

A Review Of Best Practices

Preventing Falls and Fall-related Injuries In Manitoba

Prepared for Manitoba Health by



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INTRODUCTION

Falls are the leading cause of unintentional injury hospitalization for all Canadians and the leading cause of injury hospitalization for Manitobans (including intentional injuries).^{1,2,3} The association between age and injury due to falls is a U-shaped curve (Figures 1 and 3), where children and older adults are at greater risk than other age groups. This paper will, therefore, focus on falls prevention for children and older adults. This report includes a description of fall-related injury data, an examination of risk and protective factors, fall prevention interventions, and best practice recommendations. Falls among children and older adults are addressed separately, given that different risk and protective factors and different interventions are applicable to each age group.

Falls: The Problem in Manitoba

Manitoba Health Data¹

In Manitoba, falls are the third leading cause of injury death and the leading cause of injury hospitalization. The following figures depict falls by age group and gender. Beyond 64 years of age, separate figures are shown as injuries and deaths due to falls occur much more often in older age groups, requiring a much larger (20-25X) scale for presentation.

Figure 1. Deaths Due to Falls 1992-1999 (0-64 years)

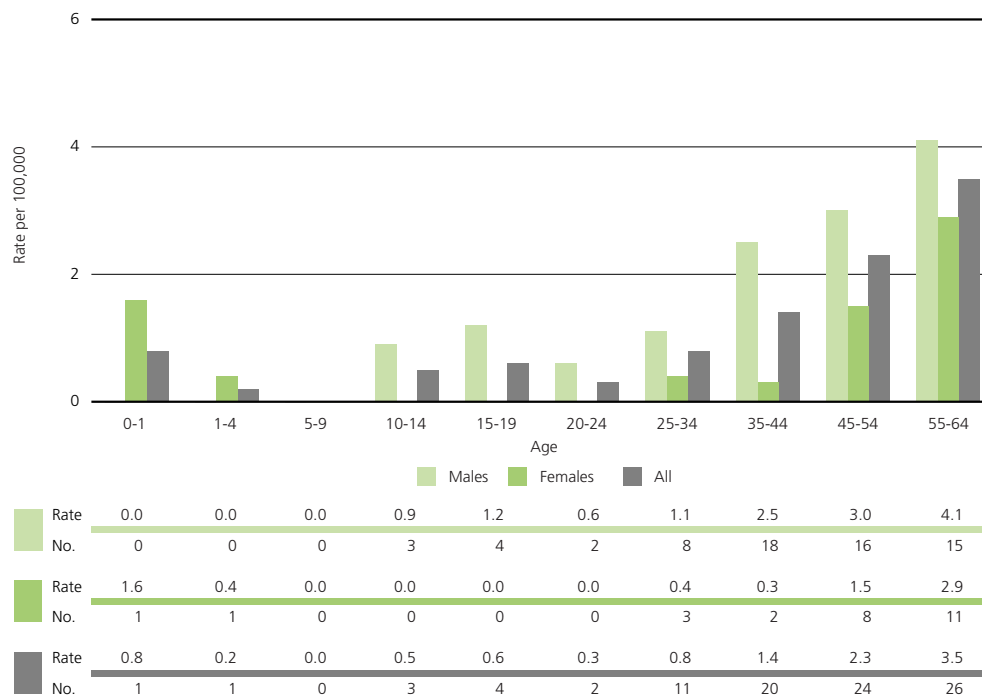


Figure 2. Deaths Due to Falls 1992-1999 (65 years and older)

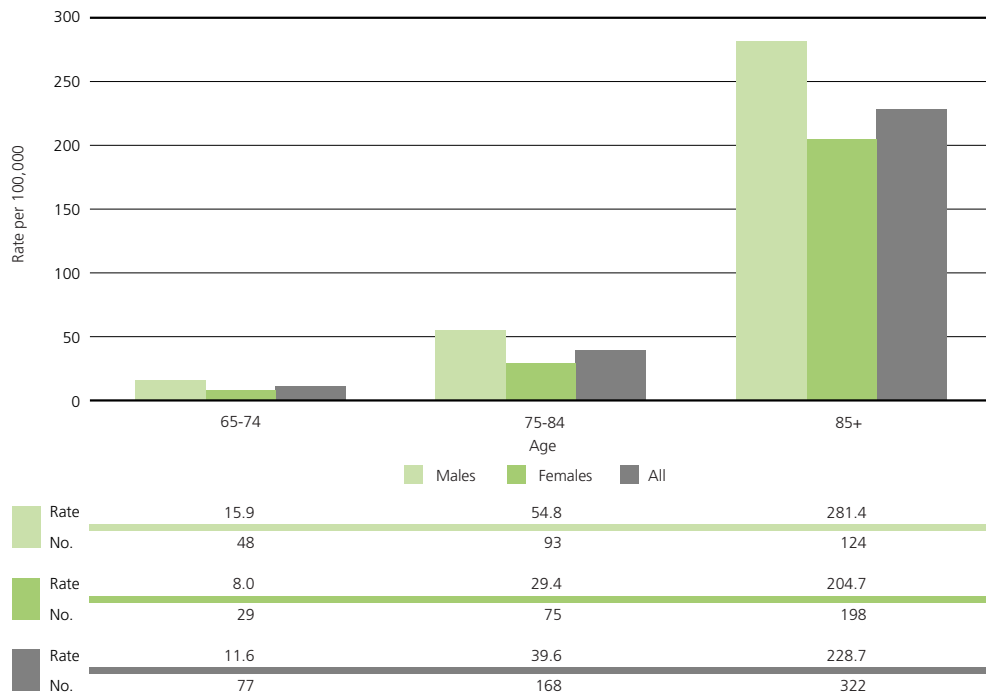


Figure 3. Hospitalizations Due to Falls 1992-2001 (0-64 years)

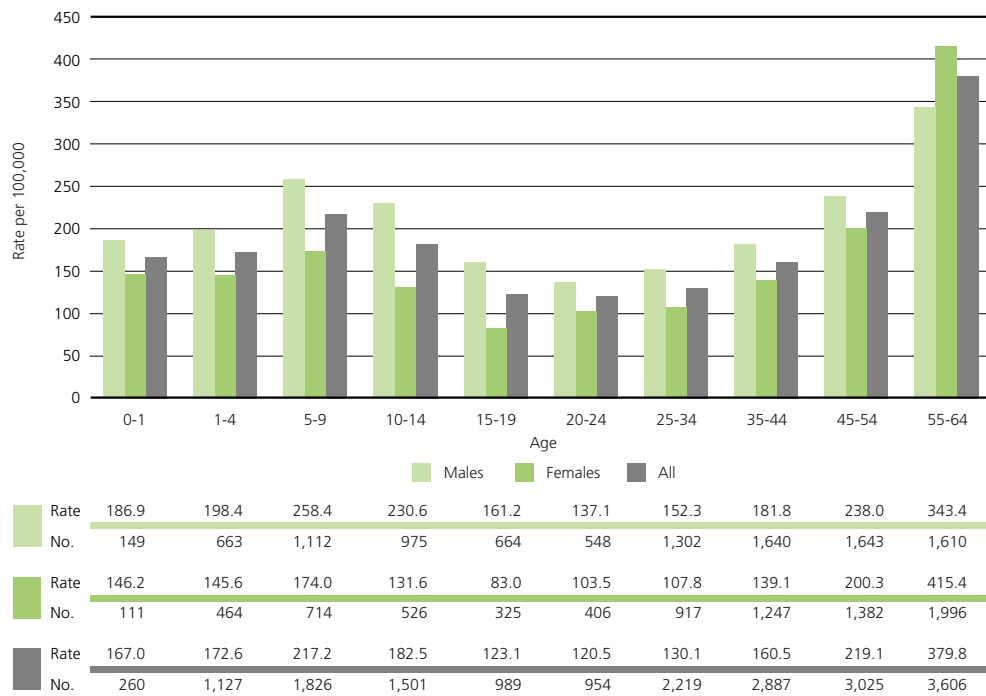
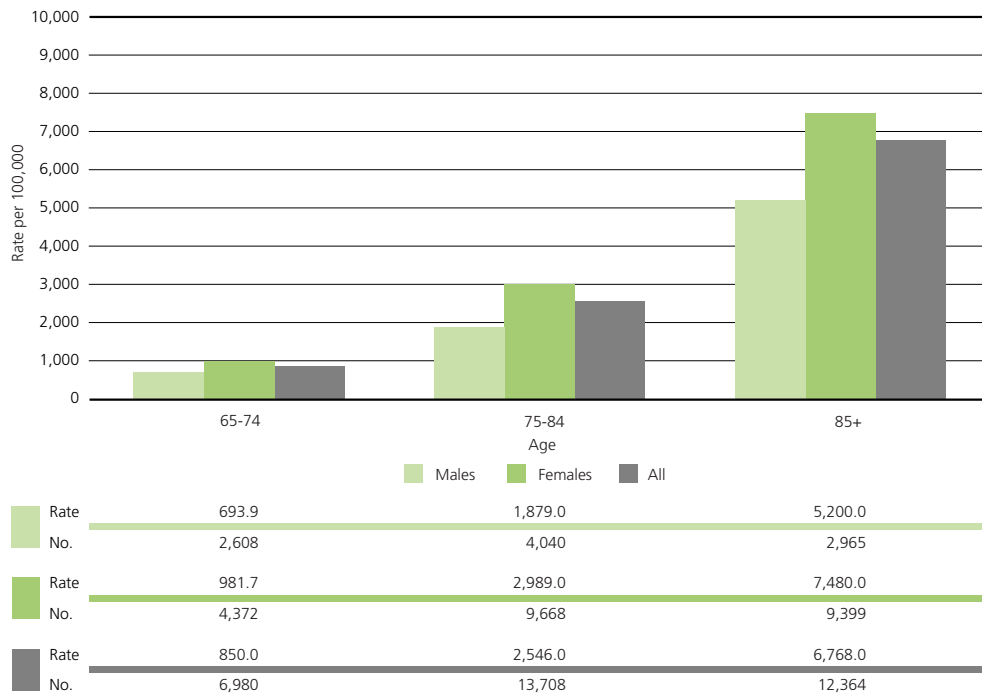


Figure 4. Hospitalizations due to Falls 1992-2001 (65 years and older)



Combining the data from the above tables for all age groups, there were 659 fatalities (1992-1999) and 51,446 hospitalizations (1992-2001) attributed to falls. Fall-related deaths resulted in 3,273 potential years of life lost (PYLL) with an average of 5.0 years of life lost per death. Relative to other types of injury, the PYLL are low, as falls tend to occur at older ages. Individuals 65 years of age and older accounted for 86% of deaths and 64% of hospitalizations due to falls. The rates of fatal falls (hospitalization rates) highest among older adults and children. While deaths from falls were evenly distributed by gender, more females (61%) than males were hospitalized for falls. Manitobans hospitalized in 2001 for fall injuries had an average length of stay of 19.8 hospital days.

The fourth leading cause of injury death in Manitoba, which includes 266 cases, is ‘fractures – cause unspecified’. A proportion of these deaths are suspected to be the result of falls, however, the data

needed to confirm this were not available. This category accounted for 2.7% of the 101,031 unintentional injury hospitalizations between 1992 and 2001.

