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# AGING AND CHRONIC DISEASES

A PROFILE  
OF CANADIAN  
SENIORS



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# AGING AND CHRONIC DISEASES

A PROFILE OF CANADIAN SENIORS

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## FOREWORD

### MESSAGE FROM CANADA'S CHIEF PUBLIC HEALTH OFFICER

Canada's population is aging. Most Canadian seniors living in the community report that they are happy, satisfied with their lives and have good physical and mental health. However, the aging process can bring about many challenges. One of these is the impact of chronic diseases and conditions, which can affect activities of daily living, reduce quality of life and increase mortality risk.

Four chronic diseases, namely cancer, cardiovascular diseases, diabetes and chronic respiratory diseases account for over 60% of all deaths in Canada. The onset of these diseases can be delayed or mitigated through changes in behavioural risk factors as well as broader determinants of health.

In late 2019, a new respiratory virus emerged and has since become a global pandemic. COVID-19 has had unprecedented consequences and has quickly revealed seniors' vulnerability to infectious diseases. Seniors face an inherent higher risk of severe COVID-19 outcomes due to declines in immunity related to advanced age and higher prevalence of underlying chronic diseases and conditions. The Canadian Chronic Disease Surveillance System estimates that in 2021, the overall number of adults aged 65 years and older who will be living with chronic conditions will be about 6.3 million. As of November 2020, there have been more than 10,200 reported deaths due to COVID-19 in Canada, with close to 90% of those deaths in individuals aged 70 years and older.

My latest report, *The Chief Public Health Officer's Report on the State of Public Health in Canada 2020: From risk to resilience: An equity approach to COVID-19*, shows that individuals and groups such as seniors face disproportionately higher risks for infection and physical, social and mental health impacts from COVID-19 than others. Yet, by working together and continuing to explore and implement cross-sectoral actions to address both direct and indirect impacts of the pandemic, we can find pathways to create real and immediate change to protect and support our vulnerable populations now and in the future.

I am pleased to present *Aging and Chronic Diseases: A Profile of Canadian Seniors*. This report was developed before the current pandemic and focuses on the health and chronic disease patterns of Canadian seniors. It provides the data and scientific context we need to make evidence-based decisions to address chronic diseases, some of which increase the risk of severe COVID-19, and other challenges to the health of seniors. Going forward, we will monitor the impacts related to the comorbidity of COVID-19 and chronic diseases and other long-term consequences.

Canada's seniors make important contributions to families, communities and our country. With reliable information, a multisectoral approach and the engagement of older people from all walks of life, we can work towards improving their health and well-being.

**Dr. Theresa Tam**

Chief Public Health Officer  
Public Health Agency of Canada

# EXECUTIVE SUMMARY

The goal of this report is to increase knowledge on seniors' health by providing information and data on the prevalence of chronic diseases and conditions, associated disability and mortality and information on key individual and social determinants of health. It aims to inform stakeholders, policy makers and health care providers as they plan for, implement and evaluate policies, programs and practices intended to help seniors live healthy and fulfilling lives.

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## WHO ARE CANADIAN SENIORS?

This report defines Canadian seniors as people aged 65 years and older (65+) who live within the geographical boundaries of Canada.

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## AN AGING POPULATION

In 2019, there were 6.6 million seniors in Canada, almost one-fifth (17.5%) of the overall population. The population of seniors is projected to increase and reach close to one-fourth of the overall population by 2040. The oldest group of seniors, age 80+ years, is growing rapidly and represents a growing share of the senior population. The number of centenarians reached over 10,000 in 2019, with women accounting for 82% of those aged 100 and over.

Other demographic characteristics include:

- In 2017–2018, most seniors were living in population centres (79.5%). The largest share of seniors living in rural areas was in the Atlantic provinces (47.5%) and northern Canada (42.1%).
- More senior women (4.7%) than men (3.3%) lived below the low-income cut-offs in 2018.
- In 2015, 19.8% of seniors were employed (25.7% men and 14.6% women), the highest proportion since 1981.
- The population of seniors is diverse and growing more so. In 2017–2018, 4.6% identified as East or Southeast Asian, 3.1% as South Asian, 1.3% as Black, 0.7% as West Asian or Arab, 0.3% as Latin American and 2.3% as from other ethnic or cultural backgrounds.
- About 1.9% of seniors identified as Indigenous, specifically, First Nations, Métis or Inuit.
- Most Canadian seniors (92.1%) live in private dwellings in the community. About 7.9% live in residential care facilities such as residences for seniors or health care and related facilities.
- Almost one-third (27.9%) living in independent dwellings reported living alone. Of these, more than half were women.



## KEY FINDINGS

### 1. SENIORS' LIFE EXPECTANCY IS INCREASING AND THEY REPORT OVERALL GOOD HEALTH, ALTHOUGH THE RISK OF DEVELOPING CHRONIC DISEASES INCREASES WITH AGE.

The average 65-year-old Canadian can expect to live an additional 21.0 years (19.5 years for men and 22.3 years for women). However, women spent a greater proportion of their life post-65 years in an unhealthy state (30.9%) compared to men (27.7%).

In 2017–2018, almost half of Canadian seniors (46.5% of men and 48.3% of women) perceived their health as very good or excellent, and over two-thirds (72.0%) reported their mental health as very good or excellent, despite that many are living with chronic diseases. This apparent paradox reflects the fact that people's perception of personal health status is influenced by factors other than the absence of disease, such as economic security, social connectedness, satisfaction with life and psychological well-being. As such, some seniors may report good levels of health, despite living with chronic diseases.

### 2. CHRONIC DISEASE PATTERNS VARY BY SEX, AGE AND OVER TIME.

#### **Certain diseases occur more often in the senior population.**

About two-thirds (65.5%) of seniors were living with diagnosed hypertension, over half (52.0%) of those aged 65–79 had moderate-to-severe periodontal disease and over one-third (37.9%) of those aged 65+ were living with diagnosed osteoarthritis.

#### **The prevalence of most chronic diseases increases with age and over time.**

The prevalence of most chronic diseases and conditions increases with age. Among those aged 85+, the five diseases with the highest prevalence were hypertension (83.4%), osteoarthritis (54.0%), ischemic heart disease (IHD) [42.0%], osteoporosis (36.9%) and chronic obstructive pulmonary disease (COPD) [27.3%].

Although the age-standardized prevalence of the use of health services for mood and anxiety disorders declined from 13.1% in 2000–2001 to 10.5% in 2016–2017, it increased for the majority of the other diseases. The largest increases were seen for osteoporosis, diabetes, asthma, cancer and hypertension.

Certain chronic diseases are more common among women while others are more common among men.

Compared to men the same age, **WOMEN** aged 65+ are:



4.2x more likely to have diagnosed **osteoporosis**



1.9x more likely to have diagnosed **rheumatoid arthritis**



1.6x more likely to use health services for **mood and anxiety disorders**



1.5x times more likely to have diagnosed **dementia**



1.5x more likely to have diagnosed **asthma**



1.4x more likely to have diagnosed **osteoarthritis**

Compared to women the same age, **MEN** aged 65+ are:



2.7x more likely to have diagnosed **gout**



1.5x more likely to have diagnosed **IHD**



1.5x more likely to have diagnosed **parkinsonism**



1.3x more likely to have diagnosed **diabetes**



1.2x more likely to have diagnosed **cancer**



1.2x more likely to have diagnosed **heart failure**

### Many common chronic diseases are preventable or manageable.

Hypertension, which is one of the main risk factors for the development of heart disease and the most important risk factor for stroke, is largely preventable and manageable. Osteoarthritis, the most common form of arthritis, cannot be cured but interventions (including lifestyle modifications) can reduce pain, improve function and, in some instances, delay the progression of the disease.

Oral diseases, which are associated with many chronic diseases, are largely preventable and treatable. Over half (52%) of those aged 65–79 have moderate-to-severe periodontal diseases. Seniors face barriers accessing oral health care and treatment in part because they lose their dental insurance coverage upon retirement and are less likely to have consulted a dentist or another oral health professional in the last 12 months.

### **Falls are a major cause of injury, disability, hospitalization and premature mortality.**

In 2017–2018, approximately 350,000 seniors (or 5.8%) reported a fall-related injury in the past 12 months; almost two-thirds were women. Falls can affect a person's quality of life and lead to loss of mobility, hospitalization, longer hospital stay and death. Falls are preventable and their consequences can be avoided through multifactorial interventions that target multiple risk factors.

### **Over one-third of seniors have two or more chronic diseases.**

Conservative estimates from the 2017–2018 Canadian Community Health Survey (CCHS) indicate that about 37% of seniors report having at least two of the ten common chronic diseases described in this report, with almost half of those aged 85+ reporting multimorbidity. Women younger than 75 years were more likely to report multimorbidity than men the same age. Although many individuals living with one or more chronic diseases maintain a high level of functioning, living with multiple diseases can affect activities of daily living, reduce quality of life and increase mortality risk. It can also lead to additional challenges, including chronic pain and the use of multiple medications, which in turn has been linked to an increased risk of inappropriate drug use and adverse drug events.

### **Years lived with disability (YLD) vary and increase sharply with age for some diseases.**

Leading causes of YLD among seniors were diabetes, high systolic blood pressure, stroke, heart failure and COPD. YLD increases sharply with age for Alzheimer disease and other dementias, as well as for cardiovascular diseases (stroke, heart failure, high systolic blood pressure and ischemic heart disease).

### **While mortality rates have declined for most chronic diseases and conditions, some have increased.**

In 2017, the five leading causes of death due to a chronic disease among seniors were cancer, IHD, dementia, COPD and stroke. Since 2000, age-standardized mortality rates have declined by over 30% for most of the diseases described in this report. However, mortality rates due to dementia have increased by 59% while mortality rates due to Parkinson disease and hypertension have increased by about 26% and 12%, respectively, since 2000.

### **3. INDIVIDUAL LIFESTYLE BEHAVIORS INCREASE THE RISK OF DEVELOPING CHRONIC DISEASES.**

**Four key behavioural risk factors include tobacco use, harmful use of alcohol, unhealthy eating and physical inactivity.**

Compared to younger adults aged 20–64, seniors reported low rates of smoking in 2017–2018. Men aged 65+ were 1.2 times more likely to report smoking than women the same age.

Men aged 65+ were also 1.2 times more likely to report exceeding the low-risk alcohol drinking guidelines than women the same age.

