

# An Observational Study of Fall Injuries among Infants in Special Reference to the Incidence and Risk Factors

Raja Basak

Assistant Professor, Department General Surgery, Malda Medical College and Hospital, West Bengal, India

## Abstract

**Objective:** The objective of the study was to assess the incidence and risk factors of fall injuries among infants admitted in our institution.

**Design:** Review of data from a large injury database.

**Setting:** The Emergency Department Injury Surveillance System.

**Patients:** A total of 2672 injured infants. Interventions Children's guardians were interviewed using a questionnaire. The results of an independent survey of 777 mothers of non-injured children younger than 2 years attending the same emergency departments were used to allow quantification of the role of specific nursery equipment in the causation of infant fall injuries. Main Outcome Measures: Annual rate of injury by falling in infants, overall and by cause.

**Results:** An annual incidence rate of 44 injuries per 1000 infants. The incidence of falls increases with increasing infant age. A high percentage of severe injuries was detected, most of them concussions (14.3%) and fractures (9.4%). Approximately 10% of infants with fall-related injuries required hospitalization. More than 36% of fall injuries involved nursery equipment. Infant walker use was associated with a higher incidence of falls (about 9/1000 infant-years), and these falls occasionally involved stairs and caused serious injuries.

**Conclusions:** Falls are a common cause of serious infant injuries, and nursery equipment is frequently involved in the injury-causing event.

**Key words:** Fall injuries, Infants, Nursery equipment, Risk factors

## INTRODUCTION

Falls from different causes have been recognized as a major cause of death and disability worldwide and as a factor responsible for substantial morbidity among children of all ages.<sup>[1-3]</sup> A characteristic of injuries among very young children is that aspects of their normal behavior that is the natural curiosity or the physiologic development of motor skills could be associated with increased injury risk,<sup>[4-9]</sup> especially in an unknown environment or when inappropriate nursery equipment is used. Moreover, caretakers often show insufficient concern for the risks linked to the developmental

milestones and sometimes forget that they should be prepared for unexpected behavior on the part of the infants.<sup>[10]</sup> Most fall-related injuries affect children during their early stages of development, and they usually occur at their home.<sup>[11]</sup> Falls are one of the most common causes of injuries among infants, and they have long been studied in relation to nursery equipment. Several studies have claimed the role of specific types of nursery equipment, such as infant walkers and bouncers, in the causation of fall-related injuries.<sup>[5,12-15]</sup> The present study aimed to assess the incidence of fall-related injuries among infants and assess the risk factors. The study was based on infant injury data collected from hospital records.

## MATERIALS AND METHODS

The focus of this investigation was on fall-related injuries among infants younger than 12 months who were brought for care in an emergency department during a 4-year period, from January 1, 2016, through December 31, 2019. The interviews

### Access this article online



www.ijss-sn.com

**Month of Submission :** 05-2020  
**Month of Peer Review :** 06-2020  
**Month of Acceptance :** 07-2020  
**Month of Publishing :** 07-2020

**Corresponding Author:** Dr. Raja Basak, No. 3, Government Colony, Malda, West Bengal, India.

took place in the emergency departments as well as in indoors of the hospital along with the child's medical examination by the attending surgeons. The questionnaire covers sociodemographic variables, the mechanism and the objects involved in the injury, type of injury and injured body part, supervision patterns, medical assessment of the injured child, and treatment provided. To assess the frequency of use of the various types of infant nursery equipment in the underlying population, and thus derive equipment-specific incidence rates of infant fall injuries, a special survey was conducted in the same hospitals. In this survey, mothers of 777 non-injured very young children (1–2 years old) who consecutively, during a 3-month period, contacted the OPD services of the hospital for check-ups or very minor ailments were interviewed about the frequency of use of nursery equipment throughout the infancy of their children. It is worth noting that both studies were based on the same population. We performed this task with the use of pre-coded questionnaires covering the various types of nursery equipment. There were only 11 refusals among the 788 contacted women.

For the analysis, the injured infants were classified by age, sex, principal object involved in the event, and type of principal/primary injury. Subsequently, we calculated the incidence of infant fall injuries by equipment per 1000 infant-years, taking into account infant-years at risk in the underlying population and frequency of use of nursery equipment as estimated in the ad hoc survey. The number of infants at risk every year in the catchment areas (namely almost three districts Uttar and Dakshin Dinajpur and Malda district along with neighboring areas of Bihar state) was 12 075 (9250+ 2825). The study period was 4 years; therefore, the total infant-years at risk were 60 375. We multiplied this figure by the proportion of users of each specified type of nursery equipment. The incidence of falls by type of equipment (per 1000 infant-years) was calculated as the ratio of each nursery equipment-related number of fall injuries to the corresponding infant-years at risk. Due to overlapping person-time at risk during the 1 year of infant life and the joint contribution of more than one type of nursery equipment to an injury, the estimated figures per single equipment add to more than the total infant fall injuries from all nursery equipment. Throughout the analysis, SAS statistical software (SAS Institute Inc., Cary, NC) was used.

