Public Health Agency of Canada
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Report on **Seniors' falls in Canada**

Canada

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Dedication

The Division of Aging and Seniors dedicates this document to the memory of Margery Boyce (1932-1997), who devoted over two decades to the field of aging and seniors. She was a passionate advocate for all aspects of seniors' safety, and the inspiration for much of Health Canada's, and now the Public Health Agency of Canada's leadership in the area of seniors' falls prevention. Her deep concern for seniors is perpetuated in the work of the Division through its continued federal leadership on health issues related to aging and seniors.

Acknowledgements

The creation of this document has truly been a collective effort by many who share a commitment to seniors' falls prevention. The Public Health Agency of Canada wishes to thank all those who contributed their time and effort to the development, review and production of this document.

Special thanks to Jennette Toews, Policy Analyst, Division of Aging and Seniors, for her leadership and commitment to the research and analysis that led to the creation of this document.

Foreword

Most of us have heard of a senior who has fallen, been injured and suffered devastating effects: disability, chronic pain, loss of independence and a lesser quality of life. Such falls not only alter the course of aging, they also have serious repercussions on the lives of family and friends, and on Canada's public health resources.

Recognizing that falls are one of the most costly and complex injury issues facing seniors, the Public Health Agency of Canada (PHAC) has prepared this *Report on seniors' falls in Canada* to support and promote research, policies and programs to prevent seniors' falls. It is the first report to present comprehensive data on fall injuries and deaths, as well as evidence on risk factors and best practices for prevention, solely for Canadians age 65 years and over.

The development of this report was inspired by the unprecedented momentum and interest in seniors' falls prevention over the past decade in Canada and around the world. Health Canada and the Public Health Agency of Canada are proud of the work that has been carried out in the area of injury prevention and, in particular, of fall prevention among seniors.

The *Report on seniors' falls in Canada* provides information to support continued research and action to prevent falls and injuries among seniors in Canada. As surveillance, research and program initiatives expand, our collective understanding of risk factors and the prevention of falls will increase. This improved understanding holds promise for the development of effective new interventions and policies to reduce the human suffering and financial costs of falls and fall-related injuries among Canadian seniors.

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Statistics on seniors' falls

- Falls are the second leading cause, after motor vehicle collisions, of injury-related hospitalizations for all ages, accounting for 29% of injury admissions.[1]
- Almost 62% of injury-related hospitalizations for seniors are the result of falls.[2]
- The fall-related injury rate is nine times greater among seniors than among those less than 65 years of age.[3]
- Almost half of seniors who fall experience a minor injury, and 5% to 25% sustain a serious injury such as a fracture or a sprain.[4]
- Falls cause more than 90% of all hip fractures in seniors and 20% die within a year of the fracture.[5]
- Families are often unable to provide care, and 40% of all nursing home admissions occur as a result of falls by older people.[6]
- Even without an injury, a fall can cause a loss in confidence and a curtailment of activities, which can lead to a decline in health and function and contribute to future falls with more serious outcomes.[7]
- A 20% reduction in falls would translate to an estimated 7,500 fewer hospitalizations and 1,800 fewer permanently disabled seniors. The overall national savings could amount to $138 million annually.[8]
- The magnitude of the problem of falls among older adults is reflected in the 300% increase in publications on the issue between 1985 and 2005.[9]

1 Introduction

This report was designed to support the efforts of all those who work on research, programs and policies to reduce seniors' falls and fall-related injuries. It presents a comprehensive analysis of national data – for Canadians age 65 and over – on fall injuries and deaths, as well as evidence on risk factors and best practices for the prevention of injuries to seniors living in both community and institutional settings.

The report provides new national information through analysis of the following data:

- epidemiological evidence on falls highlighting seniors' self-reported data from the Canadian Community Health Survey;
- hospitalization data from the Canadian Institute for Health Information Discharge Abstract Database; and
- mortality data from Statistics Canada's Canadian Vital Statistics.

It also examines:

- information on multifaceted risks for falls among seniors;
- evidence-based best practices for the prevention of falls and injury from falls; and
- issues surrounding the development and sustainability of fall prevention initiatives.

In addition, appendices provide a comprehensive list of risk factors for falls and fall-related injuries, and a list of the Public Health Agency of Canada's fall prevention publications (including the online *Inventory of fall prevention initiatives in Canada – 2005*).

Four *Technical reports* are available online (www.phac-aspc.gc.ca/seniors-aines/pubs/seniors_falls/technical/index.htm) describing in detail the data requests, analyses and interpretation of the data used on:

- injury resulting from falls among Canadians age 65 and over;
- hospitalizations due to falls among Canadians age 65 and over;
- hospitalizations due to falls among Canadians age 65 and over living in residential care facilities; and
- deaths due to falls among Canadians age 65 and over.

1.1 How this report is organized

Chapter 1, Introduction, presents the document's objectives, definitions, the main data sources used and the work of the Canadian government in the area of seniors' falls prevention.

Chapter 2, The scope of the problem, provides the first comprehensive overview of data on fall-related injuries and deaths among Canadians age 65 and over. Sections present data on self-reported falls, fall-related hospitalization data for all seniors and for seniors living in residential care facilities, and vital statistics data on fall-related mortality.

Chapter 3, Risk factors for falls and fall-related injuries in seniors, presents the latest evidence concerning fall risks from widely adopted guidelines and reviews other more recent studies on the prevention of falls. The information is organized under

biological, behavioural, environmental and socio-economic risk factors.

Chapter 4, Evidence-based best practices for the prevention of falls, summarizes the evidence for a broad range of best practices for the prevention of falls and fall-related injuries, plus some recent findings on addressing fear of falling, selecting the best approaches for specific settings, and recovery from a fall.

Chapter 5, Supporting fall prevention strategies, presents new information about factors affecting the sustainability of fall prevention programs.

Chapter 6, The way forward, addresses the potential of provincial and territorial data, including those on hospitalizations and deaths due to falls, to support local and regional fall prevention initiatives that respond to the unique circumstances in each jurisdiction.

1.2 Seniors' falls – definitions

All statistics and information reported in this document refer to ***Canadians age 65 and over*** unless otherwise stated. Words or expressions such as '*senior*', '*older adult*', '*older person*' – all refer to this age group.

A ***fall*** is often defined as a sudden and unintentional change in position resulting in an individual landing at a lower level such as on an object, the floor, or the ground, with or without injury. Different data sets define falls in various ways. These are described under each section.

1.3 Action on seniors' falls

Throughout Canada, stakeholders are taking action to reduce falls and fall-related injuries among seniors. Several provinces and territories have identified falls among seniors as a serious public health issue and are developing interventions and strategies for fall prevention. In some cases, strategies are an element of broader approaches that address injury prevention, healthy living or chronic disease across all ages. Professional health associations, universities and research institutes are developing new evidence on seniors' falls and this knowledge development is supported by fall prevention activities of professional and voluntary organizations that have a focus on either injury prevention or seniors' issues.

> The *Canadian Medical Association* "urges federal, provincial and territorial governments to develop and support initiatives to reduce the risk of older persons from falling and sustaining fractures and other serious medical complications."
>
> Source: *Resolutions concerning impact of falls on the health of older persons*, Canadian Medical Association, 135th AGM, Saint John, NB, 2002.

The Public Health Agency of Canada (PHAC) is leading continued federal action on seniors' falls as an important part of its mandate in preventing disease and injury and promoting good health. PHAC has

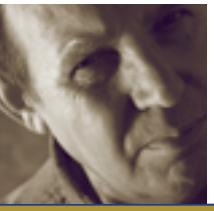
developed a unique capability as a result of more than a decade of dedicated Health Canada investments in seniors' falls prevention. Within PHAC, research, surveillance and epidemiological activities support the development of evidence to reduce falls.

The Division of Aging and Seniors, originally in Health Canada and now part of PHAC, has been the focal point for seniors' falls prevention activity within the federal government. The launch of *The safe living guide: A guide to home safety for seniors* in 1996 was the first of several fall prevention publications developed by the Division. (See Appendix B for a complete list of the Division's publications on seniors' falls prevention). The Division has also supported collaborative jurisdictional action between the federal government and the provinces and territories through the Federal/Provincial/Territorial Ministers Responsible for Seniors. In 1999, the F/P/T Ministers Responsible for Seniors commissioned an inventory of prevention programs, *An inventory of Canadian programs for the prevention of falls among seniors living in the community*, and a systematic review of the effectiveness of fall prevention programs for community-dwelling seniors. The findings of these studies formed the basis of *A best practices guide for the prevention of falls among seniors living in the community*, published in 2001.

The growing interest in seniors' falls prevention led to the first national meeting of stakeholders from across Canada in July 2000, to determine national priorities and directions on seniors' falls. The subsequent launch of a partnership between Health Canada and Veterans Affairs Canada enhanced the momentum on fall prevention both regionally and nationally.

This partnership, the Health Canada/Veterans Affairs Canada Falls Prevention Initiative, sought to advance understanding and knowledge of effective seniors' falls prevention interventions and to enhance community capacity to deliver fall prevention programs using a population health approach. The Initiative provided time-limited funding to community-based fall prevention projects that addressed environmental hazards, personal health practices, high risk populations and assistive device use. Throughout its four-year mandate, it supported knowledge development on the risk factors for falls, capacity building to address falls, and contributed further evidence on program models best able to reach seniors living in the community.

Across Canada, there are ever growing numbers of fall prevention interventions taking place within community, acute care, and long-term care settings. Key to targeting resources for the prevention of falls and related injuries is enhanced knowledge on the scope and nature of seniors' falls and the evidence for best practices for prevention. It is hoped that the overview of seniors' falls data and the review of the evidence contained in this report will contribute to the ongoing development of seniors' falls prevention strategies of the future.



2 The scope of the problem

A comprehensive overview of the nature and scope of seniors' injuries in Canada was derived from the study and analysis of:

- epidemiological evidence on falls highlighting seniors' self-reported data from the Canadian Community Health Survey (CCHS);
- hospitalization data from the Canadian Institute for Health Information Discharge Abstract Database (DAD) for all seniors, then more specifically for seniors in residential care; and
- mortality data from Statistics Canada's Canadian Vital Statistics.

It is important to note that every data source has its own definition of a fall based on the nature of the data, for example, self-reports vs. hospital records. Consequently, **care should be taken in comparing falls data from different sources**. It is also critical to recognize the distinct limitations of any data source, including the inherent potential for data errors and the impact on hospitalization and mortality data of changes in the International Classification of Diseases (more details are provided on pages 15-16, and in the *Technical reports*, at: www.phac-aspc.gc.ca/seniors-aines/pubs/seniors_falls/technical/index.htm).

2.1 What seniors report about falls and related injuries

This section provides national estimates based on the **Canadian Community Health Survey** (CCHS) data from seniors age 65 and over who indicated that they had suffered a fall-related injury in the previous year, serious enough to limit their normal activities. Included are estimates of cases and rates of injurious falls, types of injury, types of activity, and where treatment was obtained.

The Canadian Community Health Survey

CCHS is a component of the Population Health Survey Program of Statistics Canada. Cycle 2.1 of the Survey provides estimates of health determinants, health status and health system utilization for the health regions across the country. The CCHS targets individuals age 12 or older who are living in private dwellings. The CCHS uses face-to-face interviews with respondents randomly selected from households in selected sample areas based on the area frame designed for the Canadian Labour Force Survey. People living on Indian reserves or Crown lands, residents of institutions, full-time members of the Canadian Armed Forces, and residents of certain remote regions are excluded. The CCHS produces estimates representing approximately 98% of the Canadian population age 12 and older.

Definition and data

In the CCHS data, a fall is 'defined' by the respondents when they indicate first, that they suffered an injury in the previous year serious enough to limit their normal activities, and second, that the injury was the result of a fall.

This section:

- provides estimates for the Canadian population based on self-reports from a sample of individuals;
- includes data for those age 65 and over for 2002/03 (cycle 2.1 of the CCHS);
- presents data for the age groups 65-69, 70-74, 75-79, and 80 and over; and
- analyzes data collected over a 12-month period beginning in September 2002.

The estimates provided come from a sample of respondents randomly selected from households in selected sample areas. It should be noted that such estimates are prone to error. The *Technical report – Injury* (www.phac-aspc.gc.ca/seniors-aines/pubs/seniors_falls/technical/index.htm) provides details about the sampling method, sampling and non-response error, the specific survey questions used for the falls analysis, and an interpretation of the findings. Also, there is a well documented tendency for persons self-reporting falls to understate actual incidence. Further, the CCHS provides information about only the most serious injury resulting from a fall in the prior year, thus losing information, important in this context, from those who experienced more than one fall or from those who fell but were not injured.

Findings

Table 1 data have been extrapolated from the sample (CCHS, cycle 2.1) to the total population age 65 and over. It shows that the sample of approximately 29,000 respondents for 2002/03, represents a population of approximately 3.8 million Canadians age 65 and over. In the sample age 65 and over, 56% were female. The median age for the sample age 65 and over was 72 years. Sixty percent of the sample age 65 and over was married, while 34% was widowed, separated or divorced.

The CCHS data indicates that, compared to the population of seniors as a whole, those who reported experiencing an injurious fall were more likely to be female (68% vs. 56%), more likely to be in the 80+ age group (28% vs. 21%), more likely to be widowed, separated or divorced (46% vs. 34%), more likely to have post-secondary graduation (34% vs. 32%), and more likely to have a household income of less than $15,000 (14% vs. 10%).

The finding that those experiencing an injurious fall were more likely to be women and more likely to be age 80 and over is well supported by the literature on falls among seniors.[10] What is not well known is the significant association between marital status and fall injury risk. The CCHS data suggests that those without a spouse, who may be living alone, may be at greater risk for a fall with injury. It was surprising, and contrary to the literature,[11] to find that more years of education were associated with a higher risk of sustaining a fall-related injury.

Figure 1 presents estimated cases of injurious falls based on self-reports from the CCHS sample, broken down by gender and age group. Adding the total cases for each age group, there are almost 180,000 injurious falls annually in the Canadian population age 65 and over.

Figure 2 shows rates of injurious falls for men and women by age group. The rate of injurious falls increased with age from a low of 35 per 1000 population age 65-69 to a high of 76 per 1000 population age 80 and over. Female rates exceed male rates in all age groups. These differences are statistically significant except for age 75-79. Overall,

Table 1 DISTRIBUTION OF CCHS (CYCLE 2.1) SAMPLE FOR AGE 65 AND OVER, 2002/03

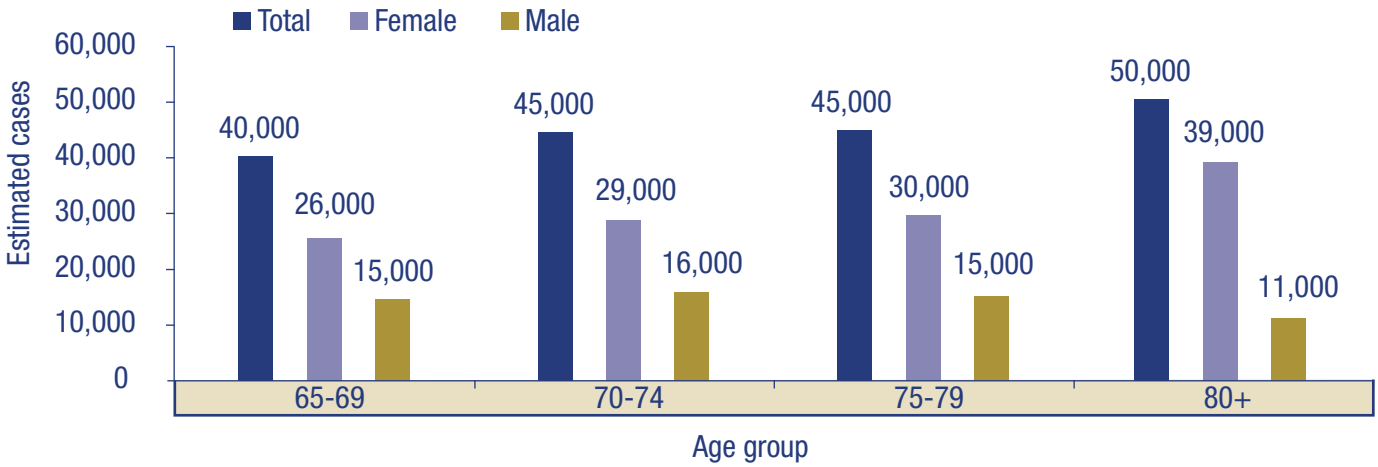
	Total CCHS				With a fall			
	Population	Percent	95% confid interv		Population	Percent	95% confid interv	
Gender								
Male	1,658,918	43.8	42.8	44.9	56,912	31.6	30.8	32.3*
Female	2,124,857	**56.2**	55.3	57.1	123,441	**68.4**	67.3	69.5*
N	3,783,775				180,353			
Age								
65-69	1,154,063	30.5	29.5	31.5	40,274	22.3	21.6	23.1*
70-74	1,027,278	27.1	26.3	28.0	44,568	24.7	23.9	25.5*
75-79	804,061	21.3	20.4	22.1	44,977	24.9	23.9	25.9
80+	798,373	**21.1**	20.3	21.9	50,534	**28.0**	26.9	29.1*
Marital status								
Married	2,268,605	60.0	59.0	60.9	86,352	47.9	47.1	48.6*
Common-law	62,219	1.6	1.4	1.9	1,269	0.7	0.6	0.8
Widowed/Separated/ Divorced	1,283,672	**33.9**	32.8	35.0	82,803	**45.9**	44.4	47.4*
Single	160,348	4.2	3.9	4.6	9,413	5.2	4.8	5.7*
Education								
Less than secondary school graduation	1,711,479	45.2	44.5	46.0	72,419	40.2	39.5	40.8*
Secondary school graduation	589,166	15.6	14.8	16.4	31,539	17.5	16.6	18.4*
Some post-secondary	166,470	4.4	4.0	4.8	10,846	6.0	5.5	6.5*
Post-secondary graduation	1,190,164	**31.5**	30.4	32.5	61,620	**34.2**	33.0	35.3*
Household income								
Less than $15,000	394,564	**10.4**	9.9	11.0	26,037	**14.4**	13.7	15.2*
$15,000 to $29,999	1,012,461	26.8	25.8	27.7	45,483	25.2	24.4	26.1
$30,000 to $49,999	793,169	21.0	20.1	21.8	37,258	20.7	19.8	21.5
$50,000 to $79,999	478,270	12.6	11.9	13.3	22,560	12.5	11.8	13.2
$80,000 or more	244,189	6.5	6.0	6.9	14,165	7.9	7.3	8.5*
Not stated	861,122	22.8	21.6	23.9	34,851	19.3	18.3	20.3*
N	3,783,775				180,353			

*significant at $p<0.05$ level

survey respondents reported a fall-related injury in the past year, serious enough to limit normal activities, at a national average rate of 47.7 per 1000 population age 65 and over.

