Falls in an acute care hospital as reported in the adverse event management system

A. Zecevic

Journal of Hospital Administration

ORIGINAL ARTICLE

Falls in an acute care hospital as reported in the adverse event management system

Barbara J. Watson *[1], Alan W. Salmoni[2], Aleksandra A. Zecevic[3]

[1] *Health & Rehabilitation Sciences, Western University, London, Canada*
[2] *School of Kinesiology, Western University, London, Canada*
[3] *School of Health Studies, Western University, London, Canada*

Received: March 21, 2015 **Accepted:** May 8, 2015 **Online Published:** May 27, 2015
DOI: 10.5430/jha.v4n4p84 **URL:** http://dx.doi.org/10.5430/jha.v4n4p84

ABSTRACT

Background: The increasing number of falls in hospitals precipitates the need to collect and analyze falls data. Hospital falls data have been captured through staff documentation and incident reporting systems. Objective: The purpose of this study was to identify the variables associated with falls and injurious falls in an acute care hospital over the five years from the implementation of the Adverse Event Management System (AEMS). A secondary purpose was to identify problems associated with the AEMS.
Methods: Falls data recorded in the AEMS system from February 2009 to February 2014 were analyzed to observe trends of falls and contributing factors occurring in various hospital units.
Results: A total of 7,721 falls occurred during the study period. The highest frequency of the falls (901) occurred between 10:00 a.m. and 12:00 p.m. There were 2,275 falls which resulted in an injury. Both total fall and injurious fall rates were highest in Medicine inpatient units and lowest in Ambulatory outpatient units. The falls rate was 4.5 falls per 1,000 patient days in 2009 and 4.4 falls per 1,000 patient days in 2014. The prevalence of falls varied among nursing unit types and the time of day but the fall rate across the hospital did not change over the five year period.
Conclusions: Continuous evaluation of falls data and improved staff education is recommended to help reduce falls in acute care hospitals. A province-wide database registry should be considered for future research on incident reporting.

Key Words: Falls, Injurious falls, Hospitals, Incident reporting systems

1. INTRODUCTION

Hospitals have a responsibility to keep their patients safe. Falls are common adverse events in acute care hospitals. Patients fall 1.3 to 11.5 times per 1,000 patient days.[1,2] Falls are a burden for patients, families and hospitals. They affect the physical and psychological health of patients through pain, injuries, immobility and decreased function. Complications from falling lead to longer hospital stays, a loss of independence and have a significant financial cost.[3] Zecevic and colleagues[4] examined the cost of falls in an acute care hospital. They found the hospital cost for a patient who experienced a serious injurious fall while in hospital was on average $30,696 more than a matched patient who did not fall. They also found, that on average, length of stay increased for fallers by 34 days.

Being in the hospital lends itself to an increased risk for falling. Elderly and frail patients admitted with one or more co-morbidities have a heightened risk of falling in a hospital

*Correspondence: Barbara J. Watson; Email: bwatson3@uwo.ca; Address: Health & Rehabilitation Sciences, Western University, ON, N6G 1H1, London, Canada.

 ISSN 1927-6990 E-ISSN 1927-7008

environment.[5] Hospitals have identified falls as a systemic issue and from a risk management and patient safety perspective, institutional strategies to prevent falls and fall injuries must be developed.[6] Corporate goals include fall reduction as a strategic priority and quality assurance organizations such as Accreditation Canada have highlighted fall prevention as a required standard of practice.[7]

One way hospitals are meeting this standard is by implementing institution-wide incident reporting systems. This safety practice makes it possible to methodically gather information which can be tracked and potentially lead to changes in unsafe circumstances in the hope of minimizing future falls. However, collecting data in an incident reporting system can be a challenge even with a standardized reporting process in place. Issues such as under-reporting, missing data and limited detail can miss risk factors and distort the information on falls.[8–10] Capturing accurate information is vital for identifying risk factors and preventing further falls.