Economic Impact⁴

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 treatment of falls in Manitoba account for 41% of the total unintentional injury treatment costs for the province. Between 1999 and 2002, the total cost of fall injury for Manitoba was \$335 million per year with \$256 million spent on direct costs. For the elderly, the annual direct treatment costs related to falls was estimated at \$164 million. In comparison, annual treatment costs related to falls were \$31 million for children and \$28 million for youth, with direct costs being \$16 million and \$13 million, respectively.

METHODOLOGY

Literature Search

Databases

Seven electronic databases were searched for fall prevention research articles. The databases included CINAHL (1982-2004/07), EMBASE (1980-2004/08), MEDLINE (1966-2004/08 wk 3), PsycInfo (1972-2004/08 wk 3), PubMed (1951-2004), SportDiscus (1830-2004/08) and Social Sciences Full Text (1983/02 to 2004/06). Search terms included 'falls', 'fall' 'injury prevention', and 'review'. On-line archives of the Injury Prevention journal were searched (ip.bmjournals.com) using the headings 'falls' and 'fall prevention' to identify any additional articles or relevant editorial content. Cochrane databases were also searched for systematic reviews and studies of fall prevention initiatives. These searches focused on identifying systematic reviews of evaluated interventions as well as capturing the risk factors associated with falls and fall injury.

Internet Searches

The Google search engine (www.google.ca) was used to search for best practices and systematic reviews on the topic of fall injuries. Search terms were the same as described above. In addition, many injury-specific websites were targeted including

- Centre for Disease Control's National Centre for Injury Prevention and Control (www.cdc.gov/ncipc),
- Safe Kids Canada (www.safekidscanada.ca),
- Health Canada's Injury Section (www.hc-sc.gc.ca/pphb-dgspsp/injury-bles),
- Harborview Injury Prevention & Research Centre (www.depts.washington.edu/hiprc),
- World Health Organization's Department of Injuries and Violence Prevention (www.who.int/violence_injury_prevention),
- and international injury prevention centres.

Other Sources

Additional sources included the IMPACT library of resource material, relevant texts, and injury data reports, and the Winnipeg Regional Health Authority's collection of documents regarding falls among the elderly.

FALLS AMONG CHILDREN

Injury Profile

Each year in Canada, about 26 children and youth less than 20 years of age die and over 20,000 more are hospitalized due to fall-related injuries (Table 1).² Data from the Paediatric Death Review Committee (1990-1999) show that children less than 15 years of age rarely die from fall injuries in Manitoba.⁵ Falls account for one-third of all injuries seen in the emergency department, according to the Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP), an emergency department injury surveillance program based in 16 Canadian hospitals.²

Falls may be classified by their mechanism (type or circumstance, see Table 1). Several specific mechanisms can be coded using the International Classification of Diseases (ICD), such as falls from stairs, buildings, ladders, play equipment, chair or bed, and falls during sports activities.

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 specific cause within this category.^{6,7}

Falls result in a variety of injuries, with different patterns for fatal and nonfatal falls. Head injuries are

responsible for the majority of deaths due to falls. Falls are the second leading cause of head injury in Canadian children, with transport injuries being the leading cause.² Nearly three-quarters (74%) of fall-related hospital admissions are due to fractures and dislocations, with serious head injuries accounting for an additional 20%.⁶ For fall-related emergency department visits, the head and neck are injured most often (49%), followed by injuries to the extremities (upper limbs 27%, lower limbs 18%).² As management patterns change, and more children are treated as outpatients (e.g., day surgery, fracture reduction in the emergency department), the injury profiles will change, with only the most serious injuries being admitted, such as head injuries and multiple or medically complex injuries.

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).⁸ A study of hospitalizations due to falls from heights exceeding 10 feet found that 70% of cases were male and 78% of victims fell 20 feet or less.⁹ In this study, 64 cases were identified and one death occurred, resulting from a fall greater than 50 feet. The falls were from balconies (23%), windows (20%), trees (14%), roofs (9%), and stairs (9%).

Table 1. Annual Deaths and Hospitalizations for Falls by Age and Mechanism Among Canadian Children and Youth, 1990-1992 (0-19 years)²

External cause of injury, ICD-9	Deaths		Hospitalizations	
	N	%	N	%
Fall on or from stairs or steps (E880)	1	5.2	1,633	8.1
Fall on or from ladders or scaffolding (E881)	0	1.3	128	0.6
Fall from or out of building or other structure (E882)	7	27.3	634	3.1
Fall into hole or other opening in surface (E883)	1	3.9	206	1.0
Other fall from one level to another (E884)	8	32.5	7,718	38.0
Fall from playground equipment (E884.0)	-	-	2,850	14.1
Fall from chair or bed (E884.2)	1	3.9	1,446	7.1
Other (E884:1,9)	7	28.6	3,423	16.9
Fall on same level from slipping, tripping or tumbling, collision, pushing or shoving (E885, E886)	1	5.2	6,087	30.0
Fall in sports (E886.0)	1	5.2	1,460	7.2
Other and unspecified (E885, E886.9)	-	-	4,627	22.8
Fracture, cause unspecified (E887)	2	7.8	384	1.9
Other and unspecified fall (E888)	4	16.9	3,496	17.2
Total	26	100.0	20,285	100.0

Fall injuries present a significant burden on the health care system. 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.

Risk Factors

Knowledge of the risk factors associated with paediatric falls can aid in the development of effective prevention strategies.

Age

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.² 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 five to 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.

Fall mechanisms and circumstances are also age-specific (Table 2). Falls at home decrease with age while falls at educational sites, sports and recreational areas, and in the road environment increase with age.² 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 (one to four years of age) fall from stairs, windows, and furniture (bed, crib, chair); older children (five to nine years of age) fall from play equipment; youth (10-14 years of age) fall most frequently during sports activities.^{2,8}

Gender

Male children are twice as likely to be injured in a fall than females.^{6,8,10} Canadian injury data reflect that males account for 62% of deaths, 77% of hospitalizations, and 56% of emergency department visits from falls among children.²

First Nations Populations

Falls are the leading cause of injury hospitalization for First Nations and non-First Nations Manitobans. Fall hospitalization rates per 100,000 are 1.3X higher for First Nations Manitobans relative to non-First Nations Manitobans.¹ First Nations male infants are at greatest risk of hospitalization for fall injuries (582.1 per 100,000) relative to children of other ages, females, and non-First Nations children.

Specific Injury Mechanisms

Furniture

For infants and toddlers, nursery equipment (e.g., change tables, cribs, strollers, high chairs) is frequently 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 the risk of falls. 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.

Table 2. 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

Falls from beds are a frequent occurrence for children, and may result in injury. Several studies have assessed falls from beds, their circumstances, and outcomes. In one study of 85 children treated in a UK Emergency Department, 85% of children fell out of bed while they were asleep.¹² All of the injuries related to children sleeping in conventional beds or on the top level of a bunk bed. In 32% of cases the child suffered a head injury while in 29% of instances the child sustained a fracture. Sixteen per cent of children were admitted to hospital and most injuries (78%) occurred among children less than six years of age. This study recommended that children less than six years of age should not sleep in the upper bunk. A case-control study of 1881 children injured in falls from bunk beds and conventional beds documented an incidence rate of three per 1,000 child years for bed injuries. Bunk bed injuries were more serious, with significantly more brain injuries, fractures, multiple injuries, and admissions to hospital. The authors recommended that children less than five years of age should not use bunk beds and that improved upper bunk rail design could reduce the risk of falls during sleep.¹³

Baby Walkers

Baby walkers have been a leading cause of serious infant falls. In April 2004, the burden of injury related to baby walkers led to a Canadian ban on the sale of new and used walkers.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.⁸ Other mechanisms for baby walker injuries include tipovers, rolling off porches, and burns and scalds due to contact with hot food or liquids.^{7,15} Baby walker reach/pull down injuries present a high risk of hospitalization, long-term treatment, and potential disability, largely due to scalds and burns. For this reason, the newer style walkers with a braking mechanism (e.g., friction strips) are also not recommended.

Buildings

Falls from buildings present a potentially significant health issue for children, particularly those living in apartments. While building falls are infrequent, the consequences are often serious and can be fatal.² Window fall fatalities tend to occur more often

when the child falls more than 6.7 metres (2 stories) or strikes a hard surface or structure.¹⁰ Falls exceeding two stories generally involve windows, roofs, and balconies as the point of origin. While preschool children tend to fall from windows, older children fall from other locations (e.g., roofs).¹⁰ Window screens do not prevent falls since they cannot withstand a child's weight and so can dislodge when sufficient pressure is applied, enabling the child to fall through the open window.^{2,6}

In a study of building falls resulting in hospital admission, falls from windows accounted for 62% of cases with the remainder being due to falls from balconies, fire escapes, and roofs.¹⁶ The victims in this study tended to be male (62%), less than three years of age, who were playing at the time of the incident. The mortality rate was 0.7%, with two-thirds of children sustaining a fracture and 30% requiring intensive care. A study of falls from apartment windows and balconies in Dallas County, Texas, showed that children (<15 years of age) sustained serious head injuries in 40% of cases.¹⁷ Window falls occurred in 52% of cases and balcony falls in 45% of cases. In over two-thirds of the balcony falls, the child slipped through the railings, as the gap between the rails exceeded four inches (the maximum gap allowed by the Canadian and US building codes). The average rail gap in this study was found to be seven and a half inches, and was related to falls from older apartments, where current building codes did not apply.

Playgrounds

Playground falls resulting in injury occur most often among children five to nine years of age and are the leading cause of injuries to children in the school environment.^{18,19} Most playground falls that cause injury result from falling to the ground surface.²⁰ Fractures are the most common type of playground-related injury, with the wrist, lower arm, and elbow involved in nearly 80% of fractures.¹⁸ Most playground injuries seen in the Emergency Department are fractures and dislocations involving the upper extremities; head injuries account for 2% of cases.²¹ Children younger than five years of age tend to injure the head and face more frequently, while older children injure the extremities.²²

Sports and Recreation

Falls or collisions during sports and recreational activities are the leading cause of injury hospitaliza-

tion for Canadians less than 20 years of age.² A recent analysis of the Ontario Trauma Registry database documented that falls from playground equipment are the second leading cause of sports and recreation hospitalizations (10%), preceded by cycling injuries (21%), and followed by all-terrain vehicle incidents (8%).²³ Other popular summer sports with a significant risk of falls injury include inline skating, skateboarding, and roller skating. Falls are also frequent in winter sports, such as hockey, recreational skating, skiing, snowmobiling, and snowboarding.²³ One study which investigated serious winter sport injuries among children demonstrated that half of the injuries involved a ground-level fall and 13% resulted from falling off a ski lift.²⁴

Note: A full review of the spectrum of sports and recreation injuries is beyond the scope of this paper. Only general summaries and recommendations are provided.