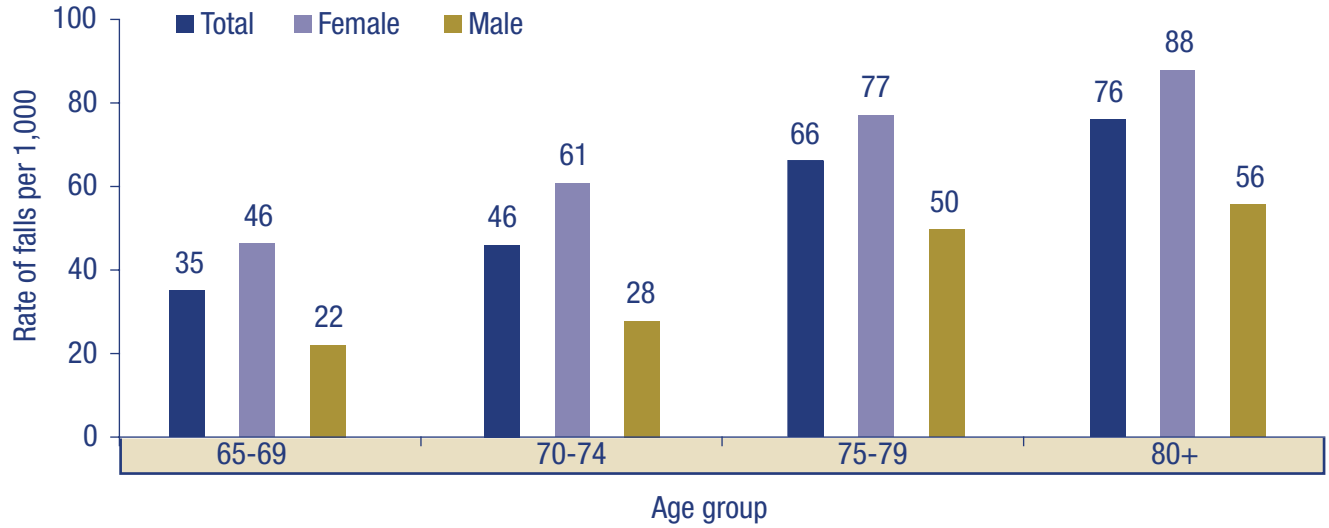
It is not surprising that the number of falls increased with age with the greatest increases among women. However, the increases found in the *rate* of falls by age and gender is of concern. The finding that the rates for women are statistically significantly higher than those for men among all but one age group may be related to lower income, greater social isolation and higher rates of chronic disease among women.

Figure 1 | **ESTIMATED CASES OF INJURIES RESULTING FROM A FALL, BY AGE GROUP AND GENDER, AGE 65+, CANADA, 2002/03**



Source: *Canadian Community Health Survey, Cycle 2.1.*

Figure 2 | **ESTIMATED RATES OF INJURIES RESULTING FROM A FALL, BY AGE GROUP AND GENDER, AGE 65+, CANADA, 2002/03**



Source: *Canadian Community Health Survey, Cycle 2.1.*

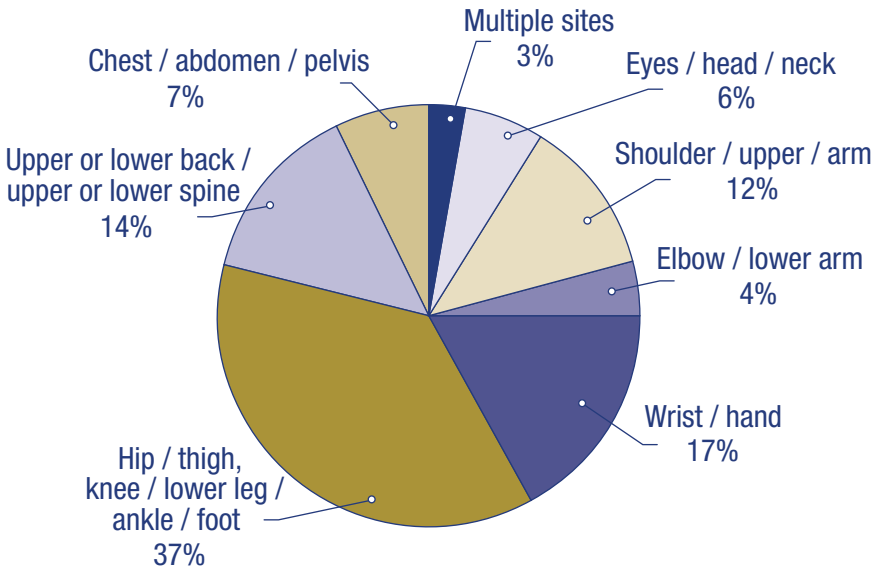
Figure 3 presents the distribution of the types of injuries reported by seniors who experienced an injury as a result of a fall. Over one third (37%) of the injuries sustained were to the hip, thigh, knee, lower leg, ankle, or foot, followed by the wrist or hand (17%) and the back (14%).

Figure 4 shows that the majority of respondents (44%) reported slipping, tripping, or stumbling. Over one quarter (26%) reported falling while going up or down stairs. Response categories were combined in the data set due to small numbers and consequently, no further detail is available. It is most likely that the 20% who reported "skating/skiing/snowboarding/slipping/tripping stumbling" on ice/snow had predominantly slipped, tripped, or stumbled on ice/snow.

The findings depicted in Figure 4 are similarly reflected in the National Trauma Registry,[12] where 23% of severe injuries due to a fall among those age 65 and over were due to a fall on or from stairs or steps.

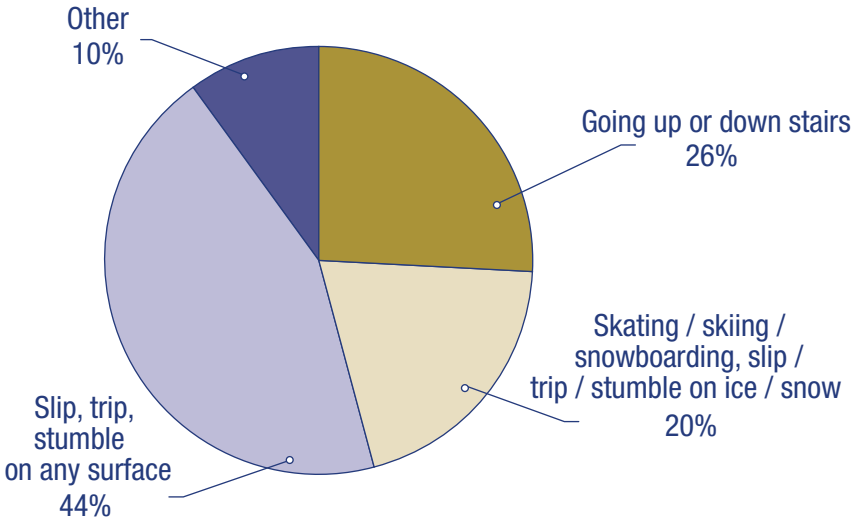
Figure 5 indicates that, for the 72% who sought medical treatment within 48 hours, the majority (65%) were treated in a hospital emergency department. Many were treated in a doctor's office (20%) or a hospital day clinic (9%). Of those treated in the emergency department, 38% reported that they were admitted to hospital for at least one night as a result of the injury.

Figure 3 | **SELF-REPORTED FALLS RESULTING IN INJURY, BY TYPE OF INJURY, AGE 65+, CANADA, 2002/03**



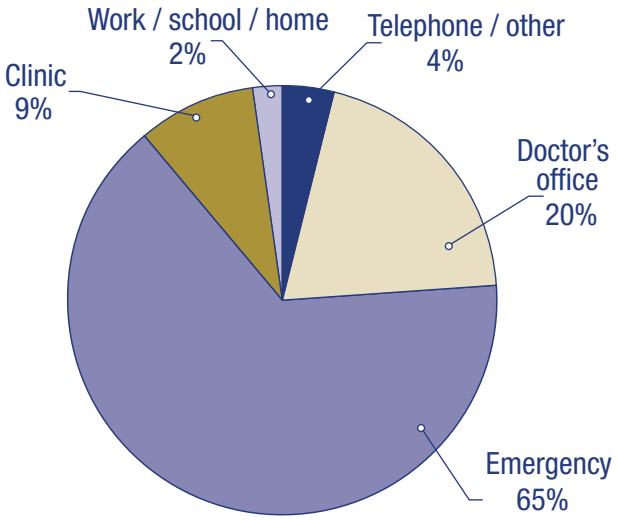
Source: *Canadian Community Health Survey, Cycle 2.1.*

Figure 4 | **SELF-REPORTED FALLS RESULTING IN INJURY, BY TYPE OF ACTIVITY, AGE 65+, CANADA, 2002/03**



Source: *Canadian Community Health Survey, Cycle 2.1.*

Figure 5 SELF-REPORTED FALLS RESULTING IN INJURY, BY TYPE OF TREATMENT RECEIVED WITHIN 48 HOURS, AGE 65+, CANADA, 2002/03



Source: *Canadian Community Health Survey, Cycle 2.1.*

Summary

The 2002/03 CCHS sample for those age 65 and over was approximately 29,000 respondents, representing a population of about 3.8 million Canadians age 65 and over. Compared to the population of seniors as a whole, those who reported experiencing an injurious fall were more likely to be female; in the 80+ age group; widowed, separated or divorced; have post-secondary graduation; and a household income of less than $15,000. Based on the self-reports, the rate of injurious falls increased with age and the rates for women exceeded the rates for men in all age groups. Over one third of the injuries sustained were to the hip, thigh, knee, lower leg or ankle. Most respondents reported slipping, tripping, or stumbling and over a quarter reported falling while going up or down stairs. Almost three quarters (72%) received medical treatment from a health professional within 48 hours of the injury.

2.2 What hospitalization data tell us about seniors' falls

The analyses provided in this section are based on the **Discharge Abstract Database** (DAD) at the Canadian Institute for Health Information (CIHI). They include fall-related hospitalization cases and rates, length of hospital stay, injury type, place of occurrence of fall, and differences by age group and gender for seniors age 65 and over, for the years 1998/99 through 2002/03.

The Discharge Abstract Database (DAD)

The DAD of the Canadian Institute for Health Information was originally developed in 1963 to collect data on hospital discharges in Ontario. Over time, the mandate of the DAD has expanded in scope, as determined by each provincial and territorial ministry of Health. The DAD includes hospital in-patient data, as recorded in their discharge records, from all acute care hospitals across Canada, with the exception of rural hospitals in Manitoba and all hospitals in Quebec.

Definitions and data

Revisions to codes in the International Classification of Diseases (changes from ICD 9 to ICD 10) greatly affected the coding of data in hospitals around the world and especially affected data on fall injuries. Therefore, care must be taken in comparisons of data based on the two different

classifications. The ICD 10 classification for hospitalization data is being gradually implemented during the 2001-2006 period.

ICD 9 and ICD 10

The ICD 9 and ICD 10 provide for classification of a wide variety of falls including:

- fall on same level from slipping, tripping and stumbling;
- fall on same level due to collision with, or pushing by, another person;
- fall on and from stairs and steps;
- fall on and from ladder or scaffolding;
- fall from, out of or through building or structure;
- other fall from one level or another; and
- other/unspecified fall.

This section uses the DAD data pertaining to acute care hospitalizations for falls among persons 65 years and over in Canada. Fall-related hospitalizations for a specific population are a good estimate of all falls resulting in serious injury for that population. However, this data source does not capture information on injurious falls of lesser severity, which may be treated at hospital emergency departments or physicians' offices, or falls for which medical treatment was not sought (see discussion on Figure 5, on p. 14).

The Injury pyramid below provides a graphic illustration of the possible sources of falls data, and shows that data currently available provides an incomplete picture.

Source: *Prevention of falls and injuries among the elderly: A special report from the Office of the Provincial Health Officer,* B.C. Ministry of Health Planning, 2004.

Data for this section:

- include fall-related hospital discharges from acute care facilities for those age 65 and over during fiscal years 1998/99 through 2002/03 (hospital discharges include cases who have left hospital alive or have died in hospital after admission);
- reflect the number of hospital discharges rather than the number of injured seniors;
- present information by age groups of 65-74, 75-84 and 85 and over;
- identify causes of injury by the documented "External Cause of Injury" code unless otherwise specified;
- exclude cases with unknown age; and
- show 95% confidence intervals where appropriate.

The online *Technical report – Hospitalizations* (www.phac-aspc.gc.ca/seniors-aines/pubs/seniors_falls/technical/index.htm) provides detailed information on the data source, the analyses conducted and interpretations of the findings.

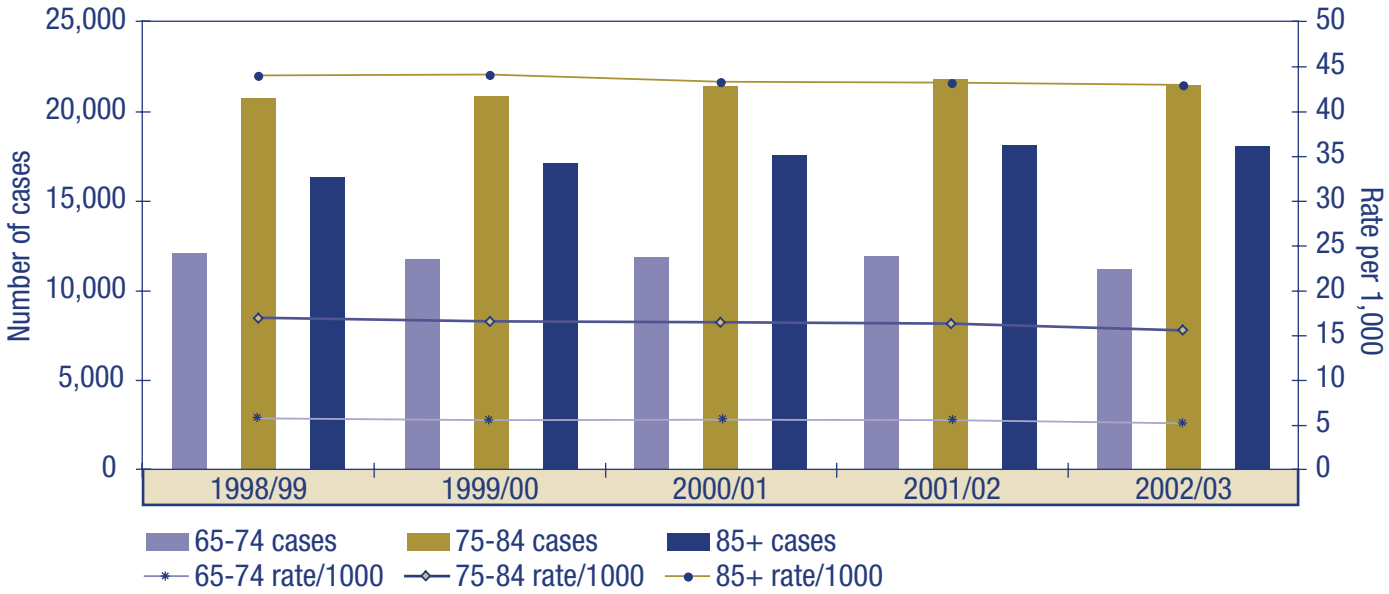
Findings

Figure 6 shows that, on an age-specific basis, the fall-related hospitalization rates for the 65-74 and 75-84 age groups were stable at about 6 and 16 per 1000 population respectively during 1998/99 to 2002/03. The 85 and over age group was also stable during this period at 43 per 1000 population. The anticipated growth among the 85 and over age group in Canada from 430,000 in 2001 to 1.6 million by 2041,[13] together with the fact that people are living longer with chronic conditions, may suggest that the rate of fall-related hospitalizations for this age group could increase.

Figure 7 shows fall-related hospitalization rates by gender and age groups for Canadians age 65 and over for the year 2002/03. Men and women both had increasing rates of hospitalization with age. Women age 65-74 had rates of about 6 per 1000 population increasing to 46 per 1000 in the 85 and over age group. Men had a similar rate to women in the 65-74 age group (4 per 1000) but increased to only 32 per 1000 in the 85 and over age group. For all those age 65 and over, women had a rate of hospitalization of about 16 per 1000 and men of 9 per 1000.

