4 (22.2)

19.5% more likely to fall at a higher severity level ($AOR = 1.195$, 95% CI: 1.044-1.367, $p = 0.010$), in the 75-83 years were 29.3% more likely to fall at a higher severity level ($AOR = 1.293$, 95% CI: 1.133-1.477, $p < 0.001$) and > 84 years were 39.1% more likely to fall at a higher severity level ($AOR = 1.391$, 95% CI: 1.210-1.599, $p < 0.001$). Females were 15.1% more likely to fall at higher severity level compared to males ($AOR = 1.151$, 95% CI: 1.063, 1.247, $p < 0.001$). With respect to activity at time of the fall incidents during toileting and showering activities were 14.5% more likely to fall in higher level of severity ($AOR = 1.145$, 95% CI: 1.022, 1.284, $p = 0.020$) compared with attempting to sit or stand.

Using bathroom as the reference point, fall incident in a communal area was approximately 26% more likely to fall in higher level of severity ($AOR = 1.257$, 95% CI: 1.003, 1.576, $p = 0.047$). In the univariable analysis using low fall height (< 0.5 m) as the reference group, fall incidents with unknown height were 18.1% more likely to be associated with a higher level of severity ($OR = 1.181$, 95% CI: 1.015, 1.374, $p = 0.031$). However, none of the height of falls were found significant in the multivariable model.

Comparison of patient risk factors and the severity level of the fall

Additional assessment was carried out to examine intrinsic factors: history of falls, behavioural, medication and mobility factors of individuals involved in fall incidents and the associated level of severity (Table 3). Under behavioural factors, depression and alcohol or illicit drug use revealed significant association with the level of severity associated with fall incidents. Polypharmacy was identified to have a trend towards significant association with the level of severity associated with fall incidents. In relation to mobility, conditions such as poor balance, and requiring standby assistance had

significant association with the level of severity. Muscular weakness was identified to have a trend towards significant association with the level of severity associated with fall incidents.

Table 2 Univariable and multivariable risk factors associated with the severity level of the fall

Variables	Univariable analysis			Multivariable analysis		
	Est. (SE)	OR (95% CI)	p-value	Est. (SE)	AOR (95% CI)	p-value
Intercept				-1.889 (0.078)	0.151 (0.130-0.176)	< 0.001*
<i>Age</i>						
< 50	0	1	-	0	1	-
50-64	-0.065 (0.065)	0.937 (0.824, 1.065)	0.320	-0.051 (0.068)	0.951 (0.832, 1.086)	0.457
65-74	0.149 (0.066)	1.161 (1.020, 1.321)	0.023*	0.178 (0.069)	1.195 (1.044, 1.367)	0.010*
75-84	0.250 (0.065)	1.284 (1.131, 1.459)	< 0.001*	0.257 (0.068)	1.293 (1.133, 1.477)	< 0.001*
> 84	0.328 (0.068)	1.389 (1.231, 1.601)	< 0.001*	0.330 (0.071)	1.391 (1.210, 1.599)	< 0.001*
<i>Gender</i>						
Male	0	1	-	0	1	-
Female	0.154 (0.039)	1.166 (1.080, 1.260)	< 0.001*	0.141 (0.041)	1.151 (1.063, 1.247)	0.001*
<i>Activity at fall</i>						
Attempting to sit/ stand/ Bending and reaching over	0	1	-	0	1	-
Getting in/out of bed	0.040 (0.057)	1.041 (0.932, 1.163)	0.476	0.068 (0.059)	1.070 (0.953, 1.201)	0.251
Toileting and showering	0.162 (0.522)	1.175 (1.061, 1.303)	0.002*	0.136 (0.058)	1.145 (1.022, 1.284)	0.020*
Walking & running	0.015 (0.056)	1.015 (0.909, 1.134)	0.787	-0.062 (0.061)	0.940 (0.834, 1.060)	0.311
Unknown	0.135 (0.074)	1.144 (0.990, 1.322)	0.067	0.160 (0.115)	1.174 (0.938, 1.470)	0.161