Trampolines

In recent years, there has been a considerable increase in trampoline-related injuries, most of

which involve falls, either on the trampoline itself, or onto surrounding surfaces and equipment. Two-thirds of these injuries are among children five to 14 years of age, and serious outcomes such as head and cervical spine injuries have been documented.⁷ A recent Manitoba study demonstrated that backyard trampoline use by young children can lead to serious orthopaedic injuries.²⁵ This study investigated all children less than 16 years of age who sustained an injury on a backyard trampoline and were seen at the Winnipeg Children's Hospital in 1996 and 1997. Eighty cases were reported, with most children (65%) being injured on the trampoline mat or ejected from it (30%). Most children (75%) were found to have a fracture or fracture-dislocation, and most injuries (80%) were to the upper extremity. The American Academy of Paediatrics recently reaffirmed their position on banning trampolines for use in homes, schools (routine use for physical education classes or recreation), and outdoor play areas.²⁶ Many researchers have also recommended a ban on trampolines for recreational and home use by children.²⁷⁻³²

INTERVENTIONS

Home Safety

A recent systematic review of strategies to modify the home environment with the aim of reducing hazards failed to demonstrate a reduction in injuries.³³

Anticipatory guidance, which is prevention counselling provided by physicians, has been proposed as a method of reducing falls and fall-related injuries in the home. One review concluded that some evidence exists for injury reduction.³⁴ Relative to home falls, another review showed that physician counselling led to fewer falls yet more hospitalizations.³⁵ In one study, parents were not aware of common childhood injuries and ways to prevent them, particularly parents with low socio-economic status and less education.³⁶ The authors concluded that it would be beneficial for paediatricians to provide counselling on these issues. The Canadian Guide to Preventive Health Care concluded that anticipatory guidance can increase home hazard recognition yet the impact on injury is unknown.³⁷ Improvements in parental knowledge and behaviours can result from parent counselling.³⁸

Window Safety

In 1977, a study was conducted with the goal of reducing pediatric morbidity and mortality from window falls.⁴² A multi-pronged intervention was used which included counselling, police reporting, a media campaign, and the provision of 16,000 free window guards to families with young children. (Window guards reduce the size of the open space in a window so that a child cannot fall through the window.) This initiative led to a significant reduction in the incidence of window falls; falls decreased by 50% over two years and deaths reduced by 35%. Following the study, New York passed legislation requiring window guards in multiple family dwellings where children less than 10 years of age reside. There was a 96% reduction in fall admissions post legislation.⁷ Based on these findings, researchers have concluded that window guards can help prevent falls from windows and the resulting injuries.^{7,10,34,37} Studies with more rigorous methods are needed to further investigate and confirm the benefits of window guards. It has been suggested that strategies combining regulation and education

Cochrane Review of Modification of the Home Environment to Reduce Injuries

Lyons RA, Sander LV, Weightman AL, Patterson J, Jones SA
Lannon S, Rolfe B, Kemp A, Johansen A (2004)

Results: 28 published trials and one unpublished study were identified. Studies were divided into three groups: children, older people and the general population. None of the 11 child studies demonstrated a reduction in injuries due to environmental changes. One study reported a reduction in injuries and in hazards but the two could not be linked. The majority of studies used hazard reduction as the outcome. Of the 15 studies in older people, none demonstrated a reduction in injuries due to hazard reduction, although two demonstrated a reduction in falls that could be due to hazard reduction. In the mixed age group there were two trials; neither demonstrated an effect on injuries.

Conclusions: There is insufficient evidence for interventions that modify environmental home hazards. Further interventions should be evaluated by adequately designed randomized controlled trials measuring injury outcomes.

could lead to substantial reductions in injury outcomes for falls.⁴³

Note: Window guards should be operable to allow exit in case of fire.

Experts recommend the following home safety practices to reduce falls:^{8,39-41}

- Keep large toys and bumper pads out of playpens and cribs so they cannot be used for climbing aids
- For cribs, lower the mattress to the lowest position, raise the rails to the highest position when a child is in the crib
- Use safety gates at the top and bottom of staircases (pressure gates at bottom of stairs; installed gates at the top of stairs)
- Keep furniture away from windows; do not allow children to play alone on porches, balconies or fire escapes
- Supervise at arms-length in the bathtub and check for slip-resistant surfaces or use a bath mat
- Secure loose carpets
- Use available safety restraints in nursery equipment and follow the manufacturers instructions regarding proper use (e.g., high chairs, strollers, change tables)
- Do not place car seats and bouncers on elevated surfaces such as counters or dryers
- Cover sharp table edges with foam or padding, such as a blanket, for infants pulling to stand and toddlers learning to walk
- Use operable (that allow escape in the event of a fire) window guards or window limiters to limit opening to less than 10cm for second or higher storey windows
- Install window locks for added protection against falls.

Preventing Falls From Heights

The American Academy of Pediatrics recommends that physicians provide anticipatory guidance to parents as a method of preventing falls from heights, including the following prevention tips: young children should be supervised at all times near open windows; operable window guards are recommended for all windows at or above the second storey; children should be discouraged from playing on fire escapes, roofs, and balconies; having furniture near a window or on the balcony is discouraged as children may use it as a climbing aid.¹⁰

Baby Walker Ban

Several programs have attempted to reduce baby walker use, such as consumer product “recall” and “round-up” events, but none have been rigorously evaluated.⁷ To date, non-regulatory efforts to discourage baby walker use (e.g., warning labels, public education) have not reduced baby walker-related injuries.⁴⁴ Preliminary unpublished data from the United States show a reduction in injuries following an enhanced baby walker standard by the American Society for Testing and Materials (ASTM) C618ASTM, which requires a braking mechanism designed to prevent falls down stairs.⁴⁵

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 This ban also makes it illegal to sell used baby walkers. This amendment followed a voluntary “ban” within the retail industry, related to a requirement that Canadian baby walkers be wider than a standard doorway. This voluntary agreement did not result in injury reductions.⁷ There are no data available at this time to evaluate the effectiveness of the April 2004 Canadian baby walker ban, although many walkers and walker shipments have been seized by Health Canada, and walkers are no longer available for sale in Canada (Health Canada, personal communication, January 2005). The American Academy of Pediatrics also supports a ban on the manufacture and sale of mobile infant walkers.⁴⁴

Playground Safety

A national 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. The CSA standards for playground safety are voluntary; greater awareness and compliance with this standard could contribute to a reduction in the risk of fall injuries, particularly in terms of surfacing recommendations.^{7,22} Trained and certified playground inspectors should be used to evaluate compliance with the highly technical CSA standard. The Canadian Parks and Recreation Association offers professional inspector training that emphasizes compliance with the CSA standard (www.cpra.ca).

For falls from play equipment, the risk of injury relates to the fall height and the energy absorption potential of the playground surface.⁷ The risk of falls is also related to children's behaviour on the equipment, and may be affected by various supervision strategies. Although indoor play equipment is typically not as high as outdoor equipment, the same safety recommendations apply to all play structures. This is of particular importance for childcare settings, where large numbers of children may use this equipment on a daily basis.

The height of play equipment relates to the occurrence and severity of playground falls. Equipment height should be reduced to minimize the risk of fall injury. A case control study demonstrated that fall injury risk is much greater when playground equipment has a maximum fall height exceeding 1.5 metres and concluded that maintaining equipment heights below this limit could result in a 45% reduction in pediatric emergency department visits.⁴⁶ The Canadian Paediatric Society recommends the use of a maximum equipment height of 1.5 meters for preschool-aged children and 2.3 meters for school-aged children, and proposes the development of innovative play spaces with lower overall heights as a strategy to address pediatric playground falls.²² This type of play space, often termed natural playground or outdoor classroom, may have additional benefits in terms of educational value, and is more environmentally friendly (www.evergreen.ca). There is also some evidence that naturalized play spaces may reduce injuries, improve student behaviour, reduce aggression, and improve academic performance.²⁹

Elevated play equipment should also comply with the CSA standard in terms of preventing falls from elevated platforms and stairs (barriers, guardrails, etc.). One study documented a protective effect for handrails and guardrails that conform to current Canadian safety standards.⁴⁷

Protective surfacing materials have impact absorption capabilities which aid in the prevention of injuries due to falls.⁶ The CSA playground standard describes acceptable surface materials and depths, as well as maintenance and installation guidelines.⁴⁸ Several studies have documented a protective effect of appropriate surface material and recommended surface depths.^{46,47} Sand and wood chips have been found to be the most effective surfacing materials when maintained at an optimal depth.⁷ Other playground surfaces that are acceptable include loose fill rubber, engineered wood fibre, and pea gravel. All surface materials should be maintained at the CSA recommended depths for a distance of six feet from all sides of the play equipment.⁸ To provide a safe playground for children surfaces must be continuously maintained at a safe depth and surfacing and equipment must remain free from hazards.⁷

Surfacing recommendations are relevant to indoor and outdoor structures. Alternative or improvised indoor surfacing materials such as gym mats and foam pads vary considerably in their impact performance when tested, and should be used with caution. Play equipment experts or installers should be consulted regarding surfacing recommendations for play equipment in day cares and other indoor settings.

Supervision is one of the strongest protective factors for many injuries within the home and community.⁴⁹ Close parental supervision of preschool-aged children on playgrounds is essential. Parents should stand at arms-length (or less) beside preschool children, when they are climbing, on a swing, or on an elevated platform.⁴¹ Supervision in the school setting could also prevent falls, by rule enforcement, age-appropriate use of equipment, monitoring and controlling risky and aggressive behaviour on play equipment, and restricting the number of children on the equipment. Supervision ratios have been suggested, but have not been widely adopted or evaluated. The effectiveness of parental supervision and supervision strategies in the school setting have not been evaluated. Parents should ensure that their children play on equipment that is appropriate for them (e.g., preschool or school-aged).

Sports and Recreation

While a complete review of the interventions for each sport and recreational activity is beyond the scope of this paper, broad summary recommendations are provided.

Families, schools, and communities should provide physical and social environments that encourage physical activity in a safe setting. Adult supervision, education and training in safe physical activity, safe facilities, and the use of protective equipment are all components of a safe environment for physical activity.^{50,51}

1. Selecting activities

Activities should be selected that are developmentally appropriate and consider age, physical size, skills, and cognitive maturity. Lower risk activities should be chosen, such as walking, swimming, and cycling. High-risk activities include those that involve height, motorized equipment (ATVs, snowmobiles), speed (downhill skiing), and uncontrolled environments (traffic, rivers). Active supervision, protective equipment, and training are particularly important for higher risk activities.

2. Substance use

The risks of alcohol and drug use should be discussed with older children and youth. Alcohol is frequently a contributing factor in serious and fatal incidents involving swimming, boating, diving, ATV injuries, and snowmobiling.

3. Clothing and equipment

Clothing should be appropriate for the activity and weather conditions. Sun protection is

important in all seasons, including sunscreen (SPF 30 or higher) on exposed areas for children older than six months, hat, sunglasses, and loose clothing. For activities around traffic, light and/or reflective clothing is recommended.

Helmets are recommended for cycling and all other road activities (inline skating, scooters), and for winter activities such as hockey, sledging, downhill skiing, ice skating and snowboarding. All helmets should be the correct type, certified for the sport or activity, and fit properly, as per the helmet instructions. Mouth guards are recommended for contact sports such as hockey, ringette, and football. Wrist guards are recommended for inline skating and skateboarding, but should not be used for cycling or riding scooters. Protective eyewear should be used for activities such as hockey, baseball, and racquet sports. A lifejacket or personal flotation device (PFD) should be worn while boating and for activities on and around water.

4. Safe environments

Safe environments should be selected for recreational activities. Parks, walking trails, bicycle and fitness paths, and public swimming facilities should be developed and maintained by communities to encourage children to be active and away from traffic and other hazards. Playing fields and facilities should comply with current standards and should be free of hazards. Supervising adults should be trained in the sport, First Aid, and return to play guidelines. They should enforce the rules of the game and encourage fair play.