In 2008–2009, women aged 65+ (37%) were more likely than men the same age (29%) to report being at nutritional risk, that is, to have poor nutritional intake. Older women aged 65–84 were about 1.6 times more likely than men the same age to report eating fruit and vegetables at least 5 times per day in 2017–2018.

Very few seniors (15.2%) aged 65–79 were physically active in 2016–2017 according to activity monitor data from the Canadian Health Measures Survey (CHMS). At the same time, 39.4% of seniors self-reported meeting the Canadian Physical Activity Guidelines in the 2017–2018 CCHS, which suggests that certain results have to be interpreted with caution.

**There are health risks associated with overweight and underweight.**

Although very few seniors (1.4%) reported a body mass index (BMI) in the underweight category, more senior women (1.8%) than men (1.1%) reported being underweight. Just over 30% of seniors reported having a normal weight, some 40.1% (43.7% of men and 37.0% of women) reported having a BMI within the overweight category and 28.1% in the obese category.

Overweight and obesity have been shown to increase the risk of developing many chronic diseases. Studies have also shown that underweight and obesity are associated with impairments in functional health. At the same time, a higher BMI can be protective against bone loss, fractures, cognitive decline and malnutrition when seniors have trouble eating or absorbing nutrients.

**Although just over half of Canadian seniors reported meeting the recommended sleep guidelines, sleep disturbances were common.**

Adequate and appropriate sleep is associated with better health and well-being. Some 29.6% of seniors reported sleeping less than the recommended 7 to 8 hours of sleep per day. About 46.8% (54.3% of women and 38.8% of men) reported having trouble falling sleep at least some of the time, and 28.6% reported difficulty staying awake during normal waking hours at least some of the time.

#### 4. OTHER HEALTH DETERMINANTS AFFECT THE RISK OF DEVELOPING CHRONIC DISEASES.

##### **Canadian seniors report strong levels of social support, social networks and social engagement, but social isolation is a growing concern.**

Up to 16% of Canadian seniors experience social isolation, and about 30% are at risk of becoming socially isolated. Having compromised health status or multiple chronic health problems are factors that may place seniors at risk of social isolation and loneliness.

##### **Creating age-friendly environments is one way to address the determinants of health.**

In age-friendly communities, the policies, services and structures related to the physical and social environments are designed to foster well-being and the participation of people as they age, and to prevent or delay the onset of disease and functional decline.

## DATA SOURCES AND PRESENTATION

The chronic diseases and conditions discussed in this report are selected based on their impact on the health of Canadian seniors. Health administrative and survey data are used to present the distribution of over 15 chronic diseases as well as the main individual and behavioural risk factors that affect health. Data are presented by sex wherever possible to reflect this important influence on life expectancy and risk factors, disease courses and outcomes. Due to data limitations, data are not presented by Indigenous or other ethnic identity.

Prevalence estimates for the majority of the chronic diseases discussed in this report were obtained from the Canadian Chronic Disease Surveillance System, the population coverage of which is nearly universal. For cancer, falls, as well as suicidal ideation, attempts and planning, prevalence estimates were obtained from the CCHS. Oral health data were obtained from the CHMS. Estimates from the Global Burden of Disease project were used to describe YLD for the different diseases while vital statistics were used for mortality estimates.

## MOVING FORWARD ON HEALTHY AGING

This report seeks to increase knowledge on chronic diseases among Canada's aging population. It also points to gaps and areas where data could be enhanced, such as for Indigenous seniors, new Canadians, seniors living at low income and with mental and physical challenges, and in residential care facilities (most of whom are in the oldest age groups and require care that cannot be met in the community). Enhancing data on the health and illness status of vulnerable seniors and select groups of seniors can further support and inform public health policy, programs and practices that promote healthy aging among Canada's diverse population of older adults.

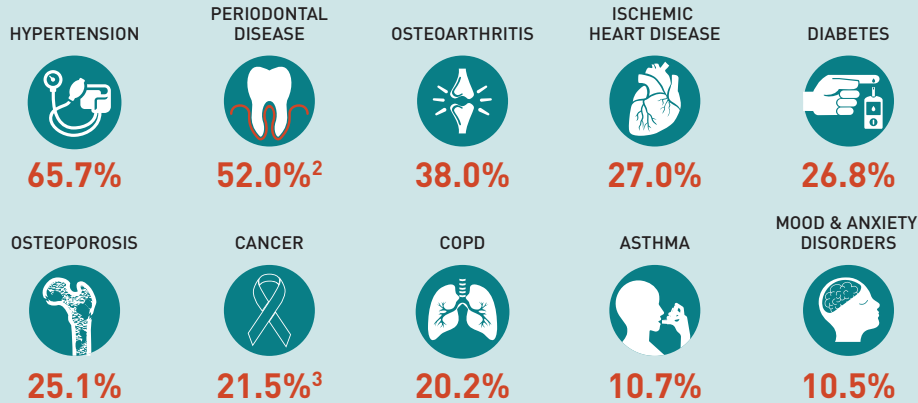
The findings in this report also emphasize the need to target the unique and diverse situations of seniors. Although the prevalence of most chronic diseases and conditions increases with age, many can be prevented, delayed or mitigated through supporting healthy behaviours and choices, the creation of age-friendly, safe and socially supportive environments and reducing health inequities faced by vulnerable seniors.

# PREVALENCE OF CHRONIC DISEASES AND RISK FACTORS AMONG CANADIANS AGED 65+

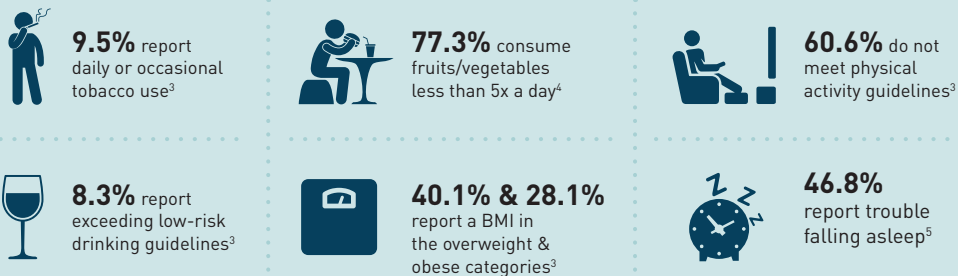
**73%** of individuals aged 65+ years have at least **1 of 10** common chronic diseases<sup>1</sup>



## PREVALENCE OF THE MOST COMMON CHRONIC DISEASES AND CONDITIONS



## PREVALENCE OF COMMON BEHAVIOURAL RISK FACTORS



To learn more about Chronic Diseases in Canada, visit [Canada.ca](http://Canada.ca)

Get Data from the [Public Health Infobase](#)

Like us on Facebook [@HealthyCdns](#)

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Prevalence data are from the Canadian Chronic Disease Surveillance System 2016–2017, except where noted:

<sup>1</sup> The ten selected chronic conditions described include heart disease, stroke, cancer [ever had], asthma, chronic obstructive pulmonary disease, diabetes, arthritis, Alzheimer disease or other dementia, mood and anxiety disorders. Data are self-reported from the Canadian Community Health Survey 2017–2018.

<sup>2</sup> Canadian Health Measures Survey 2007–2009 (ages 65–79 years).

<sup>3</sup> Canadian Community Health Survey 2017–2018.

<sup>4</sup> Canadian Community Health Survey 2015–2016.

<sup>5</sup> Canadian Health Measures Survey 2007–2015 (ages 65–79 years).

Abbreviations: BMI = body mass index; COPD = chronic obstructive pulmonary disease.

# INTRODUCTION

Canada’s population is aging. In 2016, for the first time in Canada’s history, seniors outnumbered children and youth under 15 years of age.<sup>(1)</sup> In 2019, there were 6.6 million seniors in Canada, almost one-fifth (17.5%) of the overall population.<sup>(1)</sup> The population of seniors is projected to increase to about 10.7 million by 2040,<sup>(2)</sup> close to one-fourth of the overall population.

While seniors are living longer and with more years in good health, population aging also means an increase in the number of people living with chronic diseases and conditions.

## GOAL OF THIS REPORT

The goal of this report is to improve our knowledge on seniors’ health by providing information and data on chronic diseases and conditions as well as on key individual and social determinants of health. This report aims to inform stakeholders, policy makers and health care providers as they plan for, implement and evaluate policies, programs, and practices intended to help seniors live healthy and fulfilling lives.

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### WHO ARE CANADIAN SENIORS?

This report defines Canadian seniors as people aged 65 years and older (65+) who live within the geographical boundaries of Canada.

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## SENIORS ARE A DIVERSE GROUP

Canada’s seniors are not a homogenous group. The life experiences, disease profiles and determinants of health of people aged 65 can differ tremendously from those of people in their 80s or 90s. Even though age per se does not determine health status, where possible, data were disaggregated into three age groups: 65–74, 75–84 and 85+ years.

Data are presented by sex wherever possible to reflect the fact that sex has an important influence on life expectancy and exposures to various risk factors, disease courses and outcomes. Due to data limitations, data are not presented by Indigenous or ethnic identity, or by socioeconomic status (e.g. income, education).

## DATA SOURCES

The chronic diseases and conditions discussed in this report are selected based on their impact on the health of Canadian seniors. Administrative health and survey data are used to present the distribution of over 15 chronic diseases and other health outcomes, as well as the main individual and behavioural risk factors that influence health.

Prevalence estimates for the majority of the chronic diseases included in this report were obtained from the Canadian Chronic Disease Surveillance System (CCDSS). The CCDSS collects data on all Canadian residents who are eligible for provincial or territorial health insurance, making its population coverage near universal. For cancer, falls, as well as suicidal ideation, attempts and planning, prevalence estimates were obtained from the 2017–2018 Canadian Community Health Survey. Oral health data were obtained from the 2007–2009 Canadian Health Measures Survey. The prevalence of a number of other diseases and conditions that were outside the scope of this report is also presented (see Appendix 4, Tables A and B).

Estimates from the Global Burden of Disease project were used to describe years lived with disability for the different diseases, where possible, while vital statistics were used for mortality estimates.

In interpreting the findings in this report, it is important to remember that these results are based on administrative health data and self-reported information from cross-sectional surveys. Although the coverage of the CCDSS is near universal, only data of those individuals who have sought care during the capture period are included. As for survey data, these only capture people living independently in the community and do not include the 8% of seniors who live in residential care facilities who are generally older and in poorer health.

