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## REVIEW

# Factors associated with risk of falling among younger inpatients in a mental health setting—A systematic review

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**Abstract**

**Aim:** To synthesise evidence related to risk factors of falls among younger mental health inpatients age  $\leq 65$  years old.

**Background:** Hospitalised patients with mental illness are at increased risk of falling. Specific risk factors for falls for younger inpatients are poorly understood.

**Design:** Systematic review.

**Methods:** Medline, CINAHL, APA PsycINFO, Scopus and Web of Science were searched for studies published in English till December 2022. The review followed the 2020 PRISMA checklist. Odds ratios and P values of significant risk fall factors and the frequency of factors related to circumstances of falls were extracted.

**Results:** Nine studies were included and 95 risk factors, across seven categories were extracted. These categories included socio-demographic, fall-related factors, functional status, health and mental status, psychiatric diagnosis and assessment, medication, and staff related factors. Factors related to medication, health and mental status are most reported. Majority of the patients sustained minor or no injury from the fall and circumstances of fall vary across studies.

**Conclusion:** Factors strongly associated with risk of falls were dizziness, use of psychotropics and antihypertensive drugs. A meta-analysis of risk factors was not possible due to different dependent variables studied, controlled confounding variables and control groups used.

**Relevance to clinical practice:** Fall prevention is relevant to all patients in mental health settings. Approaches to fall risk assessment and management need to be better tailored to younger mental health patients in the psychiatric setting.

**Patient and public contribution:** Patient or public contribution was not possible because of the study design.

**KEYWORDS**

accidental falls, inpatients, mental disorders, psychiatric hospitals, risk factors

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## 1 | INTRODUCTION

The World Health Organisation defines a fall as the act of a person inadvertently coming to rest on the ground or other lower level (World Health Organisation, 2021). Adverse events resulting from patient falls in hospitals account for between 38 and 41% of patient safety incidents (Hemsley et al., 2019), with an estimated rates of 2 to 8 falls per 1000 bed days in the acute hospital settings (Morris et al., 2022). Falls resulting in injury are the leading cause of hospital-acquired morbidity and mortality among older people. In Australia, patients experiencing fracture or intracranial injury due to falls remained in hospital for 18.8 days longer than the average length of hospital stay and cost an extra of \$38,991 per admission (Australian Commission on Safety and Quality in Health Care, 2018). The Australian Commission on Safety and Quality in Health Care (2017) therefore identifies that the prevention of falls and harm from falls as a priority area due to the significant impacts of fall injury on patients, families and health services.

Although financial costs related to falls are difficult to compare across countries due to the varied variables used to examine such costs, Australia's increasing financial burden associated with falls is likewise observed in numerous other nations (Florence et al., 2018). In individuals aged 65 years and above, the annual expense for hospitalisation resulting from fall-related injuries and deaths was £2.3 billion (US\$ 2.8 billion) in the UK and US\$ 29.2 billion in the United States in 2018 (Florence et al., 2018). These expenditures are anticipated to surge significantly, reaching a staggering US\$ 240 billion by 2040 (World Health Organisation, 2007).

The World Health Organisation estimated that one-eighth of the global population will suffer a mental illness throughout their lifetime (World Health Organisation, 2022). Mental illnesses with the highest morbidity rate include anxiety, depression and bipolar, with a cumulative global diagnosis count of 301 million, 280 million and 40 million individuals, respectively, in 2019 (World Health Organisation, 2022). These disorders significantly contribute to the proportion of individuals necessitating hospitalisation for mental health concerns (World Health Organisation, 2022). Recent data reveal that depression remains the foremost principal diagnosis among patients admitted to mental health settings (Australian Institute of Health and Welfare, 2022; Mudgal et al., 2020).

Patients in the mental health settings may experience a higher incidence of falling than those in the general acute care settings due to their psychiatric conditions and related treatments (Blair & Gruman, 2005; Turner et al., 2020). Nurses and allied health staff are required to provide appropriate screening, assessment and clinical interventions for patients at risk of falling according to best clinical practice guidelines in these settings. As summarised by McMinn et al. (2016), risk factors for falls and injuries among older inpatients in mental health unit include age, poor nutrition, medical illnesses, mental disorders, psychiatric treatments, mobility, visual perception and sleep. In a recent study, Chang and Jen (2021) reported that psychiatric inpatients who had dizziness, unsteady gait and not

### Impact

#### What problem did the study address?

- The risk of falling for patients in hospital with mental illness.
- Treatment for mental illness may increase the risk of falling.

#### What were the main findings?

- Younger people with mental illnesses are also at risk of falling.
- Patients with serious mental illness and those on multiple medications are at an increased risk of falls.
- The risk of falls is higher during medication adjustment—ceasing or tapering.

#### Where and whom will the research have an impact?

- Fall prevention strategies need to include younger inpatients with mental illness.
- Increased visual and physical observations may be needed during medication adjustments or changes.

using aids were at greater risk of falling. Tängman et al. (2010) found that acute side effects of drugs including neuroleptics accounted for more than half of the falls. These findings are supported by a systematic review that found that medication use was a recurring risk factor for falling among inpatients in the mental health settings (Thibaut et al., 2019).

A recent study from Japan by Suga et al. (2021) that assessed age differences in risk factors for falls requiring treatment reported that about 30% of the incidents were of younger patients (below 65 years old). Older patients who fell were more likely to suffer from organic mental disorder and younger fallers suffered from schizophrenia (Suga et al., 2021). The study also found that older mental health patients were more likely to fall due to decreased activities of daily living, while younger patients are susceptible to risk of falling due to side effects of medication affecting gait and mental status (Suga et al., 2021). However, Meng et al. (2010) reported that young females with eating disorders faced a similar risk of falling, even if they were not taking psychotropic medications. Further, most falls took place while the patients were walking next to the bed but these did not result in severe injuries. Mostly, the patients were alert, oriented, and did not exhibit muscle weakness or a prior history of falls (Meng et al., 2010).

Few studies focused on the perspective of staff. Abraham (2016) conducted a cross-sectional study on nursing directors' perceptions of patient falls in psychiatric inpatient units found that participants

believed intrinsic factors such as history of falls, psychotropic medications and agitation, were more strongly related to the likelihood of patients experiencing recurrent falls than extrinsic factors such as teamwork, physical therapy evaluation and supervision. Lee et al. (2012) reported that the most common root cause of falls with injury in the psychiatric unit is problems with rules, policies and procedures such as falls assessment not being done, and lack of fall prevention interventions. More recently, a database search of adverse events in acute mental health units also identified the main causes for falls is poor communication of patients' fall risk between shifts and poor systems for evaluating falls risk of patients (Mills et al., 2018).