RECOMMENDATIONS

Grading System

An alphabetical grading system indicates whether the level of research evidence for each intervention was determined to be good (A), fair (B) or poor (C). Similar systems have been employed in other assessments of intervention effectiveness.⁸³ This grade translates into a recommendation of *strongly recommended* (or discouraged), *recommended*, *recommended based on expert opinion*, or *insufficient evidence to recommend* (see Appendix).

Strongly Recommended

Recommendations that receive a ‘good’ (A) grade (*strongly recommended*) are supported by the best type of evidence, and have been demonstrated to be effective methods to prevent falls. These are interventions that have been evaluated using randomized controlled trials (Level I evidence).

Recommended

Recommendations that receive a ‘fair’ (B) grade (*recommended*) are supported by fair evidence and

include quality ratings beginning with ‘II’ (i.e., Levels II-1, II-2, II-3). Within the pediatric falls literature, one study received a rating of Level II-I evidence, and several were case control studies (Level II-2 evidence), however the majority were other designs which satisfied only the II-3 level of evidence criteria.

Recommended Based on Expert Opinion

Much of the falls prevention literature is descriptive, or represents recommendations of respected authorities or expert committees (Level III evidence).

Best practice recommendations supported by the current literature are summarized below. Many can be applied within the community setting to target pediatric fall and fall-related injury prevention on a local scale.

Table 3 summarizes the interventions that have been systematically reviewed, includes an evaluation of the strength of the evidence, and provides a summary recommendation.

Table 3. Summary of Evidence and Ratings for Interventions to Prevent Falls in Children

Intervention	Qualifying Studies	Strength of Evidence*	Recommendation
Falls in the home setting			
Home environment modification (home hazard reduction strategies including parent education, safety checklists, provision of safety devices, etc.) ³³	3	Good (I)	Available studies do not provide sufficient evidence to assess
Limit bunk bed use to children at least 5 years of age ¹³	1	Fair (II-2)	Recommended
Infants should not be placed for sleep on adult beds, sofas, or other furniture ⁵⁰	1	Poor (III)	Recommended based on expert opinion (CPS policy statement)
Nursery equipment safety (change-tables, cribs, bouncers, strollers, high chairs): strict adult supervision, follow manufacturer’s instructions, use safety restraints ⁵¹	1	Poor (III)	Recommended based on expert opinion
Falls from heights			
Window bars (public education with free devices and regulation) ^{7,34,35}	2	Fair (II-3)	Recommended
Legislation requiring landlords to install operable window guards above the ground floor in multiple-storied dwellings ¹⁰	1	Poor (III)	Recommended based on expert opinion (AAP Policy Statement)
Provide anticipatory guidance for children who live in multiple-storied dwellings, including: supervision, use of window locks and guards, not playing on balconies/roofs, placement of furniture away from windows and railings ¹⁰	1	Poor (III)	Recommended based on expert opinion (AAP Policy Statement)

Intervention	Qualifying Studies	Strength of Evidence*	Recommendation
Limit spacing between balcony and other guard rails to a maximum of four inches (10cm) ¹⁷	1	Fair (II-3)	Recommended
Building codes that ensure balconies, decks, porches, bleachers, roofs, and fire escapes have non-climbable railings with openings not greater than 4 inches (10cm) ¹⁰	1	Poor (III)	Recommended based on expert opinion (AAP Policy Statement)
Baby Walkers			
Ban mobile (wheeled) infant walkers ⁴⁴	1	Poor (III)	Recommended based on expert opinion (AAP Policy Statement)
Playground Falls			
Ensure compliance with surfacing requirements ⁷	11	Good (I)	Strongly recommended
Limit maximum fall height to 1.5m ⁷	3	Fair (II-2)	Recommended
Ensure compliance with guardrail and handrail recommendations ⁴⁷	1	Fair (II-2)	Recommended
Hazard reduction programs in schools (education/training, hazard reports, correcting hazards, follow-up) ^{7,34}	2	Fair (II-1)	Recommended
Certified playground inspectors should conduct periodic assessments of playgrounds to ensure compliance with the current CSA standard ⁴⁸	1	Poor (III)	Recommended based on expert opinion (CPS Policy Statement)
Keep children less than 5 years of age off equipment that is higher than 1.5m ⁴⁸	1	Poor (III)	Recommended based on expert opinion (CPS Policy Statement)
Falls in sports and recreational activities			
Encourage safe physical activity at home, schools, and the community, including: adult supervision, selection of age and developmentally appropriate activities, training and education of participants and supervisors, use of protective equipment appropriate for the activity, and provision of safe facilities and equipment ^{50,51}	2	Poor (III)	Recommended based on expert opinion (AAP and CPS Policy Statements)
Trampolines			
Ban trampoline use for home, schools (routine physical education), and outdoor playgrounds ⁵²	1	Poor (III)	Recommended based on expert opinion (AAP Policy Statement)
Programs which use trampolines for supervised training programs should meet specific design and other safety guidelines ⁵²	1	Poor (III)	Recommended based on expert opinion (AAP Policy Statement)

*Indicates the strongest level of evidence when more than one study is cited. See Appendix for definitions.

CHILDHOOD FALLS PREVENTION BEST PRACTICES

Strongly Recommended

Ensure compliance with current playground surfacing guidelines

Recommended

Use Window and Stairway Guards

Limit bunk beds to children ages 5 and over

Use operable window bars above the ground floor

Spaces between balcony and other guardrails are not to exceed 10cm

Play structure maximum fall height is 1.5m

All play structures comply with guardrail and handrail recommendations

Playground hazard reduction programs in schools

Recommended based on expert opinion

Infants not to sleep on adult beds, sofas or other furniture

Use manufacturers' restraints and follow instructions for all nursery equipment

Legislate landlords to install window guards above the ground floor

Provide anticipatory guidance on falls prevention to parents of young children

Building codes limit opening to balconies, decks, etc. to 10cm

Ban baby walkers

Certified playground inspectors assess playgrounds for CSA compliance

Children under 5 years old not to use equipment higher than 1.5m

Encourage safe physical activity: using proper equipment and a safe environment

Ban trampoline use at home, for routine physical education, and in playgrounds

Programs that use trampolines have supervised training and meet safety requirements

APPLICATION OF FINDINGS

Recommendations for the prevention of falls among children are applicable to parents, individuals and organizations in the health care sector, schools and child care providers, and all levels of government. Outlined below are suggested strategies for reducing childhood falls and fall-related injuries.

Parents

- Parents should ensure that unsafe children's equipment (e.g., baby walkers, trampolines) is not used in the home or other settings their children are exposed to, such as schools, daycares, and community centres, and that proper safety equipment is used (e.g., stair gates, operable window guards, child restraints on nursery equipment).
- Parents should inspect the playgrounds their children use in terms of the surfacing and fall hazards. Suspected deficiencies should be reported to the playground operator (school, daycare, business, municipality).
- Parents should actively supervise their children. For children less than five years of age ensure that equipment is age-appropriate, supervise at arms-length for elevated play equipment, and restrict access to windows, balconies and other significant fall risks.
- Parents should encourage safe physical activity at home, schools, and in the community. This includes using available protective equipment, providing supervision, and choosing appropriate activities.

Schools/Daycare Centres

- Schools and child care providers should be aware of significant fall hazards for children, including hazards related to equipment, stairs, and buildings (windows, balconies, roofs) and take appropriate measures to prevent these falls.
- Schools and childcare settings with play equipment should ensure that the surfacing type, surfacing depth, fall height, and fall

barriers comply with the Canadian Standards Association standard. Indoor equipment should also satisfy these requirements.

- Schools and childcare settings should ensure that adequate playground supervision is provided before and after school, and during recesses and lunch breaks
- School and childcare playgrounds should be used with caution or restricted during cold weather conditions when ice on the equipment or playground surfaces may increase fall risk and severity.
- Standardized checklists and information should be developed to facilitate these efforts.

Physicians/Health Care Providers (HCP)

- Physicians/HCP should provide parents with age-appropriate anticipatory guidance regarding falls and specific strategies to prevent falls in the home and community.
- Continuing Medical Education activities should include teaching sessions for physicians and trainees regarding the risks and interventions associated with falls for children and youth.
- Physicians/HCP should be encouraged to educate the public regarding falls prevention, through the media or other venues.

Public Health Nurses/Home Visitors/Community Health Care Providers

- During home visits and other encounters with families, public health nurses/community health care providers should provide anticipatory guidance to reduce falls among children in the home.
- Home visitors and community health care providers should be alert for fall hazards in homes they visit, and inform parents of observed risks.

- Age-specific standardized checklists and parent information materials should be developed to facilitate these efforts.

Regional Health Authorities (RHAs)

- RHAs should ensure that data regarding pediatric falls are collected and monitored. This could include sentinel or periodic surveillance of emergency department visits.
- RHAs should work with community partners (municipalities, recreation centers, schools, childcare providers, and other organizations) to build regional capacity for implementing child-focused falls prevention programs and strategies.
- RHAs should work with relevant partners to ensure that fall prevention strategies for children are implemented and evaluated.
- RHAs should provide educational opportunities for their employees regarding the best practices for designing, implementing, and evaluating falls prevention programs for children.

Municipal Governments

- Municipal governments should ensure that their playground sites comply with the Canadian Standards Association's playground safety guidelines.
- Municipal governments should ensure that current building codes are enforced with respect to significant fall risks for children (falls from buildings, windows, through balcony or deck rails).
- Municipal governments should consider regulating operable window bars for multiple-storied housing where children reside.

Manitoba Health

- Manitoba Health should consider the use of the National Ambulatory Care Reporting System (NACRS) in regional Emergency Departments to improve the data collection, analysis and monitoring of falls.
- Manitoba Health should support the development of standardized assessment tools and educational materials for fall prevention strategies for children, for use by the RHAs.

FALLS AMONG THE ELDERLY

Injury Profile

Beyond fifty years of age there is a steady increase in the occurrence of falls and the magnitude of fall-related complications.⁵³ Each year over one-third of all seniors residing in the community fall at least once.⁵⁴ The fall-related injury rate is magnified nine times in seniors (aged 65 years of age and over) relative to those under 65 years of age. Over half of the injury deaths in women over 65 years of age are due to falls, with one-third in males.⁵⁵ Seniors account for a significant portion (58%) of all fall admissions to Canadian hospitals. The majority of injuries requiring hospitalization in this age group (85%) are falls.⁵⁶ The leading cause of falls requiring hospitalization among the elderly is slipping, tripping or stumbling on the same level.⁵⁷ Falls occur in the home in 49% of cases; this finding is stable across seasons.⁵⁷ Many factors can cause an individual to fall in the home including stairs, slippery surfaces, and obstructions.