## ORGANIZATION OF THIS REPORT

- The Introduction describes the scope of the report and its main data sources.
- Chapter 1 provides a brief demographic overview of the population of seniors in Canada.
- Chapter 2 provides a summary of seniors' general health status.
- Chapter 3 provides key statistics on chronic diseases, conditions and other health outcomes, as well as multimorbidity (i.e. the co-occurrence of two or more diseases in the same individual).
- Chapter 4 looks at key determinants of health and disease and provides information on individual and behavioural determinants of health, and discusses the broader influence of social determinants of health.
- The Concluding Remarks offers an overview of the report's key findings.
- Appendix 1 provides a glossary listing the terms used in this report.
- Appendix 2 provides detailed methodological notes.
- Appendix 3 summarizes overall prevalence, years lived with disability and mortality trends for selected chronic diseases and conditions.
- Appendix 4 provides an overview of the prevalence of selected chronic diseases and conditions by sex and age group.
- Appendix 5 lists the contributors to this report.





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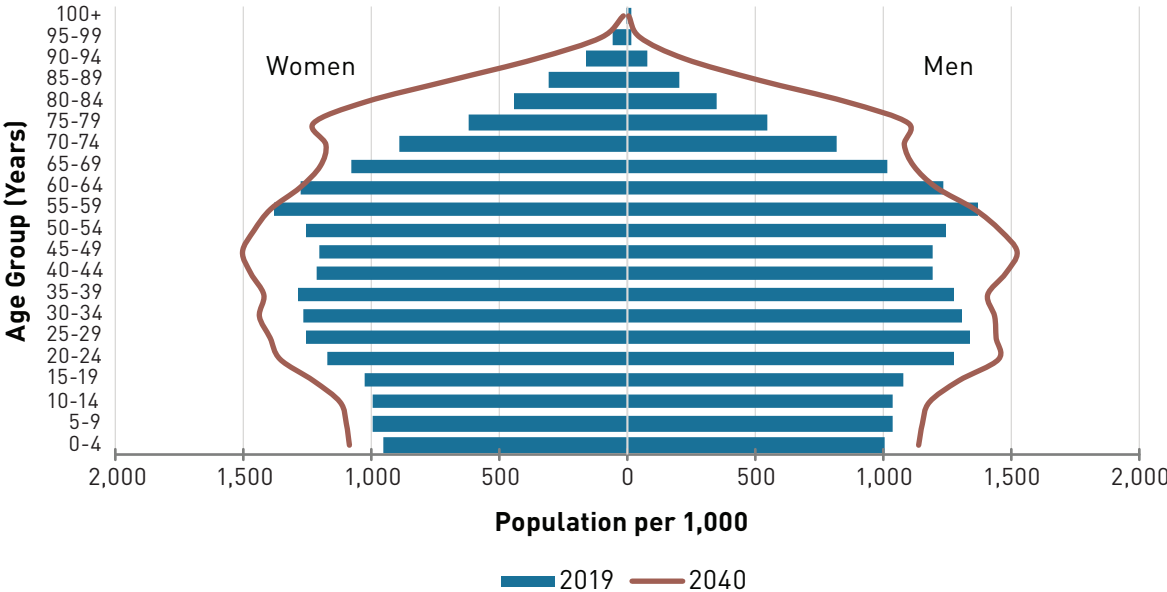
# A PROFILE OF CANADA'S SENIORS

# DEMOGRAPHIC SHIFT

Canada’s population demographic has changed dramatically since the 1950s. With a total fertility rate of 1.54 children per woman in 2016 (down from 3.94 in 1959), declining mortality rates, important gains in life expectancy and the aging of baby boomers (those born between 1946 and 1965), a demographic shift is being observed.<sup>[3-6]</sup> In fact, the proportion of seniors is continually increasing while that of children and youth is decreasing. As such, the proportion of seniors (17.5%) now exceeds the proportion of children younger than 15 years old (16.0%) and could reach 22.7% in 2031.<sup>[1,7]</sup>

In 2019, around 6.6 million seniors (54.0% women and 46.0% men) were living in Canada according to the most recent population estimates.<sup>1</sup> Over half (57.7%) were aged 65–74, 29.6% were aged 75–84 and 12.7% were aged 85+. It is estimated that population aging will accelerate over the next two decades as baby boomers continue to age. According to medium-growth scenarios, there could be about 10.7 million seniors by 2040. (Figure 1.1).<sup>[2]</sup> The number of people aged 80+ is also increasing and will account for a growing proportion of the senior population in future decades.<sup>[8]</sup> Moreover, for the first time in Canada’s history, the number of centenarians (those aged 100+) has reached over 10,000 in 2019 with women accounting for 82%.<sup>[7]</sup> Although they will still account for a small proportion of all seniors (i.e., 0.2% or less), centenarians are expected to be the fastest-growing age group over the next 50 years.<sup>[8]</sup>

**FIGURE 1.1**  
Population estimates as of July 1 (x 1,000), 2019 and 2040, by sex and age group, Canada



Source: Statistics Canada. Table 17-10-0057-01 Projected population, by projection scenario, age and sex, as of July 1 (x 1,000).

# SOCIODEMOGRAPHIC COMPOSITION

Senior men and women in Canada have a similar demographic profile, although some differences are worth noting: women are more likely to live in population centres, more likely to live below low-income cut-offs, more likely to be retired or not working full-time, less likely to be married or in common-law partnerships and more likely to live alone (Table 1).

**TABLE 1.**  
Selected socioeconomic and demographic characteristics of Canadian seniors aged 65+

	PERCENTAGE (%)		
	MEN (95% CI)	WOMEN (95% CI)	TOTAL (95% CI)
Living in a population centre	77.6 (76.7–78.6)	81.0 (80.1–82.0)	79.5 (78.7–80.3)
Low income*	3.3 (NA)	4.7 (NA)	4.0 (NA)
Employed†	25.7 (NA)	14.6 (NA)	19.8 (NA)
White (identity)	85.1 (84.0–86.2)	86.3 (85.3–87.3)	85.7 (85.0–86.5)
Immigrant or non-permanent resident	29.6 (28.4–30.8)	27.6 (26.5–28.7)	28.5 (27.7–29.3)
Married or in common-law relationship	77.4 (76.2–78.6)	53.1 (51.7–54.5)	64.4 (63.3–65.4)
Living alone	19.0 (17.9–20.1)	35.6 (34.2–37.0)	27.9 (26.9–29.0)

\* Low income refers to low-income cut-offs after tax, 1992 base.<sup>(9)</sup>

† Employed refers to someone reporting being in the paid labour market at some point in 2015.<sup>(10)</sup>

**Abbreviations:** CI = confidence interval; NA = not available.

**Note:** The 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Sources:** All estimates are from the 2017–2018 Canadian Community Health Survey, except statistics about low income<sup>(9)</sup> and information about working status.<sup>(10)</sup>

For further information on the data sources used in this chapter and throughout the report, refer to Appendix 2.

## PLACE OF RESIDENCE

According to the 2017–2018 CCHS, over three-quarters (79.5%) of Canadian seniors living in private dwellings reported living in a population centre. Fewer of those lived in a population centre in the Atlantic provinces (52.5%) and in the three territories (57.9%), whereas approximately 80% lived in a population centre in other regions of Canada, with the highest proportion in British Columbia (85.6%). Overall, a greater proportion of senior women than men lived in population centres (81.0% vs. 77.6%).

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A population centre is an area with at least 1,000 persons and no fewer than 400 persons per square kilometer. All areas outside population centres are defined as rural.<sup>(11)</sup>

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## INCOME

The proportion of seniors living below the low-income cut-offs declined from 7.6% in 2000 to 4.0% in 2018.<sup>(9)</sup> In that year, more senior women than men (4.7% vs. 3.3%) lived below low-income cut-offs, a differential that has declined over time but still persists. Seniors living in low income may have poorer health outcomes due to lack of nutritious foods, experience housing insecurity and have limited access to affordable transportation and non-insured health services.<sup>(12)</sup>

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Low-income cut-offs, one possible measure of low income, are income levels below which a family will likely spend a larger percentage of their income on food, shelter and clothing than the average family.

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## WORKING STATUS

More and more seniors are now working past the age of 65. One-fifth (19.8%) reported employment in the labour market at some point in 2015. More men (25.7%) than women (14.6%) reported working.<sup>(10)</sup> At 5.9%, the proportion of seniors reporting working full-time for the full year in 2015 was the highest since 1981. Seniors with a university degree, those without private retirement income and those living in rural areas were more likely to work than other seniors.

## ETHNIC AND CULTURAL ORIGINS AND IMMIGRANT STATUS

In 2017–2018, 85.7% of seniors living in private dwellings identified as White, 4.6% as East or Southeast Asian, 3.1% as South Asian, 1.3% as Black, 0.7% as West Asian or Arab, 0.3% as Latin American and 2.3% as from other ethnic or cultural backgrounds.

Almost 2.0% (1.9%) of seniors living in private dwellings identified as one of the Indigenous peoples of Canada (First Nations, Métis and Inuit) in 2017–2018. Although they are about 10 years younger than the rest of Canadians, their population is rapidly aging and seniors will constitute a larger portion of First Nations, Métis and Inuit populations in coming years.<sup>(13)</sup>

About 28.5% of seniors reported themselves as landed immigrants or non-permanent residents, while 71.5% said they were Canadian born.

## MARITAL STATUS

In 2017–2018, approximately 64.4% of seniors living in private dwellings reported being married or living in common-law partnerships, while 18.7% were widowed, 11.1% were separated or divorced and 5.9% were single or never married.

## LIVING ARRANGEMENTS

In 2017–2018, 72.1% of seniors reported living with others (with a partner, children, relatives and/or nonrelatives). However, 27.9% reported living alone, and of these, more than half were women.

Most seniors (92.1%) reported living in private dwellings in the community. About 7.9% were living in residential care facilities, for example, residences for senior citizens or retirement homes or health care facilities. These proportions have remained stable since 2001 when 92.6% of seniors lived in private dwellings and 7.4% lived in residential care facilities.<sup>(14)</sup>

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**Most seniors do not live in long-term care institutions. In fact, over 92% live in private dwellings.<sup>(14)</sup>**

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## SUMMARY

About 6.6 million seniors were living in Canada in 2019, almost one-fifth (17.5%) of the overall population. The population of seniors is projected to increase to about 10.7 million by 2040, close to one-fourth of the overall population. The population aged 80+ is growing fast and the centenarian population (those aged 100+) is growing even faster. The number of centenarians reached over 10,000 in 2019, with women accounting for 82% of those aged 100 and over.

