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Falls prevention: Identification of predictive fall risk factors

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ABSTRACT

Patient falls are the most common adverse safety event in hospitals and healthcare facilities nationwide. There are many risk factors associated with inpatient falls such as medications, unsteady gait, alteration in mental status, and environmental hazards. Risk assessment is the primary intervention for falls prevention. This study aims to provide a detailed review of the literature to identify and synthesize research evidence on risk factors that may contribute to patient falls in the adult inpatient hospital setting that are not captured by current fall risk assessment tools. After the identification of those key risk factors not found on the most common fall risk assessment tools, the results of this review will be used to develop a new evidence based fall risk assessment tool.

1. Introduction

Falls and fall related injuries are a serious problem in acute care hospitals. Patient safety, efficient patient care and quality patient care are top priorities of healthcare organizations (Mha et al., 2012). Falls are a safety hazard that threatens the effectiveness, efficiency and timeliness of care rendered to a patient. The National Database for Nursing Quality Indictors (NDNQI) defined falls as "an unplanned descent to the floor, with or without an injury to the patient" (NDNQI, 2013). Falls are prevalent in the hospitalized adult population and even more common in those patients over 65 years of age (Joint Commission, 2013). Falls are the leading cause of injury among those 65 years and older, followed by traffic accidents, burns, and fires (Gallardo, Asencio, Sanchez, Banderas, & Suarez, 2012). Over 84% of all adverse events that occur in the hospital setting have been associated with falls (Gallardo et al., 2012). Approximately 33% of hospital falls result in injury, with 4–6% resulting in serious injuries (i.e. fractures and subdural hematomas) that may lead to co-morbidity and death (Choi, Lawler, Boenecke, Ponatoski, & Zimring, 2011). The Joint Commission in 2002 established its National Patient Safety Goals (NPSGs) program that includes the goal to reduce falls and the risk of injury from falls (Joint Commission, 2013). Injury from falls is the fifth most common cause of death in acute care adult inpatient facilities (Mha et al., 2012).

1.1. Cost to hospitals

Inpatient falls are associated with increased length of stay; increased healthcare costs and higher rates of discharge from hospitals to long term care facilities (Miake-Lye, Hempel, Ganz, & Shekelle, 2013). Falls result in excessive healthcare costs for hospitals. Hospital related costs for falls that sustained a serious injury incurred $13,806 additional costs and had an increased length of stay of 6.9 per 100,000 patient care days in comparison to those patients who did not fall (Wong et al., 2011). The Centers for Medicare and Medicaid Services estimated that by 2020, the annual direct and indirect cost of fall related injuries in the United States is expected to reach $54.9 billion (CMS, 2012). Additionally, CMS will not pay for additional costs associated with many preventable errors, including those considered "never events" such as falls and falls with injury (CMS, 2012). Therefore, the high costs of falls are unreimbursed expenses to medical facilities.

1.2. Falls benchmarking

NDNQI is a proprietary database of the American Nurses Association (ANA) that was established in 1998. As of 2009, 25% of all hospitals nationwide participate in the database (Lake, Shang, Klaus, & Dunton, 2011). This database was established as a central resource for providing comparative information to healthcare organizations for quality improvement activities and to develop data to correlate nursing staffing to patient care outcomes. NDNQI is the only national quality measurement program that provides hospitals with unit-level performance comparison. This unit-level comparison gives organizations the opportunity to compare quality measures, such as falls, at the national, regional and state level. Institutions rely on the NDNQI database to identify and prioritize quality improvement initiatives. Prior to the establishment of this database, no consistent unit-level reporting benchmarking data source existed that allowed organizations to manage and prevent adverse quality outcomes (NDNQI, 2013).

1.3. Relevance for nursing

The quality of patient care outcomes is directly related to nursing care (Kolin, Minnier, Hale, Martin, & Thompson, 2010). The National Quality

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Forum (NQF) links rates of patient falls to nursing care (NQF, 2013). To this end, the NQF published a set of performance measures in 2004 that are used to assess the nurses' contribution to healthcare quality (NQF, 2013). Nurses at the forefront of care, should be able to identify which patients are considered "high risk" for falls. Nurses must ensure that all patients are assessed and re-assessed for fall related risk factors. Nurses have the role of initiating a comprehensive plan of care to aid in the safety of hospitalized patients.

