Childhood Falls in Manitoba

CHIRPP Report
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An Assessment of Injury Severity and Fall Events by Age Group

By:
Lynne Warda, MD, FRCPC
Medical Director, IMPACT

Gemma Briggs, MA
Research Assistant, IMPACT

The injury prevention centre of Children's Hospital
NA335-700 McDermot Avenue
Winnipeg, Manitoba, R3E 0T2
TEL: 204-787-1873
FAX: 204-787-2070

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Introduction

Background

As part of an evolving provincial injury prevention strategy, Manitoba Health and the Regional Health Authorities have identified priority areas on which to focus prevention efforts, based on the burden of injury to Manitobans. These include: motor vehicle occupant injuries, falls, suicide, and drowning. A provincial Falls Prevention Framework is currently being developed, with a focus on children and the elderly, yet provincial data on Emergency Department (ED) visits for fall-related injury are lacking. Adult fall data are not well captured for ED visits in Manitoba, however, a surveillance system exists for paediatric ED presentations at the Winnipeg Children's Hospital.

Fall Classification

Falls may be classified by their mechanism (type or circumstance), which can include falls from stairs, buildings, ladders, play equipment, chairs or beds, and falls during sports activities. Head injuries are responsible for the majority of deaths due to falls. The severity and outcome of a fall depends on the fall distance, surface characteristics (e.g. resiliency, contours, obstacles), and the use of any protective devices (e.g. helmet, wrist guards).[1] For children, the most frequent type of fall leading to significant injury and requiring medical treatment is from one level to another, with falls from play equipment the leading cause within this category.[2,3]

Objectives

This research will involve an investigation of fall injury in Manitoba using Emergency Department data collected by the Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP). The CHIRPP data for Manitoba includes presentations at the Children's Hospital Emergency Department in Winnipeg.

Methods

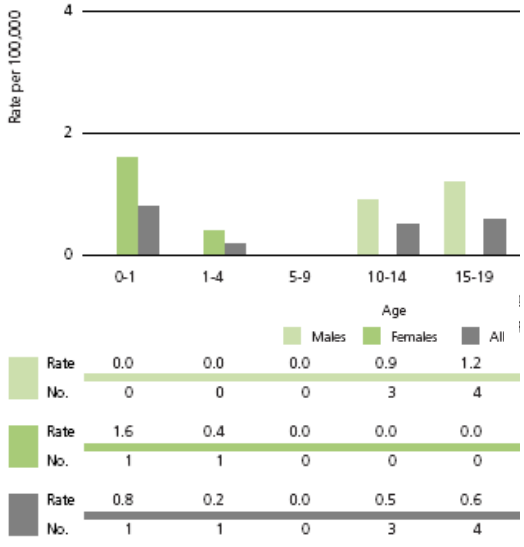
The CHIRPP child injury surveillance system collects information on Emergency Department visits in ten paediatric hospitals in Canada, including the Winnipeg Children's Hospital. This is a voluntary system in which a child's parents and physicians are requested to complete a standardized form providing information regarding the child's injury. A search of the Winnipeg CHIRPP database was conducted for the most complete five year period. Descriptive statistics are used to describe fall injury patterns and outcomes. Winnipeg CHIRPP data are presented along with local data regarding deaths and hospitalizations for falls in an attempt to describe the fall injury pyramid more completely. The Winnipeg Children's Hospital only treats children up to 16 years of age.

