Applied Nursing Research 48 (2019) 81–87

Contents lists available at ScienceDirect

Applied Nursing Research

journal homepage: www.elsevier.com/locate/apnr

In-hospital falls in a large hospital in the south of Brazil: A 6-year retrospective study

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ARTICLE INFO

Keywords:
Accidental falls
Aged
Accident prevention
Hospitals
Nursing
Patient safety
Risk management

ABSTRACT

Background: Reporting falls in the hospital setting is a world-recognized strategy to prevent these incidents.
Objective: To describe in-hospital falls reported in a large hospital in the South of Brazil.
Method: Retrospective, descriptive study of falls reported in the hospital's electronic reporting system.
Results: We analyzed 1071 fall incidents. The incidence of falls in inpatient units was 1.7 per 1000 patient days. Among the recorded falls, 95.3% occurred in patients who had been previously assessed as being at high or moderate risk of falls; 61.5% were using medications associated with increased risk of falls. Regarding age, 70.8% of the falls occurred in patients aged ≥60 years. Falls occurred mostly (72.6%) in inpatients units, and in 63.4% of the incidents the fall was witnessed by a family member/companion or a health team professionals. No injuries were recorded in 71.4% of the patients. Serious adverse events or sentinel events, such as fractures or head trauma occurred in 2.1% of the patients. Of these, 80% were in the group aged ≥60 years; 83% of the head traumas and 58% of the fractures occurred in patients who had been assessed as being at high risk of falls. Fractures were associated (p = 0.026) with age 70–79 years.
Conclusion: At the hospital where the study was performed, new fall prevention strategies must focus on patients admitted to inpatient units, aged ≥60 years, assessed as being at high risk of falls, and using medications associated with increased risk of falls.

What is already known about the topic?

- In-hospital falls are avoidable accidents, but continue to be a high prevalent patient safety issue with a negative impact on health systems.
- The reporting of falls in hospital settings is a well-known prevention strategy. However, because falls are probably underreported, most estimates are likely to be underestimated.
- Little is known about the associated factors of in-hospital falls.

What this paper adds?

- Serious adverse events or sentinel events, such as fractures or head trauma occurred in 2.1% of the patients who had falls. Of these, 80% were in the group aged ≥60 years; Fractures were associated (p = 0.026) with age 70–79 years.
- 95.3% of falls occurred in patients who had been previously assessed as being at high or moderate risk of falls; 61.5% were using medications associated with increased risk of falls. 70.8% of the falls occurred in patients aged ≥60 years.
- New fall prevention strategies must focus on patients admitted to inpatient units, aged ≥60 years, assessed as being at high risk of falls, and using medications associated with increased risk of falls.

1. Introduction

Falls are the second leading cause of accidental or unintentional deaths in the world. The World Health Organization (WHO) estimates that 37.3 million severe falls requiring medical care occur every year. Around 646,000 people die every year in the world as a result of falls (World Health Organization, 2018).

In-hospital fall rates have been reported to range from 1.3 to 16.9 per 1000 patient days, with a negative impact on health systems (Tucker, Bieber, Attlesey-Pries, Olson, & Dierkhising, 2012; Oliver,

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https://doi.org/10.1016/j.apnr.2019.05.017
Received 5 November 2018; Received in revised form 8 May 2019; Accepted 27 May 2019

Healey, & Haines, 2010, al Tehewy, Amin, & Nassar, 2015). However, because falls are probably underreported, most estimates are likely to be underestimated (Oliver et al., 2010; Lorenzini, Santi, & Báo, 2014). The lack of a standard definition of "fall" in the literature represents an additional challenge. Falls have been described as a complex and multifactorial phenomenon, a syndrome, and a sign of underlying or more serious health conditions (Al-Aama, 2011). The WHO defines a fall as "an event which results in a person coming to rest inadvertently on the ground or floor or other lower level" (World Health Organization, 2018).

In-hospital falls are responsible for an increase in mortality rates, hospital length of stay, and admission costs, and for a decrease in quality of life (QoL) (Morello et al., 2015; Alekna, Stukas, Tamulaitytė-Morozovienė, Šurkienė, & Tamulaitienė, 2015; Brand & Sundararajan, 2010; Guirguis-Blake, Michael, Perdue, Coppola, & Beil, 2018). Considering these deleterious impacts, falls prevention strategies have been discussed worldwide. Even though some studies have reported some success in reducing fall rates, in general these rates have remained stable and problematic across time (Tucker et al., 2012; Miake-Lye, Hempel, Ganz, & Shekelle, 2013; Wilkinson et al., 2018).