1.4. Risk factors

There are multiple synergistic pathologies and risk factors that contribute to an inpatient fall. Hospitalized patients in the acute phase of their disease have specific characteristics requiring specialized assessment to prevent falls within the context of their environment (Gallardo et al., 2012). There are many variables that increase a patient's risk for falls and the risk of falling is directly related to the number of risk factors present at the time of the fall (Ang, Mordiffi, & Wong, 2012). Patient risks for falls are described as both intrinsic and extrinsic. Intrinsic factors are patient related factors such as age, co-morbidity, previous falls, gait, visual/auditory impairment, musculoskeletal deficits and cognitive impairment; extrinsic factors are related to the physical environment of the hospital, medications, supportive and assistive equipment in bathrooms, lighting, and footwear (Spoelstra, Given, & Given, 2012). Medications, such as opioids, neuroleptic agents, benzodiazepines and tricyclic antidepressants, were identified as extrinsic factors leading to increased fall risk (Graham, 2012).

Falls are positively related to medications such as cardiac medications, analgesics, psychotropic, anti-hypertensives, anti-arrhythmic, diuretics and anti-platelet medications as well as the number of medications a person is on, poly-pharmacy (Mamum & Lim, 2010). These medications may contribute to orthostatic hypotension and postural weakness (Mamum & Lim, 2010). Cardiac and analgesic medications have been implicated as one of the main risk factors leading to falls in the adult population (Mamum & Lim, 2010). In addition, patients over 65 years of age are at an increased risk of falls due to anti-hypertensive medications and co-morbidities that raise their fall risk (Gallardo et al., 2012).

1.5. Risk assessment

Fall risk assessments provide an objective format for a structured evaluation to identify threats that may increase a patient's risk of falling. Comprehensive fall predictor tools can be used to facilitate nurse identification of patients at risk for falls so that processes and interventions can be implemented to decrease patient risk. Fall risk assessment tools were developed as a measurement to guide the healthcare provider in determining a patient's risk of suffering a fall or fall with an injury (Gallardo et al., 2012). Establishing a process for predicting the risk of falling in the adult inpatient population is a key factor in falls prevention. Many fall risk assessment tools have been developed in recent years. However, even the most promising tools when tested by other researchers have shown reduced specificity (Sheth, Faust-Smith, Sanders, & Palmer, 2013). These bedside tools have low specificity and are poorly predictive of injurious falls in hospitals (Sheth et al., 2013). As noted by Gallardo et al. (2012) no new systematic literature reviews have been published on fall risk instruments in the acute hospitalized patient population since 2007.

The most commonly used fall risk assessment tools are the Hendrich II Fall Risk Model (HFRM II) (Hendrich, Bender, & Nyhuis, 2003), the Morse Fall Scale (MFS) (Morse, Morse, & Tylko, 1989), and the St. Thomas Risk Assessment Tool (STRATIFY) (Oliver, Brittion, Martin, & Hopper, 1997). Fall risk assessment tools must have sound psychometric properties; the ability to correctly identify high risk populations (sensitivity) and similarly identify those populations not at risk (specificity).These instruments' are described in the following section.

1.5.1. Hendrich II Fall Risk Model

HFRM II published in 1995, and updated in 2003, is a standard widely used fall risk assessment tool (Hendrich et al., 2003). HFRM II established an acceptable sensitivity value of 74.9% and an acceptable level of specificity of 73.9% when tested in an acute care tertiary hospital (Hendrich et al., 2003). Ang, Mordiffi, Wong, Devi, and Evans (2007)), evaluated the HFRM II for use in an acute care population found substantially lower sensitivity (70%) and specificity (61.5%). The tool is intended for use by the nurse at the point of care to predict a patients' risk of falling. Risk factor domains on the HFRM II include the following categories: (1) confusion/disorientation, (2) depression, (3) altered elimination, (4) dizziness/vertigo, (5) gender, (6) administration of antiepileptics/benzodiazepines, and (7) get up and go test/ability to rise in single movement. Nurses use a point system to score each of the domains on the HFRM II from a 0 for not present to a 4 for present. If a patient accumulates 5 or more points, the patient is deemed high risk for falls.