## RESULTS

Table 1 shows the distribution of 2672 infants with fall injuries of a total of 4340 infants with injuries of any type recorded by demo-graphic variables, main objects involved in the event, and type of principal injury. It is estimated that about 4400 infant fall injuries occur annually in this area corresponding to an annual incidence rate of approximately

44 injuries/1000 infants. As far as infant age is concerned, the infant population at risk can be assumed to be equally distributed across the three 4-month age intervals. Thus, the substantial increase in the frequency of falls among all infants with increasing age was statistically highly significant (0–3 months, 12.7%; 4–7 months, 33.3%; and 8–11 months, 54.0%;  $P < 0.001$  from a goodness-of-fit  $\chi^2$  test with 2df). There was also evidence of a slight excess of male infants among those with fall injuries. Among the infant fall injuries, 269 (10.1%) were sufficiently serious to require hospitalization. As expected, most of the serious injuries were concussions (14.3%) and fractures (9.4%), which required hospitalization in 17.3% and 61.7% of instances, respectively. Among the 2672 infant fall injuries, 967 (36.2%) involved nursery equipment, mostly walkers (11.5%), strollers (8.8%), and bouncers (5.7%). Changing table-related infant falls required the highest hospitalization rate among the studied nursery items (17.1%). About half of the recorded infant fall injuries (54.7%) were related to home objects other than nursery equipment, mainly furniture (37.2%) or other immobile home structures (15.9%); of those, almost 1 in 10 required hospitalizations. In 244 instances (9.1%), the caregivers reported that infants slipped and fell from their arms; 1 in 5 infants who slipped and fell required hospitalization, and 36 of them had a fracture.

Table 2 shows the incidence of falls among infants by type of most frequently used nursery equipment, highlighting their involvement in the causality of these types of injuries. As indicated, in the catchment areas of the study hospitals, an average of 12,075 new deliveries are recorded every year. On the basis of this number and the fraction of users of specified nursery equipment, as ascertained from the mothers of 777 non-injured infants. The incidence of falls by equipment per 1000 infant-years can be estimated. Infant walker use was associated with the highest incidence of falls, and these falls frequently involved stairs and caused non-minor injuries (among these injuries, 8% were fractures, 20% were concussions, and 26% were open wounds). Infant bouncers, strollers, and changing tables were associated with a similar incidence of falls (about 4/1000 infant-years).

## COMMENT

Falls among infants are responsible for a substantial fraction of infant morbidity and mortality, accounting for about six deaths annually/1 million infants in the United States.<sup>[16]</sup> The findings of our study indicate that almost two-thirds of all injuries recorded among infants were due to falls. More than one-third of these falls were associated with the use of nursery equipment. Another third of infant falls were related to home furniture and equipment, which implies either inappropriate use of these objects in infant care or

**Table 1: Distribution of infants with fall injuries**

Variable	Fall injuries, No. (%) (n = 2672)	No.	% of total hospitalized	% of all fall injuries in category
Age, mo				
0–3	340 (12.7)	57	21.2	16.8
4–7	891 (33.3)	89	33.1	10.0
8–11	1441 (54.0)	123	45.7	8.5
Sex				
Male	1465 (54.8)	149	55.4	10.2
Female	1207 (45.2)	120	44.6	9.9
Object involved in accident				
Nursery equipment	967 (36.2)	91	33.8	9.4
Walker	308 (11.5)	30	11.1	9.7
Stroller	234 (8.8)	11	4.1	4.7
Changing table	76 (2.8)	13	4.8	17.1
High chair	66 (2.5)	5	1.9	7.6
Crib	85 (3.2)	6	2.2	7.1
Bouncer	152 (5.7)	19	7.1	12.5
Other nursery equipment	46 (1.7)	7	2.6	15.2
Human arms	244 (9.1)	52	19.3	21.3
Home furniture	994 (37.2)	84	31.3	8.5
Immobile structures	425 (15.9)	38	14.1	8.9
Outside home objects	42 (1.6)	4	1.5	9.5
Type of principal injury				
Concussion	381 (14.3)	66	24.6	17.3
Fracture	251 (9.4)	155	57.6	61.7
Open wound	431 (16.1)	3	1.1	0.7
Strain/dislocation	22 (0.8)	0	0.0	0.0
Contusion/abrasion	884 (33.1)	31	11.5	3.5
No identifiable injury	686 (25.7)	8	3.0	1.2
Other injuries	17 (0.6)	6	2.2	35.3