The reporting of falls in hospital settings is a well-known prevention strategy. Incidents are reported via institution-based or nationwide patient safety incident reporting systems in various countries (Howell et al., 2017). The focus of these systems should not be on the incident itself, but rather on the learning process. In other words, the prevention of falls associated with severe injuries should result from organizational advancements produced by insights generated during the learning that takes place through ongoing data analysis. Thus, the objective of reporting systems should not be limited to taking corrective actions – rather, the aim should include the identification of which corrective actions are truly appropriate or which incidents signal the need for systemic adjustments (Leistikow, Mulder, Vesseur, & Robben, 2017).

Considering this context, the objective of the present study was to describe in-hospital falls reported in a large hospital in the South of Brazil. The knowledge regarding the characteristics and profile of these incidents can provide a major contribution to the identification of prevention and improvement processes that are effective to reduce the risk of falls in this setting.

2. Method

Data for the present descriptive, retrospective study was obtained from the Office for Risk Management at a 497-bed hospital located in South of Brazil (Souza et al., 2019). This institution is one among only six hospitals in Brazil to be rated as a Center of Excellence by the Ministry of Health. It was also the first hospital in the South region to be accredited by the Joint Commission International, in 2002. Organizational planning and a strong safety culture are important aspects of the institution's strategic plan. All actions are guided by the search for excellence, and the institution has invested in continuous improvement to enhance the quality and safety of the care provided. This, substantially, contribute to improve the adherence of self-reporting system.

The hospital´ Office for Risk Management, leaded by a Registered Nurse, regularly monitors all falls reported in the hospital's reporting system by reviewing the electronic report form.

The institution has a group dedicated to falls prevention, which, monthly, performs root cause analyses of all serious events, with briefing and debriefing at the unit where the fall occurred involving the frontline team in the case discussion. Falls prevention strategies, previously discussed by this group, are implemented in the work environment and included as part of process improvement planning. The falls prevention protocol involves the following measures: use of the Johns Hopkins Fall Risk Assessment Tool (Martinez et al., 2016); indication for the presence of a family member or caregiver throughout the admission; use of risk identification bracelet; physical restraint if unavoidable; use of safety belt when sitting if indicated; providing education for patients and family members/companions regarding falls prevention; and indication for use of anti-slip shoes, among others.

Other measures taken by the hospital to prevent falls include: a field in the electronic prescription to inform "medications associated with fall risk"; environmental improvements, with installation of call bells in the bathroom and bedside, mattress belts to prevent stretcher mattresses from sliding, rubber covered steps for access to surgical beds; keeping the floors dry at all times and covered with anti-slip materials; and installation of rails in the bathrooms.

All falls are reported in the hospital's incident reporting system as soon as they occur by frontline staff. The incident reporting system was implemented at the hospital in 1st January 2012. Data collection for the present study was performed in January 2018 by the principal investigators (AB/EL). An Excel spreadsheet was generated. No exclusion criteria were applied, and therefore all falls reported from 1st January 2012 to 31 December 2017 were included.

The data were analyzed using the Statistical Package for the Social Sciences v. 20.0 (SPSS Inc., Chicago, IL, USA, 2010) for Windows, considering the following variables: age, sex, use of drugs associated with risk of falls, prescription for physical restraint, prescription for physical therapy, presence of companion (family member or caregiver), fall risk classification, implemented fall protocol, year of occurrence, shift, area and location of fall, incident severity classification, and type of injury.

Data were analyzed using descriptive statistics and expressed as measures of central tendency (mean and median) and variability (standard deviation and interquartile range). Absolute and relative distributions (n - %) were also reported. The symmetry of continuous distribution was assessed by the Kolmogorov-Smirnov test.

To compare intra-variable category proportions (univariate analysis) the Pearson's chi-square test for homogeneity was used, complemented by adjusted residual analysis, in which estimates equal to or above $|1.96|$ indicate a significant difference between the categories being compared. For comparison of two independent categorical variables, Pearson's chi-square test was used. A 5% significance level was adopted.