1.5.2. Morse Fall Scale

The MFS was published in 1989 and the tool has widespread use across the United States. This instrument was established to have an acceptable sensitivity value of 78% and an acceptable level of specificity of 83% (Morse et al., 1989). Ang et al. (2007), tested the MFS for use in acute care settings and found a sensitivity value of 88.3% and a specificity value of 48.3%. This tool is intended for use by the nurse at the point of care to predict a patients' risk of falling. Risk factor domains on the MFS include the following categories: (1) history of falling, (2) secondary diagnosis, (3) ambulatory aids, (4) IV saline lock, (5) gait, and (6) mental status. Using a point system the nurses' score each of the domains. A score of less than 25 is low fall risk. A score of 26–50 is medium fall risk. A score 51 or greater is of high fall risk. The fall risk numeric range on the MFS can range from 0 to 125 (Morse et al., 1989).

1.5.3. St. Thomas Risk Assessment Tool

The STRATIFY was published in 1997 with an established acceptable sensitivity value of 93% and an acceptable specificity value of 87.7% (Oliver et al., 1997). Ang et al. (2007)), tested the STRATIFY for use in acute care settings and found a sensitivity value of 55% and specificity value of 75.3%. This tool is intended for use by the nurse at the point of care to predict a patients' risk of falling. Risk factor domains on the STRATIFY tool include the following categories: (1) history of falling, (2) mental status, (3) visual impairment, (4) frequent toileting, and (5) transfer and mobility. Items on the scale are numerically scored as 1 if present and a score of 0 if not present. The total possible score is a 5. A score of 2 or greater is deemed high risk for falls (Oliver et al., 1997).

Although these tools have an acceptable level of sensitivity and specificity, the concern remains that a large percentage of patients who fell were scored as low risk using the identified fall risk assessment instruments (Swartzell & Fulton, 2013). The fall risk scales have been developed to identify at risk patients, however the population and setting have been shown to affect the performance of these tests. These results indicate difficulty in identifying at risk patients, and salient risk factors that can be generalized across varying acute care populations (Swartzell & Fulton, 2013).

Limitations of fall risk assessment tools or inaccurate use, can lead to inappropriate identification of a patient at risk for falls and delay or result in non- implementation of fall prevention interventions and programs. This can provoke a dangerous diversion of attention and resources towards patients who would least benefit from preventative measures, or ignore those who really need them (Gallardo et al., 2012). Risk assessment tools cannot predict all inpatient falls and there is no gold standard for risk assessment, however, hospitals must examine the predictive accuracy when selecting a tool. Selecting the right assessment tool can influence the failure or success of a fall prevention program. Nurses should be able to use the tool as a guide to identify and predict those patients who may fall, however, when fall

risk assessment tools are used correctly, and falls occur, new or modified assessment strategies should be considered (Spoelstra et al., 2012).

The risk factors listed on the assessment tools should be re-evaluated periodically to ensure that risk factors are consistent with current treatments, including medical interventions. Unfortunately, HRM II, MFS, and the STRATIFY do not encompass all of the intrinsic and extrinsic fall risk factors identified as causative factors for inpatient falls. The initial and most effective approach to fall prevention is to use an accurate fall risk assessment tool that examines the etiology of falls, intrinsic, extrinsic and situational risk factors and match the risks identified on the tool with the implementation of appropriate interventions (Choi et al., 2011).