The circumstances of falls varied according to patients' characteristics and activities. In a descriptive study of falls in an inpatient geriatric psychiatric unit, patients who experienced falls were older than non-fallers, had higher activity level and were ambulating before the falls occurred (Blair & Gruman, 2005). Many of the fallers only sustained minor injuries and had no prior history of falling. Likewise, a root cause analysis of falls in Veterans Affairs hospitals from the United States, Lee et al. (2012) reported that most falls occurred when patients were getting up from a bed, chair or wheelchair (21.3%) followed by walking or running (10.7%). These findings were confirmed by a review of 139 falls in two older adult mental health units in Western Australia that most patients had fallen around the bed area, during walking and sustained minor harm that do not require treatment (Heslop et al., 2012). Since the study only focused on older adult mental health patients, it is unclear if the circumstances of falls were related to increasing age or specific acute and/or mental health diagnosis.

Nurses and allied health staff are required to provide appropriate screening, assessment and clinical interventions for patients at risk of falling according to best clinical practice guidelines in these settings. The phenomenon and risk factors of falls must be viewed from a multifaceted perspective to identify the best possible fall prevention interventions for the patients. To date, there is no systematic review of literature that explores evidence related to the fall risk factors of younger mental health inpatients. Previous reviews only focused on older mental health patients or the risk factors for the general population of psychiatric inpatients (McMinn et al., 2016; Rao et al., 2018). It is unclear if the risk factors related to older patients are significant for younger patients in the mental health unit. Our review will address two research questions including (1) What are the risk factors of falls among younger inpatients (<65 years) in the mental health units, and (2) What are the circumstances associated with the fall incidents in the inpatients in mental health units. The study will inform fall prevention strategies for patients in acute mental health including staff, patient and family education.

## 2 | AIM

This study aimed to synthesise evidence related to risk factors and circumstances of falls among younger mental health inpatients aged ≤65 years old.

## 3 | METHODS

### 3.1 | Design

This review followed the 2020 updated Preferred Reporting Items for Systematic and Meta-analysis (PRISMA) statement (Page et al., 2021) (Supplementary file 1). This approach incorporates outlining the rationale for the review and the objectives, selection of studies, quality assessment of the studies, data extraction and synthesis of the data into a narrative format. The protocol for the systematic review was developed in collaboration between all authors and registered with the International Prospective Register of Systematic Reviews (PROSPERO registration number: CRD42022303386).

### 3.2 | Inclusion and exclusion criteria

To address the research questions, the review included (a) quantitative studies (prospective and retrospective cohort studies, case-control studies, cross-sectional studies and experimental studies) comparing the risk factors of patients with and without falls, (b) published in English till December 2022, and (c) explored risk factors of falls among younger inpatients aged 65 and below in the mental health care unit. Studies that recruited older patients were included if the analysis of younger patients aged below 65 could be distinguished from the results.

The studies were excluded if they: (a) focused on patients aged 65 and over, (b) did not examine the risk factors of falls, or (c) were not carried out in an inpatient mental health setting.

### 3.3 | Search strategy

A comprehensive search was conducted using Medline, CINAHL, APA PsycINFO, Scopus and Web of Science in December 2022. No date restrictions were applied. The search strategy used keywords and Mesh terms related to the four concepts: 'mental disorders', 'accidental falls', 'psychiatric hospital' and 'inpatients'. An initial search was developed using Medline and validated with the University librarian. After which, the search terms were used for searching other databases. Additional records were also identified from the reference lists of all selected studies. The full search term list is presented in Table 1.

### 3.4 | Study selection

Following the search, the search results were uploaded into EndNote 20 and duplicates removed. Two independent reviewers screened the titles and abstracts against the inclusion and exclusion criteria and studies that met the inclusion criteria were retrieved

TABLE 1 Full search strategy and search terms used.

No	Search	Medline	CINAHL	PsyINFO	Scopus	Web of science
1	"mental disorder*"	224,208	82,350	196,578	223,580	63,850
2	"mental illness*"	165,311	64,249	112,055	57,170	55,025
3	"psychiatric illness*"	146,421	49,454	80,626	12,425	9891
4	"psychiatric disorder*"	176,995	56,350	103,214	62,258	68,862
5	MH "Mental Disorders"	175,243	66,595	—	—	—
6	"accidental fall*"	28,464	26,069	4201	26,421	3038
7	"fall* risk*"	6261	7840	1503	10,648	8149
8	"fall* risk factor*"	734	5048	205	873	792
9	"risk* of fall*"	7990	5149	1712	9167	7608
10	"fall* predictor*"	75	45	23	93	84
11	"predictor* of fall*"	505	329	140	505	525
12	MH "Accidental Falls"	27,694	25,965	—	—	—
13	"psychiatric hospital*"	31,359	7658	33,107	18,443	11,553
14	"psychiatric unit*"	3984	4169	5768	4041	2558
15	"psychiatric ward*"	2554	1135	2654	3515	2273
16	"psychiatric inpatient*"	5850	2270	9180	7290	6923
17	MH "Hospitals, Psychiatric"	25,958	7569	—	—	—
18	Inpatient*	145,226	131,406	80,894	164,193	143,970
19	"Hospital* patient*"	65,918	27,358	19,706	160,123	57,787
20	MH "Inpatients"	28,135	87,049	—	—	—
21	1 OR 2 OR 3 OR 4 (OR 5)	284,413	104,183	248,134	310,875	178,834
22	6 OR 7 OR 8 OR 9 OR 10 OR 11 (OR 12)	33,927	28,649	5310	36,579	16,171
23	13 OR 14 OR 15 OR 16 (OR 17)	49,225	15,762	44,446	30,576	21,234
24	18 OR 19 (OR 20)	191,484	145,849	89,110	265,391	194,450
25	21 AND 22 AND 23 AND 24	25	10	22	17	3

Note: No 21 to 24: MeSH terms only included for Medline and CINAHL databases.

for their full text to be assessed in detail. Any disagreements between the reviewers were resolved through discussion with a third reviewer.