The ethical aspects of research involving human beings were observed in accordance with Brazilian regulations (Resolution 466/2012) (Ministério da Saúde, 2012). The project was approved by the institution's research ethics committee (CAAE: 57679316.9.0000.5330 - approval 1.833.572).

3. Results

There were 1017 falls reported in the hospital's system. The incidence of falls was 1.7 per 1000 patient days.

Table 1 shows that the number of falls was significantly different in the night and morning shifts (n = 409, 38.2%; and n = 375, 35.0%) as compared to the afternoon shift (n = 287, 26.8%) ($p < 0.001$). Regarding location, most falls happened in the "room" (n = 585, 54.6%). A high number of falls was also recorded in the bathroom/shower (n = 310, 28.9%) ($p < 0.00001$). The number of falls happening in the presence of a companion (n = 679, 63.4%) was significantly higher ($p < 0.001$) than the number of falls happening without a companion. In most cases, the companion was a relative (n = 296, 43.6%). The use of medications associated with fall risk (including antihypertensive agents, sedatives and hypnotics, neuroleptics and antipsychotics, antidepressants, and benzodiazepines) was significantly associated with the occurrence of falls (n = 659, 61.5%) ($p < 0.001$). Regarding the estimated fall risk measured by the Johns Hopkins Fall Risk Assessment Tool (Martinez et al., 2016), a significant difference in the occurrence of falls was detected ($p < 0.0001$) for the comparison between high risk (n = 633, 59.1%) and moderate risk (n = 388, 36.2%) vs. low risk. It should be noted that the difference between high and moderate risk was also significant, since the proportion of fall incidents in patients classified as high risk was almost twice as that recorded in patients at

Table 1
Characteristics of falls reported in a large hospital in the south of Brazil, 2018.

Variable	Total sample (n = 1071)[a]		
	n	%	p¥
Shift			< 0.001
Morning	375	35.0a	
Afternoon	287	26.8b	
Night	409	38.2a	
Location			< 0.00001
Outpatient area	3	0.3	
Bathroom/shower	312	29.1b	
Medical office	2	0.2	
Hallway	45	4.2c	
Surgical table	2	0.2	
†Others	13	1.3d	
Nursing station	1	0.1	
Room	585	54.6a	
Exam room	58	5.4c	
Operating room	2	0.2	
Waiting room	26	2.4c	
Exam room	7	0.7	
Medication room	4	0.4	
Surgical prep area	3	0.3	
Recovery room	5	0.5	
Triage area	1	0.1	
Vaccination room	2	0.2	
Patient with implemented fall prevention protocol			< 0.0001
No	145	13.5b	
Yes	926	86.5a	
Restraint prescription missing data = 310 (28.9%)			< 0.00001
No	757	99.5a	
Yes	4	0.5b	
Physical therapy prescription missing data = 465 (43.4%)			0.576
No	298	49.2	
Yes	308	50.8	
Presence of companion			< 0.001
No	392	36.6b	
Yes	679	63.4a	
Companion was			0.001
Caregiver	16	2.3d	
Nurse	126	18.5c	
Family member	296	43.6a	
Physical therapist	19	2.8d	
Physician	6	0.9	
Unknown	216	31.8b	
Sex			0.455
Female	575	53.7	
Male	496	46.3	
Age (years)			
Mean ± SD (min-max)	65.0 ± 21.4		
Median (1st-3rd quartile)	70.0 (56.0–80.0)		
Age (years)			< 0.00001
< 1	7	0.7	
1–12	34	3.2e	
13–19	5	0.5	
20–29	37	3.5e	
30–39	59	5.5d	
40–49	72	6.7 cd	
50–59	99	9.2c	
60–69	194	18.1b	
70–79	278	26.0a	
80–89	233	21.8b	
≥ 90	53	4.9d	
Medication associated with fall risk			< 0.001
No	412	38.5b	
Yes	659	61.5a	
Risk level			< 0.0001
Low	50	4.7c	
Moderate	388	36.2b	
High	633	59.1a	

¥:Pearson's chi square for homogeneity: intra-variable category proportions followed by different letters are statistically different at 5%. Categories not followed by a letter were not included in the statistical test because the number of occurrences was not sufficient for analysis.
†Others: Parking, elevator.
[a] Percent of total sample.