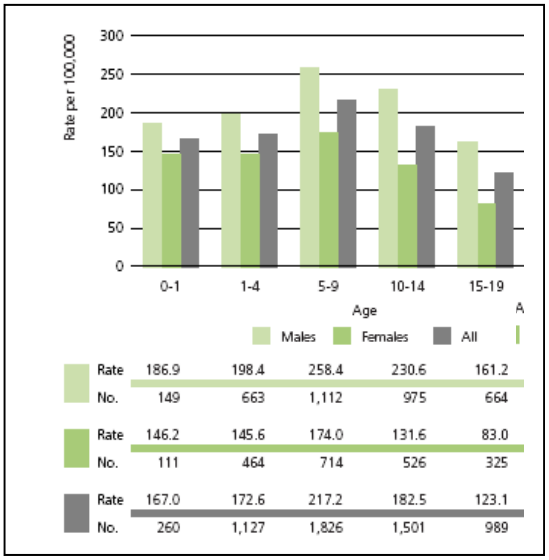
Results

EPIDEMIOLOGY

Falls are the leading cause of injury hospitalization for Manitobans and the third leading cause of injury death, preceded by suicide and motor vehicle traffic injury.[4-6] Manitoba Health data document that approximately one child dies from a fall each year. Fall-related deaths result in an average of 5.0 potential years of life lost per fatality and an average length of hospital stay of 19.8 days.[6] These results reflect the large proportion of fall injuries and deaths occurring in the elderly. The Manitoba College of Physicians and Surgeons Child Health Standards Committee (1990-1999) data also illustrate that children less than 15 years of age rarely die due to fall injuries.[7] Falls are the second leading cause of head injury in Canadian children, with transport injuries being the leading cause.[5] Annually, there are approximately 570 paediatric hospitalizations and 3,327 Emergency Department visits for child fall injury in Manitoba.[6,8] When examining injuries, the injury pyramid is often used to illustrate how the number of injuries increases from deaths to hospitalizations, Emergency Department (ED) visits, and finally physician or clinic visits.[9] While there are sufficient death and hospitalization data, Emergency Department and physician visits represent missing pieces of the pyramid. The figures below illustrate unintentional fall deaths (1992-1999) and hospitalizations (1992-2001) for Manitoba children and youth.[6]

Figure 1 & 2. Deaths (Left) and Hospitalizations - Fall Injury





Here, the ratio of male to female child deaths is 3.5:1. These gender disparities are less pronounced for paediatric fall-related hospitalizations (1.66:1).

Fall-related injuries among children tend to be less severe with increasing age, with the highest rates of hospitalization and death found in infants 0-12 months of age.[5] Injury patterns also vary with age. Falls among infants and toddlers frequently result in minor head injuries or concussions, and other injuries to the head and face (dental injuries, lacerations). Children 5-14 years of age are more likely to suffer fractures and dislocations. Adolescents 15-19 years of age more often experience sprains and other soft tissue injuries. For First Nations Manitobans, death due to falls is not among the five leading causes of death, yet for both First Nations and Non-First Nations Manitobans falls are the leading cause of injury hospitalization. Fall hospitalization rates per 100,000 are 596.9 for First Nations Manitobans and 440.5 for Non-First Nations Manitobans, with a ratio of 1.3:1.[6]

Economic Impact

Falls have a significant economic impact on the province, including costs to individuals and their families, workplaces, the health system, as well as community and social services. The direct costs related to the treatment of falls in Manitoba account for 41% of the total unintentional injury treatment costs for the province.[10] Between 1999 and 2002, the total cost of fall injury for Manitoba was $335 million per year with $256 million spent on direct costs. Childhood falls cost the province $31 million with an additional $28 million attributed to falls among youth each year. Here, direct costs are estimated at $16 million and $13 million, respectively.[10]

Emergency Department (CHIRPP) Data

All data for children less than 20 years of age with the injury group description code of '10' for 'falls' were accessed for the most complete five year time span (1999-2003). Six records were excluded as they were considered to have been miscoded as a fall (five swimming/diving, one machinery). The final sample size was 16,636 which equates to an average of nine visits each day for fall injury at the Winnipeg Children's Hospital Emergency Department. As shown in Table 1 and Figure 3, the incidence of falls was consistent over the study period, with approximately 3,330 fall presentations per year among children and youth.

Table 1. Number and Proportion of Falls by Year (CHIRPP, 1999-2003)

Year	Number	Proportion
1999	3486	21%
2000	3,261	20%
2001	3,381	20%
2002	3,300	20%
2003	3,208	19%
Total	16,636	100%

Age & Gender

Five age groups were used to categorize children less than 17 years of age. Falls occurred more among children 1-14 years of age (see Table 2). The proportion of male children injured in a fall was determined after the removal of cases for which gender was unknown. Overall, 59.5% of Emergency Department visits for falls were among male children, the proportion of males increased for children 10-16 years of age.