### 3.5 | Assessment of methodological quality

The Mixed Methods Appraisal Tool (MMAT) was used to appraise the quality of included studies (Hong et al., 2018). The critical appraisal was conducted by two independent reviewers, and any disagreement between the reviewers was discussed and resolved with the third reviewer. The MMAT contains two screening questions about the clarity of research questions and appropriateness of data collection method, and five criteria based on the study design. The criteria for quantitative non-randomised study design were used. The criteria include participants' representativeness, appropriate measures used, outcome data were complete, confounders accounted for, and exposure occurred as intended. The reviewer rated each criterion using 'yes', 'no' or 'can tell', and the overall quality score was calculated based on percentage of criteria met for each

category. The methodological quality of the included studies is presented in Table 2.

### 3.6 | Data extraction

The data were extracted by two reviewers independently using the standardised Joanna Briggs Institute (JBI) data extraction tool and verified by a third reviewer (Moola et al., 2020). The data extracted included details about the author, year, and country, study aims, design, timeframe, sample, setting, and significant risk factors for falls. For the study results, odds ratio and confidence intervals were extracted for analysis using logistic regression and p values were extracted for linear models. Table 3 shows the summary of included studies.

### 3.7 | Data synthesis

It is not possible to conduct meta-analysis because the included studies vary greatly from each other in terms of the investigated

TABLE 2 Methodological quality of included studies (MMAT).

Studies	Overall quality <sup>a</sup>	Clear research questions	Data address research question	Represent target population	Appropriate measures	Complete outcome data	Confounders accounted	Exposure occurred intended
From search								
An et al. (2009)	80%	Yes	Yes	Yes	Yes	Yes	No	Yes
Chan et al. (2013)	100%	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Estrin et al. (2009)	100%	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lavsa et al. (2010)	100%	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Tsai et al. (1998)	60%	Yes	Yes	Yes	Yes	No	No	Yes
From end reference search								
Aso and Okamura (2019)	80%	Yes	Yes	Yes	Yes	Yes	No	Yes
Chang and Jen (2021)	100%	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lu et al. (2018)	80%	Yes	Yes	Yes	Yes	Yes	No	Yes
Seeherunwong et al. (2022)	100%	Yes	Yes	Yes	Yes	Yes	Yes	Yes

<sup>a</sup>Overall quality calculated based on percentage of criteria met for each category.

variables, analysis method and comparison groups used. Therefore, the authors synthesised the quantitative data narratively by grouping similar risk factors together and presenting them in tables. Any disagreement with the categories was resolved among the third and fourth authors. The classification of significant risk factors and circumstances of falls are presented in Table 4.

## 4 | RESULTS

### 4.1 | Study selection

In total, 77 potential records were generated from five databases including Medline (n=25), CINAHL (n=10), PsycInfo (n=22), Scopus (n=17) and Web of Science (n=3). After 40 duplicates were removed, 37 studies were screened for their title and abstract. Based on the inclusion criteria, 11 studies were selected for full-text review. Six studies were excluded for the reasons listed in Figure 1. Another four studies were identified from the reference list, and nine studies were included in this review (Aso & Okamura, 2019; Chang & Jen, 2021; Lu et al., 2018; Seeherunwong et al., 2022). The search strategy is presented in the PRISMA framework, shown in Figure 1.

### 4.2 | Study characteristics and quality

Among the nine studies, the sample size ranged from 120 (Aso & Okamura, 2019) to 7921 (An et al., 2009). Mean age of the participants, where specified, ranged from 38.3 (SD=16.8) (Estrin et al., 2009) to 64.6 (SD=14.8) years (Aso & Okamura, 2019). Three out of the eight studies where the mean age was reported, participant mean age was less than 50 years (Chan et al., 2013; Estrin et al., 2009; Seeherunwong et al., 2022).

Three studies were conducted in the United States (Estrin et al., 2009; Lavsa et al., 2010; Tsai et al., 1998) and Taiwan (Chan et al., 2013; Chang & Jen, 2021; Lu et al., 2018), one study in China (An et al., 2009), Japan (Aso & Okamura, 2019) and Thailand (Seeherunwong et al., 2022). The duration of study timeframe ranges from 3 months (Aso & Okamura, 2019) to 5 years (Chang & Jen, 2021; Estrin et al., 2009; Lavsa et al., 2010; Seeherunwong et al., 2022).

The systematic search resulted in nine studies: two retrospective cohort studies, four retrospective case-control studies, two prospective cohort studies and one prospective case-control study, examining the risk factors and circumstances of falls. Methodological quality of the included studies was assessed using the MMAT (Hong et al., 2018). No studies were excluded due to poor methodological quality. All nine studies fulfilled the screening criteria and provided clear research questions and appropriately addressed the research questions. The included studies had clearly described the target population, used appropriate measurements and had exposures as intended. Only one study had incomplete data collected (Tsai



TABLE 3 (Continued)

Studies/country	Aims	Design/timeframe	Sample/setting	Age (year)	Risk factors	OR (95% CI)	P					
Estrin et al. (2009) United states	Research on risk of falling among psychiatric inpatients in an acute setting.	Retrospective case-control study/2000 to 2005	74 who had fallen and 74 who had not fallen match on primary psychiatric diagnosis/58-bed inpatient psychiatric facility	38.3 (16.8)	Physical complaints on day of fall	3.31 (1.94–5.67)	—					
					Clonazepam	4.05 (1.61–10.2)	—					
					Number of prescriptions		.001					
					Medical history		.041					
					Urinary frequency/incontinence		.005					
					Generalised weakness		.009					
					Mental status impairment		.017					
					Dizziness		.017					
					History of falls in past 90 days		.013					
					History of syncope		.028					
					History of impaired mobility		.037					
					Acute medical condition		.001					
					Antihypertensive		.003					
					Laysa et al. (2010) United States	Investigate the association between medications and other variables with increased fall risk among psychiatric inpatients.	Retrospective case-control study/ July 2002 to June 2007	774 inpatients who had fallen and 774 who had not fallen matched by age, sex, and admission year	Median age 60 years	Alpha-blockers, nonselective	5.82 (1.25–27.09)	—
										Sleep aids, nonbenzodiazepines	2.58 (1.07–6.25)	—
										Benzodiazepines	2.49 (1.98–3.14)	—
										Histamine H2 blockers	2.41 (1.22–4.76)	—
Lithium	2.97 (1.59–5.54)	—										
Atypical antipsychotics	1.98 (1.57–2.49)	—										
Atypical antidepressants	1.34 (1.04–1.72)	—										
Anticonvulsants/mood stabilisers	1.64 (1.26–2.14)	—										
Conventional antipsychotics	1.50 (1.07–2.10)	—										
Laxatives or stool softeners	1.43 (1.08–1.91)	—										
Dementia or Alzheimer's disease	1.61 (1.13–2.31)	—										
Drug dependence	0.66 (0.51–0.85)	—										
Bipolar disorder		.001										
Selective serotonin-reuptake inhibitors		<.001										
Alzheimer's disease medications		.019										
Angiotensin-converting-enzyme inhibitors		<.001										
Beta-blockers		—										
Calcium channel blockers		<.001										
Oral hypoglycaemics		.003										
Nonsteroidal anti-inflammatory drugs		<.001										
Muscle relaxants		.005										
Parkinson's disease medications		—										
Opioids		.034										
		.003										
		.002										