While the minor injury is the outcome for 50% of falls among the elderly; up to 25% result in serious injuries.^{58,59} According to the Canadian Institute for Health Information 74% of fall injuries are fractures and dislocations, 8% are head injuries, and 12% are lacerations and contusions.⁵⁶ Fall-related fractures most often include osteoporotic fractures of the hip, spine, or forearm.⁶⁰ The most disabling injuries are hip fractures and traumatic brain injuries, the consequences of which often lead to reduced independence, social isolation, and restrictions on daily activities and recreation, due to physical limitations as well as fear of falling again.⁶¹ The majority (over 90%) of hip fractures in later life are associated with osteoporosis. Some falls will lead to a need for long-term residential care or hospitalization. One-fifth of seniors who suffer a hip fracture die within a year and most never recover fully from the injury.⁶² A fall was the precipitating factor in 40% of nursing home admissions.⁶²

Risk Factors

The following section is largely derived from a report published by leading falls researchers in

British Columbia, items are listed in alphabetical order.⁶² Additional examples and categories from the sources listed in Table 2 have also been incorporated. These risk factors are inter-related and frequently occur in combination.⁶³

Biological Risk Factors

- **Age:** advanced age is defined as being over 80 years of age.
- **Gender:** Elderly women (65+) are twice as likely to be hospitalized for fall-related injuries.^{56,57}
- **Cognitive Impairments:** Alzheimer disease, memory loss, dementia, depression, and anxiety.
- **Chronic or Acute Illnesses:** Parkinson disease, arthritis, osteoporosis, heart disease, stroke, bowel and bladder incontinence, diabetes, atherosclerosis, blood pressure abnormalities, epilepsy, peripheral neuropathy, thyroid conditions, and infectious diseases such as influenza.
- **Muscle Weakness and Diminished Physical Fitness:** loss of muscle strength, balance, coordination and flexibility; poor endurance; unable to complete activities of daily living independently.
- **Physical Disabilities:** gait disorders, diminished sensation, poor hearing, poor balance, dizziness, postural hypotension, lower extremity weakness, prior injuries from a fall, reduced walking speed, slow reaction time, special toileting needs, and foot problems.
- **Sensory Deficits:** poor vision (e.g., cataracts, glaucoma, impaired visual acuity), Sensation and hearing deficits are also risk factors.

Behavioural Risk Factors

- **Alcohol:** alcohol impairs judgment and coordination and may combine with certain medications and increase imbalance, drowsiness, and dizziness.

- **Fear of Falling:** often leads to inactivity, which is also a fall risk, and overcompensation, which can result in abnormal gait and movement. Fear of falling is not limited to individuals with a prior fall. In fear of falling, the perception of fall risk is elevated, which causes the individual to withdraw and/or avoid activities that may lead to a fall. Reduced activity levels lead to decreased muscle strength, and loss of coordination and/or balance, thereby increasing the potential for falling.⁶² Fear-driven activity avoidance is predictive of future falls.⁷¹
- **Handbags:** heavy/awkward purses and bags can impair balance.
- **Inadequate diet or exercise:** poor diet, inadequate hydration, insufficient weight bearing and other types of exercise.
- **Inattention:** lack of awareness or attention to hazards or changes in the environment.
- **Inappropriate Footwear:** poorly fitting shoes and slippers, stockings/socks without shoes, slippery soles, high heels, thick soles, frequent variations in shoe type.
- **Medication use:** multiple agents implicated, including: sedatives, benzodiazepines, antihypertensives, hypoglycemic agents, and antihypertensives. The use of multiple medications magnifies risk; this is termed polypharmacy. The use of four or more drugs is particularly problematic.⁷² Different drugs can interact to produce adverse effects one would not otherwise experience. Medications should not be combined with alcohol or over the counter medicines for sleeping, pain or coughs, without medical consultation.⁶⁴ In particular, psychotropic drugs increase the risk of falls.
- **Risk-taking Behaviours:** climbing, clearing snow/ice, improper use or non-use of assistive devices.

Environmental Risk Factors

- **Community Hazards:** sidewalk cracks, uneven pavement/surfaces, tree roots, snow/ice, unsafe stair design, poorly lit areas, lack of handrails, obstacles in walking paths or on sidewalks, no rest areas.

- **Home Hazards:** throw rugs and loose carpets, electrical cords, pets, cluttered floors and stairs, poor lighting, low toilet seat, slippery floors/shower/bath, a lack of assistive devices and supports (e.g., grab bars), ambient temperature too warm or cold.
- **Institutional Hazards:** poorly designed or maintained buildings and grounds, inadequate or poorly enforced regulations, lack of handrails/grab bars, beds left in raised position and/or too high, wheeled beds and chairs, unsafe or broken equipment, slippery floors, hard (non-resilient) surfaces, poor lighting, lack of rest areas, not enough storage, lack of appropriate transportation.

Table 2: Risk Factors for Falls or Fall Injury in the Elderly^{4,57,61,62,63-70}

Biological	Behavioural
Advanced age (80+)	Alcohol use
Chronic diseases	Fear of falling
Cognitive impairments	Handbags
Gender (Women)	Inadequate diet/exercise
Muscle weakness	Inappropriate footwear
Poor physical fitness	Inattention
Physical disability	Medication use
Sensory deficits	Past history of falls
	Risk-taking behaviours
Environmental	Socio-economic
Community hazards	Inadequate housing
Home hazards	Inadequate access to services
Institutional hazards	Income inadequacy
	Lack of support networks
	Lower educational levels
	Social Isolation

Socio-Economic Risk Factors

- **Inadequate Housing:** disrepair may cause tripping and other fall hazards, homes may not meet current design and safety standards, lack of handrails, lack of non-slip bathtub.
- **Inadequate Access To Services:** including medical, nursing, social services, home care, occupational therapy, physical therapy, meals-on-wheels and other community supports.
- **Inadequate Income:** may result in poor diet, low levels of physical activity, inability to address home hazards or purchase assistive devices or required services such as home care.

- **Lack of Support Networks:** poor compliance with management plan, reduced access to nutritious foods, and missed appointments.
- **Lower Educational Levels:** inadequate knowledge and resources about proper diet and exercise, healthy lifestyle, and falls prevention; literacy affects ability to read and follow directions for medications and safety warnings for household equipment; and increased barriers to advocate for changes (e.g., municipal hazards, landlord requests, health-related services).
- **Social Isolation:** may result in lower levels of physical activity, decreased energy, symptoms of depression, and poor diet, as well as lack of transportation to appointments, etc.

Another common risk factor classification system divides risk factors into intrinsic and extrinsic factors.⁷³⁻⁷⁵ Intrinsic factors pertain to an individual's health, physical condition, and behaviour, while extrinsic risk factors apply to their interaction with their environment. The biological and behavioural risk factors listed above are intrinsic factors, and environmental risk factors are extrinsic factors.⁷⁴ Risk factor lists that use the intrinsic/extrinsic categories often do not incorporate socio-economic risk factors, which are often neglected in program planning. Programs tend to address behavioural interventions most often, environmental and biological risk factors may be targeted, and, generally, socio-economic risk factors are not addressed.⁶³ When weighing potential interventions, it should be determined whether the risk factor is modifiable. Lower body weakness, and gait and balance impairments are typically modifiable risk factors, whereas age and gender are not.^{76,77} Behavioural and environmental risk factors can be addressed more readily by the individual.

First Nations Populations

In Manitoba First Nations, death due to falls does not rank in the top five causes, yet it is ranked third for all Manitobans.¹ Falls rank as the leading cause of injury hospitalization for all Manitobans, including First Nations. Fall hospitalization rates per 100,000 are higher for First Nations Manitobans

relative to non-First Nations Manitobans (596.9 vs. 449.6, respectively).¹ First Nations Manitobans are 1.3 times more likely to be hospitalized for fall injuries. First Nations women over 85 years of age were at highest risk of hospitalization for fall injuries (9.343 per 100,000) relative to other ages, males, and non-First Nations women.

Patterns of Falls in the Community vs. Institutions

In the home and community, well elderly tend to fall while engaged in physical activity, while the frail elderly are more likely fall while engaged in regular tasks (e.g., bathing).⁶² Older adults in hospitals are at greater risk of falling and have more complications compared with their community-dwelling counterparts.⁵³ In acute care hospitals, risk factors for falls include: being male, acute and chronic medical conditions, extended bed rest, unfamiliar surroundings, gait instability, lower limb weakness, urinary incontinence, need for assisted toileting, falls history, delirium/agitation/confusion, impaired judgment, sensory deficits, and use of psychotropic and other medications.^{67,68,78} Following hospital discharge, patients are also more likely to fall, which may be due to medication use, weakness, or ongoing recovery and rehabilitation.⁶² In long-term care homes, contributing factors include frailty, impaired vision, wandering behaviour, cognitive impairment, inactivity, high-risk medications, and inadequate caregiver to patient ratios.^{62,68}

Fall History

The risk of falling increases significantly as the number of risk factors increases.^{53,79} Risk factors for future falls among patients seen for falls in the Emergency Department include a history of falling in the past year, falling indoors, and an inability to get up following a fall.⁷² Protective factors included moderate alcohol consumption and hospital admission as a result of a fall. One study differentiated between non-fallers, occasional fallers (one fall in the past year) and multiple fallers (two or more falls in the past year).⁸⁰ Occasional fallers were more likely to be women, to have reported back pain, and to have four or more medical conditions compared with non-fallers. Multiple fallers also tended to be women.

INTERVENTIONS

Overall Findings

The goals of fall prevention strategies are to maximize mobility and function, decrease the risk of falls and fall-related injuries, and preserve seniors' independence.⁶⁵ This section presents the effectiveness of interventions, with the goal of determining the best methods for reducing falls and fall-related injuries in the elderly. For the most part, systematic reviews and meta-analyses are summarized here, rather than individual studies, given the vast falls literature. Effective interventions include exercise, home environment modifications, medication modifications, clinical assessments, and interventions combining these features. Education was beneficial when included as a component of a more comprehensive program.

Exercise

Remaining active throughout the lifespan can help preserve independence and quality of life.⁸¹ Exercise is a well established, effective strategy for decreasing the incidence of falls and fractures in the elderly, including hip fracture.^{67,82,83} One report demonstrated that exercise reduced the risk of falling by 14%, as measured by the likelihood of falling at least once.⁸⁴ In another study, participation in a community-based group exercise program with supplemental home exercises led to improved balance and a 40% reduction in falls.⁸⁵

Four types of exercise are applicable to falls prevention among older adults; these are endurance, strength, balance, and flexibility.⁸⁶ Participation in any of these types of exercise may reduce fall injury risk. Canada's Physical Activity Guide for Healthy Active Living in Older Adults encourages 30-60 minutes of moderate physical activity most days including all four types of exercise.⁸⁷ Much of the literature has focused on balance, strength training, and walking programs (which impact endurance, strength, and balance). Exercise strategies found to be beneficial in terms of falls prevention include moderate strength training, balance training, and Tai Chi.⁶⁷

Balance Training

Balance control is a key requirement for successful mobility and falls reduction.⁸¹ A meta-analysis of Frailty and Injuries: Cooperative Studies of Intervention Techniques (FICSIT) trials demonstrated a 17% reduction in fall risk for balance training, which exceeded the fall risk reduction level attributed to a general exercise program (10%).⁸⁸ In this analysis endurance, resistance, and flexibility training were not found to reduce fall risk. A balance training component was present in the most programs demonstrating a significant decrease in falls.⁸⁹ Balance training led to a significant reduction (60% decrease) in fall risk for frail older women (70+ years of age) in residential care homes.⁹⁰ In this study, the intervention group also had less fear of falling and increased levels of physical activity following the training period.