2. Method

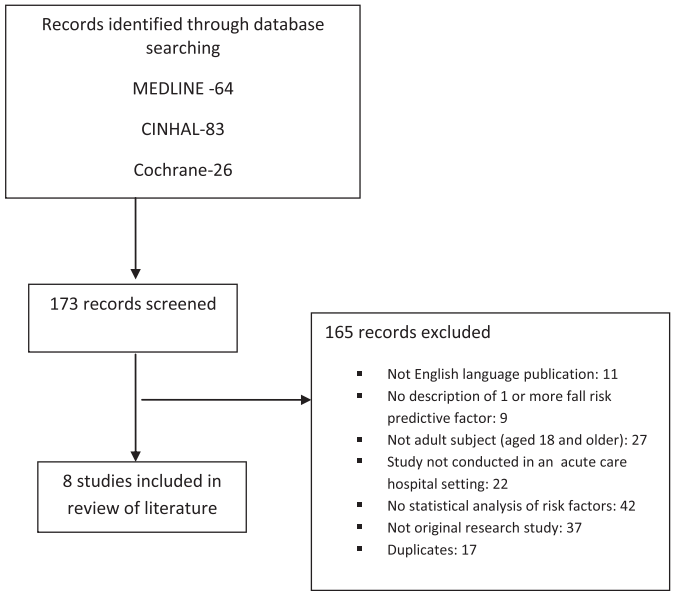
A systematic literature search was conducted using the following databases; CINAHL, MEDLINE, and Cochrane Library. The search strategy used a combination of the following terms; "risk assessment," "inpatient," "falls," "risk factors," "fall prevention," and "accidental falls." All searches were conducted to identify relevant articles published within the last 5 years, 2009 to current 2014. Inclusion criteria were predetermined to be (1) English language publications, (2) description of 1 or more predictive fall risk factor,(3) adult patient (18 and older) in acute care hospital setting, (4) detailed description of qualitative or quantitative study design, (5) peer reviewed primary research report, (6) studies published within the last 5 years (unless landmark study) and (7) studies within and outside the United States. Duplicate reports for the same cohort of subjects or studies that were published only as abstracts with insufficient information were excluded. The primary investigator, a student in the doctorate of nursing practice program at Rutgers School of Nursing and the co-investigator, an advanced practice nurse (APN), employed at the workplace of the primary investigator, independently screened the titles and abstracts of all identified citations and subsequently assessed full text versions of potentially eligible studies for inclusion. The two reviewers trained in research methodology documented information collected in each of the articles (i.e. study characteristics, main findings) independently and in duplicate using a standardized form to describe the internal and external validity of the studies for review. Disagreements regarding study eligibility for inclusion and collected information were resolved through discussion.

3. Results

The electronic search of the databases yielded a total of 173 potentially eligible articles. After full text screening, eight articles met inclusion criteria (see Table 1). Most of the studies were excluded because they were either not original research, not a landmark study or not about falls in an acute care setting. Selected articles were published between 2010 and 2013.Overall the studies included10, 479 patients in acute care hospital settings who were followed for the investigation of predictive fall risk factors. Among the eight retrospective studies, research designs included the following: one randomized control trial, four case-control studies, one crossover study, one cohort study and one descriptive study. The studies had homogeneity of settings, populations and risk factors studied. Demographic information was not available for all studies in the review, preventing the reporting of rates adjusted by demographic differences; likewise it is unclear if all of the studies adjusted for confounders. Patient ages ranged from 56 to 82 years. Additionally, definitions of what constituted a patient fall were not consistent or were missing from the reported study designs which could have resulted in subjectivity in the interpretation and classification of a fall in each of the studies.

Twenty risk factors emerged as statistically significant among the studies (see Table 2).The literature review identified eight studies that depicted factors associated with increased fall risk in the acute care

Table 1
Flow-diagram: selection of studies.



inpatient setting. Medications that are known to significantly affect the central nervous system (CNS) such as benzodiazepines, opioids, antipsychotics and antiepileptics were identified as predictive fall risk factors. Cardiac mediations and those medications known to cause orthostatic hypotension and dizziness/vertigo were identified as predictive fall risk factors. Altered elimination/incontinence and those medications that cause frequency in elimination were identified as predictive fall risk factors. Muscoskeletal weakness and a history of falling were also identified as factors that predispose a patient to have a higher risk of falling. Lastly, patients with a medical diagnosis of cancer and patients who were prescribed numerous medications (polypharmacy) had an increased risk of falling in the inpatient hospital setting.

