

## brief report

# Prevalence of fall injuries and risk factors for fall among hospitalized children in a specialized children's hospital in Saudi Arabia

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**BACKGROUND:** Fall injuries among children during hospital stay is a major patient safety issue. Inpatient pediatric falls can lead to numerous negative consequences. In contrast to adults, there is a paucity of information on the prevalence and risk factors associated with children's falls during hospitalization.

**OBJECTIVES:** Identify the prevalence of fall injuries among hospitalized children and describe the demographic and environmental factors that could predict a higher risk of severe outcomes of fall.

**DESIGN:** Descriptive, cross-sectional prevalence study.

**SETTING:** Specialized children's hospital.

**PATIENTS AND METHODS:** Data was obtained through the electronic Safety Reporting System (SRS). All reported fall events during hospitalization in children  $\leq 14$  years of age for the period from 1 April 2015 to 30 April 2016 were included. Fall events that occurred in the day care unit and the outpatient clinic were excluded.

**MAIN OUTCOME MEASURES:** Prevalence and possible risk factors for fall events.

**SAMPLE SIZE:** 48.

**RESULTS:** The prevalence of falls among the 4860 admitted children was 9.9 (95% CI=7.5, 13.1) per 1000 patients (48/4860). A majority of the falls were among boys (n=26, 54%), in the age group from 1-5 years old (n=22, 46%), in children at high risk of falling (n=35, 73%), with normal mobility status (n=21, 44%), and with no history of previous falls (n=33, 69%). Severe injuries accounted for 25% of falls (n=12). However, falls among the moderate risk category (n=9, 69%) were more often severe than falls among the high risk category of children (n=12, 34%) (P=.03).

**CONCLUSION:** Risk factor identification is required to prevent falls and their severe outcomes.

**LIMITATIONS:** Underreporting and single-centered study.

**CONFLICT OF INTEREST:** None.

Everyday, hundreds of children are admitted to hospitals for various reasons. Promoting their safety during hospitalization is crucial. The first study to address the safety of children in the hospital was conducted in Great Britain, where it was reported that children were at risk for accidents in hospitals.<sup>1</sup> Inpatient pediatric falls are a concern in any medical institution. A fall is defined as “an unplanned descent to the floor, either with or without patient injury”.<sup>2</sup> In the United States, the rate of falls among hospitalized children was estimated to be 0.56 to 2.19 falls per 1000 patient days.<sup>3</sup> Children are a vulnerable population in the hospital, and falls may lead to injuries, prolonged hospitalization, waste of resources, and an increase in costs.<sup>4</sup> One study demonstrated that up to 30% of falls in toddlers may result in a concussion.<sup>3</sup>

There are many factors that may increase the risk of falls among admitted children. One of these factors is age. The mechanism of falling can differ according to the child's age group. For example, in infants, falls can occur when they begin rolling on the bed, crawling, or taking their first steps; in young children, falls can happen when they run through halls and are learning how to use the toilet.<sup>5</sup> Adolescents are usually shy or occasionally hesitant to ask for help to go to the bathroom or change their clothes. In addition to age, mobility status upon admission, hospital environment, previous history of falls, certain medical conditions such as seizures, and medications all play a role in increasing the risk of pediatric falls in hospitals.<sup>6</sup>

A recognition of these factors and patient outcomes are required to promote a comprehensive fall prevention and patient safety program. This should begin from the first day of admission, since most pediatric falls occur during the first five days of hospitalization.<sup>5</sup> More than one-third of falls are preventable.<sup>5</sup> Currently, there is a lack of evidence to guide health care practitioners in terms of effective practices for pediatric falls. This lack of evidence creates a potential risk for individuals and the community. The aim of this study was to identify the prevalence of fall injuries among hospitalized children and its associated risk factors that lead to severe outcomes.

### PATIENTS AND METHODS

We conducted a retrospective review of the inpatients records of children who had fall events after presenting to King Abdullah Specialized Children Hospital (KASCH) in Riyadh, Saudi Arabia, during the period from 1 April 2015 to 30 April 2016. KASCH is a tertiary care center that serves the Saudi National Guard population. In April 2015, the Pediatric Department was moved to

KASCH from King Abdul-Aziz Medical City (KAMC). Data were collected during the transition period. The study included children ( $\leq 14$  years of age) with reported fall events, defined as any sudden, uncontrolled, unintentional, downward movement of the body to the ground or other objects, during hospitalization. Patients who had fall events in the day care unit and outpatient clinic were excluded.