There have been many studies focusing on risk factors for falls. Tzeng and Yin[11] compiled a list of factors perceived by registered nurses to be associated with falls. The list included confusion, gait problems, Alzheimer's disease, disorientation and the inability to follow safety instructions. Bueno-Cavanillis and colleagues[12] categorized risk factors as intrinsic or extrinsic. Intrinsic factors are internal patient conditions whereas extrinsic factors are environmental elements that can lead to falls. Common intrinsic factors include altered mental status, decreased mobility and incontinence. Common extrinsic factors include type of flooring, clutter and poor lighting. Mion *et al.*[13] added situational risk factors to their study to describe occurrences such as the transfer of patients and patients going to the bathroom. Risk factors can also be categorized as modifiable and non-modifiable.[14] Understanding of the various risk factors can be used to advance fall prevention strategies.

Some falls however may not be preventable.[15] Balancing rehabilitation needs and patient autonomy is a challenge for institutions and care providers who are trying to respect patient wishes and promote functional independence while keeping patients from falling. This balancing act produces instances where some falls are difficult to prevent.[15] As a result, there has been interest in understanding the risk factors which contribute to serious injuries as these factors are clearly a heightened concern.[6, 11, 16] The primary purpose of this study was to identify the variables associated with falls and injurious falls in an acute care hospital over the five years from the implementation of the Adverse Event Management System (AEMS). A secondary purpose was to identify problems associated with the AEMS. In acute care hospitals falls are one of the adverse events that impact patients, staff and the integrity of the hospital. By identifying the variables associated with falls, hospitals can intervene to improve overall patient safety.

2. METHODS

The setting for the study was a large urban acute care teaching hospital located in Canada. This facility has 15,000 physicians, staff, students, scientists and volunteers who provide services for more than one million patient visits per year. There are 1,000 beds across two sites and over 50,000 admissions per year. The broad range of patient services consist of 28 different programs including Emergency Care, Neurology, Oncology, Medicine, Surgery, and Mental Health Services. The data used in this study were gathered from front-line staff who submitted reports to the AEMS data base. The research team received an anonymized secondary dataset, collected and extracted by staff of the participating hospital for the analysis. Hence, the study was approved without individual review by the Research Ethics Board. The study period was from February 2009 to February 2014.

The AEMS reporting system was set up in February 2009 to collect data from adverse events (*e.g.* falls, medication errors and other iatrogenic errors) across the organization into one database. This software program, purchased from Canadian Courseware Development (CCD) Health Systems, was adapted to fit the needs of the hospital.[17] A staff member, for example, logs onto the program using an electronic signature and confidential password. The initial instructions prompt the staff to create a report on general information such as the department and location of an event. The content of subsequent pages is dependent on the initial information. A patient fall report will probe for details and contributing factors related to the fall while a medical error report will probe for other information pertaining to the event.

In window one of the falls report, collected data include whether the fall was witnessed, describes the position in which the patient was found and whether or not any fall prevention strategies were being implemented at the time of the fall. Answers are offered in drop down menus to make it easier to check the correct response; however, there is also a text box available to add comments and/or more details. The second window with a drop down menu asks for contributing factors which can indicate possible reasons for the fall event. Certain situations or conditions might explain why the fall took place. For example, factors may be related to the condition of the environment (*e.g.* poor lighting, wet

floor and cluttered area), staff factors (*e.g.* fatigue, haste, knowledge deficit) or patient related factors (*e.g.* unsteady gait, non-compliance or confusion). If equipment or medical devices were involved, that will also be noted in this section. The third window records the actions taken, the staff member's immediate and post fall assessments and follow-up procedures.

Charts and reports can be created in AEMS for different types of events in order to show trends over time. This gives the organization an effective method to examine the number and characteristics of falls. Staff are instructed to complete as much information as possible about each event. This process may take up to 20 minutes and staff have 24 hours to complete an AEMS report after an adverse event. The event report is then sent to unit management for review and follow-up as required. Comments from coordinators are recorded along with the corrective actions implemented. The severity of the consequences determines the individuals who will receive the report for follow-up actions. Email alerts are used for this purpose. A link in the email message provides a direct connection to view the incident. The degree of injury associated with each fall is recorded using a 5-point severity level scale: 1. No injury/harm-assessment required; 2. No injury/harm-intervention/monitoring required; 3. Minor to moderate injury/harm; 4. Serious injury/harm/disability; and 5. Death. In the higher severity levels (four and five), where further review of the event is needed, senior management, physicians and the risk management department get involved with the follow-up assessments. Comments are provided which may recommend further corrective interventions to prevent the event from reoccurring. The event is then closed.