Examining a few selected demographic characteristics, we found that:

- Most seniors (79.5%), and a higher proportion of women than men (81.0% vs. 77.6%), lived in population centres.
- More senior women (4.7%) than men (3.3%) lived below the low-income cut-offs.
- Approximately 19.8% of seniors, 25.7% of men and 14.6% of women, reported working at some point in 2015, the highest proportion since 1981.
- Some 4.6% of seniors living in private dwellings identified as East Asian or Southeast Asian and another 3.1% as South Asian.
- Almost 2.0% (1.9%) of seniors living in private dwellings identified as one of the Indigenous peoples of Canada (First Nations, Métis and Inuit).
- Most seniors lived with a partner although almost one-third of seniors living in independent dwellings reported living alone. Of these, more than half were women.
- Most seniors (92.1%) lived in private dwellings in the community.



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# AGING AND HEALTH

In comparison with other member states of the Organisation for Economic Co-operation and Development, Canada ranks among the top and middle third countries for many health indicators.<sup>(15)</sup> Life expectancy (LE) and health-adjusted life expectancy (HALE) are steadily increasing and mortality rates continue to decline for many chronic diseases. Nonetheless, gaps remain and seniors are particularly affected.

## LIFE EXPECTANCY AND HEALTH-ADJUSTED LIFE EXPECTANCY

LE has been steadily increasing over time. In 2015–2017, life expectancy at birth was 82.1 years, with the average 65-year-old Canadian expecting to live an additional 21.0 years (Figure 2.1).

However, when HALE is taken into account, only 15.0 of those 21.0 years will be lived in full health (Figure 2.1). Senior women at age 65 years lived an additional 22.3 years, longer than senior men (19.5 years). Senior women also lived longer in full health (15.4 years) compared to senior men (14.1 years) (data not shown).

However, in assessing the proportion of life spent in an unhealthy state, i.e., difference between LE and HALE proportional to LE, it was found that similar to previous years and findings from other studies,<sup>(16,17)</sup> women spent a greater proportion of their life post-65 years in an unhealthy state (30.9%) compared to men (27.7%).

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Life expectancy measures the average number of years a person would be expected to live, based on a set of age-specific death rates in a given observation period.

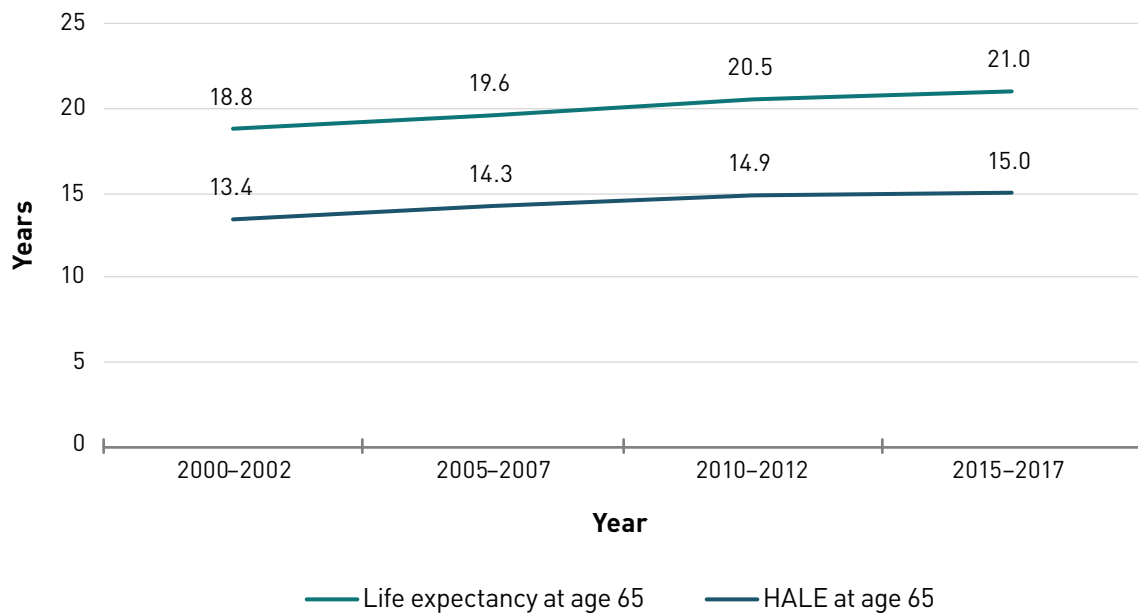
Health-adjusted life expectancy represents the number of expected years of life equivalent to years lived in full health, based on the average experience in a population.

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**FIGURE 2.1**

Life expectancy and health-adjusted life expectancy at age 65, Canada, 2000–2002 to 2015–2017



Abbreviation: HALE = health-adjusted life expectancy.

Source: Statistics Canada. Table 13-10-0370-01. Health-adjusted life expectancy, by sex.<sup>[6]</sup>

## SELF-REPORTED HEALTH

The World Health Organization defines health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”.<sup>(18)</sup> According to data from the 2017–2018 CCHS, about 47.5% of seniors (46.5% of men and 48.3% of women) perceived their health as very good or excellent. This is lower than the population aged 20–64 years (62.8%).

## MENTAL HEALTH

The Public Health Agency of Canada defines positive mental health as the capacity to feel, think and act in ways that enhance enjoyment of life and coping with challenges.<sup>(19)</sup>

In 2017–2018, about 72.0% of seniors (73.0% of men and 71.1% of women) perceived their mental health as very good or excellent. In comparison, fewer adults aged 20–64 reported their mental health as very good or excellent (68.5%). Older seniors aged 85+ were the least likely to report good or very good mental health (63.1%) (Figure 2.2).

In 2017–2018, about 90.8% of seniors reported being very satisfied or satisfied with their life, but this proportion decreased to 86.4% among those aged 85+ (Figure 2.2). Overall, 86.9% of seniors reported being happy every day or almost every day (CCHS 2015, provincial data only). About three-quarters of those aged 20–64 (76.0%) reported high psychological well-being; this proportion was even higher among seniors—80.8% (82.0% of men and 79.7% of women) (CCHS 2015, provincial data only).

About three-quarters of seniors (76.1%) reported a strong or very strong sense of belonging to a local community, compared to 65.4% of adults aged 20–64 (CCHS 2017–2018) (Figure 2.2). Further, findings from the 2012 CCHS Mental Health show that most seniors reported a high level of coping (54.8%), which is similar to the adult population average (56.9%).<sup>(19)</sup>

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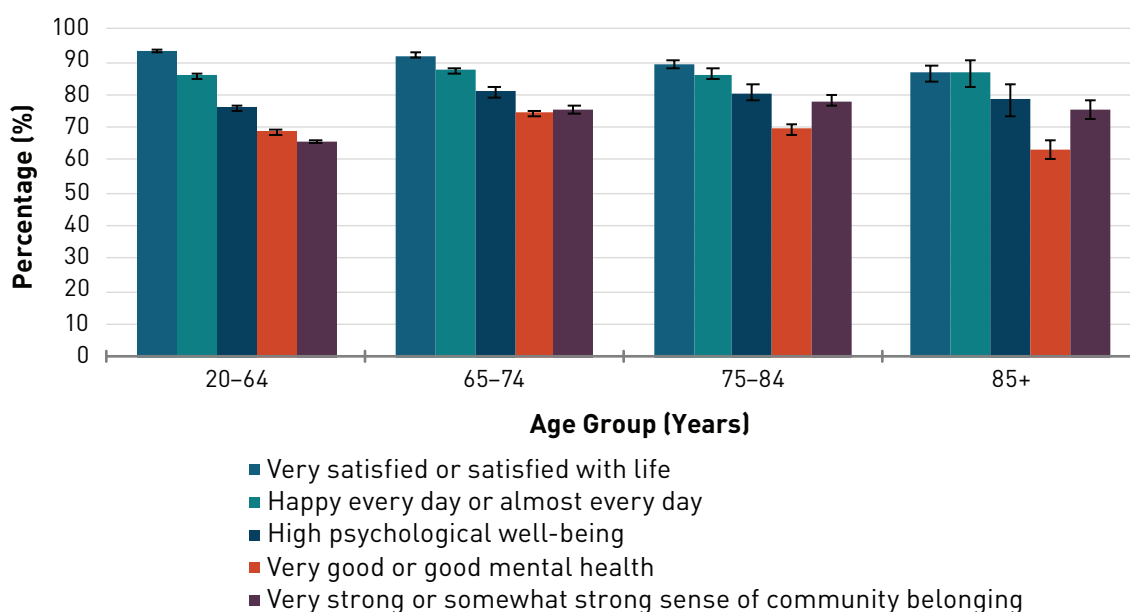
### **MOST SENIORS MAINTAIN GOOD MENTAL HEALTH**

Mental health problems and illnesses are not a natural consequence of aging. While the unique physical, psychological and social changes associated with aging may individually and together result in mental health problems or illnesses, most seniors maintain good mental health.<sup>(20)</sup>

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**FIGURE 2.2.**

Prevalence of adults self-reporting positive mental health outcomes, household population aged 20+ years, by age group, Canada\*, 2015 and 2017–2018



\* Data from the territories are not available for the 2015 Canadian Community Health Survey.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Sources:** Canadian Community Health Survey, 2017–2018 (self-perceived life satisfaction, mental health and community belonging); Canadian Community Health Survey, 2015 (self-perceived happiness and psychological well-being).

## SUMMARY

Canadian seniors are living longer, an additional 21.0 years (19.5 years for men and 22.3 years for women). However, women spent a greater proportion of their life post-65 years in an unhealthy state (30.9%) compared to men (27.7%).

Most seniors living in the community report overall good health. In 2017–2018, almost half (46.5% of men and 48.3% of women) perceived their health as very good or excellent and over two-thirds (72.0%) reported their mental health as very good or excellent; this proportion declined with age.