**Table 2: Estimation of incidence of infant injuries due to falls from nursery equipment by type of equipment**

Nursery equipment	Users in population at risk			
	No. of falls (1996–2000)	(777 infants) No. (%)	Infant-years at risk by indicated equipment*	Incidence of falls by equipment per 1000 infant-years
Crib	85	705 (90.7)	54,760	1.6
Bouncer	152	482 (62.0)	37,433	4.1
Stroller	234	750 (96.5)	58,262	4.0
Walker	308	456 (58.7)	35,440	8.7
High chair	66	294 (37.8)	22,822	2.9
Changing table	76	243 (31.2)	18,837	4.0

lapses in parental supervision. As has been pointed out by other authors, use of nursery equipment carries a significant risk of falls during infancy.<sup>[5-8,12-18]</sup> In line with the literature, infant walkers tended to be associated with a relatively high risk of an infant fall injury.<sup>[6,8,19-21]</sup> Among the other objects in nursery equipment, infant bouncers, strollers, and changing tables were associated with a similar level of time-integrated risk [Table 2]. Infant falls led more frequently to an injury that required hospitalization. This may be attributed to the fact that the changing table may be furniture height or may be placed on a piece of furniture, which may result in an infant fall from a considerable height. Cribs appear to be less risky, even though they are used for longer periods. Obviously, there are variations in both times of exposure to and risk from nursery equipment so that our estimates are by necessity

indications of average nursery equipment-related risk. In 251 instances, the reported fall injury led to a fracture. Several studies have suggested that fractures in very young children may involve an element of physical child abuse.<sup>[22,23]</sup> Whatever the true underlying reason, these ratios are comparable with those reported from other series of infant fall injuries.<sup>[24]</sup>

Our study pointed to the significant role of nursery equipment in fall-related injuries among infants. Parents should be aware of the potential hazards when purchasing such products and always use them according to the manufacturer’s instructions.<sup>[25,26]</sup> The use of nursery items by infants should be under strict adult supervision. Leaving an infant on a changing table or other surface even for an instant without supervision may result in an injury since

infants who are left unsupervised can roll off and fall, especially if they are placed on an elevated surface.<sup>[25-27]</sup> If parents decide to purchase a walker for their child, notwithstanding current recommendations to the contrary, they should avoid its use on wheels, and they should restrict access to any stairs with a gate.<sup>[25]</sup> Infants should always be securely fastened with a safety belt when placed in a high chair, a changing table, or any other similar equipment.<sup>[25-28]</sup>

The advantages of this investigation are its general population coverage, large sample size, and use of a standard protocol. Moreover, the use of a comparison sample allowed the estimation of exposures in the population at risk, making it possible to calculate the nursing equipment-specific incidence rates.

As is common in injury research, we were unable to jointly examine predisposing conditions and triggering events in the causation of the infant falls. In the same context, we were unable to disentangle any hidden child abuse cases from that reported as unintentional falls. Compared with other parts of the country, a considerably higher proportion of injured infants were hospitalized, but this is a well-known phenomenon in this hospital, and it is frequently attributed to the inadequate development of primary health care in this country and the overprotective attitude of society toward children.<sup>[29,30]</sup>

In conclusion, we were able to calculate the overall incidence and estimate the nursery equipment-specific incidence of infant falls in the population. We found that among nursery equipment, use of infant walkers and, to a lesser extent, infant bouncers, strollers, and even changing tables are associated with a non-negligible risk of injury from infant falls. Diligent adult supervision informed product selection, and simple environmental modifications can contribute to the reduction of fall-related injuries in infancy.

## REFERENCES

1. Krug EG, Sharma GK, Lozano R. The global burden of injuries. *Am J Public Health* 2000;90:523-6.
2. Kypri K, Chalmers DJ, Langley JD, Wright CS. Child injury morbidity in New Zealand, 1987-1996. *J Paediatr Child Health* 2001;37:603.
3. World Health Organization. The World Health Report, 2002; 2003. Available from: <http://www.who.int/whr/2002/annex/en>. [Last accessed on 2003 Oct 15].
4. American Academy of Pediatrics. Committee on Injury and Poison Prevention. Injuries associated with infant walkers. *Pediatrics* 2001;108:790-2.
5. Mayr JM, Seebacher U, Schimpl G, Fiala F. Highchair accidents. *Acta Paediatr* 1999;88:319-22.