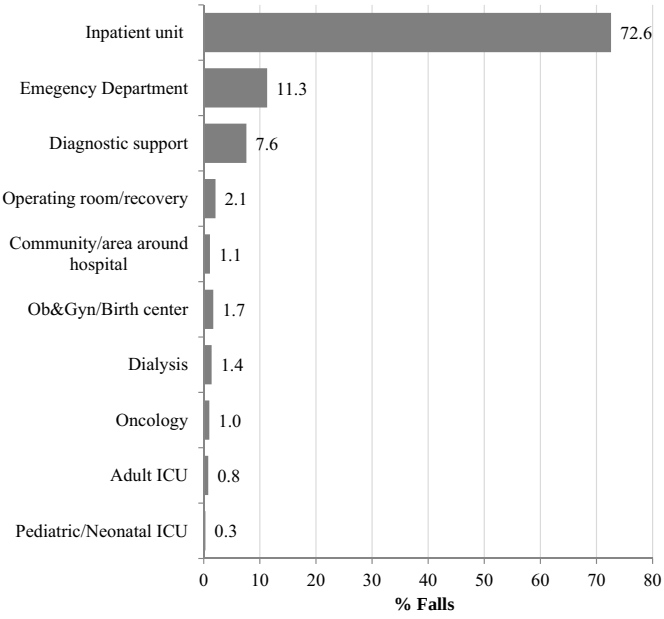

Fig. 1. Distribution of falls reported in a large hospital according to location, in the south of Brazil, 2018.

moderate risk. In this hospital, all patients have their fall risk routinely assessed by a Registered Nurse. This information is available in the medical record and it is used to implement strategies to prevent falls.

Fig. 1 shows the distribution of falls according to the location of the incident. The number of falls in inpatient units (n = 778, 72.6%) was significantly higher than in other areas ($p < 0.0001$). Significance was also observed for the falls taking place in the walk-in area (n = 121, 11.3%) and the diagnostic support area (n = 81, 7.6%) vs. all other areas.

As shown in Table 2, the main reasons reported for the falls were loss of balance (n = 324, 30.3%) and motor deficit (muscle weakness) (n = 231, 21.6%), which were significantly more frequent ($p < 0.001$) than other reasons. Regarding severity, falls classified as adverse events were significantly more frequent (n = 1049, 97.9%; $p < 0.0001$) than serious or sentinel events. Regarding the occurrence of fall-related injuries, the number of cases without injuries was significantly higher ($p < 0.01$) than the number of cases with injuries (n = 765, 71.4% vs n = 306, 28.6% respectively). Excoriations were the most common type of injury (n = 121, 39.5%; $p < 0.001$).

Table 2
Reasons for fall incidents and type of injury reported in a large hospital in the south of Brazil, 2018.

Variable	Total sample (n = 1071)[a]		
	n	%	p¥
Reason			< 0.0001
Mental confusion	139	13.0 cd	
Motor deficit/muscle weakness	231	21.6b	
Loss of balance	324	30.3a	
Equipment	9	0.9	
Slip	188	17.6bc	
Human error	16	1.5e	
Hypotension/syncope/dizziness	101	9.4d	
Sedation	1	0.1	
Trip	62	5.8e	
Severity			< 0.0001
Adverse event	1049	97.9a	
Serious adverse event	20	1.9b	
Sentinel event	2	0.2	
Injury			< 0.0001
No	765	71.4a	
Yes	306	28.6b	
Type of injury			< 0.001
Bruising	26	8.5d	
Cut	65	21.4b	
Wound dehiscence	1	0.3	
Edema	22	7.2d	
Excoriation	121	39.5a	
Fracture	19	6.2	
Hematoma	45	14.7c	
Spinal cord injury	1	0.3	
Head trauma	6	1.9	

¥:Pearson's chi square for homogeneity: intra-variable category proportions followed by different letters are statistically different at 5%. Categories not followed by a letter were not included in the statistical test because the number of occurrences was not sufficient for analysis.
[a] Percent of total sample.