(Continues)



TABLE 3 (Continued)

Studies/country	Aims	Design/timeframe	Sample/setting	Age (year)	Risk factors	OR (95% CI)	P
Tsai et al. (1998) United States	To examine the risk factors for falls and the circumstances surrounding falls among acutely ill patients in a psychiatric unit.	Descriptive study/7-month period	12 who had fallen and 180 who had not fallen	Patients who had fallen 50.9 (18–91)	History of falling past 6 months Generalised weakness Difficulty in mobility Confusion/disorientation Elimination problems Temperature elevation		<.001 <.001 <.001 <.05 <.01 <.001
Aso and Okamura (2019), Japan	Assess the association between falls and balance in patients with schizophrenia in the psychiatric ward	Prospective cohort/3-month follow-up	16 who had fallen and 104 who had not fallen with schizophrenia	Patients who had fallen 64.6 (14.8); Those who had not fall 59.0 (13.0)	History of fall (last 3 months) Romberg quotients for sway		<.01 .02
Chang and Jen (2021) Taiwan	Compare the risk factors for falling in psychiatric inpatients and general ward inpatients who had fallen.	Retrospective case-control/1 January 2015 to 31 December 2019	122 psychiatric inpatients who had fallen, 122 psychiatric inpatients who had not fallen, 122 general ward who had fallen match for gender age and length of hospital stay/50-bed acute psychiatric ward	Psychiatric inpatients who had fallen 52.20 (16.39), who had not fallen 51.69 (16.24), general ward who had fallen 51.81 (16.27)	Dizziness Unsteady gait Use of aids in hospital State of consciousness (drowsy) Use of anticonvulsant Stool softeners	7.11 (2.74–18.47) 1.97 (1.07–3.66) 0.42 (0.18–0.97)	– – – <.001 .007 <.001
Lu et al. (2018) Taiwan	Investigate the incidence rate and risk factors related to falls among acute psychiatric inpatients in a regional hospital.	Retrospective case study/26 January 2015 to 25 January 2016	16 patients who had fallen and 505 patients who had not fallen	Patients who had fallen 51.38 (17.16) and patients who had not fallen 38.52 (14.46)	Age, mean Female Use more kinds of medication Use fewer antidepressants Use more mood stabilisers Use more laxatives Number of psychotic symptoms		<.05 <.05 .008 .019 .049 <.001 <.05
Seeherunwong et al. (2022) Thailand	Investigate the staff and patient-related factors that increase the likelihood of falls among psychiatric inpatients.	Retrospective case-control study/1 January 2011 to 31 December 2014	80 patients who had fallen and 160 patients who had not fallen matched by age, sex, admission year/800-bed psychiatric hospital	Patients who had fallen 47.37 (12.95) and patient who had not fallen 47.01 (13.19)	Marital status (single/separate/divorce) Acute psychosis Co-occurring physical illness Using 5 or more medications Taking atypical antipsychotic 26–50 patients in the ward Taking cardiovascular agent 1 nurse for 16–30 patients 1 nurse for 31–45 patients 1:1 Proportion of nurse to ULN	– – 4.34 (1.45–13.05) 2.97 (1.57–5.63) 3.06 (1.59–5.88) 2.74 (1.35–5.58) 0.17 (0.04–0.72) 2.17 (1.05–4.51) 0.28 (0.11–0.69) 0.17 (0.06–0.54) 9.10 (0.73–113.92)	<.001 <.001 <.001 <.05 <.001 <.05 <.001 <.001 <.001 <.001 <.001

Note: HoNOS65+: Health of the Nation Outcome Scale scores for people over the age of 65.

Abbreviation: ULN, unlicensed nurse assistant.

et al., 1998), and four studies did not control for confounders in the analysis (Aso & Okamura, 2019; Lu et al., 2018; Tsai et al., 1998). Detailed study characteristics and assessment of study quality are shown in Tables 2 and 3.

### 4.3 | Synthesis of findings

Seven categories of significant risks factors for falls were identified. They include socio-demographic, fall related, functional status, health and mental status, psychiatric diagnosis and assessment, medication, and staff related.

### 4.4 | Social-demographic factors

Four studies reported on socio-demographic factors related to falls (An et al., 2009; Chan et al., 2013; Lu et al., 2018; Seeherunwong et al., 2022). Three studies reported that patients who fall were significantly older than those who did not fall (An et al., 2009; Chan et al., 2013; Lu et al., 2018). Specifically, An et al. (2009) found that patients aged older than 60 years were associated with 3.1 odds of falling. Contrasting findings were reported for gender with one study reported that men were 15.4 times more likely to fall compared to women (An et al., 2009), while another study reported there were significantly more women who fall than men (Lu et al., 2018).

### 4.5 | Falls-related factors

Fall-related risk factors were reported by four studies in this review (Aso & Okamura, 2019; Chan et al., 2013; Estrin et al., 2009; Tsai et al., 1998). Two studies reported that patients were more likely to fall if they had a fall in the past 3 months (Aso & Okamura, 2019; Estrin et al., 2009), and the past 6 months (Chan et al., 2013; Tsai et al., 1998). However, none of the studies reported the odds ratio for risk of falling in relation to history of falls.

### 4.6 | Functional status

Different definition and assessments were used to describe the significant risk factors related to functional status in five studies. These include difficulty in mobility (Tsai et al., 1998), impaired mobility (Estrin et al., 2009), restricted mobility and impaired gait (Chan et al., 2013), Romberg quotients for sway (Aso & Okamura, 2019) and unsteady gait (Chang & Jen, 2021).