As identified in Table 3, fall risk factors can be classified as patient related or as medication related. Among the twenty risk factors that emerged as statistically significant in at least one of the eight reviewed articles, eleven factors were not included in the three most commonly used fall risk assessment tools. They are the following;

- Polypharmacy was identified as a risk factor for falls in two out of the eight studies (Dias et al., 2014; Mamum & Lim, 2010).
- Lipid regulating medication was identified as a risk factor for falls in one out of the eight studies (Mamum & Lim, 2010).
- Cardiac medications were identified as a risk factor for falls in four out of the eight studies (Dias et al., 2014; Mamum & Lim, 2010; Obayashi et al., 2013; Shuto et al., 2010).
- Anti-Parkinson medications were identified as a risk factor for falls in three out of the eight studies (Mamum & Lim, 2010; Obayashi et al., 2013; Shuto et al., 2010).
- Anti-diabetic medication was identified as a risk factor for falls in two out of the eight studies (Dias et al., 2014; Obayashi et al., 2013).
- Opioids/narcotics was identified as a risk factor for falls in five out of the eight studies (Chang et al., 2011; Dias et al., 2014; Mamum & Lim, 2010; Mion et al., 2013; Obayashi et al., 2013).
- Antidepressants were identified as a risk factor for falls in two out of the eight studies (Dias et al., 2014; Mion et al., 2013).
- Diuretics were identified as a risk factor for falls in three out of the eight studies (Dias et al., 2014; Mamum & Lim, 2010; Mion et al., 2013).
- Antipsychotics were identified as a risk factor for falls in three out of the eight studies (Dias et al., 2014; Mion et al., 2013; Neuman et al., 2013).

- Hypnotics were identified as a risk factor for falls in three out of the eight studies (Dias et al., 2014; Mamum & Lim, 2010; Shuto et al., 2010).
- Diagnosis of cancer was identified as a risk factor for falls in one out of the eight studies (Chang et al., 2011)

4. Discussion

A comprehensive literature search was conducted to identify the most current and common predictive fall risk factors. Twenty risk factors emerged as significant. The three most commonly used fall risk assessment tools were compared with the list of risk factors identified in the literature. Following the review of the most common fall risk assessment tools, it was concluded that no one single tool effectively addressed the comprehensive nature of current fall risk factors.

The three most commonly used fall risk assessment tools the HFRM II, MFS, and STRATIFY incorporate only some of the known risk factors that predispose a patient to risks for falls. None of the three tools include questions to prompt nursing assessment of medications such as opioids, cardiac medications, diuretics, and hypnotics. Medications and especially those with central nervous system (CNS) effects are significantly associated with increased risk of falls. Dias et al. (2014) found that patients who received CNS drugs are 10 times more likely to sustain an inpatient hospital fall. Cardiovascular agents produce orthostatic hypotension increasing risk for falls. Neuroleptic agents cause side effects of sedation and mental confusion that also increase risk for falls. Hypnotics as well as narcotics, antihistamines, and systemic effects associated with a diagnosis of cancer, have adverse effects on the CNS system (Chang et al., 2011). These adverse effects cause confusion, dizziness, and daytime somnolence that can increase risk for falls (Chang et al., 2011). Lastly, the greater the number of medications, as well as the

Table 2
Overview of included studies.