All information relevant to fall events was collected from an electronic safety reporting system. All data not included in the safety reporting system, such as nursing notes, diagnosis, outcome of fall, was taken from the inpatient medical records (BESTCare [Bundang Hospital Electronic System for Total Care], Seoul National University, South Korea). Data collection was mainly focused on factors related to the fall injury, which included age, admitted diagnosis, the setting and time (day or night shift), presence of a witness, history of previous fall, length of hospital stay, and outcome. Furthermore, the relationship between fall events and the patient risk category was analyzed. Ethical approval was granted by the ethical review board of King Abdullah International Medical Research Center (KAIMRC), Riyadh, Saudi Arabia. Protocol number: RC16/207/R approved on April 11, 2017.

A customized assessment tool was used in KASCH during the study period for prevention and management of patient fall risks to reduce harm and promote patient safety. Any admitted child was assessed within four hours post admission for risk of falls. Thereafter, patients were classified as at a standard or high risk for fall. The criteria for classifying patients into high risk of fall were one or more of the following: history of a fall within the last 6 months, use of a high fall-risk medication such as laxatives and sedatives, gait or balance impairment, visual impairment, and altered mental status. Age was classified based on the American Academy of Pediatrics (AAP) into infants (up to 1 year of age), young children/preschool ( $>1$  to  $<5$  years), and children ( $\geq 5$  years).<sup>7</sup> The Nelson textbook for milestone was followed for developmental age.<sup>8</sup> Day shift in KASCH begins at 07:00 and ends at 19:00 while the night shift begins at 19:00 and ends at 07:00. Injuries due to fall events were categorized based on the National Database of Nursing Quality Indicators (NDNQI) into mild, moderate, and severe injuries.<sup>9</sup> Mild injuries are those which result in application of a dressing, ice, cleaning of a wound, limb elevation, topical medication, bruise, or abrasion.<sup>9</sup> Moderate injuries are those that result in suturing, application of strips/skin glue, splinting or muscle/joint strain.<sup>9</sup> Major injuries are those which result in surgery, casting, traction, or required consultation for neurology.<sup>9</sup>

Data was analyzed using IBM SPSS version 21, (IBM Armonk, NY, United States). Descriptive statistics are presented as frequency and percentage for the categorical variables (age, gender, department, time, and outcome). The prevalence of falls was determined by taking the number of falls during the year as the numerator, and the total number of admissions during the same period as the denominator. The prevalence was presented as falls per 1000 hospital admissions with a 95% confidence interval. The chi-square test was used to compare fall injuries and risk of fall categories. A *P* value of  $<.05$  was considered to show a significant association for having an injury due to a fall for that variable.

## RESULTS

Forty-eight fall cases were documented during the study period (**Table 1**). Forty-eight falls met the study criteria during the first year of transition to KASCH. These falls occurred in over 4860 patients admitted that year which resulted in a prevalence rate of 9.9 (95% CI= 7.5, 13.1) falls per 1000 patients. The median age of the subjects was 3.0 years with an IQR of 1.5 years. There were 26 (54%) boys. Most of the patients (n=43, 90%)

had normal development for age, with a majority (n=35, 73%) not known to have any neurological disease such as epilepsy, traumatic brain injury. The ambulation status at the time of admission of 44% of the patients was unlimited with no need for assistance (n=21). Most of the patients (n=36, 75%) had previous hospital admissions, 33 (69%) had no history of a previous fall, and 35 (73%) were identified as being at a high risk for falling.

Of the 48 falls reported, 27 (56%) resulted in mild to moderate injuries with no loss of consciousness, while 12 (25%) were severe. Most of the cases (n=26, 54%) occurred during the day shift (**Table 2**). Further, a majority of the falls (n=23, 48%) occurred under pediatric subspecialties, mostly in the pediatric hematology and oncology department (n=8, 35%) (**Figure 1**). The length of hospital stay of 28 cases (58%) was less than 10 days, with most falls occurring during the first 5 days of admission (n=23, 48%). There were 14 (29%) documented cases of children who fell from the bed, and mothers were present at the time of the event (n=22, 46%). Moreover, a majority of the events (n=35, 74%) occurred in the patients' rooms. Most of the falls were reported in the first 2 months post transition to KASCH (n=6, 13% for the first month, and n=7, 15% for the second month).