Table 3 shows that the number of falls was significantly higher in the group aged 70–79 years (n = 278, 26.0%), 80–89 years (n = 233, 21.8%), and 60–69 years, (n = 194, 18.1%) (p < 0.00001). In the 70–79 years group, falls were significantly associated with slips (n = 59, 31.4%) and hypotension (n = 16, 15.8%); and in the 80–89 years group, falls were associated with mental confusion (n = 42, 30.2%) and slips (n = 52, 27.7%). Slips were also associated with falls in the ≥90 years group (n = 13, 9.4%). In the age group younger than 1 year, falls were associated with human error (n = 4, 25.0%); in the 1–12 years group falls were associated with human error (n = 4, 25.0%) and slips (n = 8, 12.9%). Finally, hypotension was associated with falls in the 30–39 years (n = 22, 21.8%) and 40–49 years (n = 13, 12,9%) groups.

Regarding the various types of injuries, Table 4 shows that fracture was associated with falls in the 70–79 years group (n = 7, 36.8%), whereas in the group aged 80–89 years falls were associated with cuts (n = 22, 33.3%) and hematoma (n = 14, 31.1%). It should be noted that fractures were more frequent in females (n = 11, 60%) vs. males (n = 8, 40%), and that 68.4% (n = 13) of the fractures happened in inpatient units.

Considering the most severe injury observed in this study, namely head trauma, four (66.6%) out of the six reported cases occurred in the emergency department area. The other two cases occurred in the 50–59 years and in the < 1 year age group. It should also be noted that serious adverse events and sentinel events were concentrated in individuals aged ≥60 years, who suffered 66.6% (n = 4) of the head traumas, 100% (n = 1) of the spinal cord injuries, and 84% (n = 16) of the fractures.

4. Discussion

The incidence of in-hospital falls was 1.7 for each 1000 patient days, a rate that is similar to that detected in previous studies (al Tehewy et al., 2015; Oliver et al., 2010; Tucker et al., 2012). It should be noted, as previously mentioned, that the hospital where the study was performed consistently invests in establishing a culture of safety, and thus underreporting of cases is unlikely. On the contrary, analysis of the contents recorded in a "comments" field in the reporting system revealed that in about 14% of the incidents the fall was prevented – patients with muscle weakness were held by their companion or by a health care professional and were helped to sit on the floor or armchair or to lean on a wall to avoid the fall. In these cases, injuries did not occur.

The high number of fall reports in the hospital where the study was performed may reflect the different definitions of fall available in the literature, which include both the need to reach the ground or simply the need for support, even if the individual does not come to rest on the ground (Ministério da Saúde, 2013). In addition, the standards for accreditation may also explain, at least in part, the high number of reports.

In this study, the frequency of falls was significantly higher in the morning and night shifts and in the patient's room. Most falls resulted in mild injuries such as excoriations, edema, and hematoma, as also described in other studies (Abreu, Mendes, Monteiro, & Santos, 2012; al Tehewy et al., 2015). During admissions, most of the patient's time is

Table 3
Frequency of falls per age group according to reason of event in a large hospital in the south of Brazil, 2018[§].

Age group (years)	Reason (n)																Total	
	Mental confusion		Imbalance		Slip		Equipment failure		Human error		Hypotension		Muscle weakness		Sedation		Trip			
	n	%[a]	n	%[a]	n	%[a]	n	%[a]	n	%[a]	n	%[a]	n	%[a]	n	%[a]	n	%[a]	n	%
< 1					3	1.6			4	25									7	0.7
1–12	1	0.7	12	3.7	6	3.2			4	25			3	1.3			8	**12.9**	34	3.2
13–19	1	0.7	1	0.3							2	2	1	0.4					5	0.5
20–29	3	2.2	8	2.5	2	1.1					10	9.9	11	4.8			3	4.8	37	3.5
30–39	4	2.9	13	4	4	2.1					22	**21.8**	12	5.2			4	6.5	59	5.5
40–49	4	2.9	24	7.4	8	4.3	1	11.1			13	**12.9**	21	9.1			1	1.6	72	6.7
50–59	6	4.3	22	6.8	14	7.4	3	33.3	2	12.5	14	13.9	29	12.6			9	14.5	99	9.2
60–69	32	23	60	18.5	27	14.4	1	11.1	2	12.5	16	**15.8**	47	20.3			9	14.5	194	18.1
70–79	33	23.7	88	27.2	59	**31.4**	1	11.1	3	18.8	16	**15.8**	60	26	1	100	17	27.4	278	26
80–89	42	**30.2**	80	24.7	52	27.7	2	22.2	1	6.3	8	7.9	39	16.9			9	14.5	233	21.8
≥ 90	13	**9.4**	16	4.9	13	6.9	1	11.1					8	3.5			2	3.2	53	4.9
Total	139	13.0	324	30.3	188	17.6	9	0.8	16	1.5	101	9.4	231	21.6	1	0.1	62	5.8	1071	100.0