### 4.7 | Health and mental status

Six studies reported 23 risk factors related to health and mental status (Chan et al., 2013; Chang & Jen, 2021; Estrin et al., 2009; Lu

et al., 2018; Seeherunwong et al., 2022; Tsai et al., 1998). Risk factors including dizziness, generalised weakness, confusion, impaired consciousness and elimination problems were reported by two or more studies. In particular, people with physical complaints on the day of the fall (OR=3.31) (Estrin et al., 2009), co-occurring physical illness (OR=2.97) (Seeherunwong et al., 2022) and those reporting dizziness were a higher risk of a fall (OR=7.11) (Chang & Jen, 2021).

### 4.8 | Psychiatric diagnosis and assessment

Three studies reported eight factors related to psychiatric diagnosis and severity of the mental health conditions (An et al., 2009; Chan et al., 2013; Lavsa et al., 2010). The reported diagnoses were bipolar disorder, dementia/Alzheimer's disease (Lavsa et al., 2010) and schizophrenia (Chan et al., 2013). Some studies however did not specify the diagnosis but explored the length of illness or psychopathology related to falls (An et al., 2009; Chan et al., 2013). Length of the illness greater than 10 years was associated with more than 10 times the risk of falling by one study (An et al., 2009). The odds were high for greater severity in clinical global impression severity rate (OR=2.19) (An et al., 2009) and extrapyramidal symptom rating scale for Parkinsonism (OR=1.14) (Chan et al., 2013).

### 4.9 | Medication

Medication use was the largest category and was sub-categorised into three categories psychotropic medications, non-psychotropic medications and other. Six studies reported 17 risk factors related to psychotropic medications (Chan et al., 2013; Chang & Jen, 2021; Estrin et al., 2009; Lavsa et al., 2010; Lu et al., 2018; Seeherunwong et al., 2022). Significant risks from the psychotropics reported in two or more studies were use of atypical antipsychotics (OR=1.98–2.74) (Lavsa et al., 2010; Seeherunwong et al., 2022), antidepressants (OR=1.34) (Lavsa et al., 2010), benzodiazepines (OR=1.15–2.49) (Chan et al., 2013; Lavsa et al., 2010) and anticonvulsants (OR=1.64) (Lavsa et al., 2010). Six studies reported 16 risk factors related to non-psychotropic medications (Chan et al., 2013; Chang & Jen, 2021; Estrin et al., 2009; Lavsa et al., 2010; Lu et al., 2018; Seeherunwong et al., 2022). Increased odds of experiencing a fall were however reported for using antihypertensives (OR=2.17–5.82) (Lavsa et al., 2010; Seeherunwong et al., 2022) and laxatives/stool softeners (OR=1.43) (Lavsa et al., 2010). Five studies reported six factors related to other issues of medications (Chan et al., 2013; Estrin et al., 2009; Lavsa et al., 2010; Lu et al., 2018; Seeherunwong et al., 2022). Medication adjustment within 24 h (OR=10.3) (Chan et al., 2013) and the use of five or more medications (OR=3.06) (Seeherunwong et al., 2022) were associated with greater risk of falling. Drug dependence was however reported as a protective factor by one study (Lavsa et al., 2010) with a 33% reduced chance of a fall (OR=0.66).

TABLE 4 Classification of risk factors.

	Risk factors	Studies	Sample size <sup>a</sup>	OR (95% CI)	<i>p</i>
<b>No</b>	<b>Socio-demographic</b>	<b>7 factors, 4 studies</b>			
1	Age > 60	An et al. (2009)	96	3.1 (1.8–5.5)	–
2	Age, mean	Chan et al. (2013)	105	–	.001
3	Age, mean	Lu et al. (2018)	16	–	<.05
4	First admission	An et al. (2009)	96	–	.005
5	Men	An et al. (2009)	96	15.4 (7.6–31.4)	–
6	Female	Lu et al. (2018)	16	–	<.05
7	Marital status	Seeherunwong et al. (2022)	80	–	<.001
	<b>Fall related</b>	<b>5 factors, 4 studies</b>			
1	Fallen in past 6 months	Chan et al. (2013)	105	–	.000
2	History of falling past 6 months	Tsai et al. (1998)	12	–	<.001
3	History of falls in past 90 days	Estrin et al. (2009)	74	–	.013
4	History of fall (last 3 months)	Aso and Okamura (2019)	16	–	<.01
5	Risk assessment	Chan et al. (2013)	105	–	.000
	<b>Functional status</b>	<b>8 factors, 5 studies</b>			
1	Difficulty in mobility	Tsai et al. (1998)	12	–	<.001
2	History of impaired mobility	Estrin et al. (2009)	74	–	.037
3	Restricted mobility	Chan et al. (2013)	105	–	.008
4	Impaired gait status	Chan et al. (2013)	105	–	.000
5	Lower limb problem	Chan et al. (2013)	105	–	.003
6	Romberg quotients for sway	Aso and Okamura (2019)	16	–	.02
7	Unsteady gait	Chang and Jen (2021)	122	1.97 (1.07–3.66)	–
8	Use of aids in hospital	Chang and Jen (2021)	122	0.42 (0.18–0.97)	–
	<b>Health and mental status</b>	<b>23 factors, 6 studies</b>			
1	Acute medical condition	Estrin et al. (2009)	74	–	.001
2	Acute psychosis	Seeherunwong et al. (2022)	80	4.34 (1.45–13.05)	–
3	Agitation	Chan et al. (2013)	105	–	.001
4	Blood pressure	Chan et al. (2013)	105	–	.014
5	Dizziness	Chan et al. (2013)	105	–	.000
6	Dizziness	Estrin et al. (2009)	74	–	.017
7	Dizziness	Chang and Jen (2021)	122	7.11 (2.74–18.47)	–
8	History of syncope	Estrin et al. (2009)	74	–	.028
9	Generalised weakness	Estrin et al. (2009)	74	–	.009
10	Generalised weakness	Tsai et al. (1998)	12	–	<.001
11	Impaired orientation	Chan et al. (2013)	105	–	.000
12	Confusion/disorientation	Tsai et al. (1998)	12	–	<.05
13	Mental status impairment	Estrin et al. (2009)	74	–	.017
14	State of consciousness (drowsy)	Chang and Jen (2021)	122	–	<.001
15	Impaired consciousness	Chan et al. (2013)	105	–	.030
16	Medical history (number)	Chan et al. (2013)	105	–	.013
17	Medical history	Estrin et al. (2009)	74	–	.041
18	Co-occurring physical illness	Seeherunwong et al. (2022)	80	2.97 (1.57–5.63)	–
19	Number of psychotic symptoms	Lu et al. (2018)	16	–	<.05
20	Physical complaints on day of fall	Estrin et al. (2009)	74	3.31 (1.94–5.67)	–
21	Urinary frequency/incontinence	Estrin et al. (2009)	74	–	.005