6. Chiaviello CT, Christoph RA, Bond GR. Infant walker-related injuries: A prospective study of severity and incidence. *Pediatrics* 1994;93:974-6.
7. Macgregor DM. Injuries associated with falls from beds. *Inj Prev* 2000;6:291-2.
8. Smith GA, Bowman MJ, Luria JW, Shields BJ. Babywalker-related injuries continue despite warning labels and public education. *Pediatrics* 1997;100:E1.
9. Watson WL, Ozanne-Smith J. The use of child safety restraints with nursery furniture. *J Paediatr Child Health* 1993;29:228-32.
10. Tarantino CA, Dowd MD, Murdock TC. Short vertical falls in infants. *Pediatr Emerg Care* 1999;15:5-8.
11. Mathers LJ, Weiss HB. Incidence and characteristics of fall-related emergency department visits. *Acad Emerg Med* 1998;5:1064-70.
12. Powell EC, Jovtis E, Tanz RR. Incidence and description of high chair-related injuries to children. *Ambul Pediatr* 2002;2:276-8.
13. Emanuelson I. How safe are childcare products, toys and playground equipment? A Swedish analysis of mild brain injuries at home and during leisure time 1998-1999. *Inj Control Saf Promot* 2003;10:139-44.
14. Wickham T, Abrahamson E. Head injuries in infants: The risks of bouncy chairs and car seats. *Arch Dis Child* 2002;86:168-9.
15. Ridenour MV. Ages of young children who fall down stairs. *Percept Mot Skills* 1999;88:669-75.
16. National Statistical Service of Greece. Distribution of parents, during 1998, by age, educational level, and place of residence. In: *Natural Movement of the Population of Greece*. Athens: National Statistical Service of Greece; 1998. p. 129-34.
17. Dessypris N, Petridou E, Skalkidis Y, Moustaki M, Koutselinis A, Trichopoulos D. Countrywide estimation of the burden of injuries in Greece: A limited resources approach. *J Cancer Epidemiol Prev* 2002;7:123-9.
18. National Center for Injury Prevention and Control. Unintentional Fall Deaths and Rates Per 1,00,000. United States: National Center for Injury Prevention and Control; 2001. Available from: [http://www.webappa.cdc.gov/sasweb/ncipc/mortrate10\\_sy.html](http://www.webappa.cdc.gov/sasweb/ncipc/mortrate10_sy.html). [Last accessed on 2003 Oct 15].
19. WHO Statistical Information System (WHOSIS); 2003. Available from: <http://www.who.int/whosis/menu.cfm>. [Last accessed on 2003 Oct 05].
20. Shendut IH, Tan KK, Rivara F. Baby walker associated scalding injuries seen at University hospital Kuala Lumpur. *Med J Malaysia* 1995;50:192-3.
21. Petridou E, Simou E, Skondras C, Pistevox G, Lagos P, Papoutsakis G. Hazards of baby walkers in a European context. *Inj Prev* 1996;2:118-20.
22. Thomas SA, Rosenfield NS, Leventhal JM, Markowitz RI. Long-bone fractures in young children: Distinguishing accidental injuries from child abuse. *Pediatrics* 1991;88:471-6.
23. Dalton HJ, Slovis T, Helfer RE, Comstock J, Scheurer S, Riolo S. Undiagnosed abuse in children younger than 3 years with femoral fracture. *Am J Dis Child* 1990;144:875-8.
24. Trogan I, Dessypris N, Moustaki M, Petridou E. How common is abuse in Greece? Studying cases with femoral fractures. *Arch Dis Child* 2001;85:289-92.
25. Cooper CL, Jennifer D. Development of an evidence-based paediatric fall prevention program. *J Nurs Care Qual* 2007;22:107-12.
26. Fall Prevention for Infants and Young Children. Available from: [http://www.health.state.ok.us/PROGRAM/injury/factsheets/fall\\_prevention\\_for\\_children.htm](http://www.health.state.ok.us/PROGRAM/injury/factsheets/fall_prevention_for_children.htm). [Last accessed on 2004 Mar 10].
27. Conners GP, Veenema TG, Kavanagh CA, Ricci J, Callahan CM. Still falling: A community-wide infant walker injury prevention initiative. *Patient Educ Couns* 2002;46:169-73.
28. Watson WL, Ozanne-Smith J. The use of child safety restraints with nursery furniture. *J Paediatr Child Health* 1993;29:228-32.
29. Ten Leading Causes of Hospitalization by Age Group, Minnesota; 2001. Available from: <http://www.health.state.mn.us/injury/pub/ed2001/ed01appena7.pdf>. [Last accessed on 2004 Mar 10].
30. Leading Causes of Death and Hospitalization in Canada. Available from: [http://www.hc-sc.gc.ca/pphb-dgspsp/publicat/lcd-pcd97/hsp\\_mf\\_e.html#per](http://www.hc-sc.gc.ca/pphb-dgspsp/publicat/lcd-pcd97/hsp_mf_e.html#per). [Last accessed on 2004 Mar 10].

**How to cite this article:** Basak R. An Observational Study of Fall Injuries among Infants in Special Reference to the Incidence and Risk Factors. *Int J Sci Stud* 2020;8(4):89-92.

**Source of Support:** Nil, **Conflicts of Interest:** None declared.