Health is a subjective concept and does not simply relate to the absence of disease or disability. As such, some individuals living with chronic diseases may report higher levels of physical and mental health than others who are free of disease. Many factors can influence how a person perceives their health status, for example, their age, socioeconomic status and psychological well-being.<sup>(21)</sup>



3

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## **CHRONIC DISEASES AND CONDITIONS, OTHER HEALTH OUTCOMES, AND MULTIMORBIDITY**

With lifestyle changes, medication use and supportive environments, many individuals living with one or more chronic diseases can maintain a high level of functioning and still live fulfilling lives. Nonetheless, the consequences of living with chronic diseases are far reaching and can affect activities of daily living, reduce quality of life and increase mortality risk.<sup>(22,23)</sup>

This chapter presents the profile of chronic diseases among seniors in Canada. The chronic diseases, conditions and health outcomes explored in this chapter were selected based on their prevalence, their impact on the lives of seniors and data availability. They include cancer, cardiovascular diseases, diabetes, hypertension, mental illness and suicide, musculoskeletal disorders, neurological diseases, oral diseases, respiratory diseases, falls and multimorbidity.

Age-standardized prevalence trends and prevalence rates by age group and sex, where available, are reported for each disease or condition. Data primarily come from the Canadian Chronic Disease Surveillance System (CCDSS), but also from the Canadian Community Health Survey (CCHS) and the Canadian Health Measures Survey (CHMS). Other common chronic conditions that affect seniors, for example, back problems, urinary incontinence and bowel disorders are outside the scope of this report, but prevalence estimates for these conditions from the 2015–2016 and 2017–2018 CCHS can be found in Appendix 4, Tables A and B.

Years lived with disability (YLD) (i.e. burden of living with a disease or disability) are reported by age group and sex. These data come from the Global Burden of Disease Study. Age-standardized mortality trends and the number of deaths are presented for each of these conditions, where relevant. Data come from the Canadian Vital Statistics Death Database and causes of death are classified based on the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10). Finally, multimorbidity (i.e. the co-occurrence of two or more diseases in the same individual) is reported by age and sex using data from the CCHS.

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Age-standardization is a technique used to allow a comparison of rates over time or across different geographical areas. It accounts for the differences in the age structure of the populations being compared.

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## 3.1

# CANCER

Cancer is a complex disease process caused by cumulative DNA damage.<sup>[24]</sup> It is characterized by an uncontrolled growth and spread of abnormal cells anywhere in the body. There are more than 100 different types of cancer, but the four most common types (lung, colorectal, breast and prostate cancer) account for about half of all cases diagnosed in Canada.<sup>[25]</sup> Cancer is a leading cause of morbidity and the most common cause of death in Canada—nearly 1 in 2 Canadians will develop cancer in their lifetime and about 1 in 4 will die of the disease.<sup>[25]</sup>

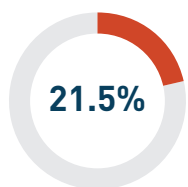
Since DNA damage accumulates with age, the risk of developing and dying from most types of cancer increases with age. Despite this, the risk levels off in the oldest age groups. Reasons for this decline are unclear, but it is hypothesized that oldest individuals may be asymptomatic or even less susceptible to cancer growth. Further, cancers may be undiagnosed in the very old due to reduced frequency of diagnostic testing and screening.<sup>[26]</sup>

Modifiable behavioural risk factors associated with the development of cancer include:<sup>[25,27]</sup>

- Smoking;
- Physical inactivity;
- Harmful use of alcohol;
- Diet low in fruits and vegetables and high in red and processed meat; and
- Overweight and obesity.

Cancer risk can also be reduced by practising sun safety and avoiding indoor tanning; getting vaccinated against cancer-causing infections; participating in cancer screening programs and getting treated for precancerous conditions; ensuring household radon levels are safe; and wearing appropriate protective equipment when exposed to carcinogens.<sup>[25,27]</sup>

## PREVALENCE

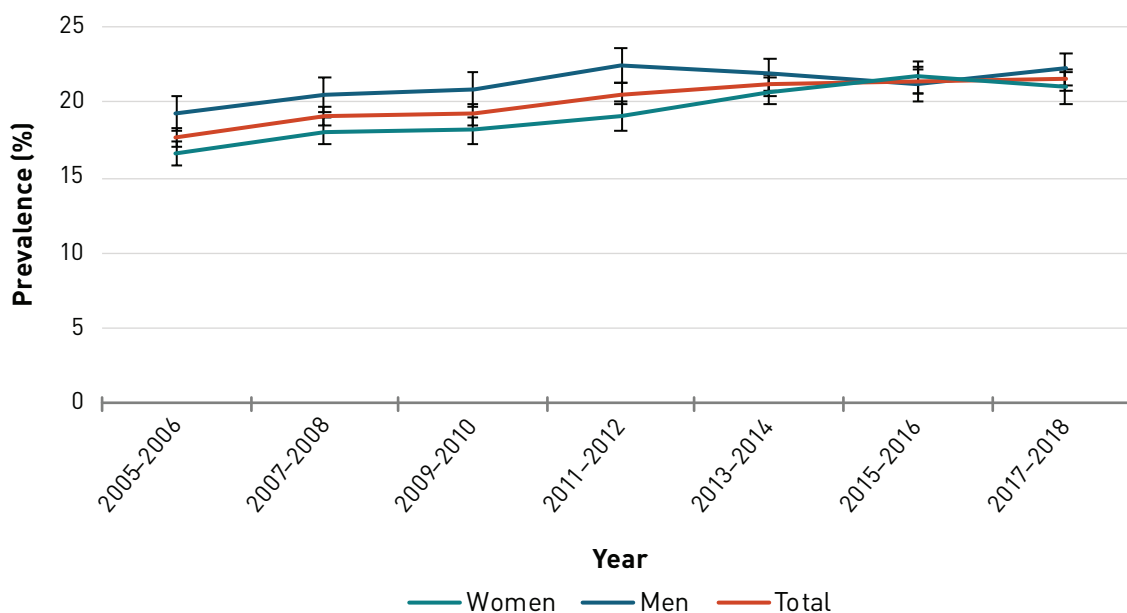


About **1.3 million** or **21.5%** of Canadian seniors (65+) reported ever being diagnosed with cancer in 2017–2018.

The age-standardized prevalence of seniors reporting being diagnosed with cancer at some point in their lifetime increased from 17.7% in 2005–2006 to 21.5% in 2017–2018 (Figure 3.1.1).

**FIGURE 3.1.1.**

Age-standardized\* lifetime prevalence of self-reported cancer, 65+ years, Canada, 2005–2006 to 2017–2018



\* Estimates are age-standardized to the 2011 final postcensal Canadian population, released in 2013, using 5-year age groups up to 85+.

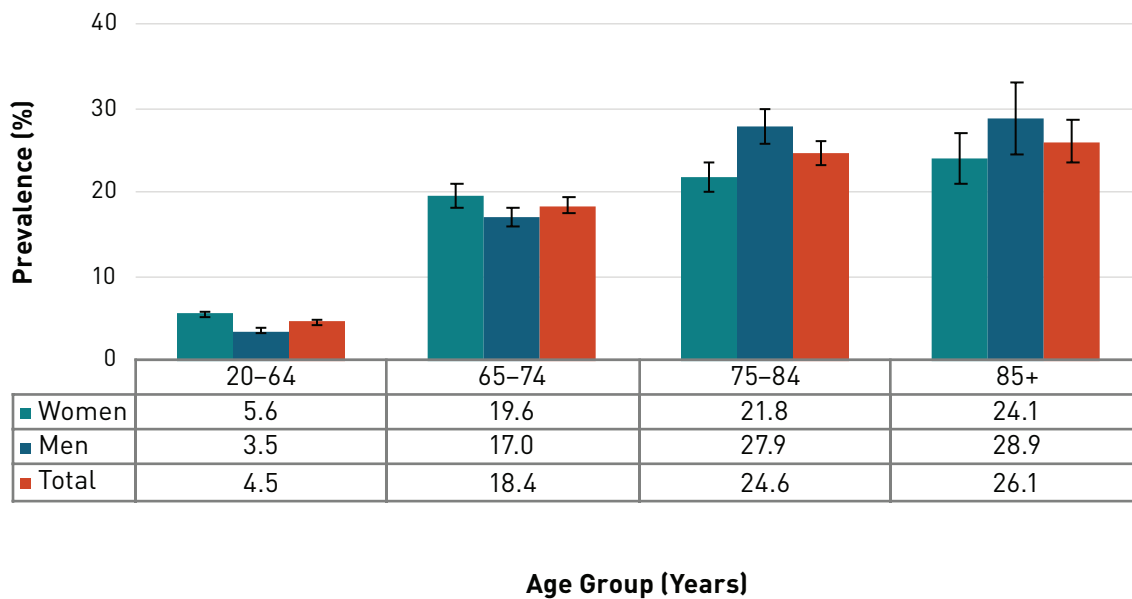
**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Canadian Community Health Survey combined annual files 2005–2006 to 2017–2018.

In 2005–2006, men aged 65+ were 1.2 times more likely than women the same age to report ever being diagnosed with cancer. After 2011–2012, this differential decreased. Sex differences in the rate of new cancer cases and cancer survival, both of which impact the prevalence of cancer, may explain this pattern. Specifically, the rate of new cancer cases is declining faster in men than women, and cancer survival is generally better in women than men.<sup>[25]</sup>

The prevalence of reporting ever being diagnosed with cancer increased with age and, at 26.1%, was highest in those aged 85+ in 2017–2018 (Figure 3.1.2).

**FIGURE 3.1.2.**  
Lifetime prevalence of self-reported cancer, by sex and age group, Canada, 2017–2018



**Note:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Canadian Community Health Survey combined annual files 2017–2018.