Author/year	Study design	Setting	*n*	Average age	Risk factors	OR	95% CI for OR	*p* value
Chang et al. (2011)	Retrospective matched case-control study	3500 bed academic hospital acute care units—Taiwan	330	76	Diagnosis of cancer	1.97	1.26–3.07	0.003
					Benzodiazepine	2.63	1.55–4.46	<0.001
					Narcotics	2.13	1.16–3.94	0.015
					Antihistamine	3.00	1.19–7.56	0.020
Dias et al. (2014)	Retrospective descriptive study	Acute care hospital— Portugal	193	75	Valporic acid	3.33	1.39–5.40	–
					Levetriacetam	5.67	1.91–13.53	–
					Hypnotic	8.68	–	<0.05
					Benzodiazepine	2.74	–	<0.05
					Antipsychotic	7.27	–	<0.05
					Antidepressants	6.34	–	<0.05
					Opioid	3.97	–	<0.05
					Diuretic	2.37	–	<0.05
					Ramipril	7.67	–	<0.05
					Anti diabetic	2.54	–	<0.05
					Polypharmacy 5–10 agents	–	–	0.0001
Neuman, Hoffmann, Golgert, Hasford, and Renteln-Kruse (2013)	Retrospective case control study	Geriatric inpatient ward—Germany	4735	*Median age* 82	History of falls	2.10	–	<0.0001
					Mental alteration	2.90	–	<0.0001
					Insecure mobility	2.30	–	<0.0001
					Frequent toileting	1.50	–	0.0053
					Antipsychotic	1.60	–	0.0002
					Male gender	1.50	–	0.003
Mamum and Lim (2010)	Retrospective matched case control study	Acute care hospital— China	298	76	Polypharmacy	–	–	0.007
					Hypnotics	–	–	<0.001
					Anti-platelet	–	–	<0.001
					Diuretic	–	–	0.026
					Vasodilators (nitrates, calcium channel blockers)	–	–	0.004
					Anti- Parkinson agent	–	–	0.002
					Opioid	–	–	0.014
Mion et al. (2013)	RCT	661 bed academic urban hospital, medical and surgical units—United States	784	63	Antidepressant	1.04	1.04–2.67	–
					Antipsychotic	3.26	1.20–8.90	–
					Opioid	1.59	1.14–2.20	–
					Diuretic	1.53	1.03–2.26	–
Obayashi et al. (2013)	Retrospective cohort study	725 bed acute care hospital acute care units—Japan	3683	56	Hypnotic	2.17	1.44–3.28	<0.001
					Antiepileptic	5.06	2.70–9.46	<0.001
					Opioid	3.91	2.16–7.10	<0.001
					Anti-Parkinson	5.06	1.58–16.2	0.006
					Anti-diabetics	3.08	1.63–5.84	<0.001
					Anti-hypertensive	2.24	1.41–3.56	<0.001
					Anti-arrhythmic	2.82	1.36–5.83	0.005
Shuto et al. (2010)	Retrospective case-crossover study	600 bed acute care hospital inpatient acute care units— Japan	349	70–79	Anti-hypertensive	8.42	3.12–22.72	<0.001
					Anti- Parkinson agents	4.18	1.75–10.02	0.004
					Anti- anxiety	3.25	1.62–6.50	0.001
					hypnotic agents	2.44	1.32–4.51	0.004
Swartzell and Fulton (2013)	Retrospective matched case control study	750 bed primary acute care hospital –Midwest United States	107	75	Confusion/disorientation	7.43	–	0.0001
					Depression	2.88	–	0.0001
					Altered elimination	1.67	–	0.01
					Dizziness/vertigo	1.90	–	0.0143
					Anti-epileptic	2.89	–	0.0006
					Benzodiazepines	1.70	–	0.0057
					Get-up and go/physical mobility	–	–	0.0001
					Male gender	1.69	–	0.0066

Table 3
Falls risk assessment tool predictive domains.

Risk factors identified in the literature	Morse Fall Scale (MFS)	Hendrich II Fall Risk Model (HRMII)	St. Thomas Risk Assessment Tool (STARTIFY)
Patient related risk factors			
Altered elimination		X	X
Altered mental status	X	X	
Depression		X	
Diagnosis of cancer			
Dizziness/vertigo		X	
Gait/muscoskeletal weakness/deficit	X	X	X
History of falls	X		X
Male gender		X	
Medications			
Anti-depressants			
Anti-diabetic			
Antiepileptic[a]		X	
Anti-Parkinson			
Anti-psychotic			
Benzodiazepines[b]		X	
Cardiac medication[c]			
Diuretics			
Hypnotics			
Lipid regulating			
Opioids/narcotic			
Poly-pharmacy (4 or more meds)			
Sensitivity	78%	74.9%	93%
Specificity	83%	73.9%	87.7%

[a] Includes: valporic acid, levetriacetam.
[b] Includes: anti-anxiety, antihistamine.
[c] Includes: anti-hypertensive, anti-arrhythmic, ramipril, anti-platelet.

presence of a greater number of fall risk factors, also increase fall risk (Dias et al., 2014).