The study design was a retrospective secondary data analysis of all falls that occurred over a 5 year period. Frequencies were the main statistic used to describe the fall incidents. They were extracted from the AEMS data base and entered into an Excel Pivot Table for analysis. Frequencies were calculated for patient ages, number of falls, location of falls, the severity of falls, the time of day falls occurred and the patient's activity prior to the fall. To describe change over time, yearly fall rates were also computed. Fall rates were based on staff-reported incidents and calculated as the number of patient falls divided by the number of patient days multiplied by 1,000.[18]

Problems associated with use of the AEMS system were identified by nursing staff (n = 3), coordinators (n = 2), physicians (n = 2) and those in Risk Management Department staff (n = 3). These stakeholders (n = 10) were selected because they represented the different points in the AEMS notification algorithm. Questions posed to them were:

(1) What are the problems using the AEMS system?
(2) How is AEMS used to reduce falls?
(3) How can the AEMS system be improved?

3. Results

A total of 7,592 inpatient falls were reported over the five years from 2009 to 2014. The fall rate was 4.48 falls per 1,000 inpatient days in 2009 to 2010 and 4.40 falls per 1,000 inpatient days in 2013 to 2014. Table 1 describes yearly falls rates and fall prevention actions taken in those years. Although there were deliberate actions taken within the hospital, the results from the present study indicate a five year trend where there has not been a substantial reduction of the number of falls.

3.1 Variables associated with falls

The inpatient units where falls occurred most frequently were the Medicine, Surgery, and Neurosciences Programs (see Table 2). These three units collectively accounted for 65 percent of all falls reported. The least number of falls occurred in the ambulatory and clinic areas where patients enter and are expected to return home after being examined and assessed. Falls occurred in all areas of the hospital including both inpatient and outpatient departments. The times during which falls were consistently high were during 10:00 a.m. to 12:00 p.m., 1:00 to 2:00 a.m. and 4:00 p.m. to 5:00 p.m. (see Figure 1). Most falls (72%) occurred in the patients' rooms with 5,557 incidents reported. The activities prior to a majority of falls were transfer routines (55%) and walking or standing (43%). The most frequent reported factors associated with falls were unsteady gait (12%), patients requiring assistance and not calling for help (12%), having a history of falls (10%), weakness (9%) and impaired balance (8%). The average patient age was 68 years old (ranged from 1 to 106 years of age).

3.2 Variables associated with injurious falls

During the study period there were a total of 2,275 falls with injuries recorded at severity levels three, four and five (see Figure 2). Most falls (70%) did not result in injuries. The highest number of falls was at levels one and two and required minimal post fall assessments and interventions. There were 2,179 (29%) level three (*i.e.* bruises and skin tears), 80 (1%) level four (*i.e.* fractures), and 16 (0.20%) level five (*i.e.* deaths related to falls). Adults age 65 years and older were most prone to injuries after a fall, and accounted for 63 percent of all injurious falls on levels 3 and 4. The 16 deaths that occurred were also from this age group. The majority of injurious falls occurred on the medicine units. The most common type of severe injury from a fall was a fracture.

ISSN 1927-6990 E-ISSN 1927-7008

Table 1. Hospital's yearly inpatient fall rates and actions taken in those years

Year	Action	Significance to Fall Safety	Falls	Patient Days	Yearly Falls Rate
2009-10	Western University Researcher completed a study on the cost of falls in Hospitals. Medicine Program formed a working group to introduce measures to reduce falls. AEMS was implemented as a central incident reporting system.	Provided evidence of the financial costs associated with falls	1,357	302,834	4.48
2010-11	"The Many Faces of Patient Falls" fall prevention strategy was introduced in Medicine Program. Initial assessment of patients using the Fall Risk Assessment and Intervention Flow sheet. Fall risk checkbox was incorporated into the patient's kardex. Non-slip socks were purchased for patients. Blue paper slippers were removed from units. Information was provided to patient and families on fall prevention strategies. Education was given to the Medicine staff on falls prevention.	Implementation of a fall prevention program on Medicine in hopes to reduce fall rates	1,464	297,056	4.93
2011-12	"Quality and Patient Safety" and "Risk Management" became separate departments. Corporate Group formed to develop a corporate falls prevention strategy. Combined Medicine fall prevention strategies with corporate strategies. "Call don't fall" arm bracelets were introduced for patients with moderate-high risk for falling. Signage at the head of bed for moderate-high risk fallers. Patients at moderate-high risk for falling were noted on Patient Capacity Management Board. Bed exit alarms and chairs alarms used. Patient/family brochures were developed.	Corporate goals included patient safety and reduction of falls	1,537	336,863	4.56
2012-13	Evaluation of fall prevention program conducted by audits and data on falls. Fall prevention program presented at the Quality and Patient Safety Summit Conference. Verbal bedside reporting introduced to coincide with patient safety checks.	Safety culture becoming prominent corporate goal	1,652	357,854	4.62
2013-14	Communication white boards put in patient rooms to note patient mobility status. Learning package for staff on the different bed exit alarms. iLearn module for fall prevention in development.	Patient safety initiatives added	1,582	362,659	4.40
Totals			7,592	165,266	4.60