Current guidelines state that older adults with prior falls should be offered long-term exercise and balance training.⁷⁷ This training can be offered to individuals or groups. One review demonstrated that home-based individualized balance training programs led to a reduction in falls, improved physical performance, and had a positive effect on disability.⁹¹ Some group-based exercise programs offered in seniors' or fitness centres have also led to fall reduction, yet these findings are less consistent. Exercise programs can prevent falls among community dwellers, particularly if the programs include Tai Chi or other balance-challenging exercises.⁹²

Strength & Balance Training Combined

Strength training can help combat weakness and the negative consequences associated with loss of muscle mass.⁹³ This type of exercise can decrease the risk of osteoporosis and alleviate some of the signs and symptoms of chronic disease, targeted at frail seniors living in retirement villages, resulted in fewer falls than in control subjects.^{94,95} Studies pooling the results of multiple trials show that an individually prescribed home exercise program that involved muscle strengthening and balance retraining that was delivered by health professionals reduced the

number of falls and fall-related injuries sustained by participants by 35%.⁹⁶ This program was found to be more beneficial among seniors 80 years of age and older. In another study, a targeted home exercise program that included strength and balance retraining reduced falls and injuries for women 80 years of age and over, and these results were sustained two years later (i.e., fall rate remained higher in the control group).⁹⁷ Multi-component group exercise programs for community-dwelling seniors show that strength exercises may not result in significant fall reduction, yet they can be effective in improving muscle strength and functional mobility.⁶⁸ In this study, a physiotherapist individually prescribed the program. Another study targeting those at increased fall risk (women with osteoporosis) demonstrated that a community-based exercise program led to improvements in balance and knee extension strength, thereby reducing fall risk factors.⁹⁹

Tai Chi

In seniors 70 years of age and older residing in the community, Tai Chi reduced the risk of multiple falls by 48%.⁷³ A recent study demonstrated that individuals who improved their functional balance by practising Tai Chi significantly (73%) reduced their risk of falls during the six month follow-up period, relative to those in the control group.⁹⁹ A systematic review of the effectiveness of Tai Chi found limited evidence for its ability to reduce falls.¹⁰⁰ Another systematic review, however, determined that a 15 week Tai Chi group exercise program reduced falls by 49%.¹⁰¹ The American Geriatrics Society Guidelines state that “Tai Chi C’uan is a promising type of balance exercise, although it requires further evaluation before it can be recommended as the preferred method of balance training”.⁷⁷

Individualized Programs

Current evidence supports the use of individually prescribed exercise programs for the frail elderly.⁹² Fall prevention guidelines recommend that individually tailored exercise programs be administered by qualified professionals and target those over 80 years of age.¹⁰² These programs can be modified to accommodate patients’ changing needs and may also benefit residents of long-term care facilities.¹⁰³ For community-dwelling seniors an exercise program that is individually prescribed by a trained health professional which targets muscle strength

and balance training can prevent falls.^{68,101} Greater benefits can be achieved when appropriate exercise programs are instituted that consider the needs and limitations of each participant.

More research is required to determine the most effective components of exercise programs for reducing falls.⁸⁹ To date, an optimal exercise prescription for preventing falls has not been determined.^{77,82,104} For instance, there is no established minimum exercise guideline for those who wish to be active yet have limitations. Factors such as the duration and intensity of exercise that are required for health gains to be protective for falls are unknown. More research is needed on the following topics: exercise programs for at-risk seniors, exercise to prevent injuries (rather than falls), and what differentiates protective levels from those causing injury (e.g., brisk walking was found to increase falls in one at-risk group).^{101,104} Another issue involving exercise programs and seniors is the issue of compliance and how to ensure patients or participants maintain the exercise program long-term.⁸⁹ Regarding compliance, preliminary findings from program participant feedback indicate that programs should be accessible, affordable, and held at convenient times.⁸⁵ Research has shown that individuals who were most active at the time of baseline measurement, who had a prior fall, and who remained confident about not falling were more likely to continue participating.⁹⁷ It is also necessary to determine what makes some seniors resistant to participating in exercise programs and whether these issues can be overcome or addressed.⁶² Programs to date have combined muscle strength and balance training; what remains to be determined is whether other combinations of exercise components are more beneficial than the individual components in isolation.⁶⁸

Environmental Modifications

Home hazard assessments and making changes in the home to reduce identified hazards may be an effective fall prevention strategy for the elderly.^{89,105} Occupational therapists are well equipped for conducting home assessments, however resource limitations will restrict this service to a small proportion of community-dwelling seniors. Hazard reduction strategies that can be simply accomplished by a homeowner or tenant include removing obstacles in walking areas, improving lighting, and securing electrical cords. If an individual can benefit from

grab bars an occupational therapist should be consulted to ensure the device is installed properly and in the optimal location. Fall prevention checklists have been developed with extensive lists and rationale for each item (e.g., <http://www.cpsc.gov/CPSCPUB/PUBS/701.html>). Given this population, providing financial and volunteer assistance may be helpful in making significant changes in the home setting.^{62,89} For instance, the Canada Mortgage and Housing Corporation's (www.cmhc-schl.gc.ca) Home Adaptations for Seniors' Independence (HASI) Program provides funding to landlords and homeowners who meet their requirements.

Not all studies have found home hazard reduction to be beneficial. One study found no impact of the interventions on at-risk community-dwelling elderly. A systematic review concluded that home hazard assessment and modification conducted by a trained professional is beneficial for individuals with a history of falling (34% reduction in sustaining two or more falls during the study period).¹⁰¹ There was no evidence of benefits for this strategy among non-fallers. Another systematic review found no evidence that home hazard reduction reduced fall risk or fall rates.⁸⁴ A third source found no evidence supporting living in a safe environment as protective for falls and fall injuries.⁶⁸ A recent Cochrane review also failed to find a link between hazard and injury reduction.³³ A number of authors have recommended this intervention as a component of a more comprehensive initiative.^{68,89} The effectiveness of programs that provide seniors with free safety devices or financial aid for device acquisition is unknown.

Barriers to home environment modification programs include difficulty in verifying that hazards are resolved, seniors' reluctance to permit home access, negative perceptions associated with some proposed changes (e.g., need for grab bars signifying frailty), and the need to maintain a safe environment long-term, requiring ongoing vigilance and action.

Education

While some studies have found education to be effective in reducing falls and fracture rates, others have not.^{67,84} Education alone may raise awareness but it does not always bring about desired behavioural changes. In general, education is not an effective method in isolation. Systematic reviews have

reported that there is insufficient evidence to determine whether education alone can reduce falls or fall injuries.^{53,89}

Medication

Medication management to reduce fall risks

Few studies have rigorously evaluated the effect of medication modification in reducing fall rates. Available evidence supports the withdrawal of benzodiazepines (sedatives), as these increase the risk of falling among seniors.^{62,67} The evidence also lends some support to the withdrawal of psychotropic medication where possible, as overall fall risk was lower when compared with a tailored exercise program.¹⁰¹ Another issue is the increased or new adverse effects that can occur when multiple drugs are taken.⁶² Various factors related to polypharmacy can increase fall risk. It is recommended that patients receive regular medication reviews and monitoring to minimize the adverse effects of medication.¹⁰⁶ This may contribute to a reduction in fall rates.^{62,68,107}

Medications which may prevent fractures

Recommendations regarding the management of osteoporosis, such as the use of calcium, vitamin D, and biphosphonate medications are beyond the scope of this paper.

Clinical Assessments

Clinical assessments involve obtaining a complete patient history including information on past falls and associated injuries, risk factors, and physical function (e.g., balance testing) by conducting a thorough physical exam.⁷⁶ Suggested clinical assessment components include medication review, a thorough physical examination relevant to falls, vision, mental status, postural blood pressure, cardiac health, and neurological, musculoskeletal and podiatry issues.⁶⁵ Clinical assessments should be conducted by health professionals followed up with a proactive strategy for addressing identified risks and injury-related problems. Specific individualized strategies for the patient include referrals to appropriate programs and services (e.g., physiotherapy, exercise, home hazard reduction). In some programs

community health nurses assess the risk factors that may contribute to falls, determine appropriate interventions, and provide guidance related to health promotion and falls prevention.¹⁰⁸ Assembling an interdisciplinary falls team to conduct comprehensive clinical assessments, offering referrals as needed, led to a decrease in fall rates, fall risk, and the risk of recurrent falls when compared with receiving standard care.¹⁰⁹ Here the population under study included community-dwelling seniors who had visited an Emergency Department.

Comprehensive and targeted clinical assessments with the goal of identifying fall risk factors and reducing these risks through targeted strategies are effective methods of preventing falls.^{62, 67,77,101,102} However, this intervention has not been well evaluated independent of other strategies.^{68,89} While many risk assessment tools exist for use in the community few have been validated.¹¹⁰ To date no single tool has been identified as superior or universally applicable.¹¹¹ The National Center for Patient Safety recommends using either the Morse or Heindrich Fall Risk Assessment Tool.⁶¹

There is debate as to whether all seniors should be assessed for fall risk or just the at-risk group. The American Geriatrics Society (AGS) recommends assessing seniors who need medical assistance following a fall, those with two or more falls during the past year, and individuals with gait or balance difficulties.⁷⁷ Other assessment candidates include those who are identified as 'at risk' by fall risk screening tools. Fall risk assessments should be conducted periodically, as risk factors change over time.⁶¹ The

AGS states that current levels of 'case finding' are sub-optimal for detecting those at risk.⁷⁷

Other Interventions

Hip Protectors

Use of hip protectors has been recommended for those with a prior history of falling and for older adults residing in nursing homes.^{112,113} In one study, the risk of sustaining a hip fracture when wearing hip protectors at the time of a fall was reduced by 77%.¹¹⁴ Similarly a protective effect was found for use of hip protectors among nursing home residents who had a history of falls (69% reduction in likelihood of hip fracture).¹¹² Compliance is major barrier to the use of hip protectors. A study of residential care patients showed compliance rates to be under 40%, and to be especially low at night time (3%).¹¹⁵ Reported adverse effects include skin irritation, abrasion, and local discomfort.¹¹³

Choice of Footwear

Different types of footwear are associated with varying risks of falls on a range of surfaces. In examining soles resistant to slipping on hard ice, polyurethane soles, while superior on indoor wet and oily floors, demonstrated inferior performance when compared to synthetic, nitrile, and natural rubber soles.¹¹⁶ A recent study concluded that athletic and canvas shoes (sneakers) were the styles of footwear associated with the lowest fall risk.¹¹⁷ Walking barefoot or walking in socks or stockings was associated with a sharply increased fall risk.

The American Geriatrics Association recommends clinical assessment of fall risk:⁷⁷

In routine care – Inquire about once a year about falls. If a fall is reported then assess the patient's ability to stand up from a chair without using their arms, walk several paces, and return. If they have no difficulty completing this task they need no more assessment. (termed "get up and go")

Following one or more falls in the past year or for gait/balance abnormalities – Have an experienced clinician conduct an evaluation. Determine the history and circumstances surrounding the fall (e.g., medication use, acute and chronic illness, mobility, vision) and conduct a thorough assessment of functioning.

Multifactorial Programs

Programs using multiple countermeasures are effective in reducing falls and fall-related injuries.^{67,89,118,119} These programs may include a variety of components such as exercise programs, home hazard reduction, clinical assessment and medication review, and patient education. The advantages of multifactorial programs are not surprising given that falls often occur as a result of multiple contributing factors.⁷⁵ Risks assessed most often in comprehensive risk assessment and management programs included medication, vision, environmental hazards and orthostatic blood pressure.⁸⁴ In general, a targeted, multi-strategy intervention involving a thorough assessment would be effective in reducing falls among those at moderate risk.⁶²

Numerous evaluations of various types of multifactorial programs have been published in the research literature, and have demonstrated variable though consistently positive effects. Several examples of reviews are listed below. Given the nature of these reports different methodologies were employed (e.g., varied time duration in the follow-up stage).