The findings that rates of fall-related hospitalizations were higher for women than for men and that these differences increased with advancing age are consistent with other studies that show a strong correlation between female gender, older age and the risk of injurious falls.[14] Conditions known to be associated with aging, such as the effects of a stroke, dementia and diabetes,

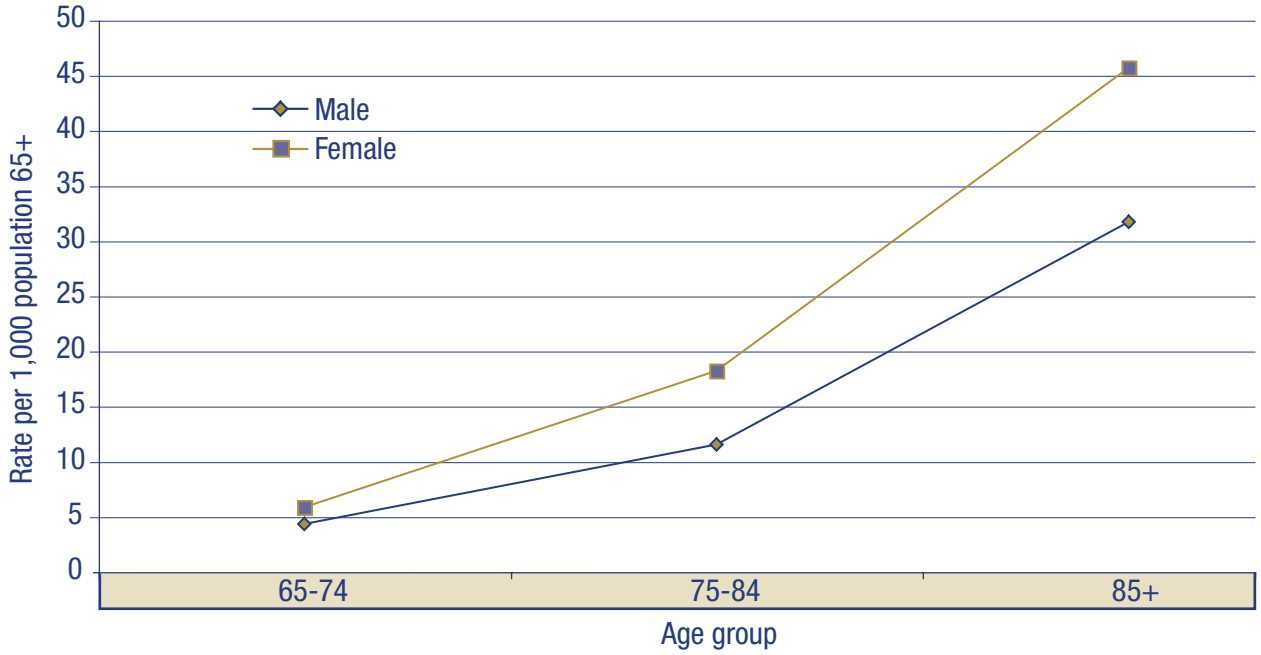
Figure 6 | FALL-RELATED HOSPITAL CASES AND RATES, AGE 65+, CANADA, 1998/99 TO 2002/03



Confidence intervals are 95% confidence intervals.
Source: *Acute separations from 1998/99 to 2002/03,* Canadian Institute for Health Information Discharge Abstract Database.

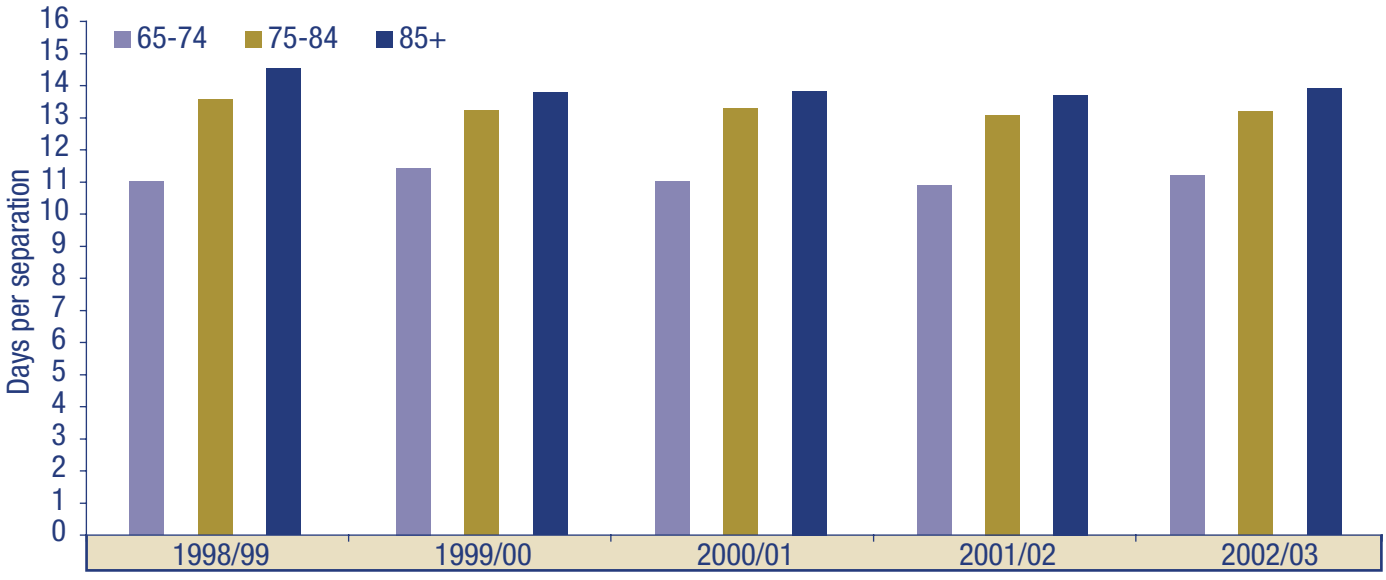
are all known to increase the risk of falling and being injured.[15] Women are known to be at higher risk for fall injuries due to their higher rates of osteoporosis, which makes them more likely to sustain a serious fracture from a fall.[16]

Figure 7 | **FALL-RELATED HOSPITALIZATION RATES, BY GENDER AND AGE GROUP, AGE 65+, CANADA, 2002/03**



Source: *Acute separations from 1998/99 to 2002/03,* Canadian Institute for Health Information Discharge Abstract Database.

Figure 8 | **FALL-RELATED HOSPITALIZATIONS, AVERAGE LENGTH OF STAY PER CASE, BY AGE GROUP, CANADA, 1998/99 TO 2002/03**



Source: *Acute separations from 1998/99 to 2002/03,* Canadian Institute for Health Information Discharge Abstract Database.

Figure 8 illustrates that, generally, the older the person, the longer their length of hospital stay for a fall-related injury. It also shows that the average length of stay for all age groups was relatively stable from 1998/99 to 2002/03. Over the five years, on average, those age 65-74 had hospital stays of 11 days after a fall, those age 75-84 had stays of 13 days, and those age 85 and over had stays of nearly 14 days. Nationally, the average number of total hospitalization days for fall-related injuries among seniors was 273 per 1000 population age 65 and over.

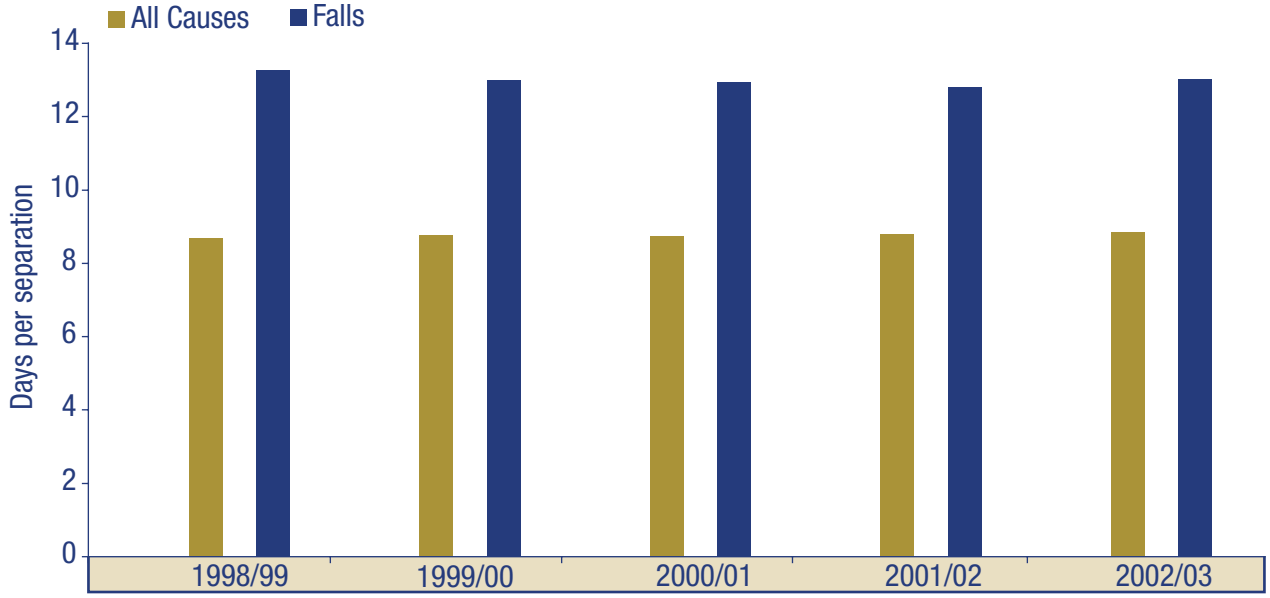
Figure 9 shows that the average length of hospital stay for a fall injury was consistently longer (by about 40%) than the average length of stay for all causes of hospitalization for seniors age 65 and over. The average length of stay for both falls and all causes showed little change from 1998/99 through 2002/03.

Figure 10 shows that, over the five years, nearly 85,000 Canadians age 65 and over had injuries to their femur, pelvis, hip or thigh, accounting for 56% of all fall-related injuries among seniors treated in hospital. Injuries to an upper limb, a lower limb, or the spine accounted for 24% of fall-related hospitalizations.

The majority of injuries to major joints, the femur or pelvis are likely associated with hip fractures, which other studies have shown contribute to up to 40% of all fall-related hospitalizations for this age group.[17]

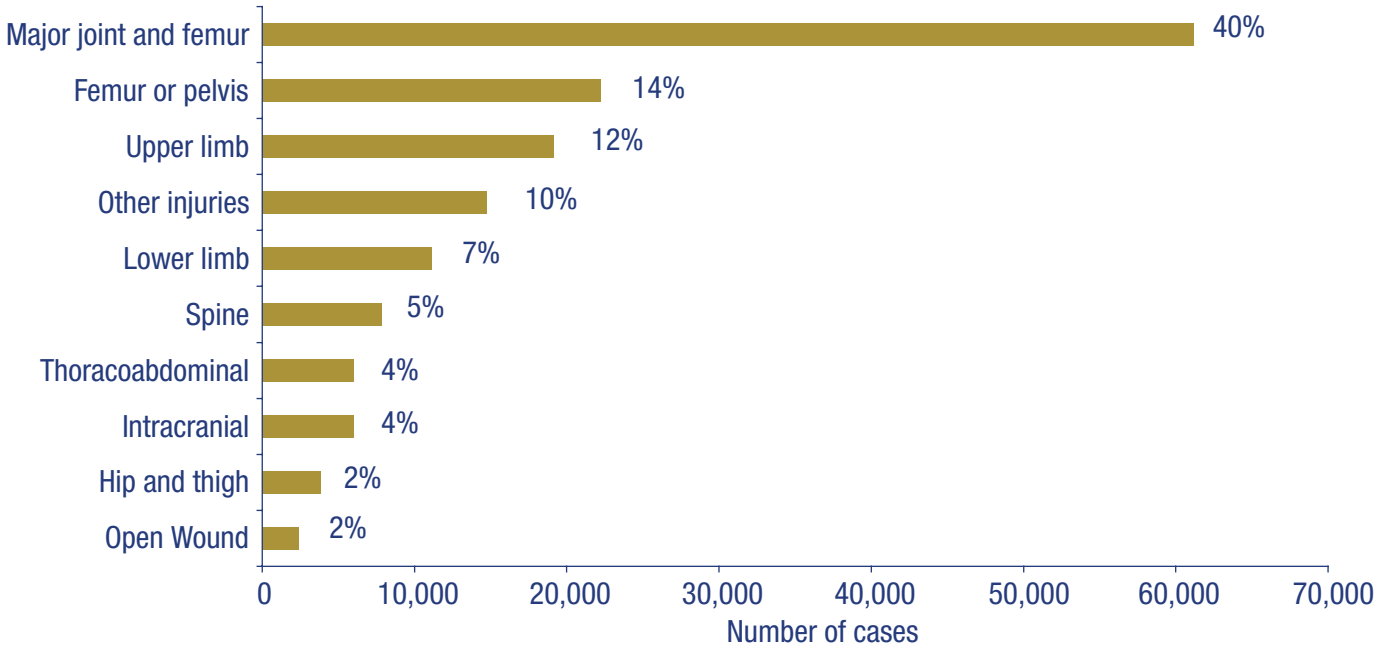
Figure 11 shows the place of occurrence of falls that led to a hospitalization, nationally, among those age 65 and over for the period 1998/99 through 2002/03. Nearly half (47%) of these falls occurred in or around the home. Falls in residential institutions accounted for 21% of hospitalizations due to falls among those age 65 and over.

Figure 9 | AVERAGE LENGTH OF STAY PER CASE, ALL CAUSES AND FALL-RELATED HOSPITALIZATIONS, AGE 65+, CANADA, 1998/99 TO 2002/03



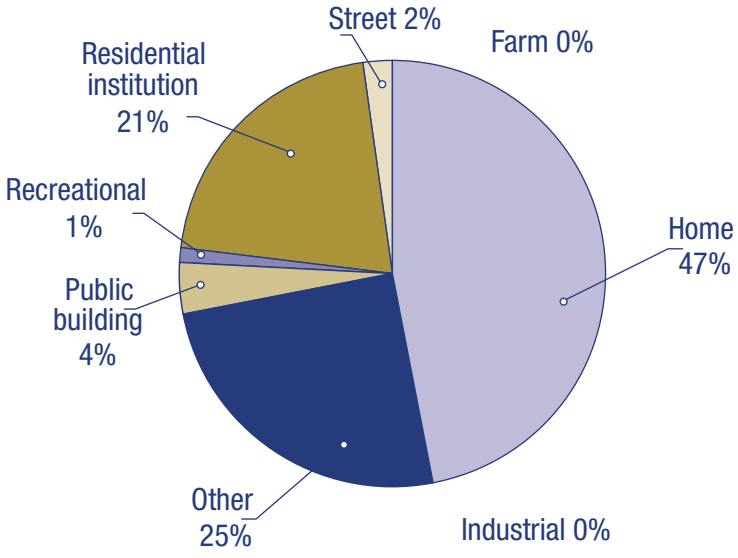
Source: *Acute separations from 1998/99 to 2002/03,* Canadian Institute for Health Information Discharge Abstract Database.

Figure 10 | **NUMBER AND PERCENT OF FALL-RELATED HOSPITAL CASES, BY INJURY TYPE, AGE 65+, CANADA, 1998/99 TO 2002/03**



Injury type as classified in Major Clinical Category 25: Significant Trauma.
Source: *Acute separations from 1998/99 to 2002/03,* Canadian Institute for Health Information Discharge Abstract Database.

Figure 11 | **FALL-RELATED HOSPITAL CASES, BY PLACE OF OCCURRENCE OF FALL, AGE 65+, CANADA, 1998/99 TO 2002/03**



Source: *Acute separations from 1998/99 to 2002/03,* Canadian Institute for Health Information Discharge Abstract Database.

Although the home is the more frequently reported place of occurrence of falls, it is important to note that approximately only 7.4% of those age 65 and over live in residential care settings[18] and are therefore contributing a far larger proportion of hospital admissions compared to seniors from other settings. However, this is to be expected given that seniors living in residential care settings are older and have more chronic health conditions that put them at much greater risk for falls than those living in the community.

Summary

Fall-related hospitalization data for all seniors were analyzed for the years 1998/99 through 2002/03. Seniors' fall-related hospitalizations

for all age groups remained stable over the five years. The rates for women were consistently higher than for men and these differences increased with advancing age. The average length of hospital stay for all age groups was relatively stable and generally, the older the person, the longer the length of stay. Nearly 85,000 Canadians age 65 and over had injuries to their femur, pelvis, hip or thigh, accounting for the majority of all fall-related injuries among seniors treated in hospital. Almost half of the falls occurred in or around the home.

2.3 What hospitalization data tell us about falls in residential care

The information in this section is based on data from the CIHI Discharge Abstract Database (DAD) pertaining to acute care hospitalizations for falls among adults age 65 and older, living in residential care facilities in Canada. (For more details about the DAD, see page 15).

The analyses provided in this section include fall-related hospitalization cases and rates, length of hospital stay, place of occurrence of fall, and differences by age group and gender for the years 1998/99 through 2002/03.

Definitions and data

The definitions and data cautions stated in the previous section also apply to this section, which uses the same data source, further narrowed by selecting for residential care.

This section:

- includes hospitalization data for persons for whom "place of occurrence" of the fall was designated as "Residential Institution," and the place they were "transferred from" to hospital was "Chronic Care Facility," "Nursing Home" or "Home for the Aged";
- does not include residents of care facilities under age 65;
- does not include falls while outside the residential care facility (this could be a source of underreporting for this population); and
- does not include a calculation of any rates, due to a scarcity of information on total populations living in residential care facilities for the years 1998/99 through 2002/03.

Fall-related injuries among those age 65 and older in residential care appear to be far more frequent than among those who are not in residential care.[19] Seniors in residential care account for approximately 7% of the 65+ population, but account for 15% of all fall-related hospitalizations for that age group.