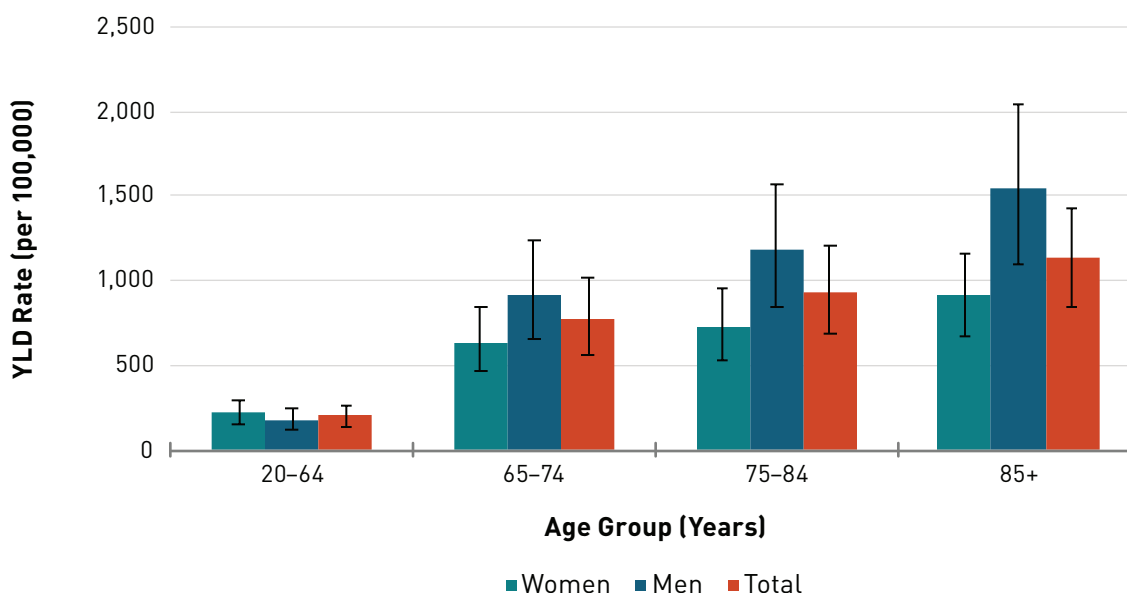


## DISABILITY

For both sexes, the YLD rate due to neoplasms (i.e., any new and abnormal growth of cells) was 868.8 per 100,000 seniors in 2017. Rates increased with age and reached a peak in men and women aged 85+ (Figure 3.1.3).

**FIGURE 3.1.3.**

Years lived with disability due to neoplasms, rates per 100,000, by sex and age group, Canada, 2017



**Abbreviation:** YLD = years lived with disability.

**Notes:** The error bars indicate 95% uncertainty interval. The 95% uncertainty interval is determined by the 25<sup>th</sup> and 975<sup>th</sup> value of the 1,000 values ordered from smallest to largest.

Neoplasms include both malignant and non-malignant neoplasms; non-malignant neoplasms account for less than 4% of the sex- and age-specific YLD reported in 2017.

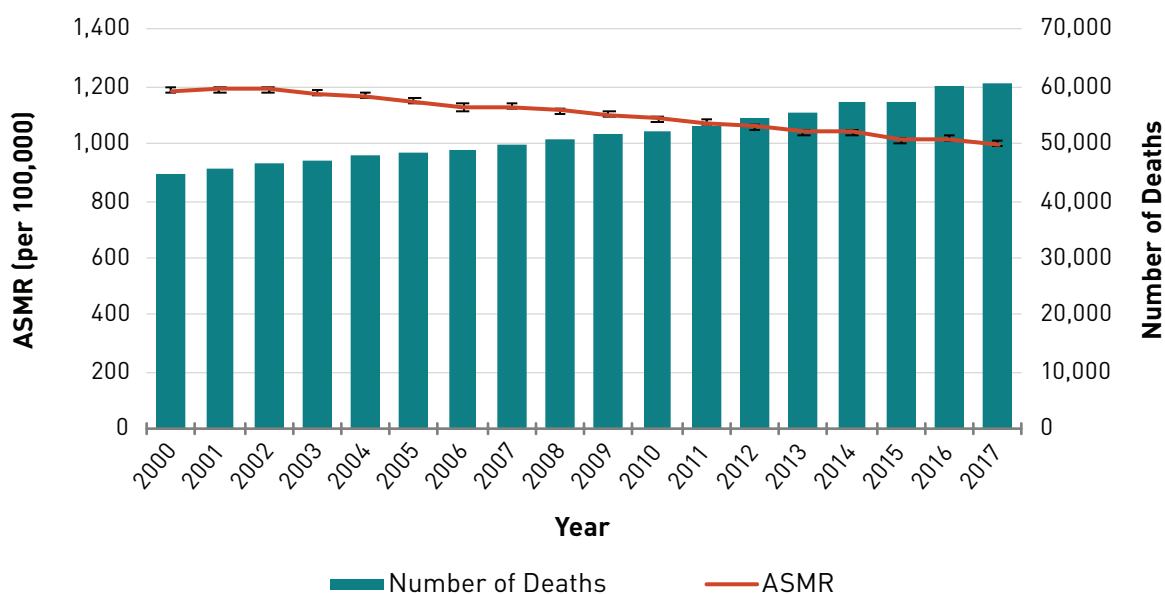
**Source:** Global Burden of Disease Collaborative Network, 2017.

## MORTALITY

Among Canadian seniors, the age-standardized mortality rate (ASMR) [per 100,000] due to cancer decreased by 15.9% from 1,186.7 in 2000 to 997.8 in 2017. The number of deaths due to cancer, however, increased from 44,565 in 2000 to 60,655 in 2017 as a result of the growing and aging Canadian population (Figure 3.1.4).

**FIGURE 3.1.4.**

Age-standardized\* mortality rates and number of deaths due to cancer, population 65+ years, Canada†, 2000–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013.

† 2017 mortality data are not available for Yukon.

**Abbreviation:** ASMR: age-standardized mortality rate.

**Notes:** The 95% confidence interval shows an estimated range of values that is likely to include the true value 19 times out of 20. ICD-10 codes: C00–C97.

**Source:** Canadian Vital Statistics—Death Database, 2000–2017.

## 3.2

# CARDIOVASCULAR DISEASES

## ISCHEMIC HEART DISEASE

Ischemic heart disease (IHD), also known as coronary artery disease and coronary heart disease, is a condition in which the heart muscle is damaged or does not function effectively.

IHD develops over decades. Plaque, which is composed of fat, cholesterol, calcium and other substances, builds up on the inner walls of coronary arteries, leading to narrowed arteries. As a result, less blood and therefore oxygen reaches the heart muscle, which can lead to heart attack or stroke.<sup>[28]</sup>

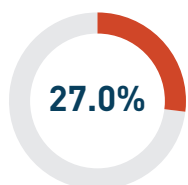
Modifiable behavioural and metabolic risk factors associated with the development of IHD include:<sup>[29]</sup>

- Abdominal obesity;
- Smoking;
- Physical inactivity;
- Harmful use of alcohol;
- Unhealthy diet;
- Hypertension;
- Diabetes (type 2);
- High blood cholesterol; and
- Psychosocial factors.

Other risk factors associated with the development of IHD include:<sup>[30-36]</sup>

- Age—the risk of IHD increases with age;
- Sex—men in all age groups are more likely to be diagnosed with IHD than women, although outcomes are often worse in women;
- Ethnic or cultural origin—Indigenous populations, as well as Canadians of South Asian descent, are at increased risk of IHD; and
- Family history of IHD.

## PREVALENCE

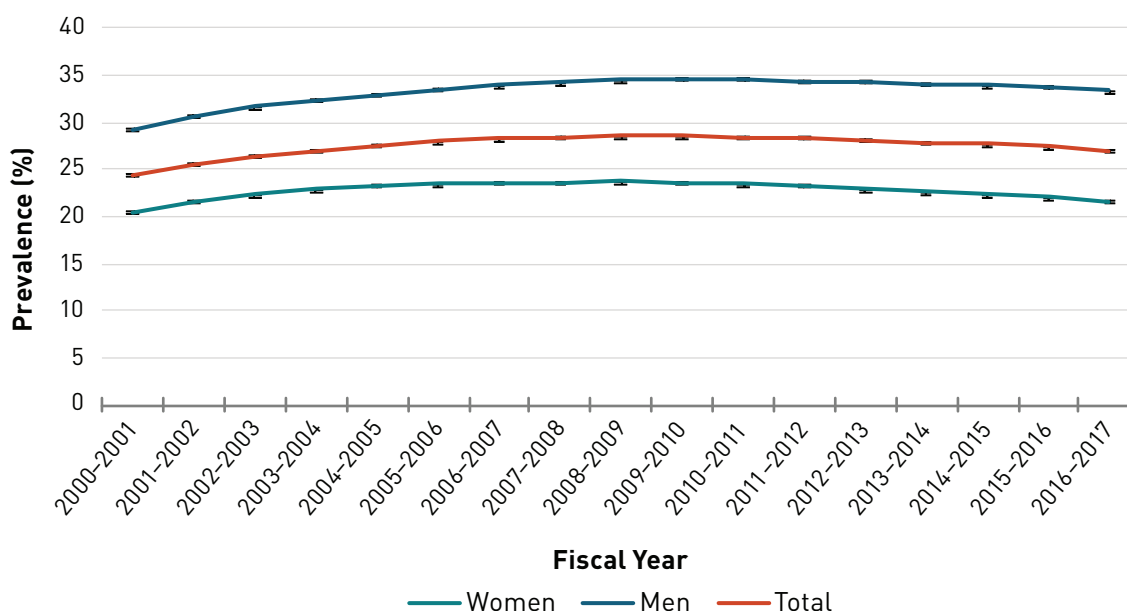


About **1.7 million** or **27.0%** of Canadian seniors (65+) were living with diagnosed IHD in 2016–2017.

The age-standardized prevalence of diagnosed IHD in seniors increased from 24.3% to 28.1% between 2000–2001 and 2012–2013, and then decreased to 27.0% in 2016–2017 (Figure 3.2.1).

**FIGURE 3.2.1.**

Age-standardized\* prevalence of diagnosed ischemic heart disease, 65+ years, Canada†, 2000–2001 to 2016–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013 using 5-year age groups.