Figure 3. Falls by Year (CHIRPP,1999-2003)

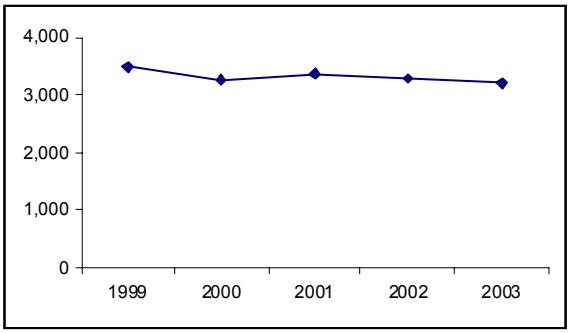


Table 2. Falls by Age Group

Age Group (years)	Count	Proportion	Proportion Male
<1	665	4%	56.6%
1-4	5015	30.1%	59.4%
5-9	5008	30%	56.3%
10-14	4965	30%	61.5%
15-16	983	5.9%	68.7%
Total	16,636	100%	59.5%

Fall Circumstances

Injuries occurred more often on Friday (15.1%), followed by Thursday (14.8%), however for the most part the days were fairly evenly distributed, with Monday being the day with the least number of fall injuries (13.8%). Unlike other injury types, falls were not found to be more common on weekend days. For time of day, falls were more common between 4:00 p.m. and 8:00 p.m. (35%), 12:00 p.m. and 4:00 p.m. (30%), and 8:00 p.m. and 12:00 a.m. (18%). Falls occurred most often in September (10%), followed by May (9.8%), June (9.4%), and August (9%). The month with the least amount of falls was December (6%).

The breakdown event was most often "fell / jumped / dropped from unspecified height" (22%), followed by loss of control (17%), fell on same level (16%), fell ≤1M (13%), and "tripped on" (12%). Excluding unspecified locations, falls were most common in the garden/yard (21%), followed by the living room (11%), stairs (10%), playground (9%), and bedroom (8.5%). Location was more often the child's own home (38%), with other common locations being school (20%), another person's house/apartment (11%), other road (7%), or public park (6%). The main fall mechanisms were floors/materials (20%), concrete/other man-made surfaces (15%), ground and other natural surfaces (13%), unknown surface (8%), ice/snow/frost (8%), and stairs/steps (6%). In 32% of cases the individual was engaging in a sport at the time of injury. This was most often cycling (20%), with other common sports being soccer (8%), skateboarding (7%), football (7%), ice hockey (7%), and inline skating (6%).

Proportion of Falls

Falls accounted for 53.6% of all injury types that occurred during 1999-2003 among children less than 20 years of age. This amounts to over half of all injury presentations to the Children's Hospital Emergency Department in Winnipeg for the time period examined.