Approximately 50% of all long-term care residents fall each year, and of these, 40% fall twice or more each year.[20] Approximately 10% of these falls result in serious injury, including up to 5% in bone fractures.[21] For women living in a residential care facility, the risk of sustaining a hip fracture is 10.5 times higher than for women of the same age living in the community; less than 15% of facility residents who sustain a hip fracture regain pre-injury ambulation status.[22]

In 2001, the Canadian population age 65 and over was approximately 3.9 million people and of these, it is estimated that 7.4% or approximately 287,500 were living in residential institutions. They represented 9.2% of senior women and 4.9% of senior men. This is a decline since 1981, when 10.5% of senior women and 6.7% of senior

men lived in these facilities. Living in residential institutions is most common for the oldest seniors, those age 85 and over. However, for this age group, the proportion of men in these facilities dropped from 29% in 1981 to 23% in 2001, and the proportion of women dropped from 41% in 1981 to 35% in 2001. Although the rates for seniors living in residential institutions are declining, this trend is offset by the aging of our population, which results in steadily increasing numbers of seniors.[23]

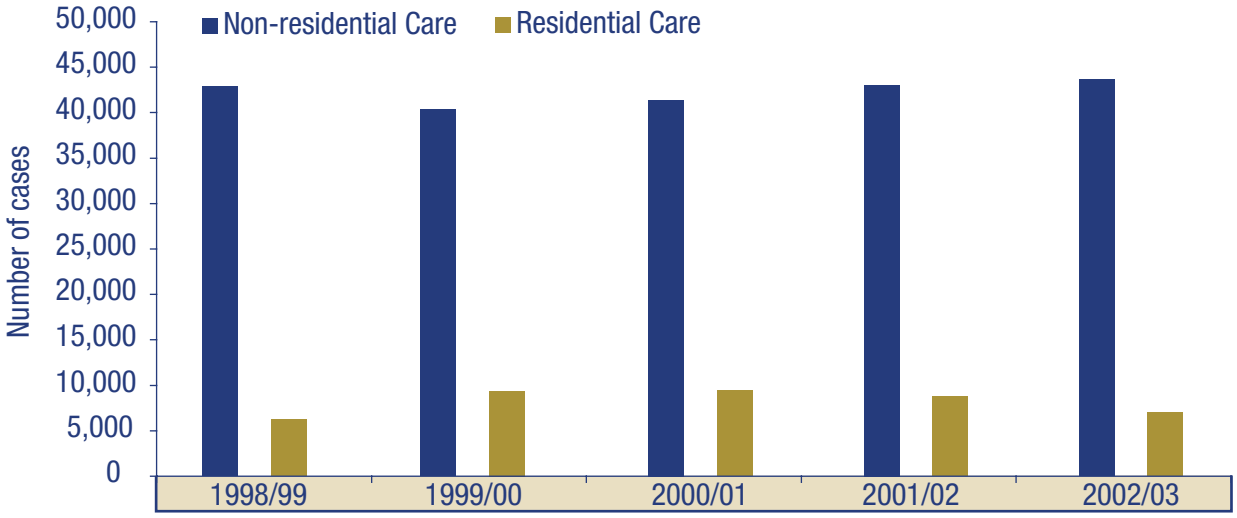
Adults living in residential institutions now tend to have more complex health challenges, such as advanced dementia, multiple chronic health conditions and limited mobility. These characteristics put this population at greater risk of falling and sustaining a fall-related injury. The online *Technical report – Hospitalizations…in residential care facilities* (www.phac-aspc.gc.ca/seniors-aines/pubs/seniors_falls/ technical/index.htm) provides detailed information on the analysis conducted and an interpretation of the findings.

Findings

Figure 12 shows that fall-related hospitalization cases for seniors not in residential care ranged between 40,000 and 43,000 per year through the period. Fall-related hospitalizations for seniors in residential care ranged from about 6,000 to 9,000 per year. Seniors age 65 and over who live in residential care facilities and who fall represent about 12% to 15% of all fall-related hospitalizations among those age 65 and over across the country from 1998/99 through 2002/03.

Over the 1998/99 to 2002/03 period, the number of fall-related hospital cases for those age 65 and over living in residential care increased from about 6,000 to 7,000 with the greatest number seen in 2000/01 at about 9,000 cases.

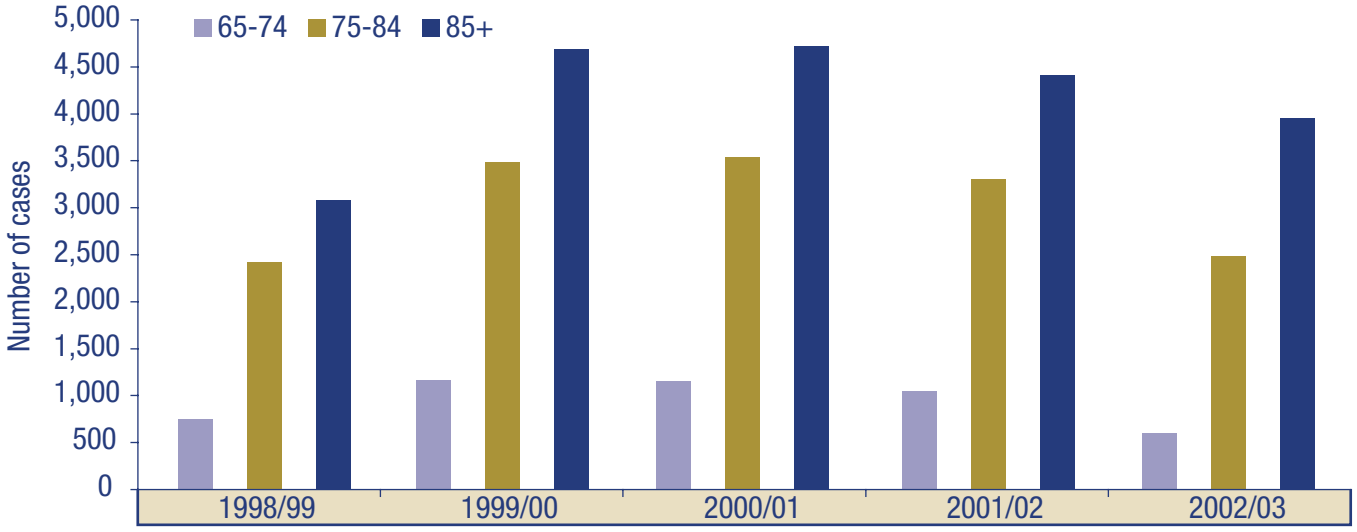
Figure 12 | FALL-RELATED HOSPITAL CASES FOR RESIDENTIAL CARE* VS. NON-RESIDENTIAL CARE, AGE 65+, CANADA, 1998/99 TO 2002/03



*Residential care homes include chronic care facilities, nursing homes, homes for the aged.
Source: *Acute separations from 1998/99 to 2002/03,* Canadian Institute for Health Information Discharge Abstract Database.

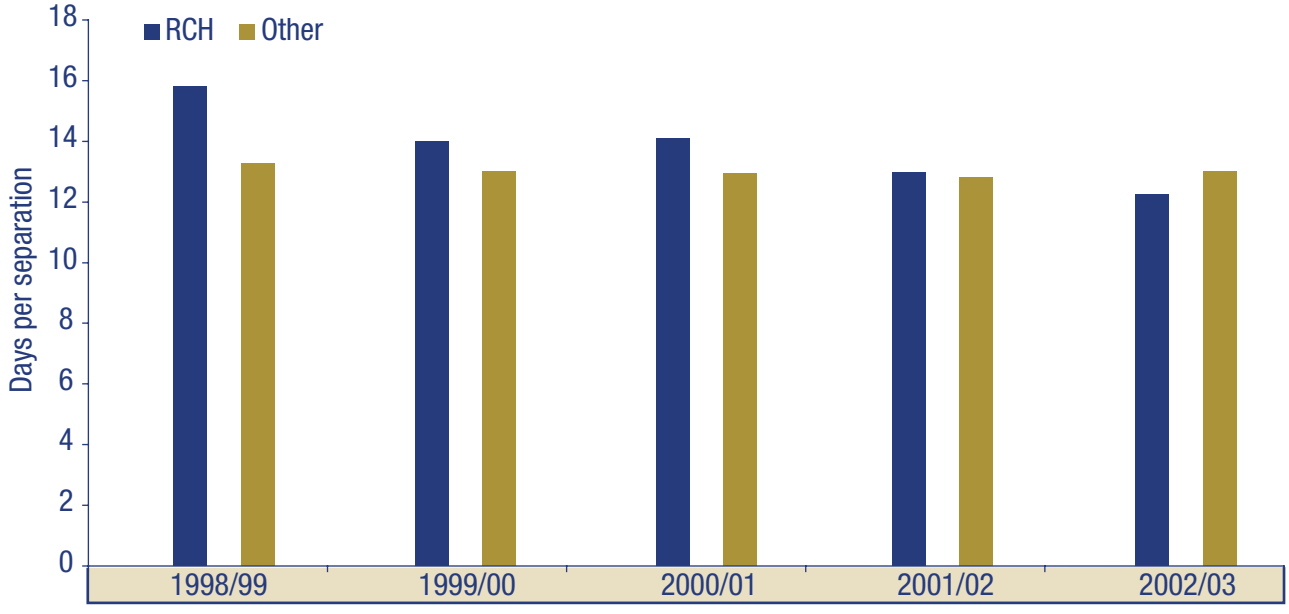
Figure 13 shows that, from 1998/99 through 2002/03, there were over 40,000 fall-related hospitalizations among Canadians age 65 and over living in residential care. This is the equivalent of approximately 8,000 hospitalizations due to falls per year.

Figure 13 FALL-RELATED HOSPITAL CASES FOR RESIDENTIAL CARE,* BY AGE GROUP, CANADA, 1998/99 TO 2002/03



*Residential care homes include chronic care facilities, nursing homes, homes for the aged.
Source: *Acute separations from 1998/99 to 2002/03,* Canadian Institute for Health Information Discharge Abstract Database.

Figure 14 FALL-RELATED HOSPITALIZATIONS, AVERAGE LENGTH OF STAY PER CASE FOR RESIDENTIAL CARE* VS. NON-RESIDENTIAL CARE, 1998/99 TO 2002/03



*Residential care homes include chronic care facilities, nursing homes, homes for the aged.
Source: *Acute separations from 1998/99 to 2002/03,* Canadian Institute for Health Information Discharge Abstract Database.

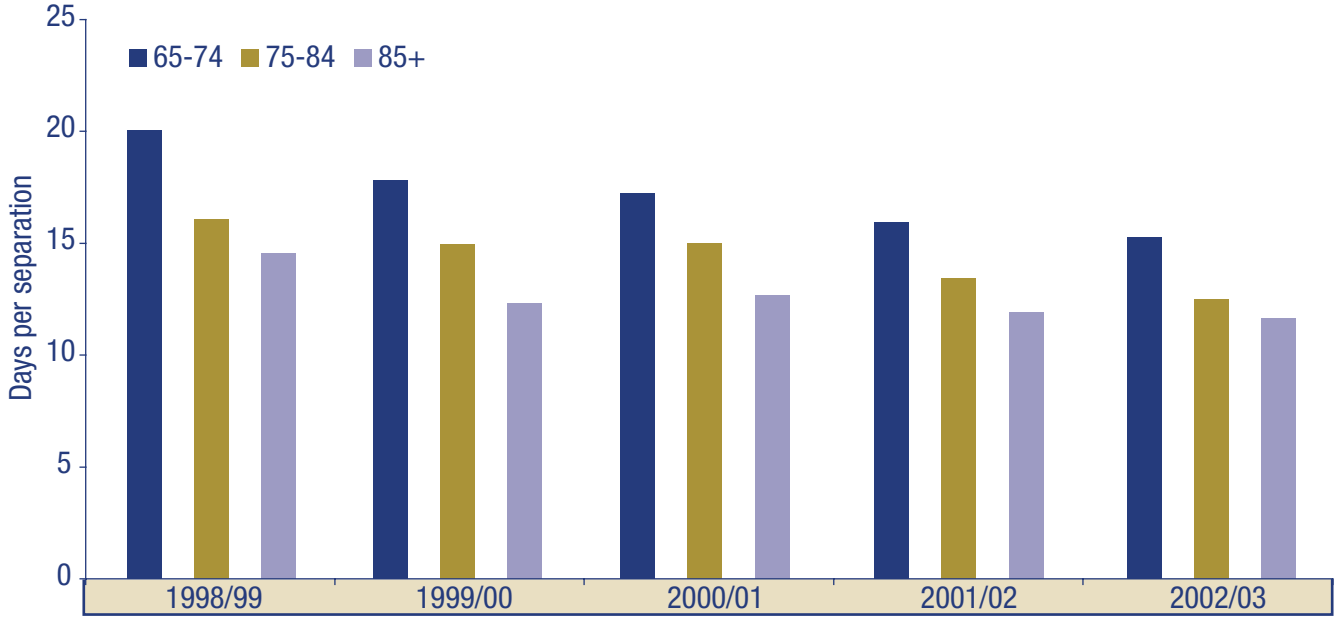
The number of hospitalizations increased with age in all years shown. The number of cases among those age 65-74 increased to over 1000 per year in 2000/01 with a decrease in the final two years. The number of cases among those age 75-84 increased to about 3,500 per year in 2000/01 with a decrease in the final two years. For those age 85 and older, there was an increase in hospitalizations due to falls to 4,500 in 2000/01 followed by a decrease over the next two years.

Figure 14 shows that in 1998/99, the average length of stay for fall-related hospitalizations for those age 65 and over living in a residential care facility was about 19% longer than the average length of stay for those not living in residential care. This gap narrowed over the five years and, by 2002/03, those not living in residential care had longer stays on average compared to those living in residential care. The average length of stay for falls for non-residential care patients has shown little change from 1998/99 through 2002/03.

Figure 15 illustrates that the older the person is, the shorter the stay in hospital. On average, those 65-74 years of age stay in hospital 15-20 days after a fall, while those 75-84 stay 13-15 days and those age 85 and over stay 12-14 days. The average length of stay in all age groups declined over the five-year period. This contrasts with the non-residential population that shows an unchanging average length of stay over the period.

Figure 16 shows that, over the five-year period, nearly 17,000 Canadians age 65 and over living in a residential care facility were hospitalized for fall-related injuries to a major joint, femur, pelvis, hip or thigh, these accounting for more than 75% of all fall-related injuries among those of this

Figure 15 FALL-RELATED HOSPITALIZATIONS, AVERAGE LENGTH OF STAY PER CASE FOR SENIORS IN RESIDENTIAL CARE,* BY AGE GROUP, AGE 65+, CANADA, 1998/99 TO 2002/03



*Residential care homes include chronic care facilities, nursing homes, homes for the aged.
Source: *Acute separations from 1998/99 to 2002/03,* Canadian Institute for Health Information Discharge Abstract Database.

group who were treated in hospital. Injuries to the upper limbs, lower limbs or spine accounted for 11% of fall-related hospitalizations for this age group. As mentioned previously, the majority of the injuries to a major joint, femur or pelvis are likely associated with hip fractures, which are shown in other studies to contribute up to 40% of all fall-related hospitalizations for this age group.[24] Most injuries are to the lower limbs.

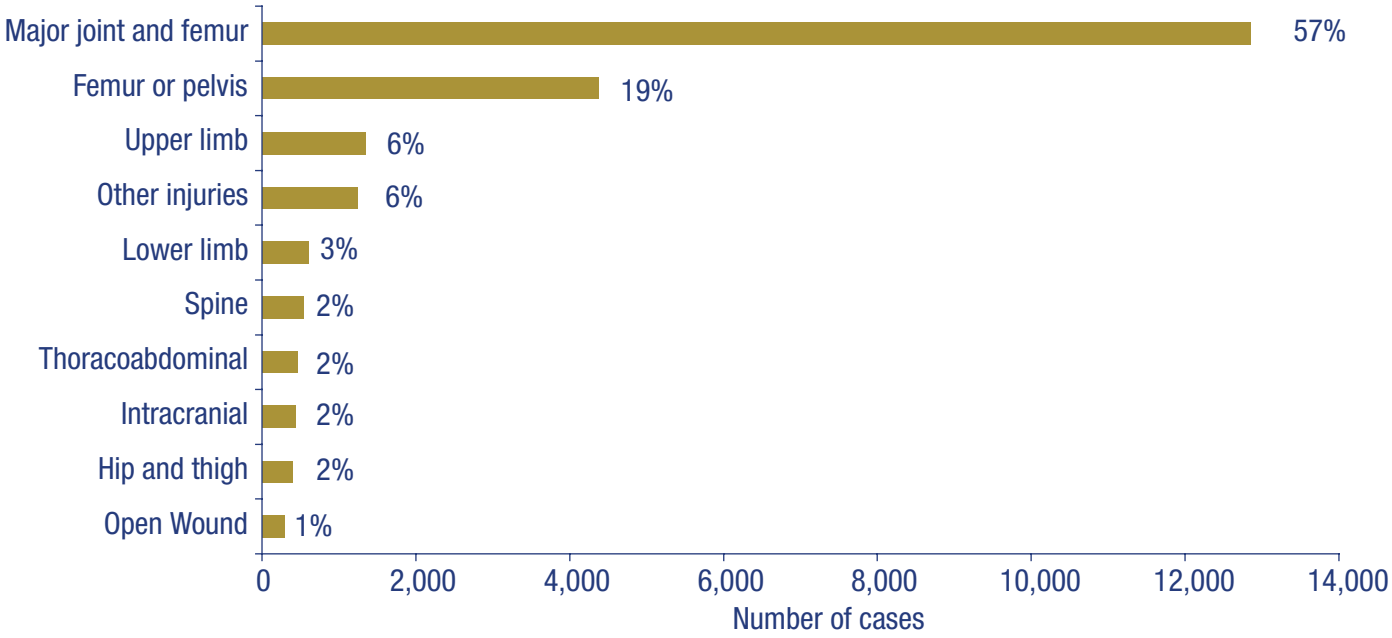
Summary

From 1998/99 through 2002/03, about 40,000 Canadians age 65 and over living in residential care were hospitalized for a fall-related injury. Although over the five years, the average length of hospital stay for those living in residential care was longer than the length of stay for those not living in residential care, the gap narrowed over the five years and, by 2002/03, those not living in residential care had longer stays on average compared to those living in residential care. Contrary to the data for fall-related hospitalizations for all seniors age 65 and over, if a senior lived in residential care, the older the person was, the shorter the hospital stay and the average length of stay declined over the five-year period. The population not living in residential care showed an unchanging average length of stay over the period.