† Data from Nunavut were excluded before fiscal year 2005–2006. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

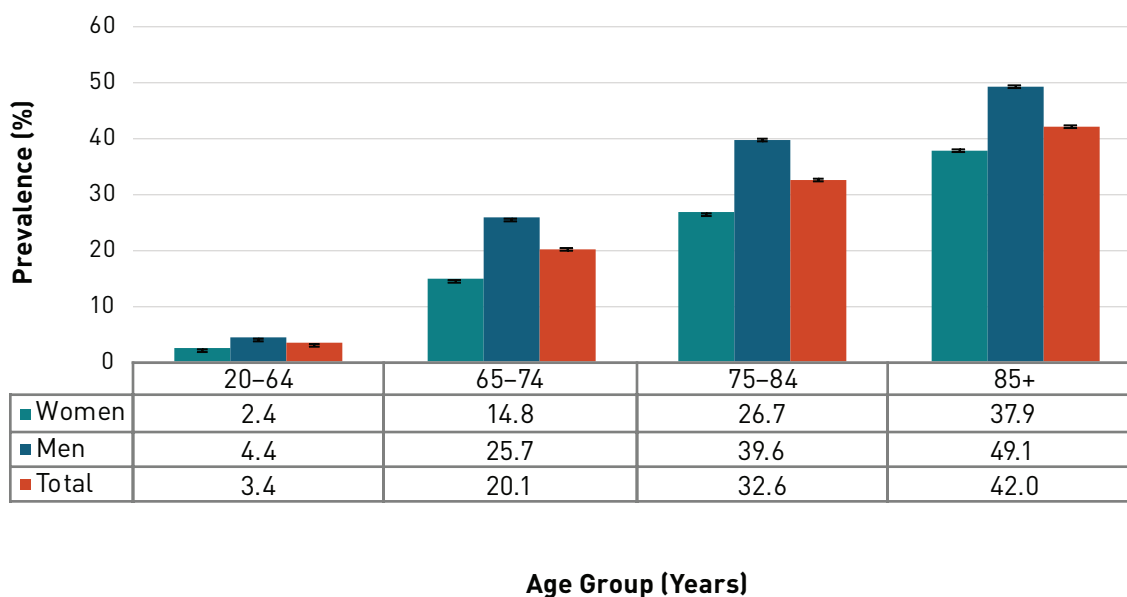
**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

In 2016–2017, men aged 65+ were 1.5 times more likely than women the same age to have diagnosed IHD.

The prevalence of diagnosed IHD increased with age and, at 42.0%, was the highest in those aged 85+ in 2016–2017 (Figure 3.2.2).

**FIGURE 3.2.2.**

Prevalence of diagnosed ischemic heart disease, by sex and age group, Canada<sup>†</sup>, 2016–2017



<sup>†</sup> Data from Nunavut were excluded before fiscal year 2005–2006. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

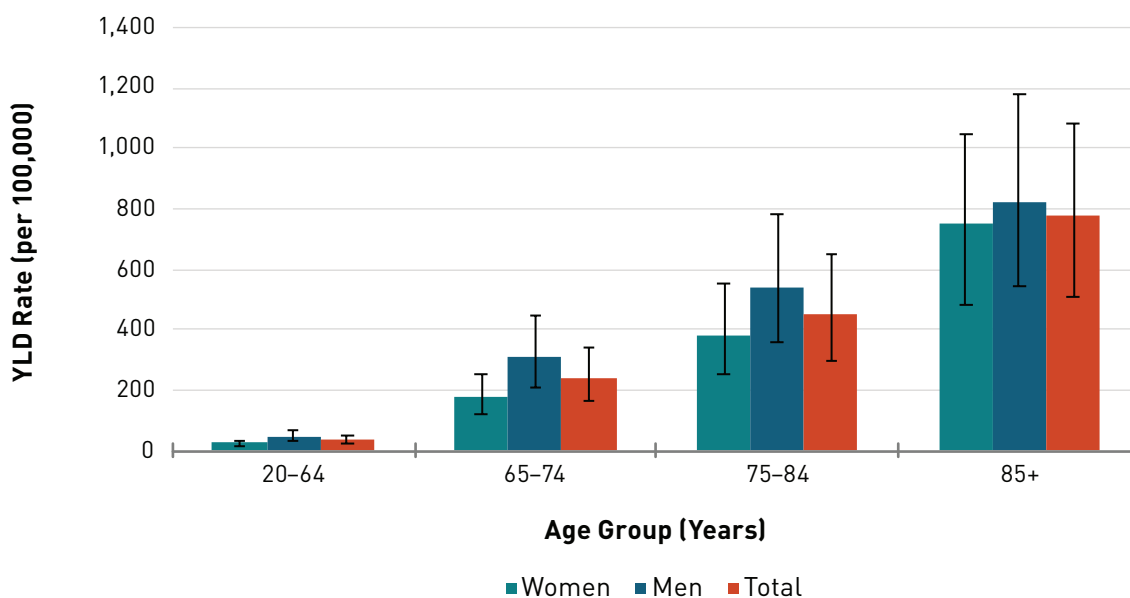
**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

## DISABILITY

For both sexes, the YLD rate due to IHD was 373.5 per 100,000 seniors in 2017. Rates increased with age and were 3 times higher in men and women aged 85+ than in those 65–74 (Figure 3.2.3).

**FIGURE 3.2.3.**

Years lived with disability due to ischemic heart disease, rates per 100,000, by sex and age group, Canada, 2017



**Abbreviation:** YLD = years lived with disability.

**Note:** The error bars indicate 95% uncertainty interval. The 95% uncertainty interval is determined by the 25<sup>th</sup> and 975<sup>th</sup> value of the 1,000 values ordered from smallest to largest.

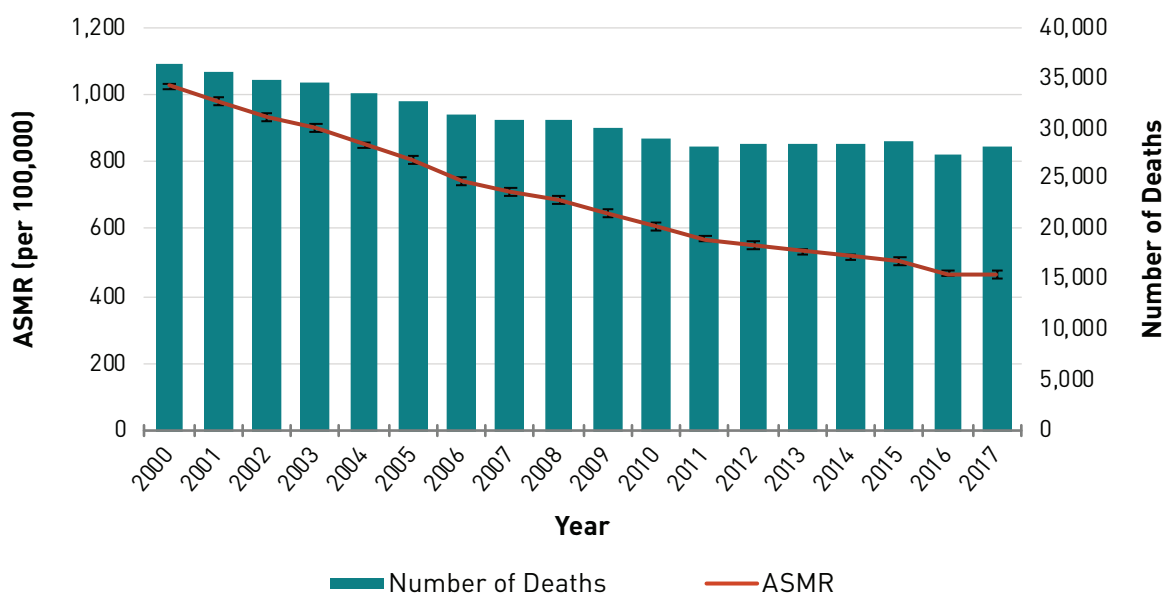
**Source:** Global Burden of Disease Collaborative Network, 2017.

## MORTALITY

Among Canadian seniors, the ASMR (per 100,000) due to IHD decreased by 54.8% from 1025.1 in 2000 to 463.6 in 2017. The number of deaths due to IHD declined from 36,330 in 2000 to 29,100 in 2010, and remaining somewhat stable since 2011, with about 28,000 deaths per year in 2017 (Figure 3.2.4).

**FIGURE 3.2.4.**

Age-standardized\* mortality rates and number of deaths due to ischemic heart disease, 65+ years, Canada†, 2000–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013.

† 2017 mortality data are not available for Yukon.

Abbreviation: ASMR = age-standardized mortality rate.

Notes: The 95% confidence interval shows an estimated range of values which is likely to include the true value 19 times out of 20. ICD-10 codes: I20–I25.

Source: Canadian Vital Statistics—Death Database, 2000–2017.

# HEART FAILURE

Improvements in treatment and control of hypertension as well as advances in cardiac care have led to an increase in the number of individuals with cardiovascular disease surviving into older age. While aging however, these individuals remain at risk of developing heart failure and as a result, the prevalence of heart failure increases drastically with age.<sup>[37,38]</sup> Heart failure is chronic and progressive. Heart failure occurs when the pumping action of the heart cannot provide enough blood to the rest of the body<sup>[38]</sup> due to damage to and progressive weakening of the heart muscle.

IHD is the most common cause of heart failure. Other modifiable metabolic and behavioural risk factors of heart failure include:<sup>[39]</sup>

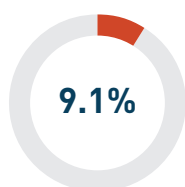
- Hypertension;
- Diabetes (type 2);
- High blood cholesterol;
- Obesity;
- Smoking;
- Physical inactivity; and
- Harmful use of alcohol.

Other risk factors for heart failure include:<sup>[30,36,37,40–42]</sup>

- Age—the risk of heart failure increases with age;
- Sex—men are more likely than women to have heart failure, but this difference between the sexes diminishes with age;
- Ethnic or cultural origin—Black populations have been shown to be at increased risk of heart failure compared to other ethnic groups; and
- Family history of cardiovascular disease.



## PREVALENCE

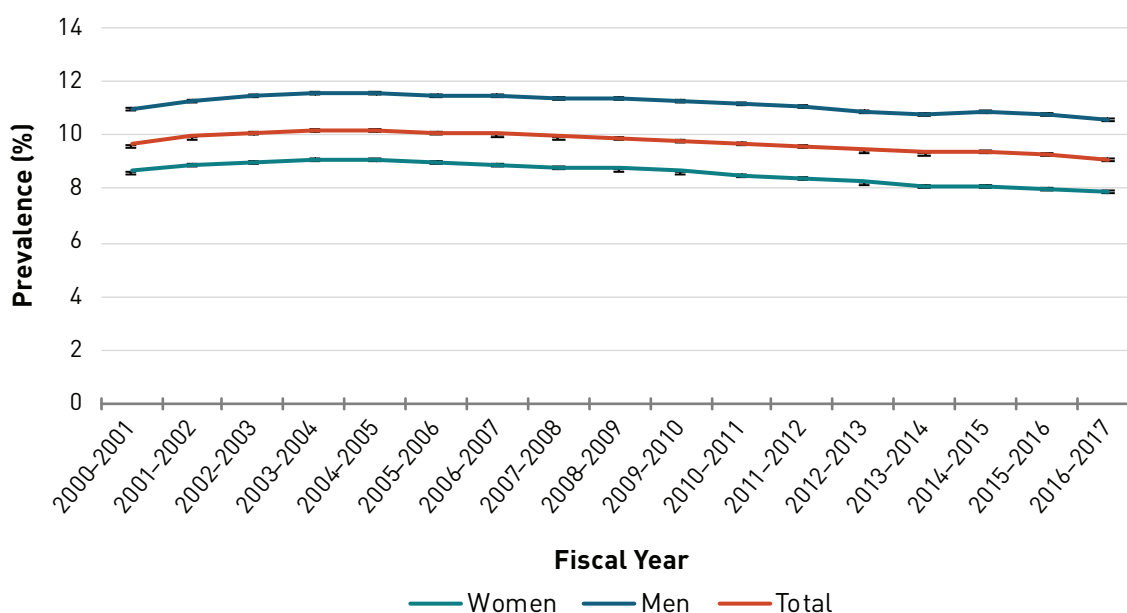


About **580,000** or **9.1%** of Canadian seniors (65+) were living with diagnosed heart failure in 2016–2017.