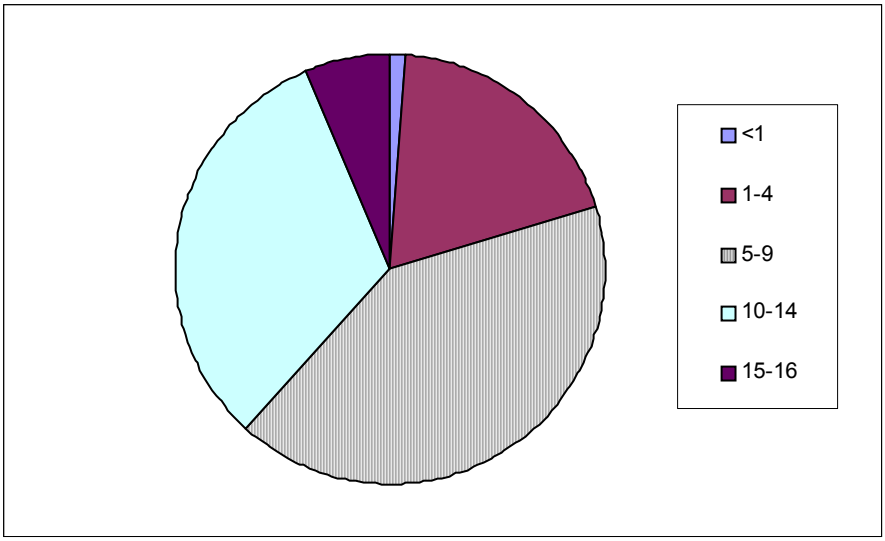
Severity

For the falls subset, 7.27% were admitted to hospital compared with 6.51% for all types of injury within the same period. As shown in Table 3, 72% were treated with further follow-up recommended while 20% received advice. Figure 4 illustrates the distribution of the 1,209 fall injury admissions by age group. From this it can be inferred that children 5-14 years of age experience the most severe fall injuries.

Table 3. Fall Injury Outcomes (Disposition)

Result	Count	Proportion
Treated, follow up required	7380	44.36%
Treated, follow-up whenever necessary	4557	27.39%
Advice only	3293	19.79%
Admitted to hospital	1209	7.27%
Short stay observation in ED	119	0.72%
Left without being seen by physician	67	0.4%
Missing	7	0.04%
Other direct admission	2	0.01%
Transferred to another hospital	2	0.01%
Total	16,636	100%

Figure 4. Fall-Related Hospitalizations by Age Group



Fall injuries most often resulted in a fracture (36%), followed by an open wound (21%), minor head injury (11%), sprain/strain (10%), a superficial injury (10%), or a soft tissue injury (7%). The seventh most common outcome was a concussion (2%). The most common body part injured was the head/face (34%; head – 21%), followed by the upper extremities (forearm / elbow / wrist - 30%), and lower extremities (ankle/lower leg - 10%).

Contributing Factors by Age Group

The top ten fall types by age group were determined using the variable that describes the primary contributing factor (Table 4). In 28% of cases the category was listed as 'missing' which restricts our findings to only those which reported contributing factors. As children age the contributing factors move from home to outdoor, as well as from furniture to playground equipment, and later to sports-related falls.

Table 4. Contributing Factor by Age Group

Rank	<1 year (74%)*	1-4 years (54%)	5-9 years (52%)	10-14 years (56%)	15-16 years (62%)
1	Beds 94 (baby beds/cribs 8)	Beds 329	Bikes/bike accessories 381	Child other than victim 403	Snowboarding 76
2	Adult other than victim 70	Sofas / couch 254	Child other than victim 371	Bikes / bike accessories 390	Skateboarding 67
3	Sofas / couch 51	Chairs 245	Monkey bars/jungle gyms etc. 321	Skateboarding 239	Basketball 62
4	Child other than victim 27	Stairs/steps 204	Play structure 242	Football 217	Bikes/bike accessories 61
5	Baby strollers/carriages 26	Child other than victim 152	Swings/swing sets 133	Soccer 215	Child other than victim 60
6	Stairs/steps 20	Play structure 95	Beds 122	Snowboarding 198	Soccer 50
7	Baby walkers 17	Adult other than victim 84	Children's games 104	Ice hockey 191	Football 49
8	Baby change tables 16	Grocery/shopping carts 81	Soccer 94	Basketball 175	Ice hockey 42
9	Baby/child car seats 15	Monkey bars/jungle gyms etc. 72	Inline/roller skating 89	Inline/roller skating 169	Inline/roller skating 20
10	High chairs/booster seats 13 Tables 13	Slides 70	Trees/branches 87	Sledding / tobogganing / snow disking / tubing 83	Stairs/steps 20

*Percentages in brackets specify the proportion accounted for by the top ten (with missing cases removed from the denominator)

Discussion

Injury Patterns and Implications for Prevention

Fall injuries present a significant burden for the health care system. They represent over half of all ED presentations during the examined time period (1999-2003). Head trauma and musculo-skeletal injuries are the most common fall injury outcomes, both of which may result in long periods of rehabilitation and treatment, and future disability.