2.4 What mortality data tell us about deaths due to falls

The analyses provided in this section present data from **Canadian Vital Statistics** on all direct deaths due to falls among those age 65 and over and include differences by place of injury, gender, and age groups, as well as trends over time.

Figure 16 | **NUMBER AND PERCENT OF HOSPITAL CASES ASSOCIATED WITH FALLS IN RESIDENTIAL CARE BY INJURY TYPE, CANADA, 1998/99 TO 2002/03**



Injury type as classified in Major Clinical Category 25: Significant Trauma.
Source: *Acute separations from 1998/99 to 2002/03,* Canadian Institute for Health Information Discharge Abstract Database.

Canadian Vital Statistics, Death Database

The information in this section is based on data from Statistics Canada's Canadian Vital Statistics, Death Database for 1997/99 through 2000/02.

Definitions and data

Data were requested for Canadians age 65 and over for deaths due to unintentional falls. Sample data runs resulted in Statistics Canada limiting the data to six years in two periods, 1997-1999 and 2000-2002.

Conversion from ICD 9 to ICD 10 coding affects analysis of data on fall-related deaths

'Accidental falls' is a 'cause of death' category that was dramatically affected by the implementation of the ICD 10. Changes in the coding structure from ICD 9 to ICD 10 occurred in the year 2000. Included under the ICD 9 group of codes for accidental falls is a code for "fracture, cause unspecified." This external cause of death is not included in the ICD 10 category of codes for falls but rather is included as a code under another category, "exposure to unspecified factor." Consequently, for this analysis, the ICD 9 code for "fracture, cause unspecified" was not included as it could not be included from the ICD 10 codes.

This section:

- includes data on direct deaths, equivalent to the 'underlying cause of death' as indicated on the medical certificate of death;
- excludes indirect deaths, where a fall may have eventually led to death but was not the underlying cause of death;
- presents data for age groups of 65-69, 70-74, 75-79, 80-84 and 85 years and over;
- excludes deaths of non-residents of Canada, deaths of residents of Canada with unknown province or territory of residence, and deaths for which age of deceased was unknown; and
- shows 95% confidence intervals where appropriate.

The online *Technical report – Deaths* (www.phac-aspc.gc.ca/seniors-aines/pubs/seniors_falls/technical/index.htm) provides detailed information on the specific data request made to Statistics Canada, data limitations, the specific codes used to identify falls, the analyses conducted and an interpretation of the findings.

Indirect deaths

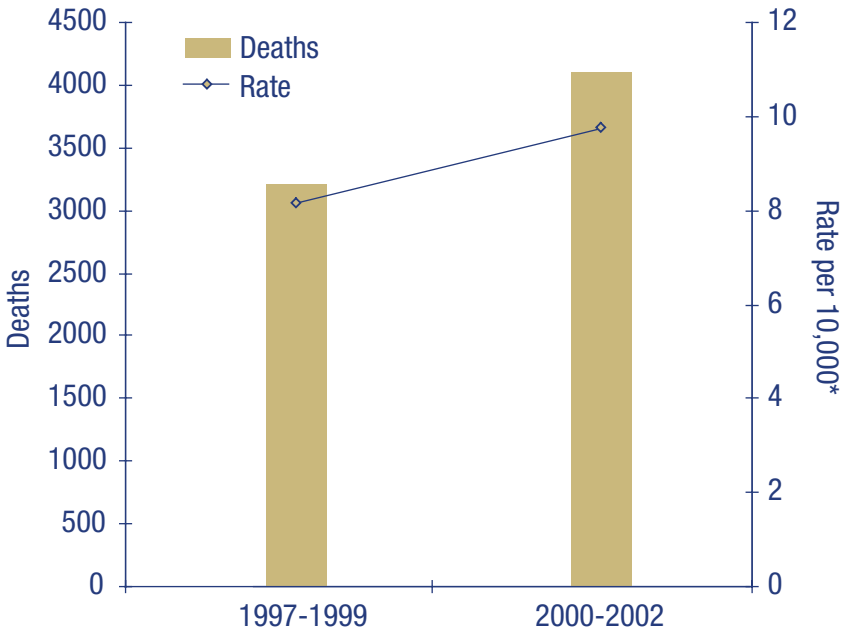
An indirect death from a fall occurs when the fall itself is not deadly, but the injuries that are sustained undermine the individual's health so much that other diseases and illnesses prove fatal. Pneumonia and infections are often the direct cause of death where a fall is the indirect cause.

Adapted from: *Prevention of falls and injuries among the elderly: A special report from the Office of the Provincial Health Officer.* B.C. Ministry of Health Planning, 2004.

Findings

Figure 17 shows that, for the six years examined, more than 7,000 Canadians age 65 and over died as a direct result of a fall. This number increased from 3,209 in the 1997-1999 period to 4,110 in the 2000-2002 period. It

Figure 17 | **DEATHS AND MORTALITY RATE* DUE TO FALLS, AGE 65+, CANADA, 1997-2002**



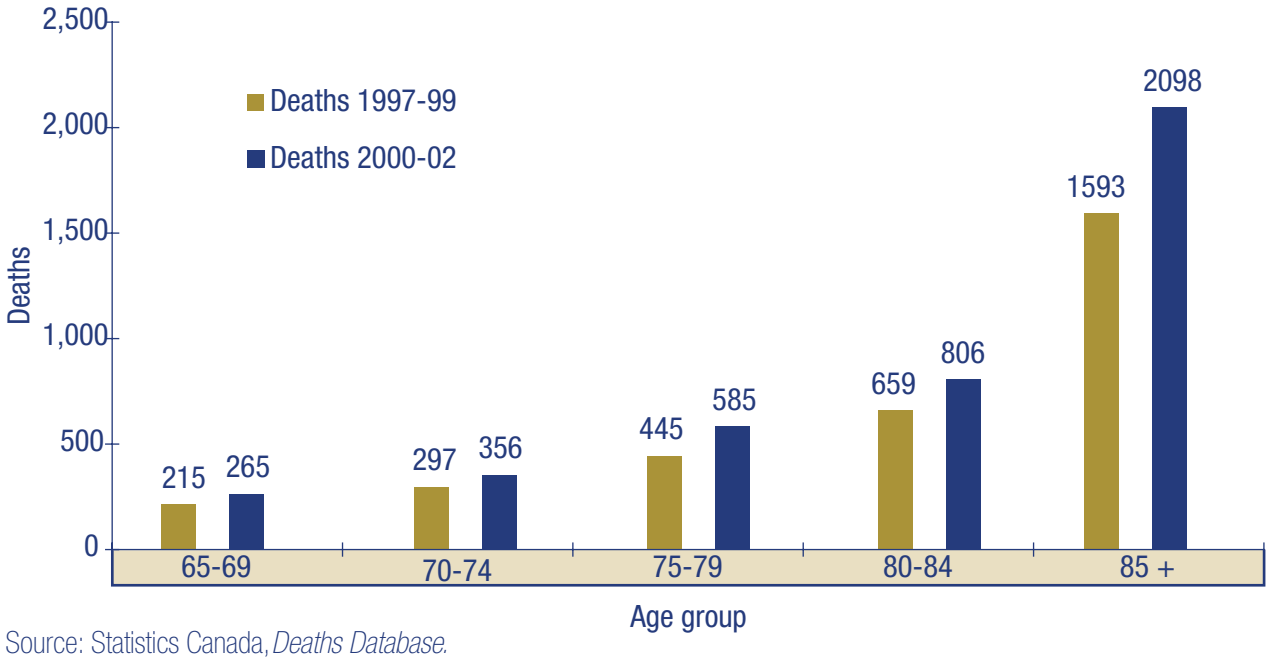
*Age standardized to the 1991 Canadian population.
Source: Statistics Canada, *Deaths Database.*

also shows rates of deaths. On an age-standardized basis, there was a statistically significant increase in the rate of deaths due to falls from 8.1 per 10,000 population in the 1997-1999 period to 9.4 per 10,000 population in the 2000-2002 period.

The increasing number of fall-related deaths among those age 65 and over reflects the growing proportion of this age group in Canada. There was also a statistically significant increase in the rate of fall-related deaths. While the interpretation of the data is complicated by the possible impact of the conversion from ICD 9 to ICD 10 coding, nonetheless, the increase in the number and rate of deaths due to falls among seniors may be due in part to an increase in health conditions associated with increasing age. These conditions can contribute to an increased risk of sustaining a severe injury and a decrease in the ability to recover from an injury.

Figure 18 shows the number of deaths by age group for the two three-year periods. For both periods, the number of deaths increased with age, rising from fewer than

Figure 18 | **DEATHS DUE TO FALLS, BY AGE GROUP, AGE 65+, CANADA, 1997-2002**



Source: Statistics Canada, *Deaths Database.*

300 in the 65-69 age group, to more than 2,000 in the 85 and over age group for the second period.

Figure 19 indicates that the rate of deaths due to falls increased with age from fewer than 10 deaths per 10,000 population in the youngest age group, to over 50 deaths per 10,000 in the oldest age group. A significant difference in the rates from the first period to the second was seen for all of the age groups.

Figure 20 shows deaths due to falls by gender for Canadians age 65 and over. Deaths due to falls among women rose from approximately 1,797 in the 1997-1999 period to 2,224 in the subsequent period. This translates into an age-standardized rate of 9.9 deaths per 10,000 in the first period and 12.4 deaths per 10,000 in 2000-2002. This increase was statistically significant ($p<0.05$).

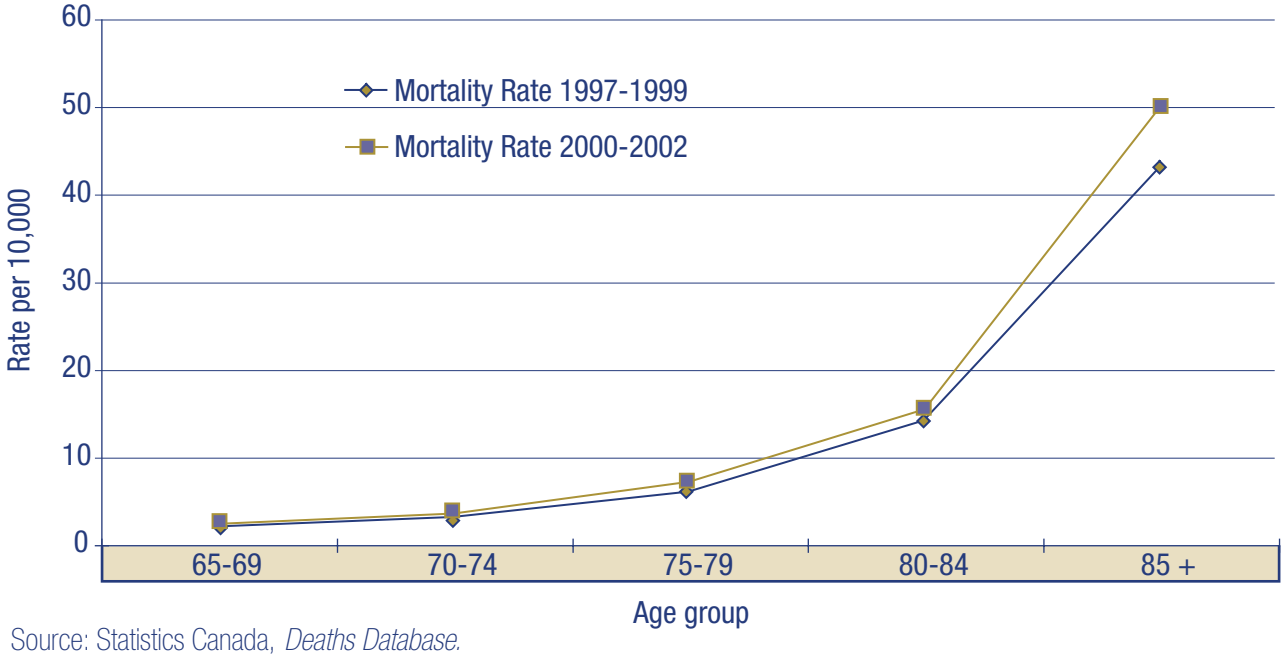
Deaths due to falls among men increased from 1,412 in the 1997-1999 period to 1,886 in the subsequent period. The age-standardized rate for men increased from 6.9 to 7.9 deaths per 10,000 population over the six-year period. However, this increase was not statistically significant ($p>0.05$).

Location and type of fall

Additional analyses were carried out on data concerning location and type of fall. Where the location of the falls resulting in death was known, over 53% occurred in a private home environment, 18% in residential care facilities, and 29% in other locations such as public buildings, on the street, in a commercial or service area, in a recreation or sport area and on a farm.

Although the majority of fall-related deaths of seniors occurred in the home environment, it is important to consider the amount of time that persons at greatest risk

Figure 19 | MORTALITY RATE DUE TO FALLS BY AGE GROUP, AGE 65+, CANADA, 1997-2002



Source: Statistics Canada, *Deaths Database.*

of falling spend inside compared to outside their homes. Twenty-nine percent of falls causing death occurred outside the home, even though much less time may be spent outside the home by those age 65 and over.

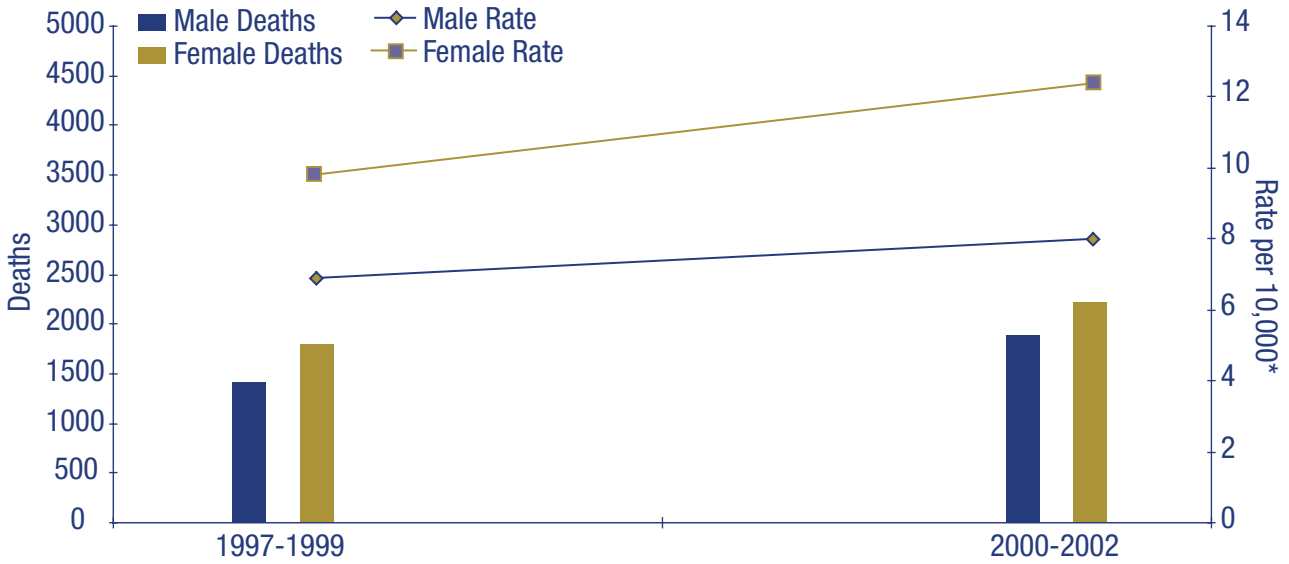
For fall-related injuries resulting in death for seniors, falls within the home occurred most often from one level to another (78%), rather than on the same level (22%). This is consistent with findings in the CIHI study of severe injuries, showing that the majority of these occurred on stairs and steps.[25]

By comparison, where a fall occurred outside the home (but not including residential care facilities), 66% were the result of a fall from one level to another and 34% were due to falls on the same level. Significantly more falls from one level to another occurred in the home environment than outside the home.

Summary

Mortality data from Statistics Canada were analyzed for all direct deaths due to falls among those age 65 and over, for the years 1997 to 2002. The analyses include differences by place of injury, gender, and age group. In the period, more than 7,000 Canadians age 65 and over died as a direct result of a fall. On an age-standardized basis, there was a statistically significant increase in the rate of deaths due to falls from 1997-1999 to 2000-2002 and the rate of deaths due to falls increased with age in both time periods. The rate of deaths due to falls was higher for women than for men. Where the location of the fall was known, the majority of falls resulting in deaths among Canadians age 65 and over occurred in the person's home.

Figure 20 | **DEATHS AND MORTALITY RATE* DUE TO FALLS, BY GENDER, AGE 65+, CANADA, 1997-2002**



*Age standardized to the 1991 Canadian population.

Source: Statistics Canada, *Deaths Database.*

3 Risk factors for falls and fall-related injuries in seniors

The previous chapter presented the epidemiology of fall-related injuries among seniors in Canada. This chapter examines current knowledge about fall risks. The information presented here was summarized from several well-known guidelines and systematic reviews of the literature on risk factors and best practices for the prevention of falls and fall-related injuries among seniors.