- One study, which included environmental modification, medication adjustment, and exercise, resulted in a net fall reduction of 31% for the intervention group relative to control participants. Patients were followed-up one year after the intervention.¹²¹
- Another review demonstrated that multidisciplinary, multifactorial programs including screening and interventions for community-dwelling seniors reduced fall risks by 27% among untargeted seniors. A 14% reduction was found for those with a history of falling, while in residential care falls were reduced 40%.¹⁰¹
- A systematic review concluded that multifactorial risk assessment and subsequent management programs reduced falls by

18% as measured by risk of falling and monthly fall risk.⁸⁴

- A review of hospital falls prevention programs demonstrated a 25% reduction in fall rate. However, it was not possible to assess which of the initiatives were most effective (e.g., increased vigilance, equipment safety programs, toileting assistance, bed alarms etc.).¹²²

Multidisciplinary teams of health professionals trained to recognize and prevent risk factors for falls should be involved in the development and implementation of multifactorial falls prevention programs for the community-dwelling elderly.^{89,123} An ongoing issue with research studying these initiatives is that programs as a whole are often the unit of analysis; it is therefore not possible to isolate which elements are most effective. More research is required in order to isolate the contributions that specific strategies make to decreasing falls and fall injuries, as well as what constitutes the best combination of components.^{68,89} These types of initiatives have been found to be costly, so with future research, components that are not value-added in terms of fall outcomes could be discontinued.¹⁰¹

Research Gaps

Critiques of the fall prevention literature highlight the fact that fall prevention is thoroughly examined whereas the prevention of injuries due to falls has not been studied as rigorously.¹⁰⁵ Interventions requiring further study to determine effectiveness include sensory impairments, lower limb strength training, vitamin D supplementation, cognitive/behavioural therapy, hormone replacement therapy, and pharmacological therapy.^{68,101} The CDC highlights the need for further research examining barriers to intervention adoption among the public and health care, the need to determine the best dissemination channels for elderly falls prevention, and to target those most in need.⁴⁹ Others stress the need

A Local Initiative

The Winnipeg Regional Health Authority developed a multifactorial seniors' falls prevention program which included a clinical assessment component, exercise classes incorporating balance and strength training, a pedometer-based walking program, and an educational component. The program was intended to be sustained through community volunteers. The 'Steppin' Out With Confidence' Seniors Falls Prevention Program was effective in increasing seniors' physical activity and knowledge of the benefits of engaging in regular exercise.¹²⁰

for early intervention and rigorous assessment to enhance case finding.^{77,105} There is also currently little information on whether physician counselling can influence safety device use.¹²⁵ Elderly fall prevention is one of the most costly and complex health promotion issues facing older Canadians;

prevention should be addressed at all government levels, within the community, and through the health care system.⁶⁷ Table 4 provides a summary of fall prevention tips published by a variety of organizations.

Table 4. Tips to Prevent Falls by Expert Opinion

Intervention	American Academy of Orthopaedic Surgeons ^{1,25}	Centers for Disease Control ^{1,26,127}	Health Canada ⁶⁶	Mayo Clinic ^{64,128}	National Institutes of Health ⁹⁴	Registered Nurses Association of Ontario ¹²⁹	SMARTRISK ⁸⁶
General Health							
Be aware of bone health and osteoporosis risk, get tested by your doctor						•	
Eat regular, well-balanced meals			•				•
Exercise regularly to increase strength and balance (consult your doctor before starting)		•	•	•		•	•
Have your vision and hearing checked at least once a year		•	•				•
Manage and monitor your medications properly (consult your doctor or pharmacist)		•	•				•
Rise slowly from the bed or chair to avoid any sudden drop in blood pressure		•	•			•	
Wear appropriate footwear (slip resistant soles, low heels) and avoid wearing only socks on tile or wood floors		•		•	•	•	•
General Safety							
Consider a 24 hour monitoring system if you live alone or have someone to check in daily			•	•	•		
Have sufficient (minimum 100 watts) lighting throughout the home; nightlights are useful		•	•	•	•	•	•
If you are at risk of falling, consider wearing hip protectors to reduce your risk of injury				•	•	•	
Inform city officials and landlords of any unsafe conditions			•				
Keep your home and garden free of hazards		•	•	•	•		•
Use gait aids prescribed for you (e.g., walker, cane) for walking			•			•	•
Bathroom Safety							
Do not use a towel rack or other product (soap/shampoo) holder for support. These will not hold a person's weight	•						
Do not lock the bathroom door – that will delay help in reaching you	•						
If prone to falls use a shower chair or handheld attachment	•		•	•	•		•
Install grab bars next to the toilet and in the tub and shower		•	•	•	•	•	•
Put non-slip mats in the bathtub and on shower floors		•	•	•	•	•	•

Intervention	American Academy of Orthopaedic Surgeons ^{1,25}	Centers for Disease Control ^{1,26,127}	Health Canada ⁶⁶	Mayo Clinic ^{64,128}	National Institutes of Health ⁹⁴	Registered Nurses Association of Ontario ^{1,29}	SMARTRISK ⁸⁶
Bedroom Safety							
Replace satiny sheets and comforters with products made of non-slippery materials such as cotton	•						
Keep a lamp or flashlight near your bed			•	•	•		•
Kitchen Safety							
Have regularly used items within reach (low shelves) to avoid having to climb		•	•	•			•
If you need to climb, use a sturdy (wide base) stepping stool, not a chair			•	•	•		•
Wipe up spills immediately to prevent slipping			•				•
Stair, Floor and Hallway Safety							
Do not carry large items that could obstruct your view of the stairs	•						
Ensure all flooring is securely fastened and remove throw rugs		•	•	•	•	•	•
Ensure stairways are well lit		•	•	•			•
Have an electrician put in light switches at the top and bottom of the stairs		•	•	•			•
Install handrails on both sides of the stairs		•	•	•	•		•
Keep at least one hand on the handrail	•						
Keep electrical and phone cords away from walking areas		•	•	•	•	•	•
Remove clutter from stairways and floors	•	•	•	•	•	•	•
Remove raised doorway thresholds in all rooms				•			
Walkways and Entryways							
Ensure areas are well lit, motion sensors may be helpful							•
Get loose or uneven steps repaired		•					•
Have a small bench in your entryway for putting on or removing footwear			•				•
Have a handrail installed along your front walkway if needed			•				•
Make sure your steps and walkways are free of ice, snow, leaves, or newspapers		•	•				•

FALLS PREVENTION GUIDELINES AND SUMMARIES OF EVIDENCE

A number of jurisdictions, organizations, and researchers have published summaries of the research evidence for falls prevention among the elderly. These summaries rate the research evidence and the level of recommendation according to various grading systems. Most of these summaries have presented consistent findings. One review concluded that multi-faceted interventions decrease fall risk (grade B evidence), that programs combining interventions reduce falls (grade A evidence), programs

assessing hypotension, medication use, balance and gait are successful (grade B) and Tai Chi can reduce fall incidence (grade B). A British Columbia review is summarized in the last section of this report. A November 2004 UK clinical practice guideline is particularly instructive, and is summarized on the following page. This guideline is based on the evidence grading system listed below. A clinical pathway is found in Appendix B.

Recommendation grade	Evidence
A	Directly based on category I evidence
B	Directly based on: <ul style="list-style-type: none"> • category II evidence, or • extrapolated recommendation from category I evidence
C	Directly based on: <ul style="list-style-type: none"> • category III evidence, or • extrapolated recommendation from category I or II evidence
D	Directly based on: <ul style="list-style-type: none"> • category IV evidence, or • extrapolated recommendation from category I, II, or III evidence
GPP	Recommended good practice based on clinical experience of the Guideline Development Group

Evidence category	Source
I:	Evidence from: <ul style="list-style-type: none"> • meta-analysis of randomised controlled trials, or • at least one randomised controlled trial
II:	Evidence from: <ul style="list-style-type: none"> • at least one controlled study without randomisation, or • at least one other type of quasi-experimental study
III:	Evidence from non-experimental descriptive studies, such as comparative studies, correlation studies and case-control studies
IV:	Evidence from expert committee reports or opinions and/or clinical experience of respected authorities

Adapted from Eccles M, Mason J. How to develop cost-conscious guidelines. *Health Technology Assessment* 2001;5:16.

Key priorities for implementation: NICE Clinical Guideline¹³⁰

Case/risk identification

- Older people in contact with healthcare professionals should be asked routinely whether they have fallen in the past year and asked about the frequency, context and characteristics of the fall/s. **C**
- Older people reporting a fall or considered at risk of falling should be observed for balance and gait deficits and considered for their ability to benefit from interventions to improve strength and balance. (Tests of balance and gait commonly used in the UK are detailed in the full guideline.) **C**

Multifactorial falls risk assessment

- Older people who present for medical attention because of a fall, or report recurrent falls in the past year, or demonstrate abnormalities of gait and/or balance should be offered a multifactorial falls risk assessment. This assessment should be performed by healthcare professionals with appropriate skills and experience, normally in the setting of a specialist falls service. This assessment should be part of an individualized, multifactorial intervention. **C**
- Multifactorial assessment may include the following:
 - identification of falls history
 - assessment of gait, balance and mobility, and muscle weakness
 - assessment of osteoporosis risk
 - assessment of the older person's perceived functional ability and fear relating to falling
 - assessment of visual impairment
 - assessment of cognitive impairment and neurological examination
 - assessment of urinary incontinence
 - assessment of home hazards
 - cardiovascular examination and medication review.

Multifactorial interventions

- All older people with recurrent falls or assessed as being at increased risk of falling should be considered for an individualised multifactorial intervention. **A**
- In successful multifactorial intervention programs the following specific components are common (against a background of the general diagnosis and management of causes and recognized risk factors): **A**
 - strength and balance training
 - home hazard assessment and intervention
 - vision assessment and referral
 - medication review with modification/withdrawal.
- Following treatment for an injurious fall, older people should be offered a multidisciplinary assessment to identify and address future risk, and individualized intervention aimed at promoting independence and improving physical and psychological function. **A**

Encouraging the participation of older people in falls prevention programmes including education and information giving

- Individuals at risk of falling, and their carers, should be offered information orally and in writing about what measures they can take to prevent further falls. **D**

Professional education

- All healthcare professionals dealing with patients known to be at risk of falling should develop and maintain basic professional competence in falls assessment and prevention. **D**

Best practice recommendations supported by the current literature are summarized below. Many can be applied within the community setting to target

elderly falls and fall-related injury prevention on a local scale.