Note. Fall Risk Assessment and Intervention Flow sheet based on Morse Fall Scale; iLearn module is part of the corporate education system

3.3 Problems associated with incident reporting systems

The AEMS is used for documentation of a fall or any other hospital adverse event. The overview of the incident begins with the creation of the event report. At this initial stage, there are challenges associated with filling out the reports. Staff indicated that they may be too busy at certain times to report falls information or to fill out the report comprehensively. According to corporate policy, these events can be documented in the AEMS up to 24 hours after the event. However, staff may not be at work to complete the AEMS within that timeframe. The majority of shift rotations are two day shifts, followed by two night shifts and then five days off before the next set of shifts. A positive view of reporting in AEMS was realized when one nurse commented that action towards safety can be achieved by reporting adverse events and "near misses". For example, bed exit alarms were elevated to a significant fall prevention strategy after staff indicated that inactivation of this feature could potentially contribute to the risk for falls. As a result, leadership and staff came together and developed a learning module to educate staff on applying the bed exit alarms for patients deemed high risk for falls. The AEMS has shown the potential to

empower staff to make positive changes for patient safety. During the management review stage, unit coordinators indicated that follow-up can be time consuming due to the other demands on the unit. Another issue identified by coordinators was the lack of detail about the fall circumstances in the reports. Coordinators said they could get a better sense of the event if more details are included, such as what may have led up to the fall. Going to the staff member to gather more information was time consuming. Respondents from the Risk Management Department suggested that there may be an education gap where staff lacked knowledge about the purpose of AEMS and thereby cannot see the value of reporting and entering details. It was suggested that more training about the AEMS can improve the reporting by staff. Physicians also concluded that more education on the AEMS can lead to improved reporting which is the catalyst to promote a safer culture.

Table 2. Hospital fall rates according to the programs with the most falls (Rates from February 2009 - February 2014)

Hospital Programs	Number of Falls
Medicine Program	2,432
Surgery Program	1,750
Neurosciences Program	823
Cardiac Program	731
Cancer Program	481
Total	6,217