Review of current knowledge

The following sources were used:

- *A best practices guide for the prevention of falls among seniors living in the community,* Federal/Provincial/Territorial Ministers Responsible for Seniors (2001);[26]
- the Rand Report (2002) more recently cited as *Interventions for the prevention of falls in older adults: Systematic review and meta-analysis of randomized clinical trials*, (2004);[27]
- the *Cochrane Review: Interventions for preventing falls in elderly people* (2001);[28] the *Cochrane Review: Population-based interventions for the prevention of fall-related injuries in older people* (2005);[29]
- the American Geriatrics Society's *Guideline for the prevention of falls in older persons*, (2001);[30] and
- additional findings, highlighting Canadian studies published after the reviews.

The review conducted for the **Best practices guide** of the F/P/T Ministers Responsible for Seniors screened 674 studies, ultimately reviewing 34 that evaluated fall prevention interventions designed to reduce falls or fall-related injuries among community-dwelling seniors.

The **Rand Report** screened 774 articles, rejecting all but 34, which contributed data to the meta-analysis. The Rand Corporation also funded a report summarizing published research on causal factors for falls, collating data from 16 studies.

The **American Geriatrics Society (AGS) Guideline** is one of the most adopted guidelines, prepared in collaboration with the British Geriatrics Society and the American Academy of Orthopaedic Surgeons. This guideline outlines recommended practice and establishes the strength of the recommendations based on the evidence in the research literature.

The **Cochrane Review** (2001) focused on randomized control trials and included 40 studies involving interventions with seniors in community, facility and acute care settings that measured falls or fall-related injuries as an outcome. The 2005 Cochrane Review reviewed five studies that reported changes in medically treated fall-related injuries among older people following the implementation of a controlled population-based intervention.

Risk factors – complex and interactive

Falls result from a complex interaction of risk factors. As the number of risk factors increases, the higher the risk of falling and of being injured. For example, one study showed that only 27% of people living in the community, with no risk factor or only

one, had a fall. The figure rose to 78% for those with four or more risk factors.[31]

Over the past 20 years or so, researchers have assessed risk factors and grouped them in various ways to facilitate comparisons in research studies. Typically, risk factors have been grouped into two main categories – intrinsic factors that lie within the individual and include both demographic and health factors, and extrinsic factors that lie within either the physical or socio-economic environment. However, a more recent model for categorizing risk factors better captures the interrelationships between behaviours and other risk factors. The four categories of risk factors in this model are biological and medical, behavioural, environmental, and socio-economic. (See Appendix A for a list of the risk factors in all of these categories).

3.1 Biological and medical risk factors

Biological and medical risk factors fall along a continuum from effects of healthy aging to pathological conditions. Normal aging inevitably brings physical, cognitive and affective changes which may contribute to the risk of falls, including sensory, musculoskeletal, neurological, and metabolic changes. Gender is also a key factor as women fall more often than men and sustain more injuries when they fall. Advanced age is associated with higher rates of falls. Seniors over 80 years of age are the most likely to fall and be injured. However, it is not age per se that increases the risk of falls – it is the co-morbidity of aging related to changes.

- **Muscle weakness and reduced physical fitness**, particularly to the lower body, are one of the most common intrinsic risk factors for falling. A panel of the American Geriatrics Society, British Geriatrics Society and American Academy of Orthopaedic Surgeons[32] found it to be the most important risk factor, increasing risk of a fall by four to five times. A loss of muscle strength, balance, flexibility and coordination can contribute to difficulty accomplishing activities of daily living. Related balance and gait disorders also have been shown to be closely linked to falls, creating a three-fold increase in the risk of falling. A recent Canadian study of veterans and their caregivers confirmed these findings.[33]
- **Impaired control of balance and gait** is a factor leading to instability and falls.[34] In particular, age-related changes in the neural, sensory and musculoskeletal systems can lead to impaired ability to maintain upright stance or react to a sudden loss of balance (e.g., a slip, trip or push).[35] Balancing reactions that involve rapidly taking a step or reaching to grasp an object for support play a critical role in preventing falls, but the ability to execute these reactions effectively can be impaired even in relatively young and healthy seniors.[36] Neurologic disorders such as Parkinson's disease or hemiparesis due to stroke can exacerbate these difficulties.[37]
- **Vision changes** can contribute to falls. Those with visual deficits such as reduced acuity or contrast sensitivity, declined accommodation to light and darkness, or altered depth perception are two and a half times more likely to have a fall.[38] Visual deficits such as myopia, ulcerative scars, corneal pathology, cataracts or complications from cataract surgery and glare intolerance are also thought to increase the risk of falling. People may also experience problems with new

glasses, particularly multi-focal lenses that distort depth perception.[39]

- **Chronic illness** has been associated with an increased risk of falling. Arthritis is a major contributor (osteoarthritis being the most common form), increasing the risk of a fall by 2.4 times.[40] Senior women experience more arthritis than men (58% vs. 42%, CCHS 2003). Other chronic illnesses such as stroke and Parkinson's disease increase the risk of falls. Hypotension (low blood pressure) affects 15% of all seniors and has been associated with as many as 20% of all falls.[41] Osteoporosis, characterized by low bone mass and the deterioration of bone tissue, does not affect the risk of falling per se, but does increase the risk of fractures from a fall, particularly those of the hip, spine and wrist. Other chronic conditions frequently implicated in falls include urinary incontinence and cardiovascular conditions including arrhythmias.
- **Physical disability** can increase the risk of falls. Physical disabilities linked to aging include gait disorders, diminished touch and sensation in limbs and feet, hearing loss, poor balance, dizziness, postural hypotension, sore feet and other feet problems, and injuries from a previous fall. [42]
- **Acute illness** may be responsible for between 10% to 20% of falls.[43] One example is acute infection. A Canadian study found that anti-infective medications were highly associated with fall-related hospital admissions, strongly suggesting that people with acute infectious disease are at a high risk for falls and injuries as a result of weakness, fatigue or dizziness.[44] Even the short periods of immobility often associated with an acute illness are known to contribute to reduced bone density and muscle mass.
- **Cognitive impairment**, such as confusion due to dementia and delirium, can also increase the risk of a fall. The Rand researchers reported an increased risk of 1.8 times for persons with cognitive impairment.[45] The Canadian study of veterans and caregivers also found that worsening memory was associated with more frequent falling.[46]
- **Depression** has been reported by many researchers as having a relationship to falls, but such studies are often retrospective and the depression could well result from the fall, rather than be a causal or risk factor.[47]

3.2 Behavioural risk factors

- A **history of previous falls** is one of the best predictors of a future fall. Any previous fall increases the risk for another fall threefold.[48] A previous fall may reduce mobility in older people, resulting in loss of strength, balance and reflexes. Feelings of fear and helplessness may also ensue, further adding to restrictions on activity and participation and reduced quality of life.[49]
- **Risk-taking behaviour** as a factor associated with falls has not been studied scientifically. The risk associated with participation in activities is influenced by individual, behavioural and situational factors. For example, an older adult's vision and strength, awareness of the environment, and protective behaviours, such as using a handrail, influence the risk of falls.[50] Risk behaviours may include climbing, reaching, or bending

while performing activities of daily living.[51] Reviews of cases presenting in the emergency department have shown that many falls result from seniors climbing ladders, standing on unsteady chairs, and even participating in vigorous sports such as skiing or tennis. Many seniors report that their fall occurred when they were rushing, not paying attention or not using mobility devices prescribed for them such as a cane or walker.[52]

- **Certain medications and multiple prescriptions** are a significant factor in many falls. Older people tend to take more drugs than younger people and, with age, they develop altered mechanisms for digesting and metabolizing drugs. Both the half-life and the active levels of a given dose increase with age, making the cumulative effects of medication use unpredictable. Medications can affect one's risk of falling in several ways. They can affect alertness, judgment, and coordination. Certain drugs increase postural hypotension – a significant drop in blood pressure with a change in position (lie to sit or stand) – resulting in dizziness. Drugs can also alter the balance mechanism and the ability to recognize and adapt to obstacles. Finally, drugs may impair mobility by causing increased stiffness or weakness.[53]
- **Polypharmacy**, defined as taking five or more prescribed medications, is shown to be a significant factor in many falls.[54] The variety of prescription medications is increasing and they are used in greater numbers and in new combinations. Drug-herb interactions may also be implicated in falls as supplements, herbs and vitamins can react with each other or with prescription medications.[55] The effects of various drug combinations are not yet clearly understood, especially the possible risks for falls in elderly individuals.
- **Benzodiazepines**, such as alprazolam (Xanax) and diazepam (Valium), are often prescribed to treat sleep problems and anxiety. Even the use of short-acting benzodiazepines has a greater association with falls and hip fractures.[56]

Everyday choices count

Behavioural risk factors are as simple as the choice of footwear, or attempts to prune a tree or reach an object on a high shelf. These risks can also include lifestyle factors such as alcohol use, poor diet and lack of exercise, or the use of high-risk medication or multiple medications that predispose some seniors to falling. It can be difficult for seniors, who may feel no different than they felt in younger years, to realize that the seemingly ordinary choices they make and the actions they take may greatly increase their chance of falling.

Source: *Prevention of falls and injuries among the elderly: A special report from the Office of the Provincial Health Officer.* B.C. Ministry of Health Planning, 2004.

- Patients taking **psychotropic medications**, such as paroxetine (Paxil) and sertraline (Zoloft) prescribed for depression, appear to have about a two-fold increased risk of falls and fractures, compared with individuals not taking these drugs. Some studies have also found that use of nonsteroidal anti-inflammatory drugs is associated with falling. However, current evidence suggests that diuretics, in general, do not cause falls and that thiazide diuretics

may help prevent fractures by slowing the development of osteoporosis.[57]

- The risks associated with **anticoagulant therapy**, especially the risk of falls-related injury, are greater in the elderly. A fall may result in head trauma but go undiagnosed because patients are confused, do not remember falling, or fail to report the fall. This is especially risky in patients on anticoagulant therapy since a fall with head trauma may result in bleeding in the brain. Blunt head trauma may cause behavioural and neurologic abnormalities and may be a sign of bleeding in the brain or brain cavity.[58]
- **Excessive alcohol** has been shown to be a factor in increased rates of falling. Consumption of 14 or more drinks per week is associated with an increased risk of falls in older adults.[59] Cross-sectional studies may fail to identify this risk of heavier drinking, perhaps because older adults at risk for falls decrease their alcohol use over time or because heavier drinkers at risk for falls tend not to enroll in studies. Alcohol may also interact with certain drugs to increase the risk of falls by producing changes in awareness, balance and gait. Alcohol used in moderation has not been associated with increased fall rates.[60]
- **Footwear, clothing and handbags** can contribute to falls, although clear research evidence is lacking. Footwear that fits poorly, has worn soles, is not laced or buckled when worn, or is of an unusual heel height for the individual, can contribute to falls. As people age, their height and posture change and long dressing gowns or trousers, which may have fit well at one time, can cause tripping hazards resulting in a fall and related injury.[61] Many older people report falling or sustaining a fall-related injury, as a result of carrying an object such as a handbag, laundry basket or grocery bag.[62] Suspected mechanisms relate to altered balance, altered recovery mechanisms upon a trip or stumble, and altered means of protection as the senior lands on the ground or floor.[63] Holding an object, for example, has been shown to impede ability to recover balance as it prevents one from rapidly grasping a handrail or other object for support.[64]
- **Inactivity and inadequate diet** may be important factors in both falls and related injuries. Again, while clear research evidence is lacking, people who are hospitalized 19 days or more have been shown to have an increased risk of a fall.[65] Undoubtedly, inactivity will result in reduced muscle mass, decreased bone density and poor balance. Dietary relationships to falls are less clear. However, adequate protein, essential vitamins and water are believed to be essential for optimum health. If deficiencies do exist, it is reasonable to expect that weakness, poor fall recovery and increased injury will ensue. Bone health is affected by intakes of vitamin D and calcium and deficiencies in these two nutrients have been associated with increased risk of fracture from a fall.
- **Fear of falling** has been identified relatively recently as a risk factor in the fall prevention literature. Fear of falling is widespread and has been reported as the most common fear of older adults.[66] It is an important aspect to consider, particularly for those who develop fear after having fallen.[67] Fear of falling is reported by a significant number of older

persons.[68] Specific fears vary but often include fear of falling again, being hurt or hospitalized, not being able to get up after a fall, social embarrassment, loss of independence, and having to move from home.[69]

Fear can positively motivate some seniors to take precautions against falls and can lead to gait adaptations that increase stability.[70] For others, fear can lead to a decline in overall quality of life and increase the risk of falls through a reduction in the activities needed to maintain self-esteem, confidence, strength and balance.[71] In addition, fear can lead to maladaptive changes in balance control (e.g., "stiffening") that may increase the risk of falling.[72] People who are fearful of falling also tend to lack confidence in their ability to prevent or manage falls, which increases the risk of falling again.[73]

Fear, as it affects client compliance with fall prevention strategies, is discussed in Chapter 4, Section 5 of this report.

3.3 Environmental risk factors

Between 25% and 75% of falls in older people involve an environmental component.[74] While individual levels of risk have not been established for many of these factors, researchers and clinicians have recognized a number of hazards in the home and public environment that contribute to falls and related injuries. These factors interact with other risk factors, such as poor vision or balance, to compound fall-related risk for seniors.

- **Stairs** can be problematic – hazardous characteristics include uneven or excessively high or narrow steps, slippery surfaces, unmarked edges, discontinuous or poorly-fitted handrails, and inadequate or excessive lighting. A recent Canadian study examined stairs which seniors said they found difficult to use. Unsafe features identified most frequently were: no contrast markings for stair edges, non-uniform risers, stair dimensions that differ from the recommended seven-inch maximum height or rise and eleven-inch minimum run (toe to heel allowance), open risers and lack of handrails.[75] Handrails that are securely mounted at an appropriate height and shaped correctly allow a functional grip to be established.[76] Stair surfaces and floors that are slippery, excessively patterned, glare-producing or uneven also have been implicated in falls.[77]
- **Factors in and around the home** that contribute to falls include: loose or uneven rugs; absence of night lights; an absence of accessible light switches at room entrances; hazardous shower stalls; baths or toilets; lack of grab bars or handrails; appliance cords or other obstacles in walking routes; items stored in high cupboards; and low furniture such as beds or chairs. Outside the home hazards can be found in such features as garden paths and walks that are cracked or slippery from rain, snow or moss. Entrance stairs and poor night lighting can also pose risks. Even pets can be a tripping hazard.[78]
- **Factors in the public environment** can also trigger falls. A Canadian study found that 65% of falls among seniors occurred outdoors while walking on a familiar route.[79] Poor building design and inadequate maintenance of buildings can also contribute to falls. Most problematic are cracked or uneven sidewalks,

unmarked obstacles, slippery surfaces, poor lighting and lengthy distances to sitting areas and public restrooms.

- **Fall hazards in long-term care settings and hospitals** also have been identified. Factors include chair and bed heights, floor surfaces, lighting and lack of rest areas. Many falls occur as people arise from bed. Apart from the dizziness sometimes associated with rising too quickly, the physical structure of the bed itself may be a factor. For example, when bed rails are in the lowered position and a person is moving to a standing position, space is lacking under the bed for proper footing and balance. It is logical to conclude that this may be a factor explaining why so many institutional falls occur in and around the bed.
- **Assistive devices** can promote independence and mobility and may prevent falls if properly used and safely maintained. However, cane tips can become worn, making them unsafe. Walkers with wheels or wheelchairs may lack a functioning locking mechanism posing a hazard. Moreover, the use of canes and walkers can interfere with the ability to maintain balance in certain situations, and the demands of using these devices can be excessive for older adults.[80] Having an assistive device does not necessarily guarantee its use. Many older people see such aids as symbols of their old age and advanced frailty, and they may be reluctant to use them because of this stigma.[81]

3.4 Socio-economic risk factors

- **Income, education, housing and social connectedness** are recognized social determinants of health but a limited body of research exists on the relationship between falls and these determinants. A recent Canadian study of veterans found that financial strain was an independent predictor of both falls and injurious falls, particularly among the caregivers of veterans.[82]

Lower socio-economic status increases risk

The study of social determinants of health has repeatedly shown that one's income, education, housing and social connectedness all bear a strong relationship to one's health, level of disability and longevity. People with low income, low education, inadequate housing, lack of support networks or lack of access to appropriate health or social services are all at a greater risk for the chronic health conditions that are, in turn, risk factors for falls. The role that social and economic factors play in contributing to falls is poorly understood. However, contributing factors may include poor literacy – resulting in an inability to benefit from printed resources on strategies for preventing falls – or muscle weakness or ill health due to lack of funds for a nutritional diet.

Source: *Prevention of falls and injuries among the elderly: A special report from the Office of the Provincial Health Officer.* B.C. Ministry of Health Planning, 2004.

It has been suggested that, because a relationship exists between income, education and housing and certain chronic health conditions, poor health may be the link between these factors and the increased risk of falling. For example, the group most affected by low income is women age 75 and over who live alone. These women may not be able to afford home modifications or assistive devices, attend fitness programs or have access to fall prevention information, all of which would help reduce falls.

Summary

Literature and guidelines report that falls result from a complex interaction of risk factors and, as the number of risk factors increases, the higher the risk of falling and of being injured. Biological and medical, behavioural, environmental, and socio-economic risk factors interact and compound. Normal aging inevitably brings physical, cognitive and affective changes which may contribute to the risk of falls. Gender is also a key factor as women fall more often than men and sustain more injuries when they fall. Advanced age is associated with higher rates of falls and fall injuries.

4 Evidence-based best practices for the prevention of falls

Information provided in this chapter on evidence-based best practices for the prevention of falls and fall-related injuries is taken from the guidelines and systematic reviews described in detail in Chapter 3. Additional evidence, highlighting Canadian interventions, is included here from studies carried out after the reviews were published.

In 2003, the *Canadian Public Health Association* called "on federal, provincial and territorial governments to play a strong coordinating role in integrating and harmonizing injury prevention to evidence-based best practices."