Age

This report highlights the fact that fall mechanisms and circumstances are age-specific. Falls at home decrease with age while falls at educational sites, sports and recreational areas, and in the road environment increase with age.[5] As shown in other reports (see Table 5), infants (0-12 months) tend to fall from furniture such as sofas, beds, cribs, stairs, and children's products such as baby walkers and high chairs; toddlers (1-4 years of age) fall from stairs, windows, and furniture (bed, crib, chair); older children (5-9 years of age) fall from play equipment; youth (10-14 years of age) fall most frequently during sports activities.[1,5]

Table 5. Rank order of factors contributing to falls by age group (Victoria, Australia, 2000)

	<1 year	1-4 years	5-9 years	10-14 years
1	Conventional bed	Conventional chair/stool/seat	Bicycle	Bicycle
2	Pram/stroller/carriage	Table/bench/counter	Monkey bar	In-line/roller skates
3	Table/bench/counter	Conventional bed	Trampoline	Football
4	Change table	Stair/step	Tree	Basketball
5	Stair/step	Bicycle	Inline/roller skates	Horse riding
6	High chair	Sofa/lounge/couch	Slide	Skateboard
7	Sofa/lounge/couch	Trampoline	Bunk bed	Motor/trail/dirt bike
8	Conventional chair/stool/seat	Slide	Flying fox	Netball
9	Bouncer/rocker	Bunk bed	Swing	Stair/step
10	Baby walker	Swing	Stair/step	Tree

Gender

The Winnipeg CHIRPP findings are also consistent with national statistics showing that males account for 62% of deaths, 77% of hospitalizations, and 56% of emergency department visits due to falls among children.[5] In Winnipeg, 60% of paediatric ED presentations were male.

Specific Injury Mechanisms

Furniture

It is important to tailor prevention efforts to the identified age-related hazards. For infants and toddlers, nursery equipment (e.g. change tables, cribs, strollers, high chairs) is commonly implicated in falls. One-third of fatal and hospitalized fall injuries among children less than three years of age are due to falls from furniture.[11] Active parental supervision and the vigilant use of available restraints (waist and crotch straps) could reduce these risks. Compliance with the manufacturer's instructions, such as weight and developmental limits for product use, and instructions for proper use (e.g. not hanging materials on stroller handles) could further reduce the risk of falls and injury.

Experts recommend against placing infants to sleep on adult beds, sofas, or other furniture (www.cpsc.gov). This represents a fall hazard as well as a suffocation and choking hazard. Children frequently fall from beds. Winnipeg CHIRPP data identified falls from beds as the leading cause of fall-related ED presentation for young children (<5 years of age). Several studies have assessed falls from beds, their circumstances, and outcomes. One study of 85 children treated in a UK Emergency Department found that 85% of children fell out of bed while they were asleep.[12] Here, 32% of cases led to the child suffering a head injury while in 29% of instances the child sustained a fracture. Bunk bed fall injuries are more serious, with significantly more brain injuries, fractures, multiple injuries, and admissions to hospital.[13] It is recommended that children less than five years of age do not sleep in bunk beds.

Baby Walkers

In April 2004, Canada became the first country worldwide to ban the sale, advertisement, and importation of baby walkers through an amendment to the Hazardous Products Act.[14] Baby walker falls often result in head and neck injuries. In one study, 29% of cases involved serious injuries such as skull fractures, intracranial hemorrhage, cervical spine fractures, and death.[15] Children who sustain baby

walker injuries (76%) have typically fallen down stairs while in the device.[1] In addition to ensuring that the ban is enforced, it is also recommended that parents destroy existing walkers and not use second-hand walkers.

Playgrounds

Playground falls resulting in injury occur most often among children 5 to 9 years of age and are the leading cause of injuries to children in the school environment.[16,17] Most playground falls that cause injury result from falls to the ground surface.[18] Fractures are the most common type of playground-related injury, with 80% involving the wrist, lower arm, and elbow.[17]

A national voluntary standard for playground safety was first published by the Canadian Standards Association (CSA) in 1990. This comprehensive standard addresses potential hazards through design and maintenance recommendations for equipment, grounds, and surfacing. For falls from play equipment, the risk of injury relates to the fall height and the energy absorption potential of the playground surface.[2] The Canadian Paediatric Society recommends the use of a maximum equipment height of 1.5 meters.[19] The risk of falls is also related to children's behaviour on the equipment, and may be affected by various supervision strategies.