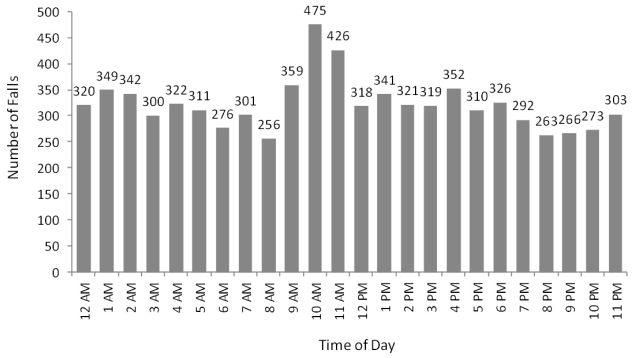

Figure 1. Fall rates recorded per hour on inpatient hospital units

4. Discussion

A primary purpose of this study was to identify variables associated with falls and injurious falls in an acute care hospital. The Medicine, Surgery and Neuroscience Programs recorded the highest number of falls during the study period. This result is consistent with other studies indicating these patient units are where most falls occurred.[19] Hitcho *et al.*[19] found that Medicine and Neurology services fall rates were both 6.12 falls per 1,000 patient days which is comparable to similar Programs in the present study. The Neuroscience Program at the present hospital consists of both Neurology and Neurosurgery patients. The most frequent diagnoses that patients were admitted with were stroke, brain tumor and spinal surgery. The Medicine Program consists of sub-specialty units such as: respiratory, acute care of the elderly and sub-acute units which care for more medically stable patients. Patients admitted to the Medicine Program have diagnoses such as chronic obstructive pulmonary disease, pneumonia, heart failure and diabetes. Both Neurosciences and Medicine patients share complex diagnoses linked to increased risks for falling which include comorbidities, weakness, impaired gait and cognitive impairment. Mobile patients with increased medical needs can also lead to falls. This is illustrated with the data showing that 55 percent of falls take place during a patient transfer. One solution to prevent these falls is conducting a more thorough assessment of the patient prior to each transfer. For example, assess whether there is a change in cognition or risk for orthostatic hypotension (which can cause imbalance) and whether the patient requires visual or hearing aids. This assessment may lead to a more appropriate transfer device and/or call for more staff assistance.

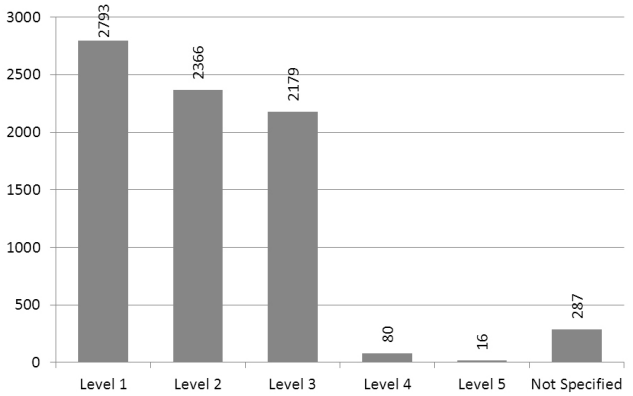

Figure 2. Severity level of falls

Level 1. No injury/harm-assessment required; 2. No injury/harm-intervention/monitoring required; 3. Minor to moderate injury/harm; 4. Serious injury/harm/disability; and 5. Death. There were 287 falls where injury severity was not specified.

The highest number of falls occurred between 10:00 a.m. and 12:00 p.m. When observing a busy medicine unit during this time of day, there were multiple patient transfers taking place in patient rooms. For example, from bed to chair, chair to walking, bed to stretcher and from the bathroom back to a chair or bed. This is also a time when patients go for tests and procedures and staff assists them to get ready. Medical teams make rounds during this time of day and new patient care orders may need to be processed. Interdisciplinary team members such as physiotherapists and occupational thera-

ISSN 1927-6990 E-ISSN 1927-7008

pists assess patients on mobility and function which can consist of getting them up and walking. As well, morning discharge time is at 11:00 a.m., when staff are given the task of providing patients with information and instructions upon their discharge. Morning breaks for nursing staff are also taken at this time. Consequently, there is less staff to supervise patients during a high activity level on the unit. Some of these activities may not be modifiable. For example consistent patients discharge is necessary to reduce the wait time in the Emergency Department. However, some activities such as non-urgent hospital tests and procedures (*e.g.* routine blood work and x-rays) can be delayed or re-scheduled for alternative times. Another high risk time is 1:00 a.m. to 2:00 a.m. Again, this is a high activity time at night with reduced staff. Nursing rounds and medication administration during this time necessitate waking up the patients and this can lead to bathroom transfers. More staff during busy times may reduce this fall risk. Nursing staff to patient ratios are based on Workload Measurement Indicators[20] that are used in conjunction with the unit needs. Staff enter their patients' plans of care for each shift into a workload computer data base. Workload measurement analysts along with administrators examine the data in order to allocate the resources (staff in this case) necessary for the care of the patients. These indicators are used to assess and adjust staff workload ratios. Reassessing the staff to patient ratios at high risk hours may be an effective strategy to reduce falls.