The complexity of inpatient hospital admissions is leading to a population of patients that are more heterogeneous than ever before resulting in medication regime and illness acuity that impair physical mobility and cognition that significantly increase fall risk (Gallardo et al., 2012). The possibility of falls and fall related injuries in acute care settings has increased over time and current fall risk assessment tools do not adequately reflect patient characteristics and environmental factors that contribute to falls.

The gaps noted in the commonly used risk assessment tools are of significant concern and threaten patient safety. Despite the known risk factors, validated risk assessment tools and preventative guidelines, inpatient fall rates continue to increase. Collectively, the findings of the authors of the identified studies suggest that the assessment of prevalent risk factors in hospitalized patients are essential and paramount to facilitate nurses' identification of fall risk and timely implementation of fall prevention methods.

4.1. Strengths and limitations

Strengths of the review include an extensive search of the databases with a sensitive search strategy and thorough methodological assessment of included studies thus, adding to a growing body of knowledge. A limitation of the review is the low number of studies included. Although not a limitation that concerns the design of this review, because of the limited number of identified studies, the possibility of error, missing data and unreported variables concerning all the predicative fall risks, cannot be ruled out. All of the studies used a retrospective design in which the data sources were chart reviews. This limits prospective validation of fall risk factors since the data were collected for clinical recording purposes and not for the intent of research. Details of the recorded fall incidences were not reported consistently; therefore it was not possible to assess external validity of the included studies. Demographic information was not available for all studies in the review, preventing the reporting of rates adjusted by demographic differences and possibly limiting the extent to which conclusions can be generalized to diverse populations and age groups. The average age of the study participant was over the age of 56 years. This may be a threat to the external validity of the study, as patients that are older in age tend to have chronic co-morbidities that predispose them to deficits and increased fall risk. Moreover, six out of the eight studies were conducted outside of the United States, which may have impacted the nature of the risk factors identified to predispose fall risk.

4.2. Implications for research

Future studies to identify and evaluate predictive fall risk factors should follow rigorous steps required for such purpose, taking into consideration the methodological issues. Prospective studies would be beneficial to eliminate the bias of recall. Future research should include larger subgroups of populations of different ages, specifically those under the age of 60 years to improve generalizability of findings. Additionally, further research should focus on the fall risk factors of the behavioral health population as their fall risk factors vary from the medical–surgical population. Further epidemiological research is suggested in order to enhance the precision and estimation of risk magnitude and knowledge translation of risk factors into clinical practice. It is difficult to ascertain if a fall risk and fall occurrence are a direct result of a drug's therapeutic effect or a consequence of a patient's underlying co-morbidities. Further research on environmental factors is needed due to limited amounts of studies that focus on the environmental factors in relation to falls.

4.3. Implications for practice

The results from this literature review identify the association between falls and the use of certain medications related to risk for falls in the acute care hospital setting. The results of the review of risk factors identified in recent literature provide guidance to clinicians on some of the crucial factors to take into consideration when assessing fall risk and fall reduction strategies. Medication is a modifiable risk factor. Minimizing the use of medications and the number of these medications in hospitalized patients may be an important strategy in preventing falls. The identification of evidence based predictive fall risk factors is useful in clinical practice to identify pertinent risk factor commonalities among hospitalized inpatients. These glaring issues warrant the need for a new evidence based fall risk predictor tool to be developed and implemented.

5. Ethics and human subject protection

This study's focus was the review of literature. Institutional review board approval was not needed for this review of the literature.

6. Conclusion

Falls are a significant clinical, legal and regulatory issue for hospitals. Falls and falls with injury are a major threat to patient safety. Eleven risk factors were identified, and importantly, these risk factors are not included in current risk assessment tools. The facts are undeniable, falls occur. Hospitalized patients are at risk for falls and subsequent injury from falls. These falls have a tremendous impact on the patient as well as directly increasing a hospital length of stay and the cost of care. Each organization must have a systematic process for evaluating each hospitalized patient for the risk of falling. That process begins with an assessment that predicts and discriminates those who may fall so that interventions can be applied to reverse or diminish the associated risk. There is no single easy answer to address the challenges posed by patient falls in hospitals because patient care practices are always changing. However, having a comprehensive fall risk assessment tool that addresses the most current predictive factors with an acceptable level of sensitivity and specificity is the initial step.

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