<i>Place of incident</i>						
Bathroom	0	1	-	0	1	-
Bed	-0.148 (0.053)	0.862 (0.777, 0.956)	0.005*	-0.112 (0.060)	0.894 (0.794, 1.006)	0.062
Allied health treatment area	-0.040 (0.052)	0.960 (0.867, 1.064)	0.441	0.002 (0.058)	1.002 (0.895, 1.123)	0.969
Communal area	0.144 (0.111)	1.155 (0.929, 1.437)	0.195	0.229 (0.115)	1.257 (1.003, 1.576)	0.047*
<i>Height of fall</i>						
Low fall (< 0.5 m)	0	1	-	0	1	-
Medium fall (0.5 – 1.0 m)	0.071 (0.043)	1.074 (0.988, 1.168)	0.094	0.084 (0.045)	1.088 (0.996, 1.189)	0.063
High fall (> 1.0 m)	-0.103 (0.220)	0.902 (0.586, 1.390)	0.641	-0.020 (0.221)	0.980 (0.636, 1.151)	0.928
Unknown	0.166 (0.077)	1.181 (1.015, 1.374)	0.031*	0.128 (0.079)	1.136 (0.973, 1.327)	0.107

*Denotes significant association at 5% level of significance

Table 3 Comparison of risk factors and the severity level of the fall

^b Chi-square; ^c Fisher exact.

*Denotes significant association at 5% level of significance.

Italic p-values indicate a trend towards significance.

Discussion

This study examined the factors that are associated with the severity of patient falls, using five years of data extracted from a clinical incident database in an acute hospital setting. Distinguishing intrinsic and extrinsic factors associated with falls was not possible, because both patient risk and environmental and organisational risks factors were interrelated. Such as poor balance or general muscular weakness (intrinsic) overlapping with place of incidents and its environmental risk (extrinsic). Therefore, it was practical to examine the associated factors which may provide an opportunity to improve policy and procedure and develop intervention by identifying the severity of falls which can cause serious injuries

Risk Factors	Level of severity			
	Low	Medium	High	p-value
	(n=3545)	(n=142)	(n=18)	
<i>History of fall n (%)</i>				
No falls history	1,414 (37.0)	52 (36.6)	10 (55.6)	0.26 ^b
>1 fall in previous 6 months				0.28 ^b
Admitted as a result of a fall	1,472 (38.5)	47 (33.1)	5 (27.8)	0.63 ^b
Had fall/s or near miss/es during current admission	638 (16.7)	27 (19.0)	4 (22.2)	0.52 ^b
	775 (20.3)	34 (23.9)	3 (16.7)	
<i>Behavioural n (%)</i>				
No behaviour/mental state/cognition issues	1,049 (27.4)	40 (28.2)	6 (33.3)	0.84 ^c
Dehydration			1 (5.6)	0.70 ^c
Delirium, anxiety, agitation issues	226 (5.9)	6 (4.2)	6 (33.3)	0.59 ^b
Dementia/Cognitive impairment issues	1,072 (28.0)	35 (24.6)	3 (16.7)	0.70 ^c
Difficulty communicating or following instructions	1,014 (26.5)	36 (25.4)	4 (22.2)	0.75 ^c
Impaired consciousness			1 (5.6)	0.42 ^c
Intellectual disability affecting judgement of physical ability	1,045 (27.3)	35 (24.6)	1 (5.6)	0.18 ^c
Marked depression	192 (5.0)	10 (7.0)	2 (11.1)	0.04 ^{c*}
Neurological condition	157 (4.1)	2 (1.4)	2 (11.1)	0.77 ^c
Under the influence of alcohol or illicit drugs	131 (3.4)	9 (6.3)	0 (0.0)	0.001 ^{c*}
	750 (19.6)	27 (19.0)		
	105 (2.7)	13 (9.2)		
<i>Medication n (%)</i>				
No medication issues	1,061 (27.8)	55 (38.7)	5 (27.8)	0.02 ^{b*}
Diuretics			2 (11.1)	0.97 ^c
General Anaesthetic (within 24/24)	490 (12.8)	17 (12.0)	0 (0.0)	0.30 ^c
Polypharmacy - more than 5 prescribed medications	69 (1.8)	5 (3.5)	12 (66.7)	0.07 ^{b*}
Psychoactive medications	1,877 (49.1)	59 (41.5)	2 (11.1)	0.71 ^c