The age group that experienced the most injurious falls (levels 3-5) were patients over 65 years of age. Older people are the largest consumers of hospital care where 60 percent of admissions age individuals over the age of 65.[15] At this hospital 67 percent of patient admissions to the Medicine Program were patients 65 years of age or older. During their hospital stay older patients are at risk for functional decline such as having difficulty with mobility, activities of daily living and cognition.[6,21] Functional decline and other characteristics of geriatric syndromes put older patients at a heightened risk for falls and fall related injuries. There is also evidence that the hospital environment plays a role in injurious falls. A safer environment, such as reduction in noise has been shown to reduce injurious falls.[22] The Medicine Program units are busy with many people, noisy call lights, bed alarms and pagers. This leads to a sensory overload on patients' mental abilities which can cause confusion.[23] Staff, being aware of this, can minimize the noise and bright lighting to ensure a calming atmosphere. Patients taking anti-hypertensive medications also pose an increased risk for injurious falls.[13,24] A review of high fall risk medications can help to decrease injuries. *Beers Criteria* is a list of high risk medications which can potentially harm older adults. It summarizes the need to avoid certain medications that are associated with falls.[25] Following this guide could reduce the risk for falls and fall injuries.

The secondary purpose of this study was to identify problems associated with the computerized adverse event reporting system. The AEMS is a centralized incident reporting system meant to permit analysis of data to inform improvements to be made. Computerized incident reporting systems in acute care hospitals are an important component of a multifactorial fall prevention program to improve safety.[26] According to the present study's five year trend, there has not been a substantial reduction of the number of falls (from 4.48 falls per patient days to 4.40 falls per patient days). In order for the reporting system to be effective there is a need for timely reporting and for staff to provide as much information as possible and as soon after an event occurs.[27] Hill *et al.*[28] examined three different methods of recorded falls in an acute care hospital. The three recording methods were: participants (fallers) reported fall events to a research assistant, falls were recorded through case notes and falls were recorded in the hospital's incident reporting system. The authors found under-reporting occurred in all three recording methods. The greatest proportion of the total number of falls was recorded in the patient case notes (92%), followed by the hospital incident reporting system (76%). Falls reported to the research assistant were the least comprehensive method with only 60 percent of falls recorded. The researchers also found that falls were less likely to be reported in the hospital reporting system if they were recurrent falls or if the fall occurred during the morning or afternoon shift. As well, falls causing injuries were reported more than non-injurious falls. Even with these limitations however, and importantly for the present study, the authors reported that the adverse event reporting system validly represented the occurrence of falls in the hospital.

Efficient and effective reporting depends on the staff and his/her circumstances. On a busy unit, staff may find it difficult to report falls at certain times. Nurses are occupied in the morning dispensing medication and performing other duties that can deter the reporting of a fall. During those work intensive times the nurses require more time and access to computers to be able to report the incidents. The efficiency-thoroughness trade-off (ETTO) principle speaks to the common response of people to adjust what they do to meet their work needs.[29] According to the ETTO principle, demands on productivity tend to reduce thoroughness and vice versa. In a busy shift it is easy for efficiency needs to dominate thoroughness and thus drive safety to a secondary concern. Another explanation for why adverse events occur can be found in the Swiss Cheese Model of Accident Causa-

tion. Unlike the ETTO principle, the Swiss Cheese Model moves away from the human element towards the system as a whole.[30] In this analogy, each slice of cheese is a defensive layer in the process or system. The holes represent opportunities for failures in the system such as inadequate policies, not enough education, poor process designs and unsafe acts. When the holes on all defense levels align, the result is an increased potential for an adverse event. The Systemic Falls Investigative Method (SFIM) studies a broader view of why falls occur.[31] This method uses multidisciplinary interviews, process mapping and fall re-enactments. Once the data is collected and analyzed and entered into a web-based database, contributing factors to an adverse event are uncovered. One research suggestion emanating from the present study would be to use the SFIM methodology to collect in-depth system-wide information on specific types of falls or fall situations. One area of obvious importance are falls resulting in serious injuries or death. Reducing or eliminating such costly falls (in human and financial terms) would be important.

Another area for future research comes from the fact that data collected from a single institution may lack the power to complete an in-depth analysis of factors associated with falls. For example, Healey *et al.*[32] analyzed fall data taken from a national incident reporting system. The 472 organizations in the database recorded 206,350 falls. Using this pooled database, they found the "time of day" (between 10:00 a.m. and 12:00 p.m.), the patient's age (between 85 and 89 years old) and the care setting (Mental Health) were significant risk factors for falls. A province-wide database and research strategy would be advantageous.