Source: *CPHA 2003 resolutions and motions, CPHA resolution No. 5, Injury prevention.*

4.1 Existing practice guidelines

In Canada and internationally, professional organizations and governments have established fall prevention guidelines based on systematic reviews of research evidence on best practices when working with seniors.

Guidelines prepared by professional organizations are generally considered prescriptive for professional practice. Professional organizations in Canada are beginning to develop practice guidelines on falls and seniors' falls. The Registered Nurses Association of Ontario recently published their professional guideline, *RNAO: Prevention of falls and injuries in the older adult*,[83] including best practices that address patient education and post-fall prevention.

Internationally, one of the most widely adopted guidelines is the *Guideline for the prevention of falls in older persons* of the American Geriatrics Society (AGS), described in the previous chapter, prepared in collaboration with the British Geriatrics Society and the American Academy of Orthopaedic Surgeons.

In the UK, the National Institute for Clinical Excellence (NICE) has published *Clinical guideline 21: The assessment and prevention of falls in older people 2004.*[84] The guideline outlines good practice based on the best available evidence of clinical and cost effectiveness. It encourages the participation of older people in fall prevention programs and supports fall prevention education for professionals working with seniors known to be at risk for falling.

Governments are developing comprehensive guidelines and strategies for reducing falls. The UK has established a National Health Service Framework for Older People with an entire section devoted to preventing falls.[85] In Australia, the Department of Health and Aging has developed a national fall prevention initiative for older people and the Australian states of Queensland and New South Wales have developed guidelines and initiatives to reduce falls. The Queensland government has produced comprehensive setting-specific guidelines for public hospitals and state government residential aged care facilities, incorporating community integration.[86] A 2004 Australian review of research on preventing falls and fall injuries in older people distinguishes between approaches for community-based, hospital-based and facility-based seniors.[87]

4.2 Best practices for fall prevention

Brief risk assessment to screen for high risk

Since it is impractical to think that all older people can be given a comprehensive fall-related assessment and treatment plan, a brief risk assessment is often the first step in identifying who may benefit most from this approach. The American Geriatrics Society's evidence-based guideline[88] suggests that a brief risk assessment would identify those who should be referred for a comprehensive fall evaluation. The three groups that such an assessment should identify are: older persons presenting for medical attention with one or more falls; older persons who report recurrent falls; and older persons with abnormalities of gait and/or balance.

Such an assessment may vary for seniors in different settings such as the community, a hospital or a nursing home. Assessments may be self-administered or used by first responders including paramedics; primary care personnel such as family physicians or nurse practitioners; physiotherapists; occupational therapists; and paraprofessionals, such as home support workers.

A Canadian study of veterans and caregivers supported the inclusion of the following factors in a brief risk assessment: lower limb disability, lower extremity weakness, worse memory than peers, one or more family doctor visits in the past month, and taking four or more medications. Physical inactivity and serious foot problems are other factors receiving some support for inclusion in a brief risk assessment.[89]

Due to the multifactorial nature of falls, any one test cannot identify individuals who are at risk for falls.[90]

Comprehensive clinical assessment

A comprehensive clinical risk assessment usually consists of:

- a review of falls history and circumstances; and
- an assessment of gait, balance, mobility and muscle weakness, osteoporosis risk, perceived functional ability and fear of falling, visual impairment and effects of corrective eyewear, urinary incontinence, home hazards, cardiovascular exam and medication review.[91]

The *AGS Guideline* advises that the assessment should be performed by a clinician with appropriate skills and experience. In addition to the factors identified above, the Guideline recommends including factors related to acute and chronic health problems; lower extremity joint function; and basic neurological function.

Multifactorial interventions

The *Rand Report*, the *Cochrane reviews* and the *Federal/Provincial/Territorial best practices guide* all conclude that there is compelling evidence to support the use of multidisciplinary, multifactorial, health and environmental approaches to fall prevention. A comprehensive approach to fall prevention among seniors typically includes a combination of assessment and interventions such as exercise programs, behaviour change, medication review and modification, treatment of contributing health conditions, assistive and protective devices, environmental modifications, and education.

Evidence for a multifactorial, population-based approach

"Despite methodological limitations of the evaluation studies reviewed, the consistency of reported reductions in fall-related injuries across all programmes support the preliminary claim that the population-based approach to the prevention of fall-related injury is effective and can form the basis of public health practice."

Source: *Population-based interventions for the prevention of fall-related injuries in older persons* (Review), The Cochrane Collaboration, 2005.

Excellent models of multifactorial interventions have been developed in Canada and elsewhere, although few have been tested empirically.

- A study conducted in Edmonton has shown promise in reducing falls using a multifactorial, risk-abatement approach, as well as a cognitive-behavioural and environmental focus. The target population was relatively healthy and mobile, community-dwelling older adults. The older adults who had completed the program made significant reductions in eight out of nine risk factors addressed in the program. Over a four-month follow-up period, the proportion of older adults who fell was lower in the treatment group (17%) than in the control group (35%). In addition, a significantly lower proportion (20%) of members of the treatment group, who had reported a fall in the year before the program, experienced a fall in the follow-up period compared to similar persons in the control group (35%).[92]

- A study in which nurse practitioners and a physical therapist were trained to conduct comprehensive assessments and three months of focused interventions demonstrated significantly fewer 'fallers' and fewer total falls compared to the control group.[93]

Exercise programs

Evidence is growing concerning the benefits of exercise in reducing the risk of falls and related injuries. Exercise can improve balance, mobility and reaction time. It can increase bone mineral density in post-menopausal women and in people age 70 and over. The Rand Report concluded that exercise interventions reduced the risk of falls by 15% and the number of falls by 22%. The falls exercise programs typically involved cardiovascular endurance, muscle strength, flexibility and balance. The research supports general activity such as walking outside or mall walking indoors, cycling, mild aerobic movements or other endurance activities, and specific regimes geared toward balance, strength or flexibility.[94]

Specific exercise regimes are associated with reduced falls and/or injuries. Overall, the Cochrane Review concluded that evidence from three randomized control trials proved that falls can be reduced through individually prescribed programs involving muscle strengthening and balance retraining. Group Tai Chi was also shown to be particularly effective.[95]

Another review reported that 10 to 12 weeks of gentle exercise that focused on balance, strength and flexibility, produced a trend toward reduced multiple falls among high compliers. The review also reported on the benefits of an 80-minute exercise program, follow-up visits, and telephone encouragement. Participants reported fewer falls than persons in a control group. A combined strength and endurance training program, three times a week for six months, reduced the risk of falling by nearly half, when compared with either strength or endurance training alone.[96]

Studies of the benefits of walking show mixed results. The Nurses' Health Study found walking to be preventive among the 61,200 women studied.[97] However, one researcher has reported increased falls from brisk walking among post-menopausal women.[98] Overall, Rand reviewers concluded that the data clearly point to the benefits of exercise in general, but they were not conclusive in recommending particular fall prevention exercises.[99]

Clinical management of chronic and acute illness

Chronic illnesses that are frequently implicated in falls risk include arthritis, Parkinson's disease, stroke, urinary incontinence, sudden reductions in blood pressure on rising, and cardiovascular conditions including arrhythmias. Unfortunately, the increased risk of falls associated with chronic illnesses may be compounded by additional risks related to adverse reactions to medications used to treat them. Similarly, the medications used to treat sleep disturbances and acute illnesses may compound the fall risk.

Medication review and modification

Suggestions for improving medication management have been identified by a variety of sources. An Australian guideline reported that programs aimed at reducing the use of sedatives and tranquillizers have resulted in fewer hip fractures in nursing homes.[100]

They recommended the following:

- use the lowest effective dosage of a medication specific to the symptoms;
- urge supervision and the use of walking aids while such medications are being taken;
- decrease chronic use of medications;
- limit multiple medication use; and
- conduct regular reviews of all patients' medications with a view to withdrawing those that are not absolutely necessary.

The use of post-menopausal hormone replacement therapy (HRT) is a controversial one. Some research has shown that fractures of the wrist and hip may be reduced with HRT and that bone loss may be prevented for up to 15 years with as much as a 50% reduction in fracture risk. However, other risks associated with HRT have yet to be resolved before informed decisions can be made about its usefulness in fracture prevention. Pending further research, decisions on the use of HRT should be made based on the risk profile of individual seniors. Other bone enhancing drugs are proving useful in reducing vertebral and hip fractures. These include biophosphonates (etidronate, alendronate, pamidronate) and selective estrogen receptor modulators (raloxifene).[101]

The B.C. Provincial Health Officer's report highlights the need for pharmacists to communicate clearly with both clients and physicians concerning the interplay of drugs and falls. It also recommends that pharmacists promote the use of assistive devices such as hip protectors and walking aids, apply stickers to drugs known to increase the risk of falls, and ensure that drug instructions are in large typeface and are readily understood by the client.[102] Non-pharmacological approaches for patients can also be considered, including chiropractic and massage therapy.

Vision referral and correction

While vision problems are a known risk for falls, no research evidence yet exists to show that treating visual problems can prevent falls. However, many vision problems can be corrected with a proper exam and corrective lenses. Progressive lenses may give better quality vision of surroundings; however, it is not recommended that older patients be switched from bifocal to progressive lenses or vice versa.[103]

Opticians can warn older persons that it takes time to adjust to new lenses – particularly multi-focal lenses – and that during this period they may be at high risk for a fall or associated injury, particularly on stairs. Simple suggestions include making sure the environment is well-lit, avoiding neutral colours, avoiding clutter and remembering to remove reading glasses when moving about.[104] Some older people may refrain from having regular eye exams and purchasing appropriate corrective lenses because of the cost.

Assistive devices and other protective equipment

Assistive and protective devices such as canes, walkers, safety poles or bathroom grab bars are often recommended to reduce the risk of falling, although empirical research to prove their effectiveness is lacking. While there is no clear evidence that assistive devices cause or prevent falls, their use can play an important role in increasing seniors' confidence and mobility and encouraging independence.[105]

A recent review of the literature highlighting the demands and problems associated with mobility aids suggests that there may be a need for more cautious prescription of mobility aids and improved training to use the prescribed device safely.[106] Safer mobility aids are currently being developed, such as novel handrail systems designed to promote safe stair use among seniors, and new types of footwear designed to improve balance by facilitating pressure sensation from the sole of the foot.[107]

In 2003, the *Canadian Association of Occupational Therapists* called for "Canadians [to] be informed of assistive technology benefits in promoting independence and health, in order to facilitate their use and social acceptance."

Source: *Position statement: Assistive technology and occupational therapy,* Canadian Association of Occupational Therapists, 2003.

A national project of the Health Canada/ Veterans Affairs Canada Falls Prevention Initiative held focus groups with older adults, service providers and assistive device stakeholders. They found that, for many older persons, assistive devices, in particular mobility aids, can be viewed as stigmatizing and symbolic of aging and inevitable decline. These perceptions can influence an individual's decisions about whether or not to use aids.[108] Other researchers identified factors affecting the use of adaptive equipment, including age, gender, living environment, and health condition. Their findings indicated that device use is greater for persons with acute orthopaedic conditions and multiple impairments. The strongest predictor of use is a client's perceived need for the device.[109]

Hip protectors are designed to reduce hip fractures with falls. This protective underwear-type garment has a soft or hard shell over the hip area. Researchers have reported that these garments may be 80% to 95% protective for hip fractures. A review commissioned by Health Canada and Veterans Affairs Canada reported that five studies showed reduced fractures among people wearing hip protectors; however, only one of these results was statistically significant. The authors note that the non-significant results may be due to different hip protectors being studied, small sample sizes and poor compliance for wear.[110] One study reported that no one who was wearing hip protectors at the time of a fall suffered a hip fracture.[111]

Personal emergency call devices are designed to enable prompt assistance to someone who has fallen and needs help. While they do not prevent people from falling, they can reduce the seriousness of injury complications by ensuring prompt treatment and reduced harm. Many residential care settings have such call devices installed as alarm buttons near the floor. Alerting systems, which alert care providers when an individual becomes ambulatory, may reduce falls. An ambulatory alarm secured to the thigh of hospitalized seniors, was shown to reduce falls by 45% in a general ward and 33% in an orthopaedic ward in less than a year[112] but these results have not been replicated and may not be applicable to a community-dwelling population.

Nutrition and supplements

Limited but promising research evidence exists for the benefits of altered nutrition and supplements. One review has suggested that increasing dietary calcium has the

greatest effect in improving bone mass among persons with low bone density and in those who have low calcium intake (<400 mg/day)[113]. It is currently advised that calcium supplements (1,500 mg/day) be used with vitamin D (800 IU/day) or other active agents. Institutionalized seniors may benefit in particular, as they have been shown to suffer vitamin D deficiency due to lack of exposure to sunlight.[114] A more recent review from the United States combined data from five randomized clinical trials and concluded that 37% of people in control groups had a fall compared with 30% taking vitamin D.[115]

It is also reasonable to assume that underweight or malnourished persons would have a greater risk of fracture due to limited adipose (fat) tissue to protect bones during a fall, muscle weakness or poor reaction time. Improving oral health and dentures may enhance nutrition as well. These issues need to be addressed population-wide as well as on a case-by-case basis.

Environmental assessment and modification

In and around the home

Most falls occur in and around the home and research indicates that home modifications may be effective in reducing the risk of falls.[116] An assessment of the home environment aims to enhance accessibility, safety, and performance of daily living activities. The Public Health Agency of Canada's *Safe living guide*[117] includes a validated home safety checklist, which can be completed by seniors themselves or together with volunteers or health care workers. Modifications include removing clutter and securing electrical cords and loose carpets to prevent tripping; installing grab bars and handrails; improving lighting and keeping a working flashlight nearby; and improving shower and tub safety.

An important aspect of successful home modifications is ensuring that the identified hazards are actually corrected. Programs that not only identified the hazards and the needed modifications, but also carried out the modifications, were more successful than programs that left the modifications up to the seniors.[118] Studies which have explored adherence to home modifications recommended by an occupational therapist indicate that factors such as the perceived need for the modification and lower cognitive or functional status are related to adherence. The older person's involvement in making the decision regarding the options for modifications may also influence adherence.[119]

In 2003, the *Canadian Public Health Association* passed a resolution to encourage the development of changes to building codes related to stair design and installation of grab bars in bathtubs.

Source: *CPHA 2003 resolutions and motions, CPHA motion No. 2, Falls among seniors as a priority public health issue.*

Best practices for environmental modifications

- Include home modifications as part of a fall reduction program.
- Combine home modification programs with strategies such as education and counselling about reducing risks (especially other risks that interact with environmental factors to increase the chance of falls).
- Offer some form of financial or manual assistance in home modification programs because it provides real help to seniors and improves the success rate.
- Use the skills and training of occupational therapists for conducting home assessments, as they are able to evaluate both the senior's environment and his or her ability to function in that environment.
- Target people who are ready to change. Readiness is often a function of having had a recent fall or an increased understanding of fall risks.

Adapted from: *A best practices guide for the prevention of falls among seniors living in the community,* Federal/Provincial/Territorial Ministers Responsible for Seniors, 2001.

In public spaces

There are many factors contributing to falls in public spaces and it is difficult to determine the impact of a specific intervention. However, a project in British Columbia called STEPS (Study to Promote Environmental Safety) produced an interesting model for reducing public fall hazards. This project pulled together government officials, seniors, city maintenance workers, and building owners to examine and reduce fall hazards in the community. A telephone hotline enabled people to report falls and hazards, leading to a repair or spray-painting of the hazard until the repair could be done.[120] Public awareness campaigns can also educate the community about fall hazards – municipal workers, seniors, caregivers, letter carriers, and others are well situated to observe and report on fall hazards in need of repair.

Building codes and standards can play an important role in the prevention of falls. The Canadian Hospital Injury Reporting and Prevention Program (CHIRPP) reports that stairs, floors and steps are implicated in seniors' falls more often than any other household areas or items.[121]

The Canadian Standards Association has undertaken several initiatives to improve safety and security for seniors. A key initiative has been the development of *B659-01: Design for Aging*, a guideline that outlines principles for the development of products, services and environments for an aging society.[122]

Education

It is generally agreed that as a stand-alone intervention, education does not produce a measurable decline in falls or injuries. However, educational efforts with individuals, family caregivers, professionals and entire communities are recommended as an adjunct to other interventions. Effective education may take many forms including pamphlets or other printed materials, public talks or discussion groups and use of the media. More intense education can take place with individual counselling. A form of skills education is being studied in Canada to determine whether people can learn to fall more safely. A researcher has found that

during a sideways fall, individuals can learn to avoid impact to the hip by changing the position of their body before they land on the floor, thereby lowering their risk of a hip fracture.[123]

Educating care providers is another approach to fall prevention. An innovative educational program equipped community health workers to do first level assessments of older community-based clients receiving home care services. Following a one-day training session, the workers implemented a risk screen and intervention tool with selective clients. The total number of reported falls dropped by 44% and the study is now being replicated as a randomized control trial to establish the relationship between a decline in falls and the benefits of the program more clearly.[124]

Addressing fear of falling

Existing education programs are tailored to prevent falls; however, a need also exists for post-fall interventions to prevent subsequent falls and to address fear of falling.[125] Many fall prevention programs target fear and self-efficacy but there is limited evidence of their effectiveness in reducing fear. One study reported a modest short-term effect in improving self-efficacy and increasing level of activity using a cognitive-behavioural intervention. No effect remained after six months.[126] An intervention involving participation in Tai Chi classes resulted in a reduction in fear of falling and risk of falling. Use of hip protectors did not appear to reduce fear of falling, but was associated with improved self-efficacy.[127]

A recent study concluded that an intervention to reduce fear of falling through group sessions was most effective for participants who were less physically impaired, had greater concern about falling and had greater self-efficacy in making changes.[128] There is evidence to suggest that interventions for people being treated for fall-related injuries should try to lessen fear arousal. Also, increased social support is needed as a means to lessening fear.[129] A multi-faceted intervention strategy showed significant improvements in the capacity of community-dwelling seniors to address fall risks.[130]

Programs seem to be more effective when they target remediable individual and environmental risk factors for falls, and when they are integrated into a range of services including prevention and management, acute care, rehabilitation, home care, and long-term support.