[§] Pearson's chi-square test (p < 0.001).
[a] Percentage refers to the total number of each type of injury.

Table 4
Frequency of injury type according to age group in fall reported in a large hospital in the south of Brazil, 2018[§].

Age group (years)	Type of injury (n)																				Total	
	Bruise		Cut		Wound dehiscence		Edema		Excoriation		Fracture		Hematoma		Spinal cord injury		No injury		Head trauma			
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
< 1											1	5.3					5	0.7	1	16.7	7	0.7
1–12	1	3.8	4	6.1			4	**18.2**	1	0.8			4	8.9			20	2.6			34	3.2
13–19	1	3.8	1	1.5													3	0.4			5	0.5
20–29	2	**7.7**	1	1.5			0		2	1.7			2	4.4			30	3.9			37	3.5
30–39	3	**11.5**	3	4.5			2	9.1	3	2.5			1	2.2			47	6.1			59	5.5
40–49	2	7.7	2	3			2	9.1	7	5.8	1	5.3					58	7.6			72	6.7
50–59			4	6.1	1	100	5	**22.7**	9	7.4	1	5.3	1	2.2			77	10.1	1	16.7	99	9.2
60–69	6	23.1	9	13.6			3	13.6	24	19.8	3	15.8	9	20			139	18.2	1	16.7	194	18.1
70–79	7	26.9	18	27.3			4	18.2	34	28.1	7	**36.8**	11	24.4			195	25.5	2	33.2	278	26
80–89	4	15.4	21	**33.3**			2	9.1	30	24.8	3	15.8	14	**31.1**	1	100	157	20.5	1	16.7	233	21.8
≥ 90			2	3					11	9.1	3	15.8	3	6.7			34	4.4			53	4.9
Total	26	2.4	65	6.1	1	0.1	22	2.1	121	11.3	19	1.8	45	4.2	1	0.1	765	71.4	6	0.6	1071	100.0

[§] Pearson's chi-square test (p = 0.026).

spent in the room, which is also the location with the highest number of obstacles, such as nightstands, chairs, and wheelchairs, all of which may limit the patient's mobility. The literature shows that extrinsic factors related to the environment represent major risk factors for falls (Registered Nurses' Association of Ontario, 2017). Another study (Abreu et al., 2012) has reported that most falls occurred in the room, namely when patients moved onto the bed, armchair, or wheelchair. In addition, 72.6% of the falls in the present study occurred in inpatient units, and in 63.4% of the cases the fall occurred in the presence of either a health care professional (22.2%) or a family member/companion (45.9%). These results raise the question of whether the universal prevention strategies that have been implemented are really effective in the study setting – for example, the education regarding fall prevention measures, which is routinely performed by nurses with patients and family members/companions, may not be fulfilling its goals.

In this sense, it should be noted that the involvement of patients in their own health care is one of the major objectives of quality and safety initiatives in the United States, and has been implemented and followed in other countries as well (LaVela & Gallan, 2014; Longtin et al., 2010; National Quality Forum, 2018). Currently, patients are no longer mere/passive recipients of health care, but rather play a vital role by actively engaging in their own safety. However, the engagement of patients in their own care is still challenging.

The results of a previous study evaluating the perceptions of hospitalized patients relating to falls and falls prevention showed that even in the presence of a positive assessment of fall risk using standardized scales, hospitalized patients may not realize that they are likely to fall. In the present study, falls were significantly more frequent in patients who had been evaluated at high or moderate risk of falls (95.3%). This is in accordance with the literature, which strongly recommends falls prevention through risk identification using validated tools, comprehensive patient assessment, and clinical judgement (al Tehewy et al., 2015; Registered Nurses' Association of Ontario, 2017).