TABLE 4 (Continued)

	Risk factors	Studies	Sample size <sup>a</sup>	OR (95% CI)	p
22	Elimination problems	Tsai et al. (1998)	12	–	<.01
23	Temperature elevation	Tsai et al. (1998)	12	–	<.001
<b>Psychiatric diagnosis and assessment</b>		<b>8 factors, 3 studies</b>			
1	Bipolar disorder	Lavsa et al. (2010)	774	–	.001
2	Dementia or Alzheimer's disease	Lavsa et al. (2010)	774	1.61 (1.13–2.31)	–
3	Diagnosis (Schizophrenia)	Chan et al. (2013)	105	–	.007
4	Length of illness >10years	An et al. (2009)	96	10.5 (4.4–24.9)	–
5	Clinical Global Impression-Severity	Chan et al. (2013)	105	2.19 (1.13–4.24)	–
6	Extrapyramidal Symptom Rating Scale—Parkinsonism	Chan et al. (2013)	105	1.14 (1.08–1.21)	–
7	Brief Psychiatric Rating Scale	Chan et al. (2013)	105	–	.000
8	Extrapyramidal Symptom Rating Scale—Subjective	Chan et al. (2013)	105	–	.000
<b>Medication (psychotropic)</b>		<b>17 factors, 6 studies</b>			
1	Atypical antipsychotics	Lavsa et al. (2010)	774	1.98 (1.57–2.49)	–
2	Taking atypical antipsychotic	Seeherunwong et al. (2022)	80	2.74 (1.35–5.58)	–
3	Conventional antipsychotics	Lavsa et al. (2010)	774	1.50 (1.07–2.10)	–
4	Atypical antidepressants	Lavsa et al. (2010)	774	1.34 (1.04–1.72)	–
5	Use fewer antidepressants	Lu et al. (2018)	16	–	.019
6	Selective serotonin-reuptake inhibitors	Lavsa et al. (2010)	774	–	<.001
7	Anxiolytics/hypnotics	Chan et al. (2013)	105	–	.000
8	Benzodiazepines	Chan et al. (2013)	105	1.15 (1.03–1.30)	–
9	Benzodiazepines	Lavsa et al. (2010)	774	2.49 (1.98–3.14)	–
10	Clonazepam	Estrin et al. (2009)	74	4.05 (1.61–10.2)	–
11	Lithium	Lavsa et al. (2010)	774	2.97 (1.59–5.54)	–
12	Mood stabiliser	Chan et al. (2013)	105	–	.000
13	Anticonvulsants/mood stabilisers	Lavsa et al. (2010)	774	1.64 (1.26–2.14)	–
14	Use more mood stabilisers	Lu et al. (2018)	16	–	.049
15	Use of anticonvulsant	Chang and Jen (2021)	122	–	.007
16	Alzheimer's disease medications	Lavsa et al. (2010)	774	–	.019
17	Parkinson's disease medications	Lavsa et al. (2010)	774	–	.003
<b>Medication (non-psychotropic)</b>		<b>16 factors, 6 studies</b>			
1	Antihypertensive drug	Chan et al. (2013)	105	–	.049
2	Antihypertensive	Estrin et al. (2009)	74	–	.003
3	Alpha-blockers, nonselective	Lavsa et al. (2010)	774	5.82 (1.25–27.09)	–
4	Angiotensin-converting-enzyme inhibitors	Lavsa et al. (2010)	774	–	<.001
5	Beta-blockers	Lavsa et al. (2010)	774	–	<.001
6	Calcium channel blockers	Lavsa et al. (2010)	774	–	.003
7	Taking cardiovascular agent	Seeherunwong et al. (2022)	80	2.17 (1.05–4.51)	–
8	Histamine H2 blockers	Lavsa et al. (2010)	774	2.41 (1.22–4.76)	–
9	Laxatives or stool softeners	Lavsa et al. (2010)	774	1.43 (1.08–1.91)	–
10	Stool softeners	Chang and Jen (2021)	122	–	<.001
11	Use more laxatives	Lu et al. (2018)	16	–	<.001
12	Muscle relaxants	Lavsa et al. (2010)	774	–	.034
13	Nonsteroidal anti-inflammatory drugs	Lavsa et al. (2010)	774	–	.005
14	Oral hypoglycaemics	Lavsa et al. (2010)	774	–	<.001

(Continues)

TABLE 4 (Continued)

	Risk factors	Studies	Sample size <sup>a</sup>	OR (95% CI)	p
15	Opioids	Lavsa et al. (2010)	774	–	.002
16	Sleep aids, nonbenzodiazepines	Lavsa et al. (2010)	774	2.58 (1.07–6.25)	–
	<b>Medication (other)</b>	<b>6 factors, 5 studies</b>			
1	Drug dependence	Lavsa et al. (2010)	774	0.66 (0.51–0.85)	–
2	Medication adjustment within 24 hours	Chan et al. (2013)	105	10.3 (1.37–76.8)	–
3	Medication adjustment within 3 days	Chan et al. (2013)	105	–	.000
4	Number of prescriptions (within 24 hours)	Estrin et al. (2009)	74	–	.001
5	Using 5 or more medications	Seeherunwong et al. (2022)	80	3.06 (1.59–5.88)	–
6	Use more kinds of medication	Lu et al. (2018)	16	–	.008
	<b>Staff and patient related</b>	<b>4 factors, 1 study</b>			
1	26–50 patients in the ward	Seeherunwong et al. (2022)	80	0.17 (0.04–0.72)	–
2	1 nurse for 16–30 patients	Seeherunwong et al. (2022)	80	0.28 (0.11–0.69)	–
3	1 nurse for 31–45 patients	Seeherunwong et al. (2022)	80	0.17 (0.06–0.54)	–
4	1:1 Proportion of nurse to ULN	Seeherunwong et al. (2022)	80	9.10 (0.73–113.92)	–

Note: For logistic regression odds ratios (OR) and confidence intervals (CI) and for linear models, p values were extracted. If more than one model is presented, the result of the most complex model is presented.

<sup>a</sup>Sample size of fallers.