**Table 1.** Characteristics of the subjects (n=48).

Demographics	n (%)
<b>Age</b>	
≤1 year	13 (27)
>1 to <5 years	22 (46)
≥ 5 years	13 (27)
<b>Gender</b>	
Boys	26 (54)
Girls	22 (46)
<b>Ambulatory status</b>	
Ambulation (limited with assistance)	17 (35)
Ambulation (unlimited no assistance)	21 (44)
Assistive device	2 (4)
Bed rest	8 (17)
<b>Other characteristics</b>	
Previous history of fall	8 (17)
High risk of fall	35 (73)
Previous admissions	36 (75)
History of neurological diseases	13 (27)

**Table 2.** Fall events (n=48).

Parameters	n (%)
<b>Event Time</b>	
Day shift	26 (54)
Night shift	22 (46)
<b>Length of hospital stay (days)</b>	
≤10	28 (58)
11–20	7 (15)
> 21	13 (27)
<b>Day of fall</b>	
First 5 days of the admission	23 (48)
6–10 days	6 (12)
>11 days	19 (40)
<b>Location of fall</b>	
Bathroom	5 (10)
Hallway	5 (10)
Room	35 (74)
Not mentioned	3 (6)

DISCUSSION

Our findings are consistent with other studies assessing inpatient pediatric falls, such as Hill-Rodriguez et al and Razmus et al, where children younger than 5 years had a high incidence of falls.<sup>10,11</sup> Falls at that age are due to developmental milestones; children begin learning how to walk, run, and jump, which may place them at a high risk of fall. Moreover, baby walkers, toilet training, and playing can contribute to a severe fall outcome. As in our study, the majority of the subjects in McGreevey and Razmus et al studies were boys.<sup>10,12</sup> On the other hand, we found that girls tended to have more severe fall outcomes than boys.

Most of the patients in Morse et al and Hill-Rodriguez et al were admitted to the Department of Pediatric Neurology;<sup>11,13</sup> however, most of our patients were hospitalized under the Department of Pediatric Hematology and Oncology. As in other studies, a majority of our patients were developmentally appropriate for their age.<sup>13</sup> In addition, most of our patients fell from the bed in their room, as reported in Leven et al, and Razmus et al.<sup>1,10</sup> This is reasonable since patients usually spend most of the time in their rooms. Studies also indicated that family members, specifically mothers, were present at time of the events.<sup>1,10</sup> In our study, we noticed that patients with both the mother and nurse as witness had a high rate of severe fall outcome.

Children at a risk for falls had a higher incidence of falling than patients at standard risk. This was similarly demonstrated in the Humpty Dumpty Fall Scale where high-risk children fell up to two times more than low-risk ones.<sup>12</sup> Contrary to our expectations, we found that high-risk patients had a low rate of severe injuries while standard risk patients had more severe fall outcomes. One explanation may be the protective protocols in the hospital, which apply for high-risk patients. As to time of the day, many studies found that falls occurred more frequently in the late morning or in the early evening.<sup>1,13</sup> In our study, more falls were reported during the day shift from 7 a.m. to 7 p.m.; however, severe fall outcomes were more frequent during the night shift. Three factors may explain this time predominance: patients may slip on objects and fall due to dim light, parents are asleep and not as observant, and the number of staff are fewer at that time. Some findings of Razmus et al were not consistent with ours: most of our patients had unlimited mobility status at the time of admission with no need for assistance, and did not have a history of previous falls. The differences in the two studies could be due to the protective methods that hospital staff and the family members used