However, despite the identification of patients at risk for falls, the engagement of patients in falls prevention behaviors varies according to the patient's self-perceived confidence, awareness of the possible consequences, and fear (or absence thereof) associated with the fall (Twibell, Siela, Sproat, & Coers, 2015). This underscores the great challenge posed by falls for nurses, who play a key role in promoting the engagement of patients in self-care (Longtin et al., 2010; Tzeng & Yin, 2015).

A possible contribution of the present study is the suggestion to review the methods of patient and family education, especially in the group identified at high risk of falls, which accounted for 59.1% of incidents in the present study. The use of well-tested tools, such as the teach back method (Agency for Healthcare Research and Quality, 2018), might be more effective than the current methods employed. Another possibility would be the evaluation of new tools still requiring adaptation and validation, such as the Intention to Engage in Fall Prevention Scale (Twibell et al., 2015). Other authors have suggested that fall risk management should change drastically to incorporate human factors and ergonomics, including the design of health care systems from the perspective of patients (Hignett & Wolf, 2016).

In any case, prevention strategies must take into consideration and address the identified risk factors, and thus they are not the same for all patients. The health care team must truly understand the notion of patient-centered care. For example, the information regarding the need for anti-slip shoes during the admission is well-disseminated; nevertheless, in some of the falls reported, the patient as wearing inappropriate shoes. The development of care plans tailored to the specific needs of individual patients is imperative; and, above all, action must be taken when risk situations are spotted. Nurses, physical therapists, physicians, and nursing technicians must proactively share information and reinforce the guidance provided to patients and their family members/companions, who are frequently present when the fall happens.

Over 400 fall risk factors have been identified in the literature. They are described and classified according to different criteria, as modifiable, when amenable to interventions, or non-modifiable, when change is not possible (for example, age). Other classifications highlight biological (intrinsic) factors, environmental (extrinsic) factors, and also behavioral, social, and economic factors. Regardless of the classification employed, it is important to keep in mind that, for many people, these risk factors are complex and interrelated (The Royal College of Occupational Therapists, 2015).

In this sense, when facing non-modifiable risk factors, and considering the various health promotion actions with well-documented effectiveness in the literature, the prevention and reduction of falls and harm require a balance between risk reduction and respect for the individual's freedom, dignity, and QoL (Australian Commission on Safety, 2009). When trying to prevent a fall, family members, caregivers, or health care professionals may choose prevention measures that inadvertently restrict independence/autonomy (Miake-Lye et al., 2013). Health care organizations should avoid approaches that are excessively custodial and risk-averse (Australian Commission on Safety, 2009). Organizational surveillance is needed to prevent harmful or adverse approaches in preventing falls, such as physical restraint, sedation, or mobility restrictions (Miake-Lye et al., 2013).

Among the causes of falls in our study, imbalance and muscle weakness accounted for 51.9% of the cases, whereas slips and trips

accounted for 24.4%. These are well-known risk factors described in in the literature (Registered Nurses' Association of Ontario, 2017). Mental confusion, reported in 13% of the falls, is also in accordance with previous studies that indicate that cognitive impairment is a risk factor for falls (Doherty, Archambault, Kelly, & Rudolph, 2014; Szewieczek, Mazur, & Wilczyński, 2016).

Patients using medications such as antihypertensive agents, sedatives and hypnotics, neuroleptics and antipsychotics, antidepressants, benzodiazepines, also had significantly more falls, accounting for 61.5% of the incidents. Medications are a well-established risk factor for falls (Woolcott et al., 2009). However, the reason for prescription must be considered before interrupting treatment with a drug with the aim of preventing falls, since the health condition that generated the need for prescription may also be a risk factor for falls. Depression, pain, and cognitive impairment are good examples. Therefore, each medication must be examined individually, and the risks and benefits of interrupting a given medication must be weighed carefully (Al-Aama, 2011).

A contribution of the present study was the suggestion that falls prevention strategies may be implemented primarily with older individuals identified as being at high risk of falls, involving pharmacists who are trained in prescription revision and case discussion with the attending physician (Ganz et al., 2013; Spoelstra, Given, & Given, 2012).