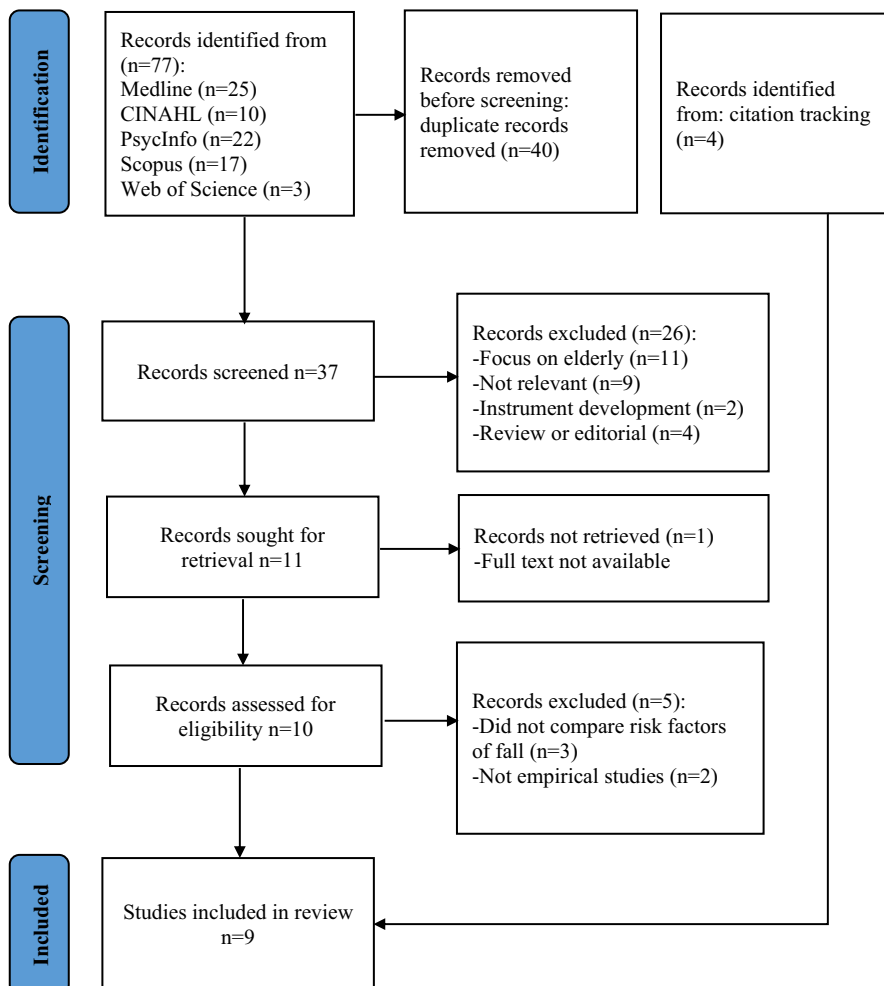


FIGURE 1 PRISMA flow diagram of search results and study selection.

#### 4.10 | Staff related factors

Only one study reported on risk factors related to staff-patient ratio (Seeherunwong et al., 2022), and found 26–50 patients in the ward was more protective for falls than with fewer patients (OR=0.17). In addition, more patients per nurse and a matching ratio of nurse to unlicensed nurse assistants also resulted in lower risk of falls.

#### 4.11 | Circumstances of fall

Regarding circumstances of the fall, five out of nine studies were included (An et al., 2009; Chan et al., 2013; Lu et al., 2018; Seeherunwong et al., 2022; Tsai et al., 1998). In this review, only factors with highest frequency were reported. Five sub-categories were investigated including location of fall, activity when having a fall, time of fall, outcome following fall and location of injury. The location of fall and activity being undertaken by the patient at the time of the fall vary across the studies. Most studies reported patients falling at night (An et al., 2009; Lu et al., 2018; Seeherunwong et al., 2022), but they did not sustain any injury from the fall (An et al., 2009; Chan et al., 2013).

### 5 | DISCUSSION

Younger patients aged below 65 in the acute mental health settings are at risk of falling, yet there is a dearth of aggregated evidence exploring the risk factors of falls among this age group. This review has synthesised the current evidence related to the risk factors and circumstances of falls among younger mental health inpatients aged below 65 years old. Nine studies were included reporting 94 significant risk factors associated with falls. These risk factors can be classified into seven categories which include socio-demographic, fall related, functional status, health and mental status, psychiatric diagnosis and assessment, medication, and staff related factors. Five studies were also included in the synthesis of the circumstances of falls that comprise location of fall, activity when having a fall, time of fall, outcome following fall and location of injury.

The most clearly associated risk factor for falls among younger mental health inpatients is the use of medication which can be further sub-categorised into psychotropics, non-psychotropic and other issues of medication. These findings are in line with another published systematic review on the risk factors and consequences of falls among psychiatric inpatients that included older adults aged above 65 (Carpels et al., 2022). Similar to the current review, the study has identified the use of psychotropics such as antipsychotics, benzodiazepine and mood stabilisers could increase the risk of falling among mental health inpatients (Thibaut et al., 2019). Considering psychotropics and their role in falls, some groups of medication have sedative properties and cause

orthostatic hypotension; thus, the risk of falls may be anticipated (Stroup & Gray, 2018).

Besides the use of psychotropic medication, the current review also found that the odds of falling increased during medication tapering and the prescription of more than one medication. This is expected considering the adverse effects of medication withdrawal such as dizziness and risk of seizures (Rothschild, 2021; Stroup & Gray, 2018). Patients on multiple medications and those on medication adjustments require a collaborative approach between the medical team and the nursing staff to put a management plan in place for increased visual and vital observations during the early days of medication changes. A screening protocol for patients with multiple at-risk medications would be necessary to ameliorate the falls risk. Patient education about falls prevention including medication use and side effects which may increase risk of falls are also crucial.

Few studies explored the risk of falls among younger mental health inpatients. It is therefore difficult to disentangle differences between the risks for younger and older patients in the mental health setting. A retrospective observational study comparing age differences in risk factors for falls among psychiatric patients found that majority of falls in younger patients were related to side effects of medication and altered mental condition, while in older patients was related to decrease the ability to perform activities of daily living (Suga et al., 2021). Although the study findings correspond with our current systematic review, it is impossible to disentangle any casual relationships between the two variables from the cross-sectional study. Besides the side effects of medication, it is likely that the psychiatric diagnosis could also result in changes of mental status leading to increasing risk of falls. This is supported in another cross-sectional study which identified older patients with mood disorders, and younger female patients with eating disorders and not on psychotropic medications were at risk of falling (Meng et al., 2010). Moreover, both groups were also reported to be alert and orientated, and with no muscular weakness.