5. Conclusions

This study exposed the variables associated with patient falls while in hospital. Two consistent variables were the hospital unit and the time of day. With this information, hospital administrators can allocate resources to high risk units during high risk times. They could have, for example, more supervision to deal with situations such as insufficient staffing on units with heavy workloads. Identifying the risk factors and determining which factors can be modified would require staff to be educated about the potential risks associated with patients in hospitals. It is also recommended that administrators collaborate with staff and inform them of the benefits of thoroughly filling out fall incidents reports in the AEMS. Future research supporting in-depth fall incident analyses should be conducted.

References

[1] Oliver D, Healey F, Haines TP. Preventing falls and fall-related injuries in hospitals. Clinics in Geriatric Medicine. 2010; 26(4): 645-92. PMid: 20934615. http://dx.doi.org/10.1016/j.cger.2010.06.005

[2] Currie L. Fall and Injury Prevention In: Hughes RG. Ed. Patient Safety and Quality: An Evidenced-Based Handbook for Nurse. Rockville, MD: Agency for Healthcare Research and Quality; 2008.

[3] Titler M, Dochterman J, Picone DM, *et al*. Cost of hospital care for elderly at risk of falling. Nursing Economic. 2005; 23(6): 290-306. PMid: 16459901.

[4] Zecevic AA, Chesworth BM, Zaric GS, *et al*. Estimating the cost of serious injurious falls in a Canadian acute care hospital. Canadian Journal on Aging. 2012; 31(2): 139-147. PMid: 22621825. http://dx.doi.org/10.1017/S0714980812000037

[5] Cumbler E, Likosky D. In-hospital falls: Evaluation and response. Continuum. 2011; 17(5): 1063-1076. http://dx.doi.org/10.1212/01.con.0000407060.48155.05

[6] Fischer ID, Krauss MK, Dunagan WC, *et al*. Patterns and predictors of inpatient falls and fall-related injuries in a large academic hospital. Infection Control and Hospital Epidemiology. 2005; 26(10): 822-827. PMid: 16276957. http://dx.doi.org/10.1086/502500

[7] Accreditation Canada. Safety in Canada health care organizations: A focus on transitions in care and required organizational practices. Canadian Health Accreditation Report. 2013; 1-24.

[8] Shojana KG. The frustrating case of incident-reporting systems. Quality Safety Health Care. 2008; 17(6): 400-402. PMid: 19064653. http://dx.doi.org/10.1136/qshc.2008.029496

[9] Shorr RI, Mion LC, Chandler AM, *et al*. Improving the capture of fall events in hospitals: Combining a service for evaluating inpatient falls with an incident report system. The Journal of the American Geriatrics Society. 2008; 56(4): 701-704. PMid: 18205761. http://dx.doi.org/10.1111/j.1532-5415.2007.01605.x

[10] Haines TP, Massey B, Varghese P, *et al*. Inconsistency in classification and reporting of in-hospital falls. The Journal of the American Geriatrics Society. 2009; 57: 517-523. PMid: 19187413. http://dx.doi.org/10.1111/j.1532-5415.2008.02142.x

[11] Tzeng HM, Yin CY. Frequently observed risk factors for fall-related injuries and effective preventive interventions: A multihospital survey of nurses' perceptions. Journal of Nursing Care Quality. 2013; 28(2): 130-138. PMid: 23117794. http://dx.doi.org/10.1097/NCQ.0b013e3182780037

[12] Bueno-Cavanillis A, Padilla-Ruiz R, Jimenez-Moleon JJ, *et al*. European Journal of Epidemiology. 2000; 16(9): 849-859. http://dx.doi.org/10.1023/A:1007636531965

[13] Mion LC, Chandler AM, Waters TM, *et al*. Is it possible to identify risks for injurious falls in hospitalized patients? The Joint Commission Journal on Quality and Patient Safety. 2012; 38(9): 408-413. PMid: 23002493.