To provide a safe playground for children, appropriate surfaces (i.e. sand, pea gravel, wood chips) must be continuously maintained at a safe depth, and surfacing and equipment must remain free from hazards.[2] Close parental supervision of preschool-aged children on playgrounds is essential. Parents should stand at arm's-length (or less) beside preschool children, when they are climbing, on a swing, or on an elevated platform.[20]

Sports and Recreation

Many prevention measures should be considered for reducing the risk and severity of falls in sports and recreation including: (i) selecting appropriate activities for the child's skills and development; (ii) discussing with older children and youth the risks of alcohol and drug use in sports; (iii) use of appropriate clothing (e.g. reflective clothing when in traffic) and equipment (e.g. helmets, mouth guards, wrist guards); and (iv) safe environments separated from road traffic and free from fall hazards.[21,22]

Falls or collisions during sports and recreational activities are the leading cause of injury hospitalization for Canadians less than 20 years of age.[5] A recent analysis of the Ontario

Trauma Registry database documented that cycling injuries (21%) are the main cause of sports and recreation hospitalizations.[23] The CHIRPP data included falls for other summer sports including skateboarding, soccer, inline skating, trampoline use, and football. Winter sports that led to fall injury visits in the ED included snowboarding and ice hockey, which are more common in children 10-16 years of age. The CHIRPP data showed that snowboarding was the leading cause of fall ED presentations for children 15-16 years of age. The Canadian Academy of Sport Medicine's Snowboarding Position Statement encourages the use of helmets, particularly for children and beginners [24]

Trampolines injuries have become more prevalent in recent years and involve falls to the trampoline itself, or onto surrounding surfaces and equipment. Trampoline injuries can have serious outcomes including head and cervical spine injuries.[2] A Manitoba study of injuries to children less than 16 years of age using backyard trampolines showed that most children (65%) were injured on the trampoline mat, while 30% were ejected from the device.[25] Here, fractures and fracture-dislocation resulted most often (75%) with the majority (80%) to the upper extremity. The American Academy of Pediatrics recently reaffirmed its position on banning trampolines for use in homes, schools (routine use for physical education classes or recreation), and outdoor play areas.[26]

Home and Window Safety

While physician counselling on home safety may increase parental awareness of home hazards, the impact on injury is unknown.[27] Window guards are effective in preventing falls from windows.[2] Many other practices have been recommended by experts to reduce child falls in the home and from windows including:[2,27,29]

1. Use safety gates at the top and bottom of staircases (pressure gates at bottom of stairs; installed gates at the top of stairs)
2. Supervise at arms-length in the bathtub and use slip-resistant surfaces or a bath mat
3. Use available safety restraints in nursery equipment and follow the manufacturers instructions regarding proper use (e.g. high chairs, strollers, change tables)
4. Do not leave infants unattended on beds, sofas, and change tables
5. Do not place infant seats and car seats on elevated surfaces

6. Keep large toys and bumper pads out of playpens and cribs so children cannot climb on them
7. Avoid falls from windows by using operable window guards (that allow escape in the event of a fire) or window limiters to limit opening to less than 10cm for second or higher storey windows
8. Keep furniture away from windows
9. Do not allow children to play alone on porches, balconies or fire escapes

Conclusions

Strategies to prevent falls injuries should be tailored to childrens' developmental stages and the specific mechanisms identified for each age group. Data sources which identify circumstances of injury, such as CHIRPP data and death review data, are vital in the assessment of these age-specific mechanisms.

Appropriate dissemination of prevention information is important to ensure that messages reach those responsible for caring for children (e.g. parents, babysitters, day care workers). Recommendations for the prevention of falls injuries among children are applicable to parents, individuals and organizations in the health care sector, child care, and all levels of government.

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