Historically, studies investigating incidence and contributing factors of falls have focused on older adults in the mental health settings due to risk factors associated with neurocognitive disorder such as Alzheimer's disease, Dementia and Parkinson's disease (Heslop et al., 2012; McMinn et al., 2016). However, studies have shown that patients with mental illness including younger adults are also at increased risk of falling (Stubbs et al., 2018; Williams et al., 2015). Within the mental health inpatient setting, the proportion of patients aged below 65 who fell vary between 57.8% and 67.0% in the included studies (Lavsa et al., 2010; Tsai et al., 1998). In the current review, only nine studies were found exploring the risk factors for falls specific to hospitalised younger patients in acute mental health settings. A number of risk factors were only mentioned once or twice in the included studies; therefore, further studies are required to confirm the association. Besides factors that are unique to mental health inpatients, the current review also found that intrinsic factors common to general ward inpatients such as impaired functional status, dizziness, general weakness and incontinence could also increase the risk of falls (Chang & Jen, 2021).

This review also identified the circumstances of falls by delineating factors with the highest frequency in each included study. Factors such as location of fall, activity when having a fall, time of fall, outcome following fall and location of injury were reported. Although the included studies did not estimate the odds of falling for these factors and the results were mixed, the findings are relevant and could be explained by Zalsman et al. (2016) argument. Modification of the ward milieu to minimise access to means for self-harm and suicide are not uncommon in the adult mental health units for safety reasons (Zalsman et al., 2016). Mobility devices such as walking sticks, frames and bedrails and shower supporting frames are uncommon in mental health intensive care wards. These modifications may place those at increased risk of falls at a much higher risk due to lack of supporting aids at the time when the risk of fall is high.

Moreover, younger patients are likely to be physically active and may be unaware the impact of the medication on their physical ability (de Smet et al., 2022). Age related enthusiasm can put younger patients at increased risk by triggering the effects of both intrinsic and extrinsic factors that can result in falls (de Smet et al., 2022). Hospitalised younger patients with mental illness are more mobile than those in the general hospital and also more likely to be agitated, which can increase the risk of falls (de Smet et al., 2022; Edmonson et al., 2011). Identifying the circumstances and risk factors for falls presents with an opportunity for service providers and clinicians to develop strategies that can lead to appropriate interventions to prevent falls. What is important to keep in mind is that that most falls are preventable if those at risk are assessed and educated about risk of falls associated with their conditions and treatment (Tay et al., 2000). These findings reinforce the importance of providing a safe environment and education of staff, patients and families about potential environmental hazards.

Our review reported that a high patient staff ratio (Seeherunwong et al., 2022) and drug dependence (Lavsa et al., 2010) were protective for falls. These results were unclear, and more studies are needed to draw these conclusions. A recent review of literature also recommended further studies to establish the role of staff related factors and their association with increased risks in mental health settings (Ngune et al., 2023). Our review also showed, there was contradictory evidence about time of falls with some studies indicating that late nights to early mornings (An et al., 2009; Seeherunwong et al., 2022) were risky times and other study daytime (Chan et al., 2013). This lack of consensus has been reported elsewhere (Kerzman et al., 2004), and more primary studies are needed to validate these findings.

### 5.1 | Limitations and strengths

Our study tabulated the results of the reviewed studies systematically, providing a clear and concise overview of the key findings. This enables easy data access for comparison and increases transparency of the results (Cloutier & Ravasi, 2020). Majority of the studies used

in our review were retrospective studies that heavily relied on administrative datasets. As in all retrospective studies, the quality and type of the data collected is related to the information available from the databases at the time of data abstraction (Kerzman et al., 2004). The validity of this information is also dependent on the quality of data entered into these databases. This limits the conclusions that can be drawn from the findings. However, our review followed a standardised criteria for assessing quality of such studies and only included studies that were deemed by the authors as strong (Moola et al., 2020).

Despite our review following a stringent criterion for searching databases, that was also validated by a librarian, it is possible that some studies may have been missed. The heterogeneity of taxonomy and nomenclature of terms and age classifications may have meant that some studies were missed during the search. Some studies may have been missed because adults were also referred to as older adults by some studies resulting in some relevant studies not being captured by our key words.

## 6 | CONCLUSION

This review found only a limited number of articles that focused on falls among younger patients in the acute mental health settings indicating more studies are needed in this setting. The evidence was also inconsistent across some risk factors such as gender, time of fall and fall history that have previously been identified as significant for older patients. Further studies are needed to explore these factors with younger patients. Significant risk factors such as medication adjustments were associated with a higher risk of fall in this group. Other factors included the current physical state on the context of their medical history and socio-demographic factors such as age and gender.

## 7 | RELEVANCE TO CLINICAL PRACTICE

In the view of the large number of risk factors being related to medications, severity of the psychiatric diagnoses and medical history such as epilepsy, younger patients on at-risk medications, those under medications adjustments, and with a significant medical history need close monitoring both clinically and visually. Education of all nursing staff to increase awareness of these issues to improve follow-up and evaluations is crucial. Interventions aimed at accurate assessment and management of patients at risk of fall need to be tailored for younger people. These programmes need to include increased awareness among staff of the importance of accurate patient histories in preventing falls. Priority should also be given to improving existing data collection systems on falls for younger patients in the psychiatric setting. Focusing on such systems would complement existing fall prevention strategies. Such systems would target at risk patients and assist in

monitoring and evaluating their outcomes to improve quality care, reduce the incidence of accidental falls and the severity of injuries from falls in the acute psychiatric settings. There is need to implement training interventions for staff and families aimed at avoiding falls of agitated patients.

#### AUTHOR CONTRIBUTIONS

Irene Ngune, Seng Giap Marcus Ang, Gelaye Nadew and Rosemary Saunders contributed to study conception, review of the final version of the manuscript and review of the draft manuscript and approval of the final manuscript. Irene Ngune and Seng Giap Marcus Ang contributed to data acquisition. Irene Ngune, Seng Giap Marcus Ang, Gelaye Nadew and Rosemary Saunders contributed to data analysis and interpretation.

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#### CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

#### DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.

#### PROTOCOL REGISTRATION

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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