[14] Center for Disease Control and Prevention. National Centre for Injury Prevention Control. 2014. Available from: http://www.cdc.gov/HomeandRecreationalSafety/pdf/steadi/risk_factors_for_falls.pdf

[15] Oliver D. Preventing falls and fall injuries in hospital: a major risk management challenge. Clinical Risk. 2007; 13: 173-178. http://dx.doi.org/10.1258/135626207781572693

ISSN 1927-6990 E-ISSN 1927-7008

[16] Krauss MJ, Nguyen SL, Dunagan WC, *et al*. Circumstances of patient falls and injuries in 9 hospitals in a Midwestern healthcare system. Infection Control and Hospital Epidemiology. 2007; 28(5): 544-550. PMid: 17464913. http://dx.doi.org/10.1086/513725

[17] Canadian Courseware Development Health Systems. Incident Reporting for Healthcare. 2014. Available from: http://dx.doi.org/10.1186/1478-4505-9-20

[18] Nurses Improving Care for Healthsystem Elders. NICHE Encyclopedia. 2014. Available from: http://www.nicheprogram.org/niche_encyclopedia-falls-fall_rates

[19] Hitcho EB, Krauss MJ, Birge S, *et al*. Characteristics and circumstances of falls in a hospital settle. Journal of General Internal Medicine. 2004; 19: 732-739. PMid: 15209586. http://dx.doi.org/10.1111/j.1525-1497.2004.30387.x

[20] Quadramed. Nursing. Clinical Solutions. 2015. Available from: http://www.quadramed.com

[21] Covinsky KE, Pierluissi E, Johnston CB. Hospitalization-associated disability: "She was probably able to ambulate, but I'm not sure." Journal of the American Medical Association. 2011; 306(16): 1782-1793. PMid: 22028354. http://dx.doi.org/10.1001/jama.2011.1556

[22] Tzeng HM, Hu MH, Yin CY. The relationship of the hospital-acquired injurious fall rates with the quality profile of a hospital's care delivery and nursing staff patterns. Nursing Economics. 2011; 29(6): 299-316. PMid: 22360104.

[23] Inouye SK. Prevention of delirium in the elderly: Risk factors and targeted intervention strategies. Annals of Medicine. 2000; 32(4): 257-263. PMid: 10852142. http://dx.doi.org/10.3109/07853890009011770

[24] Quigley PA, Hahm B, Collazo S, *et al*. Reducing serious injury from falls in two veterans' hospital medical-surgical units. Journal of Nursing Care Quality. 2009; 24(1): 33-41. PMid: 19092477. http://dx.doi.org/10.1097/NCQ.0b013e31818f528e

[25] American Geriatrics Society 2012 Beers Criteria Update Expert Panel. American Geriatrics Society updated Beers criteria for potentially inappropriate medication use in older adults. Journal of the American Geriatrics Society. 2012; 60(4): 616-631. PMid: 22376048.

[26] Hutchinson A, Young TA, Cooper KL, *et al*. Trends in healthcare incident reporting and relationship to safety and quality data in acute hospitals: Results from the National Reporting and Learning System. Quality & Safety in Health Care. 2007; 2009(18): 5-10.

[27] Wang SC, Li YC, Huang HC. The effect of workflow-based response system on hospital-wide voluntary incident reporting rates. International Journal for Quality in Health Care. 2013; 24(1): 35-42. PMid: 23220762. http://dx.doi.org/10.1093/intqhc/mzs078

[28] Hill A, Hoffmann T, Hill K, *et al*. Measuring fall events in acute hospitals comparison of three reporting methods to identify missing data in the hospital reporting system. The American Geriatrics Society. 2010; 58: 1347-1352. PMid: 20487077. http://dx.doi.org/10.1111/j.1532-5415.2010.02856.x

[29] Hollnogel E. The ETTO principle Efficiency-thoroughness trade-off: Why things that go right sometimes go wrong. Aldershot, Hants, England: 2009.

[30] Reason J. Achieving a safe culture: Theory and practice. Work and stress. 1998; 12(3): 293-306. http://dx.doi.org/10.1080/02678379808256868

[31] Zecevic AA, Salmoni AW, Lewko JH, *et al*. Seniors falls investigative methodology (SFIM): A systems approach to the study of falls in seniors. Canadian Journal on Aging. 2007; 26(3): 281-290. PMid: 18238732. http://dx.doi.org/10.3138/cja.26.3.281

[32] Healey F, Scobie S, Oliver D, *et al*. Falls in English and Welsh hospitals: A national observational study based on retrospective analysis of 12 months of patient safety incident reports. Quality and Safety in Health Care. 2008; 17: 424-430. PMid: 19064657. http://dx.doi.org/10.1136/qshc.2007.024695