4.3 Selecting appropriate approaches according to setting

Community-based settings

Many of the fall prevention approaches described above are appropriate to community-based settings. Among seniors in the community, interventions need to be tailored to an individual's level of frailty – approaches suited to healthy, active seniors will be different from those for seniors who are more frail. In 2004, Health Canada conducted a survey to determine seniors' attitudes to falls and concluded that younger, healthy seniors tend to focus on healthy eating and exercise, and do not tend to think of this as preventing falls. Those who are frail and more vulnerable tend to focus on maintaining independence, and while they are at a higher risk for falls, they have a tendency to deny their risk. However, given the right information by the right professional, many will change their environments and behaviour to minimize their risk. Frail

seniors who depend on others for their care, along with their professional and family caregivers, are often very concerned about falling and can benefit from education and interventions.

Institutionalized seniors

A number of researchers have studied fall prevention approaches in long-term care facilities. Two promising examples are as follows:

- A randomized control trial in nursing homes combined individualized assessment with interventions. Interventions were in the areas of environmental and personal safety (i.e., improvement in room lighting, flooring, footwear, etc.), wheelchair use and maintenance (i.e., assessment by an occupational therapist), psychotropic drug prescriptions (i.e., assessment and recommendations for change), transfer and ambulation (i.e., evaluation and recommendations for change), and facility-wide interventions (e.g., educational programs for staff). The 'intervention' facilities had 19% fewer recurrent falls compared with the 'control' facilities, and a 31% reduction in the rate of injurious falls.[131]
- A project funded by PHAC's Population Health Fund developed a falls surveillance tool for long-term care facilities, based on a review of the literature on fall prevention for residents in such facilities. This project developed several collaborative protocols for recording, implementing and monitoring effective prevention strategies for falls and fall-related injuries.[132]

Hospitalized seniors

Many prevention practices are in place to protect hospitalized seniors from falls including educational activities for nursing and support staff, patient orientation activities, reviews of prior falls, and modifications to the environment. Environmental modifications include reducing ward or room obstacles, adding extra lighting and grab bars in bathrooms, and lowering bedrails and bed height. Other approaches address transfer and mobility issues with scheduled ambulatory and physical therapy activities and attention to footwear (e.g., non-skid socks). In addition, hospitals have incorporated strategies to assist cognitively impaired patients by: educating family members to deal with confused patients; minimizing sedating medications; and moving confused patients closer to nursing staff.[133]

A recent systematic review reported a pooled effect of a 25% reduction in the fall rate in the studies that examined prospective interventions compared to fall risk in historical controls. Minimizing bed rest is a practical intervention that has implications for the prevention of a number of serious hospital-acquired complications.[134]

4.4 Recovery from a fall

This section summarizes the evidence presented in systematic reviews, guidelines and other studies concerning best practices for recovery from a fall and post-fall prevention of another fall.

Although there is information on the management of specific injuries, most notably hip fractures, the concept of fall recovery is not well recognized. Comprehensive fall injury management needs to go beyond care for the injury sustained to include assessment and reduction of the risk of future falls (i.e., medication review, exercise, and education) and the maintenance of a

healthy lifestyle, not prescribed by the fear of falling and being injured again.

Fall recovery goes beyond healing the physical injury

"Fall outcomes are not limited to physical trauma but include social withdrawal, psychological trauma and increased dependence."

Source: *Fall injuries among Saskatchewan seniors*, Saskatchewan Health, 2002.

A number of factors play a role in a senior's recovery from a fall. Two studies have reported that almost half of those who fell required help getting up and that 10% of falls resulted in a wait of over one hour for help to arrive.[135] Compared with those who were able to get up, those who could not were more likely to suffer lasting decline in activities of daily living. A key recommendation from the studies reviewed is that older adults presenting for medical care with a fall injury should be assessed for risk of falling and that remediable risk factors should be addressed.[136]

One worrisome complication for older adults after hip fracture surgery is delirium, which occurs in 35% to 65% of patients and can adversely affect rehabilitation outcomes.[137] Depression is another factor that has implications for practice as it may affect recovery from fall injuries. One study found that depression prior to a fall-related injury was not predictive of disability after the injury. However, symptoms of depression present two months after the injury were linked to significantly higher rates of disability over the short and long term.[138]

Clearly, depression may be triggered by a fall-related injury and may affect recovery from such injuries.

Across Canada, services for seniors who have fallen vary, especially in relation to preventing future falls. The greatest variability appears to be in home care, home supports and physical therapy services. A step to consider is the addition of evidence-based fall prevention guidelines for the professionals who see patients presenting with a complaint of falls or with a fall-related injury. These professionals can include physicians, nurses, health workers in community and long-term care, physical and occupational therapists, etc.

4.5 Factors influencing client compliance in fall prevention

A person's need for autonomy, dignity and independence, as well as the tendency to minimize the seriousness of a fall or displace blame may pose challenges to successful implementation of fall prevention initiatives. One study interviewed older women who had not followed through on recommendations to modify their environment to reduce their risk of falling. The study found that the women made decisions about whether or not to implement changes in their home based on their own perception of the level of risk, according to their own experience and knowledge, rather than on those of the person recommending the changes. The women tended to modify their behaviour rather than change their environment, opting to accept a level of environmental risk.[139]

Varying attitudes have been observed in people who have fallen. One study found four patterns of response: overall lack of

Seniors may overestimate their level of fitness

An Ontario survey supported by the Health Canada/Veterans Affairs Canada Falls Prevention Initiative found that many seniors overestimated their level of fitness and underestimated their loss of visual acuity. Such seniors may not recognize subtle deteriorations in their strength, coordination and balance that may make them prone to falling. Since they do not think they are at risk for falling, they may not take precautions and may be less likely to respond to fall prevention campaigns.

Source: *Awareness and attitudes toward fall prevention: Final report on a survey on Ontario seniors,* Ontario Public Health Association, 2002.

concern; a perception of the fall as part of the natural aging process; viewing the incident as a learning opportunity; and experiencing the event as dramatic and life-changing.[140] Those who had little or no concern tended to place great value on maintaining their independence and made no changes to reduce their risk of falling in the future. Those who saw falling as part of the aging process or as a learning opportunity took actions to reduce risk. Those who experienced the event as 'dramatic' were more fearful of falling in the future and perceived themselves as very vulnerable to falling. The latter group made the most changes to reduce their risk of falling but had a reduced sense of personal mastery. Thus, it is important for clinicians to determine a client's interpretations of a fall event as it may affect the senior's readiness to make changes.

Communicating to a client about falling and related fear is important both in treating fall-related medical conditions and in preventing future falls. Communications need to take into account the tendencies of people to dissociate from the likelihood of a future fall, displace blame for falls, and maintain a sense of personal control and independence. Also, understanding the complexity of fear of falling is important for effective communication. Communications should emphasize 'healthy fear' that results in risk reduction rather than 'unhealthy fear' that may lead to increased risk of falls.

A study of ten women living in a nursing home explored the women's experiences and feelings after having fallen.[141] The women described feelings of helplessness, annoyance and frustration as a result of falling. Most expressed a fear of falling in the future and had opted to use assistive devices for mobility. They were reluctant to participate in organized physical activity programs, in part because they had never been involved in physical activities for pleasure at any stage in their life, but also due to their fear of falling again.

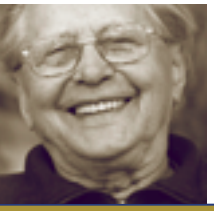
Clearly, falls are an emotionally loaded topic for older people. A study examining perceptions of falls found that the language used by older people to describe their falls avoided connotations of personal vulnerability.[142] Similarly, there is a tendency for people to dissociate themselves from the likelihood of falling and to consider others at greater risk.[143] Many individuals are strongly motivated to underplay their personal susceptibility.[144]

This tendency to avoid being perceived as vulnerable may relate to the need for personal control or autonomy. For seniors who have experienced a fall, there may be residual fear about possible loss of freedom. One researcher found that, although older nursing home residents were falling regularly, many were baffled as to why they were included in a group of 'frequent fallers' as they did not see themselves as persons who repeatedly fell. The residents described the falls as having been caused by an external factor. The authors conclude that the defense mechanism of displaced blame allowed frequent fallers to continue to view themselves as intact.[145] Interventions should take into account the tendencies of frequent fallers toward denial, as well as their need to preserve personal esteem and independence. It is important to respect the rights of seniors to live at risk.

Summary

There is compelling evidence for the effectiveness of combining comprehensive falls assessments with multidisciplinary and multifactorial interventions that address health and environmental factors to prevent falls among seniors.

Some interventions focus on the combination of factors that put a senior at risk while others address broader population-based efforts, such as education and reducing public hazards. These approaches are complementary and can be adapted to the community or the institutional environment. A comprehensive approach typically includes exercise programs, behavioural changes, review and possible modification of medications, treatment of health conditions contributing to risk, safety and protective aids, environmental modifications and the education of seniors and caregivers. With seniors who have experienced a fall injury, recovery, fear of falling and attitude need to be addressed to prevent further falls. Interventions need to support seniors' personal esteem and independence.



5 Supporting fall prevention strategies

Developing effective fall prevention programs requires an understanding of the incidence and nature of falls among seniors and of the factors associated with falls.[146] Also key to effective programming is community support to maximize program acceptance and sustainability. Programs often build on elements already in place in the community and rely on networks that extend beyond their communities, such as advocates and stakeholders from provincial and national organizations and universities. Programs are most successful when agencies integrate fall prevention projects into their broader organizational structure and goals, so that fall prevention initiatives can, in turn, support the broader missions of the organizations.

The Health Canada/Veterans Affairs Canada Falls Prevention Initiative commissioned a report to examine the factors that contribute to successful fall prevention programs. The study found that programs that build on existing support can create a climate conducive to the success of a fall prevention initiative and that the impetus and support for fall prevention programming can come from a range of sources. The common element that supports an initiative is the development of a shared understanding that falls are a significant health risk and that doing something about injurious falls is possible.[147]

Selecting the appropriate prevention strategies is best done through a collaborative process that reflects the risk profiles of individuals and the unique characteristics of their living situation. Different approaches are needed for vigorous seniors as well as for frail seniors and for those living in the community as well as for those in institutions. Specialized approaches may be required when dealing with specific populations. Recognizing client diversity, such as First Nations groups or ethnocultural groups, is important, as these may benefit from specialized approaches to planning for fall prevention. The success of any strategy is dependent on the effective leadership and active involvement of key stakeholders who have the ability to build on the existing strengths and capacities within each setting.

> "Identify, develop and support Best Practice Champions and include people who have expertise in order to support, mentor and train others within organizations to ensure knowledge transfer."
>
> Source: *Nursing best practice guideline: Prevention of falls and fall injuries in the older adult,* Registered Nurses Association of Ontario, 2005.

The Health Canada/Veterans Affairs Canada Falls Prevention Initiative funded a number of fall prevention projects and found that the projects that were sustained at the end of the Initiative were those with strong community partnerships, strong leadership, and additional financial support.[148]

Sustainability was most likely if fall prevention projects:

- addressed sustainability in the initial planning stages of projects;
- had key champions to show leadership;
- involved a wide range of stakeholders, including local officials, service groups, universities, provincial and national organizations, and particularly seniors;
- focused on specific project components rather than entire programs (e.g., resources, partnerships and volunteer networks);
- supported outcomes such as increased community interest and awareness;
- had communities with previous capacity for and experience in delivering fall prevention initiatives;
- secured funding for a project coordinator;
- had 'train the trainer' initiatives;
- secured funding from multiple partners; and
- integrated falls projects into the broader goals of the organization.

Projects identified challenges for sustainability as follows:

- developing collaborative relationships across jurisdictions;
- identifying sources of sustainable funding;
- defining the most critical components of a multi-component program;
- identifying optimal recruitment strategies to attract and retain at-risk seniors;
- adapting programs to address diversity;
- maintaining volunteers and advisory group members; and
- preparing systematic evaluation plans.

Summary

Strategies for fall prevention should reflect current literature, with consideration for its practical application and the local resources. Programs to prevent falls and injuries tend to focus on raising awareness, changing behaviours to reduce risk factors, and environmental and policy changes. For these programs to be successful over the long term, it is key to understand that sustainability is an ongoing, active process requiring periodic adaptation to conditions and circumstances.[149]

6 The way forward

Until now, a national overview was not available concerning fall-related hospitalizations, fall-related deaths and self-reported fall injuries for seniors in Canada. ***Report on seniors' falls in Canada*** provides a clearer picture of the situation and profiles compelling evidence for the effectiveness of combining comprehensive fall assessments with multidisciplinary and multifactorial interventions that address health and environmental factors to prevent falls among seniors.

While the national data presented in this report are important to demonstrate the nature and severity of falls among seniors, provincial, regional and local surveillance are also valuable sources of falls and fall-related injury data.

It is vital that the wealth of data and evidence at all levels continue to be studied, shared, and built upon to provide a truly comprehensive picture of seniors' falls across Canada. Those working within the jurisdictions are best situated to access their own data sources and to understand their strengths and limitations: regional variations in falls data need to be interpreted carefully as there are differences in the range of biological, behavioural, environmental, social and economic fall risk factors within regions. Variability also exists among jurisdictions in the types of infrastructures, policies and resources available to address seniors' falls.

As surveillance, research and program initiatives expand, collective understanding of risk factors and prevention of falls will increase. By sharing key evidence on seniors' falls and prevention strategies, the Public Health Agency of Canada and other stakeholders can contribute to the development of effective new interventions and policies, and to the reduction of trauma, disability and premature death from falls among Canada's seniors.

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Appendix A | Risk factors for falls and fall-related injuries

Biological / Medical

- Advanced age
- Female gender
- Chronic illness/disability:
  - -Stroke
  - -Parkinson's disease
  - -Heart disease
  - -Incontinence/frequency
  - -Depression
- Acute illness
- Cognitive impairment
- Gait disorders
- Poor balance
- Postural sway
- Muscle weakness
- Poor vision
- Impaired touch and/or proprioception

Environmental

- Poor building design and/or maintenance
- Inadequate building codes
- Poor stair design
- Lack of:
  - -Handrails
  - -Curb ramps
  - -Rest areas
  - -Grab bars
- Poor lighting or sharp contrasts
- Slippery or uneven surfaces
- Obstacles and tripping hazards
- Assistive devices

Behavioural

- Multiple medications
- Use of:
  - -Tranquillizers
  - -Antidepressants
  - -Antihypertensives
- Excessive alcohol
- Risk-taking behaviour
- Lack of exercise
- Previous fall/recurrent falls
- Fear of falling
- Inappropriate footwear
- Lack, inappropriate use or improper use of mobility aids
- Poor nutrition or hydration

Social / Economic

- Low income
- Lack of education
- Illiteracy/language barriers
- Poor living conditions
- Unsafe housing
- Poor social environment
- Living alone
- Lack of support networks and social interaction

Adapted by V. Scott (2005) from: *Federal/Provincial/Territorial inventory of Canadian programs for the prevention of falls among seniors living in the community,* 2001.

Appendix B | List of the Public Health Agency of Canada's resources on seniors' falls

These publications are available on the Division of Aging and Seniors Web site at:
www.phac-aspc.gc.ca/seniors-aines

12 steps to stair safety
This one-page checklist reminds seniors of the common hazards in stairways, and the proper ways to set up and use their stairs.

A best practices guide for the prevention of falls among seniors living in the community
The Guide is based primarily on a systematic review of the studies evaluating the effectiveness of fall prevention strategies for community-dwelling seniors and then, based on these studies, determining effective interventions and strategies.

An inventory of Canadian programs for the prevention of falls among seniors living in the community
This is a national inventory of Canadian programs designed to reduce falls or fall-related injuries among community-dwelling seniors.

Bruno and Alice
This light-hearted, humourous and entertaining publication offers seniors easy-to-read and important information on injury prevention in the home.

Falls prevention initiative – Health Canada/ Veterans Affairs Canada: Summaries of funded projects 2000-2004
The booklet describes 40 projects funded under the Falls Prevention Initiative, that help identify and promote effective falls prevention strategies for veterans and seniors.

Go for it! A guide to choosing and using assistive devices
The guide is aimed at helping users in finding the best solution regarding the choice of communication aids, cognition aids, personal mobility aids, housekeeping aids, adaptations to the home and other premises and recreation aids.

Help yourself to assistive devices!
This leaflet provides a wealth of information on available assistive devices to facilitate the activities of daily living.

Inventory of fall prevention initiatives in Canada – 2005 (available online only)
This inventory is a revised listing of falls prevention programs/projects available for seniors living in the community.

Promising pathways: A handbook of best practices
This handbook provides information on the most effective strategies and interventions for reducing falls and preventing injuries among seniors who live in the community. It also offers tools and resources for planning and implementing fall prevention programs.

Stay safe!
The poster illustration is of a senior's living room and contains 14 dangers that can cause seniors to fall or injure themselves.

The safe living guide: A guide to home safety for seniors

This guide presents ideas on how to prevent injuries in and around the home. It provides information in the form of check lists, fact sheets and tips, as well as a resource section.

You can prevent falls!

This pamphlet focuses on how seniors can prevent falls by making the needed adjustments to their homes and lifestyles, by eating well, staying fit, and using devices that will facilitate their daily lives while keeping them safe.

Additional Web resources

Canadian Health Network

CHN is a national, bilingual Internet-based health information service funded by PHAC.
www.canadian-health-network.ca

Health Portal

Offers resources on seniors' health issues and concerns including safety and injury prevention.
www.healthportal.gc.ca

Seniors Canada Online

Offers easy electronic access to senior-related services.
www.seniors.gc.ca