Sedation within 12/24 of assessment	654 (17.1)	21 (14.8)	0 (0.0)	0.38 ^c
Substantial change to medication regime	304 (8.0)	8 (5.6)	1 (5.6)	0.16 ^c
	118 (3.1)	1 (0.7)		
<i>Mobility n (%)</i>				
No mobility transfer issues	217 (5.7)	13 (9.2)	0 (0.0)	0.18 ^c
Dizziness, light-headedness, faintness, dehydration	541 (14.2)	21 (14.8)	0 (0.0)	0.23 ^c
Impaired lower limb peripheral sensation	486 (12.7)	12 (8.5)	3 (16.7)	0.24 ^c
Lower limb amputee	76 (2.0)	1 (0.7)	0 (0.0)	0.67 ^c
Neurological condition	462 (12.1)	16	0 (0.0)	0.34 ^c
Non or partial weight-bearing	274 (7.2)	(11.3)	1 (5.6)	0.40 ^c
Poor balance, unsteady	2,333 (61.0)	6 (4.2)	12 (66.7)	0.02 ^{b*}
Poor vision, such that it affects mobility	283 (7.4)	70 (49.3)	1 (5.6)	0.95 ^c
Requires assistance to mobilise	1,727 (45.2)	11 (7.7)	9 (50.0)	0.37 ^b
Requires standby assistance		56 (39.4)	11 (61.1)	0.002 ^{b*}
Requires walking aid or similar	1,500 (39.2)	39 (27.5)	10 (55.6)	0.21 ^b
Severe foot problems	1,462 (38.2)	49 (34.5)	1 (5.6)	0.59 ^c
Significant pain when walking, transferring	249 (6.5)		1 (5.6)	0.38 ^c
Urge incontinence, occasional incontinence	253 (6.6)	12 (8.5)	4 (22.2)	0.69 ^c
Weakness, generalised muscular weakness	590 (15.4)	13 (9.2)	7 (38.9)	0.08 ^{b*}
	1,142 (29.9)	22 (15.5)		
		31 (21.8)		

and harm.

In this study, the risk of falling with a higher level of injury-severity increased by approximately 20% for patients aged 65-74 years, 29% for patients aged 75-83 years and 39% for patients aged over 84 when compared to patients who were aged 50 years or younger. The results of increasing rate of falling with higher severity with increasing age in this study is consistent with other studies which indicated that older the patient, the higher the odds of a fall [6, 21, 22]. Older patients might also be vulnerable to high level of fall injuries due to co-existing health problems compared with their younger counterparts. In this study,

gender was a significant risk factor, where females were 15.1% more likely to fall in higher severity condition. While gender-specific risk factor is not common in inpatient-falls research, the proportion of injurious falls reported to be much higher among females than males in aging population in community dwelling-houses [23, 24].

Fall from a height was 1.2 times more common in older adult female patients leading to traumatic brain injuries requiring hospital admission [25]. Factors such as stroke, age of 85 years or older, nutritional risk, consumption of alcohol, use polypharmacy, arthritis, diabetes and osteoporosis were found to be independently correlated with female fallers [26]. The cause for gender differences in fall-related injuries is unclear. Gender differences in biomechanical differences in the gait pattern [27] could be a critical factor which was reported associated with knee osteoarthritis in older females [28]. Another possible reason could be related to footwear which can have detrimental effects on gait pattern, postural balance and other part of musculoskeletal system which cause females for falls and fall-injuries than males [29, 30]. Females have a longer life expectancy than males and so are more likely to have an increased need for nursing or residential home care [31, 32]. This also could explain the higher falls among females in aged care residents.

In our study, it was observed that falls occurring from toileting and showering activities were 14.5% more likely to result in a higher level of fall severity compared to attempting to sit, stand or reaching over. Patient falls specifically related to bathroom activities is of particular concern. Bathroom activities have resulted in 38% to 47% of falls in US hospitals [33]. Many of the falls with injuries were directly related to toileting or showering [34]. In another study, fall injuries were 2.48 times greater if a fall occurred in bathroom [4]. Fall incident in communal areas was approximately 26% more likely to fall in higher level of severity. Falls were found more likely than expected to be occurred in communal areas in a previous study [35]. These communal areas are more likely to be unattended and un-witnessed by nurses, and/or lack in risk assessment and falls prevention interventions in place. Kobayashi et al. [36] reported that falls occurred in waiting room due to the arrangement of chairs, and slippery mats at entrances, and in parking places due to its distance from hospital wards and stairs. Falls were also occurred in the passage and dining room where no call bell was available [37].

Under behavioural factors, depression and alcohol or illicit drug were major risk factors for fall incidents and significantly contributed to the level of severity. Similar to our study, patients with depression were reported to have increased odds for in-hospital fall related major injuries [38]. Depression and the use of antidepressant drug was found to increase falls risk [39, 40]. Illicit drug use was reported to be associated with increased odds of injurious falls in patients living with HIV [41]. Unlike our study the association between history of consumption of alcohol and falling was not evident in community-dwelling older adults [42-44]. The relationship of alcohol consumption and falls in community and hospital settings is unclear and deserves future investigations. Similarly, the significant association of 'no medication issues' for severity of falls is unclear and warrants further investigations. Polypharmacy was reported to be significantly associated with an increased risk of falls and fractures in older people [45-47]. The significant association of polypharmacy for severity of falls was also evident in nursing home residents

[48, 49] and community settings [42]. Patients' routine medication reviews need to be considered to mitigate the severity of fall and fall-related injuries during hospital stay. Mobility impairment due to poor and unsteady balance or muscular weakness which may or may not require standby assistance was revealed to be significant risk factors for the severity of falls, was consistent with other studies which showed mobility impairment and activities with daily living dependency as higher risk of falls [21, 22].