It should be noted that 71.4% of the reported falls were not associated with harm, in accordance with a previous study (Abreu et al., 2012). The analysis of all reports is essential to identify risk groups and to implement measures that aim to avoid the falls associated with serious injury. In this sense, the present study detected a high prevalence of falls (70.8%) in patients aged ≥60 years, corroborating previous findings (Abreu et al., 2012), (Szewieczek et al., 2016). It must be mentioned that being 70–79 years of age was significantly associated with fractures.

Injuries classified as serious adverse events or sentinel events, namely head trauma, spinal cord injury, and fractures, accounted for only 2.1% of the cases in the present study, and affected mostly (80%) individuals ≥60 years of age. Studies show that serious injuries such as head trauma or spinal cord injury entail a risk of death, and also significant increase treatment costs (Alekna et al., 2015; Hill, Vu, & Walsh, 2007). There was no significant difference in the frequency of falls between men and women, as also previously reported (Callis, 2016). However, fractures were more prevalent (60%) in women, which might be related to the presence of osteoporosis, a well-known predictor of fractures (al Tehewy et al., 2015; Cawthon, 2011).

The present data suggest that to prevent additional adverse events at the institution where the study was performed, prevention measures must focus on the population aged ≥60 years, those assessed as being at high risk of falls, those using medications associated with increased risk of falls, and also on those admitted to inpatient units. The exception would be head trauma, since of the six cases recorded four happened in the emergency department area. These high risk groups must be given priority in terms of prevention efforts.

It is important to underscore that in general, all institutional improvement efforts, such as the implementation of incident reporting systems, must aim at generating learning and identifying strategies that are capable of eliminating the occurrence of serious events. The support of the leadership and the true engagement of frontline staff are essential conditions for the development of prevention programs that enhance adherence and rely on sustainable strategies (Ganz et al., 2013; Lorenzini, Oelke, Marck, & Dall'agnol, 2017; Miake-Lye et al., 2013). Frontline workers have a deep knowledge regarding the work they do; they care about being valued and recognized, and are motivated to improve the quality of the services they provide, taking risks and using creativity. Because of their familiarity with patient care processes, frontline workers have responsibility for continuous improvement, and thus they need education and training at all levels.

To promote the safety of patients regarding falls prevention, stakeholders must be identified and involved in the design of programs that include multifaceted, multidisciplinary interventions (Lorenzini, 2017; Registered Nurses' Association of Ontario, 2017), with pilot testing of all desired interventions, which must be evaluated regarding their evidence level and adjusted to the context to which they will be applied using knowledge translation strategies.

5. Limitations

It was not possible to analyze which medications associated with the risk of falls were being used, which is a limitation of the present study. The description of the medication is not usually informed in the incident report. However, this analysis does not compromise the results, since the database included an expressive number of incidents and other variables of interest were extensively explored. In any case, it might be useful to include a field regarding the name of medications used in the electronic reporting system at the institution where the present stud was performed, an information which may be useful for future fall prevention studies.

Finally, it is important to underscore that the present study was performed at a hospital rated as an institution of excellence by the Ministry of Health in Brazil. This hospital features consolidated quality management, risk management, and falls prevention programs that are well disseminated across the organization. Therefore, the present results cannot be generalized to institutions with different characteristics.

6. Conclusions

The present study analyzed all the 1071 fall incidents reported from 2012 to 2017 in a large hospital in the South of Brazil. The incidence of in-hospital falls was 1.7 per 1000 patient days.

Analysis of the data suggests that at the institution where the study was performed, the priority group prevention strategies includes individuals aged ≥60 years, formally assessed as being at high risk of falls, using medications associated with increased risk of falls, and admitted to inpatient units.

Health care organizations may also contribute to the risk of falls, for example by using an inadequate process of risk assessment or not performing risk assessment. Risk assessment should be performed on admission – in hospitals, residential care institutions, or home care services – or in the presence of significant changes in health status that may affect the risk of falls, for example in the presence of stroke or delirium. In addition, inconsistent interventions, lack of coordination between health care services, and poor communication also increase the risk of falls in institutions.

Further investigation in future study may consider other factors that may contribute to fall risk in Brazilian organizations, such as nurse to patient ratio per hours per patient day, caseload and the percentage of Registered Nurse among the staff.

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