**FALLS PREVENTION AMONG THE ELDERLY
BEST PRACTICES**

Strongly Recommended

- A Thorough Assessment and Management Program For At-Risk Elderly
- Balance Training and Muscle Strengthening Exercise Programs
- Home Hazard Assessment and Modification
- Individually Targeted Exercise Programs Following Assessment
- Medication Reviews and Withdrawing from Medications That Increase Fall Risk
- Multifactorial Screening and Intervention Programs For Community-dwelling Elderly

Recommended based on expert opinion

- Providing Fall Prevention Education as Part of a Larger Program
- Personal and Home Environment Changes to Reduce Fall Risk (see Table 4)
- Use of Hip Protectors for those at Risk of Recurrent Falls

APPLICATION OF FINDINGS

Published recommendations from the Provincial Health Officer of British Columbia are included here as a summary of recommended strategies for fall prevention among the elderly.⁶²

Physicians/Health Care providers

- Family physicians should regularly test individuals' gait and balance, and inquire whether their elderly patients have fallen since their last visit. Those who have fallen or for whom gait/balance problems exist should receive a complete risk assessment and recommendations for appropriate intervention or referral.
- Continuing Medical Education activities should include teaching sessions for family physicians on how to conduct falls risk assessments on elderly patients.
- Physicians should promote strength and mobility exercises to patients (e.g., Tai Chi) with the goal of reducing fall risk.
- Physicians should prescribe fewer medications that have adverse effects and increase fall risk (i.e., benzodiazepines, muscle relaxants, antidepressants) among the elderly and be aware of drug interactions that significantly increase fall risk.
- Physicians should alert elderly patients with acute illnesses or chronic disease that the effects of illness and bed rest are associated with an increased fall risk.
- Physicians should work with other physicians/professionals (e.g., occupational and physiotherapy, geriatricians, neurologists) when conducting comprehensive fall assessments for elderly patients.
- Physicians should make available public education information on falls prevention.

Pharmacists

- Pharmacists should advise elderly patients about possible drug effects that increase fall

risk and ways patients can reduce risk. This is particularly relevant for those taking many medications or consuming alcohol regularly.

- Pharmacists should contact physicians when patients are prescribed drugs, or combinations of drugs, that are known to increase fall risk.
- Pharmacists should continue to provide and promote effective products that prevent falls or injuries from falls (i.e., protective devices (hip pads) and walking aids).
- Pharmacists should develop labels that warn 'May increase the risk of falling' and affix them to all prescription drugs known to have side effects associated with higher fall rates.
- Pharmacists should arrange for printed materials distributed with medications to be in a suitably large typeface to accommodate seniors with diminished vision.

Managers of Long-Term Care Facilities

- Facilities should conduct monthly surveillance and keep records of the incidence of falls, including contributing factors and action plans for correction.
- Comprehensive fall risk assessments should be carried out when patients are admitted to the facility, on a regular basis, and/or when health status changes occur.
- Hip protector use should be encouraged in long-term care homes and among the frail elderly or among community-dwellers who have significant osteoporosis.
- Facilities should work with physiotherapists and occupational therapists to assist in falls prevention for individuals and programming initiatives.

Community Health Workers/Home Care Nurses and Other Providers of Services in Seniors' Homes

- Initial intake assessments for home support clients should be carried out by professionals trained to assess and screen for levels of fall risk and contributing factors for prior falls.
- Identification of a hazardous home environment with elevated fall risk should result in the development of programs and the provision of personnel to aid in making positive environmental modifications at a reasonable expense.
- Individuals can provide fall prevention information to seniors and referrals when needed (e.g., for community program participation and home assessments).

Acute Care Hospitals

- For elderly patients, acute care hospitals should establish an admission screening procedure for fall risk, which takes into account prior history of falls, past fall injuries, and any mobility, vision or cognition deficits. For at-risk patients, a comprehensive fall assessment should be conducted shortly after admission and a prevention plan developed.
- Detailed falls assessments should be conducted upon discharge for elderly patients. Identified risk factors should be followed up with a targeted intervention (e.g., medical, modification, exercise program, or an environmental intervention).
- Emergency Department staff can provide patients with less serious injuries with community-related programming information and relevant referrals

Regional Health Authorities (RHAs)

- RHAs should collect data on falls from acute care, long-term care, emergency departments, and individuals receiving home support services. These data should be summarized and applied to the design and evaluation of fall prevention strategies and quality of care improvement programs.
- RHAs should develop programs that are applicable to all seniors including those liv-

ing in the community, in institutions, and those with limitations (e.g., frailty).

- RHAs should consider adding specific falls assessments to existing clinics (e.g., Geriatric Assessment clinics with a team-oriented approach). Assessments should include testing patient mobility, vision, current medication use, and inquiring about prior falls and contributing factors.
- RHAs should work with community partners such as municipalities (particularly Municipal Engineers), recreation centers, seniors' organizations and existing falls prevention programs sponsored by other organizations to build regional capacity for implementing falls prevention programs and strategies (see Appendix B).
- RHAs should provide educational opportunities for their health employees regarding the best practices for designing, implementing and evaluating falls prevention programs.

Manitoba Health

- Manitoba Health should mandate the use of the National Ambulatory Care Reporting System (NACRS) in all Emergency Departments to improve the data collection, analysis and reporting of this increasingly important activity in health care.
- Manitoba Health should encourage the Emergency Medical Service (ambulance) to collect and use ambulance service data to better identify pre-fall circumstances and post-fall outcomes for elderly persons requiring emergency services for fall-related events, and apply the data to emergency-based fall and injury prevention programming.
- Manitoba Health should investigate ways to encourage thorough, multidisciplinary models of care for seniors in primary care practice which include fall risk assessment and prevention protocols.
- Manitoba Health should support the development of standardized assessment tools and educational materials for fall prevention strategies for the elderly, for use by the RHAs.

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APPENDIX A: EVALUATION CRITERIA

In developing grades of recommendation for each intervention, first the body of evidence was graded according to the level of evidence, which reflects study design (Table A). For levels of evidence, the Canadian Task Force on Preventive Health Care methods were used. These correspond to grades of recommendation (good, fair, conflicting, and insufficient). Then a summary grade of recommendation

was assigned, using the Community Guide methods (Table C), in order to provide a common framework for this series of Manitoba injury prevention best practices reports. This system provides a clear hierarchy of recommendations, and clearly indicates where expert opinion is considered to increase the strength of the recommendation.

Table A. Levels of Evidence and Grade of Recommendation

Grade	Level of Evidence	Criteria
Good	I	Evidence obtained from at least one properly randomized control trial
Fair	II-1	Evidence obtained from well-designed controlled trials without randomization
	II-2	Evidence obtained from one or more cohort or case-control analytic studies
	II-3	Evidence obtained from comparisons between times or places with or without an intervention. Dramatic results in uncontrolled experiments could be included
Poor	III	Opinions of respected authorities based on clinical experience, descriptive studies or reports of expert committees

Table B. Recommendations Grades for Specific Clinical Preventive Actions

A	There is good evidence to recommend the clinical preventive action.
B	There is fair evidence to recommend the clinical preventive action.
C	The existing evidence is conflicting and does not allow making a recommendation for or against use of the clinical preventive action, however other factors may influence decision-making.
D	There is fair evidence to recommend against the clinical preventive action.
E	There is good evidence to recommend against the clinical preventive action.
I	There is insufficient evidence (in quantity and/or quality) to make a recommendation, however other factors may influence decision-making.

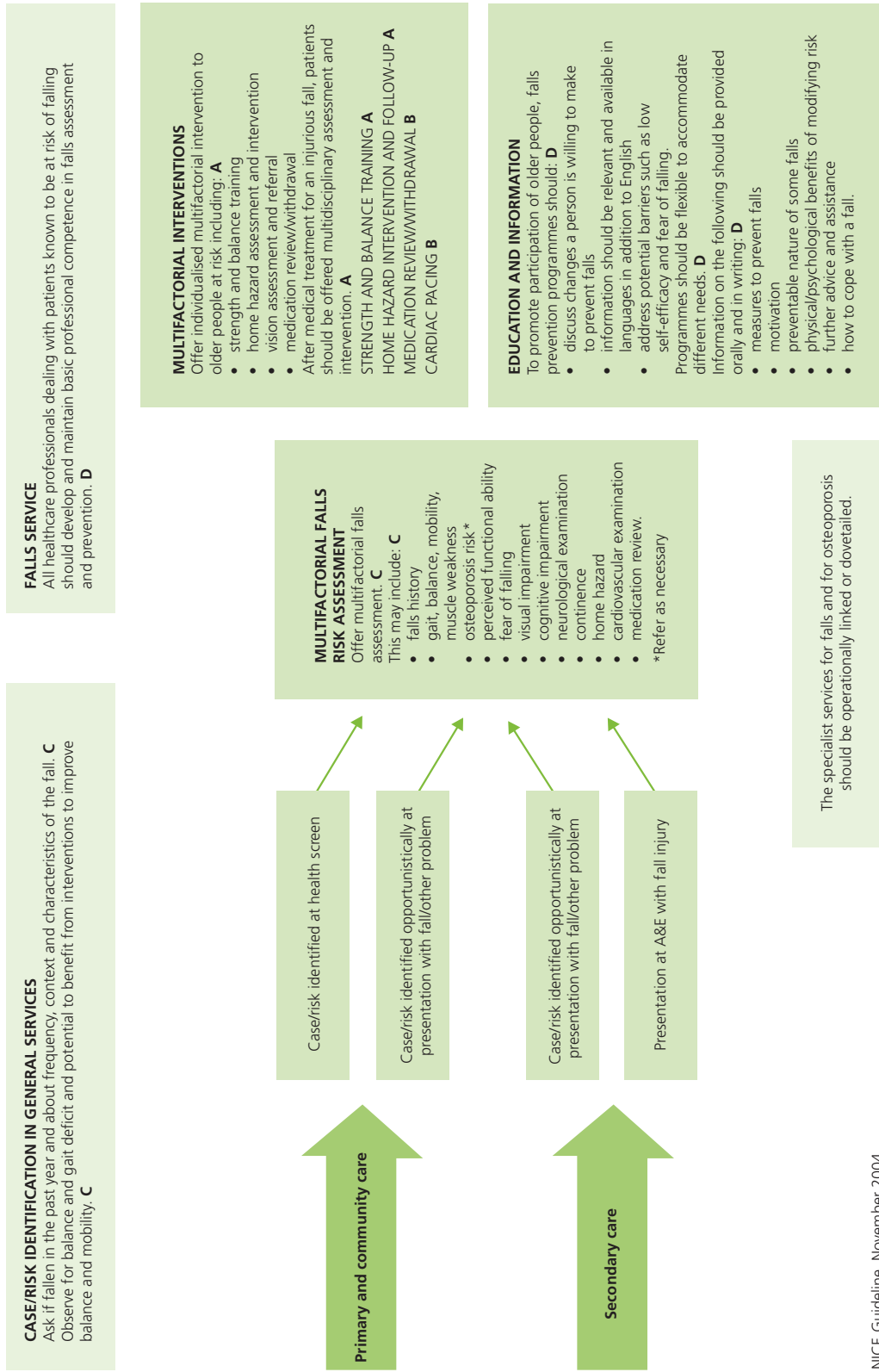
Table C. Grades of Recommendation

Code	Evidence Level of Evidence	Canadian Task Force Recommendation	Strength of Evidence	Community Guide Recommendation
I	Good	Strongly recommended or Discouraged	Strong	Strongly recommended
II-1 II-2 II-3	Fair	Recommended or Recommended based on expert opinion	Sufficient	Recommended
III	Insufficient	Recommended based on expert opinion	Insufficient empirical information supplemented by expert opinion	Recommended based on expert opinion
			Available studies do not provide sufficient evidence to assess	Insufficient evidence to determine effectiveness
Any level		Insufficient evidence to determine effectiveness	Sufficient or strong evidence of ineffectiveness or harm	Discouraged

Adapted from 'Canadian Guide to Clinical Preventive Health Care' www.hc-sc.gc.ca/hppb/healthcare/pdf/clinical_preventive/methe.pdf and the Community Guide www.thecommunityguide.org/.

APPENDIX B: NICE ALGORITHM

Patient referral and care pathway



NICE Guideline, November 2004