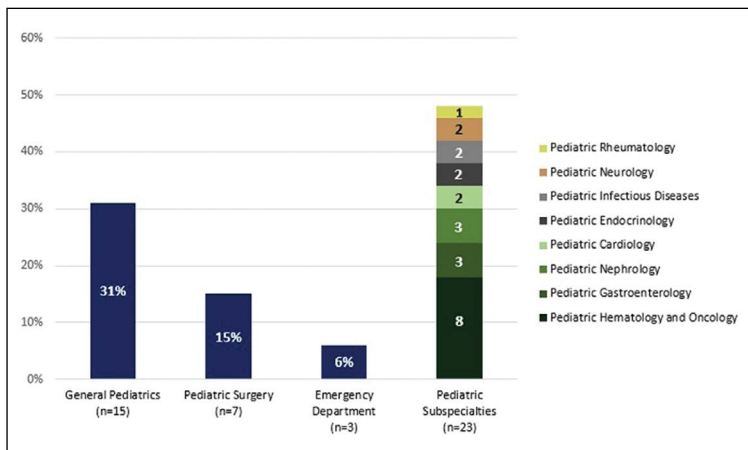


Figure 1. Fall among hospitalized children by department (n=48).

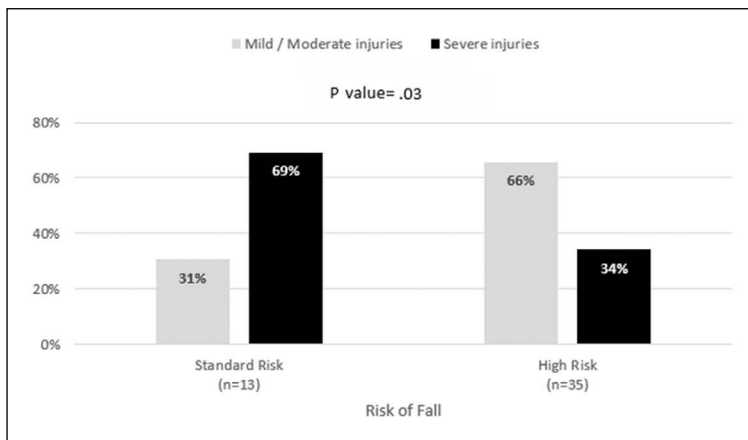


Figure 2. Comparison between the risk of fall category and severity of fall outcome (n=48).

When assessing the severity of fall outcome as compared to the demographics, girls (n=10, 45%) were more likely to have severe fall cases. Children aged from 1 to 5 years had a higher rate of severe fall outcome (n=11, 52%). During the day shift, 65% of the cases were labeled as mild/moderate injuries (n= 17) while in the night shift 55% were categorized as severe (n=12). Most of the severe injuries (n=10, 47.6%) occurred while playing and ambulating. Cases of severe falls with a mother as witness were equal to mild/moderate cases; however, those who fell with both mother and nurse as witness had a higher rate of severe injuries (67%). A majority of severe incidents occurred in the patient room (n=18, 85.7%), followed by the hospital hallway (n=2, 9.5%). Of 33 patients who had a history of a previous fall, 25% were severe cases. There was a significant difference (P=.03) between standard and high-risk patients in relation to severity of the outcome (Figure 2).

in patients with a history of falling. Most of the falls were reported in the first 2 months post transition to KASCH. This could be explained by manpower shortage, and getting acquainted with new protocols and safety measures. When assessing the severity of the outcome, most of our subjects had mild to moderate injuries which is consistent with Cooper et al.<sup>14</sup> In addition to the abovementioned factors, we also found a higher rate of severe outcome when the patient was playing or ambulating. One of the reasons for this is that patients may be connected to IV lines or monitor screens that can restrict them from playing and moving. Also, children may stumble over scattered playing equipment which may contribute to severe fall injuries.

There were several limitations to this study, one of which was the possibility of underreporting, which may result in an underestimation of the prevalence of falls. Additionally, the study was conducted in a short time interval, thereby resulting in a small sample size, which may not provide accurate findings reflective of the population. Also, information on non-fallers was not

collected; hence, specificity, positive predictive value, and odds ratios could not be calculated. Further, it was a retrospective, single-center study with a relatively small number of events to make a definitive association. Hence, a long-term multi-center study on falls in hospitalized children is suggested.

In conclusion, our study revealed that patients with falls were more likely to be boys, in the age group between 1-5 years, in the first 2 months post-transition to KASCH, to occur among those with a history of previous hospital admissions, within the first five days of admission, and in patients with an identified high risk of fall. All health care providers should recognize and take into consideration all the factors that increase the risk of falls among admitted children for better quality of care and patient safety.

#### Availability of data

*The data set and other materials pertaining to this study can be obtained from the corresponding author on reasonable request.*

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