Limitations

As the clinical incident reports are completed by a large number of nurses with various level of experience and different backgrounds, some classification of patient information can be prone to a variation in clinical judgement. As the study was conducted in one teaching hospital, generalisability of the finding is limited to similar acute care hospital settings. However, one can anticipate that severity of falls and associated risk factors would be similar at other major metropolitan teaching hospitals. Future studies should consider matching faller and non-faller groups on selected demographic variables to compare similarities and differences on the risk factors found to be significant. Future studies may consider examining disease-specific risk factors for severity of falls.

Implication for clinical practices

Preventing patient falls is an important endeavour and continues to be of interest to clinicians and researchers. Health care facilities have introduced robust falls prevention strategies such as screening patients to establish their level of risk and fall prevention care plans to reduce the number of patient falls; however, patients continue to fall. It may be that preventing falls is a difficult task unless there is the capacity for twenty-four-hour supervision, which is unrealistic. Consequently, the focus should be on how clinicians reduce injurious falls. The findings of this study add to the fall's literature identifying that the major factors associated with increased severity of falls is increased with age, being female, performing activities around toileting and showering and being in a communal space. It may be useful to provide both patients and the general community with written and media information of these issues so they can independently be more vigilant about their own risk factors and how to be more proactive about falls prevention. This may be a more efficient strategy worthy of exploring.

Conclusion

This study provides information on factors associated with the severity of falls over a five-year period in an acute care hospital. The results showed multivariable factors of increased age, being female, toileting and showering were all associated with increased severity of a fall. Additionally, univariable factors of depression, under the influence of alcohol or drugs, poor balance and requiring standby assistance were also associated with increased severity of falls. The findings suggest that assessments of severity of fall risk should weigh these variables which are associated with the severity of fall identified in this study. Interventions are recommended to be developed or implemented based on these variables. Given the differences in the severity of falls by age and gender, hospital executive must consider that one size fits all approach is not effective when developing and implementing severity of fall-prevention strategies at

both intrinsic and extrinsic level. Identification of underlying risk factors associated with the severity of falls may provide information that can inform the implementation of fall prevention strategies that mitigate the risk of injurious falls.

Abbreviations

AOR: Adjusted Odds Ratio; CI: Confidence Interval; CIM: Clinical Incident Management; DOHWA: Department of Health WA; ECU: Edith Cowan University; SCGOPHCG: Sir Charles Gairdner Osborne Park Health Care Group; WA: Western Australia

Declarations

Acknowledgements

The authors acknowledge the staff from School of Nursing and Midwifery, Edith Cowan University, and Centre for Nursing Research, Sir Charles Gairdner Osborne Park Health Care Group for their support and assistance with data extraction and data cleaning.

Authors' contributions

All authors made substantial contributions to conception and design of the study, data analysis, interpretation of data and drafting the manuscript. All authors critically revised the manuscript for important intellectual content and approved the final version to be published.

Funding

Not applicable.

Availability of data and materials

Ethical approval was not obtained to make the data publicly available.

Declarations

Not applicable.

Ethics approval

The study obtained approval from WA Health for quality improvement (GEKO-33027) and Edith Cowan University Human Research Ethics Committee (2019-00653-COVENTRY).

Competing interests

Authors have no competing interests to declare.

Consent for publication

Not applicable.

Author details

¹School of Nursing and Midwifery, Edith Cowan University, 270 Joondalup Drive, Joondalup, WA 6027, Australia. ²Centre for Nursing Research, Sir Charles Gairdner Osborne Park Health Care Group, North Metropolitan Health Service, Level 1, Harry Perkin's Building, Sir Charles Gairdner Hospital, 6 Verdun Street, Nedlands WA 6009. ³Centre for Research in Aged Care, Edith Cowan University, 270 Joondalup Drive, Joondalup, WA 6027, Australia. ⁴School of Science, Edith Cowan University, 270 Joondalup Drive, Joondalup, WA 6027, Australia. ⁵CNC Clinical Lead Falls Management and Chair Falls MD Committee, Sir Charles Gairdner Hospital, WA 6009, Australia.

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