Between 2000–2001 and 2006–2007, the age-standardized prevalence of diagnosed heart failure in seniors increased from 9.6% to 10.0% and then decreased to 9.1% in 2016–2017 (Figure 3.2.5).

**FIGURE 3.2.5.**

Age-standardized\* prevalence of diagnosed heart failure, 65+ years, Canada†, 2000–2001 to 2016–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013 using 5-year age groups.

† Data from Nunavut were excluded before fiscal year 2005–2006. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

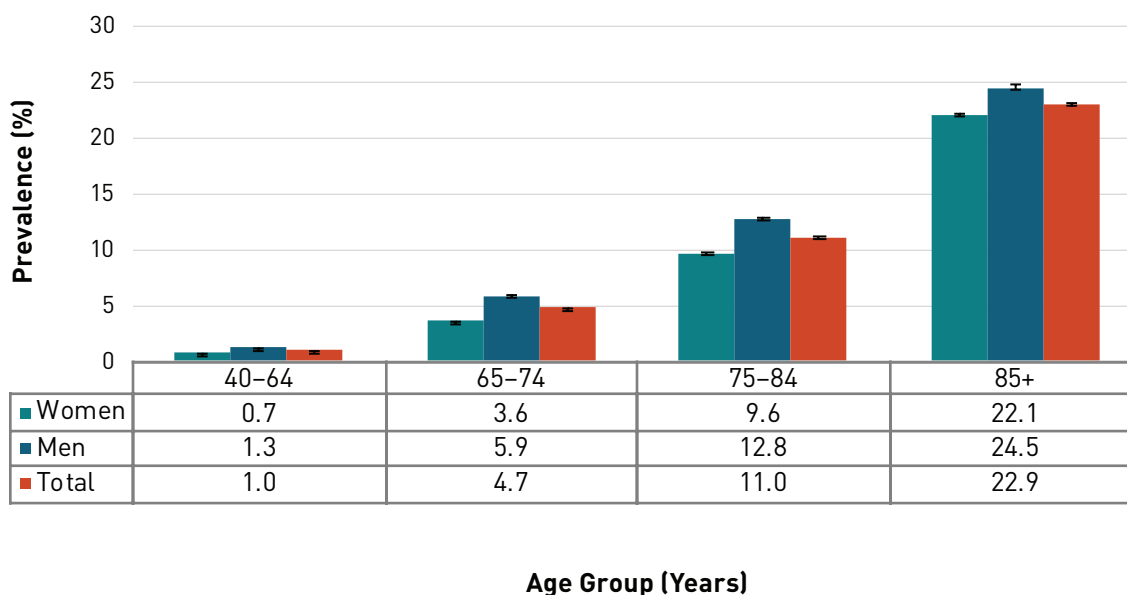
**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

In 2016–2017, men aged 65+ were 1.2 times more likely than women the same age to have diagnosed heart failure.

The prevalence of diagnosed heart failure increased with age and, at 22.9%, was the highest in those aged 85+ in 2016–2017 (Figure 3.2.6).

**FIGURE 3.2.6.**

Prevalence of diagnosed heart failure, Canada<sup>†</sup>, by sex and age group, 2016–2017



<sup>†</sup> Data from Nunavut were excluded before fiscal year 2005–2006. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

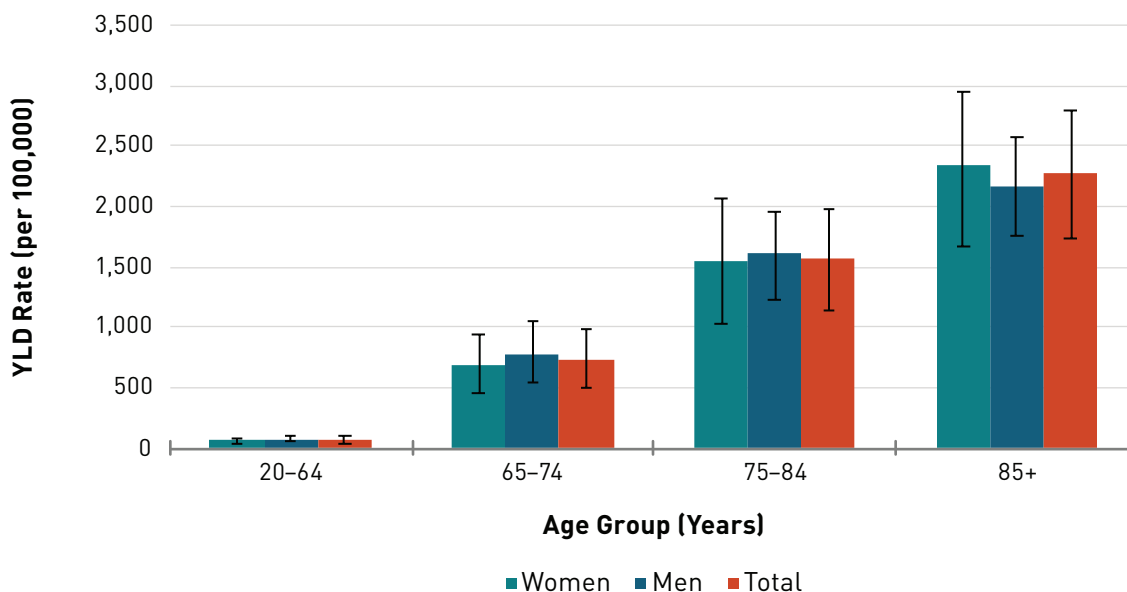
**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

## DISABILITY

For both sexes, the YLD rate due to heart failure was 1178.2 per 100,000 seniors in 2017. Rates increased with age and were 3 times higher in men and women aged 85+ years than in those aged 65–74 (Figure 3.2.7).

**FIGURE 3.2.7.**

Years lived with disability due to heart failure, rates per 100,000, by sex and age group, Canada, 2017



Abbreviation: YLD = years lived with disability.

Notes: The error bars indicate 95% uncertainty interval. The 95% uncertainty interval is determined by the 25<sup>th</sup> and 975<sup>th</sup> value of the 1,000 values ordered from smallest to largest.

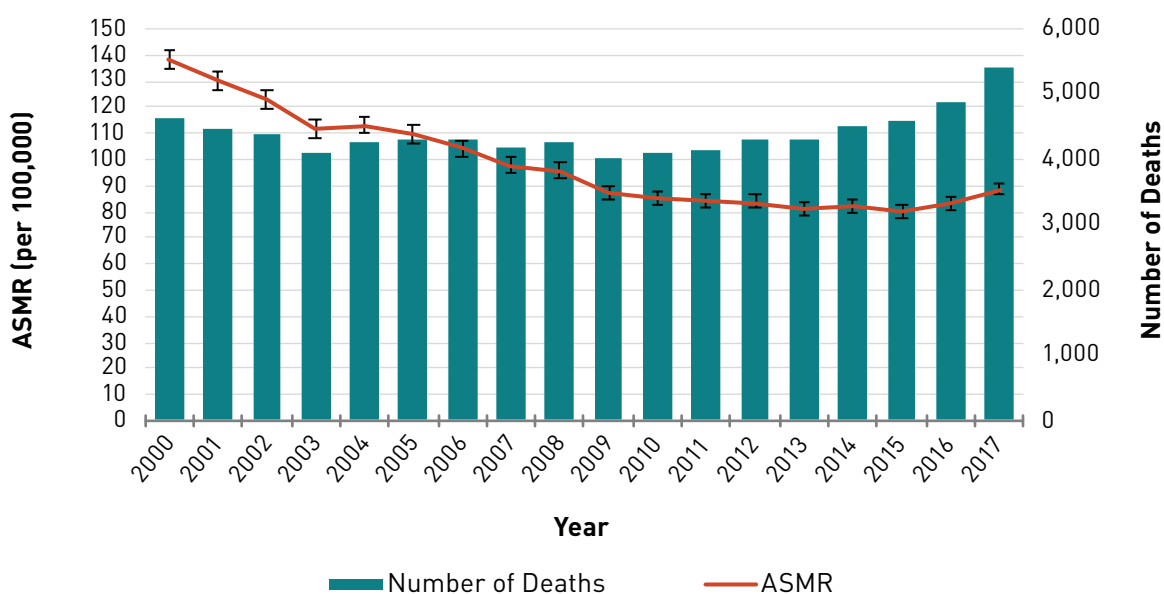
Source: Global Burden of Disease Collaborative Network, 2017.

## MORTALITY

Among Canadian seniors, the ASMR (per 100,000) due to heart failure decreased by 35.8% from 138.1 in 2000 to 88.7 in 2017. However, the decline has been slower in the most recent years. The number of deaths due to heart failure fluctuated between 2000 and 2009, but has since increased to reach 5,390 deaths in 2017 (Figure 3.2.8).

**FIGURE 3.2.8.**

Age-standardized\* mortality rates and number of deaths due to heart failure, 65+ years, Canada†, 2000–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013.

† 2017 mortality data are not available for Yukon.

**Abbreviation:** ASMR = age-standardized mortality rate.

**Notes:** The 95% confidence interval shows an estimated range of values which is likely to include the true value 19 times out of 20. ICD-10 code: I50.

**Source:** Canadian Vital Statistics—Death Database, 2000–2017.

# STROKE

Stroke is a sudden loss of brain function when blood flow to part of the brain is stopped.<sup>[43]</sup> The severity of stroke depends on the type (ischemic stroke or hemorrhagic stroke); the part of the brain damaged; and the amount of damage sustained.<sup>[44]</sup>

Ischemic stroke happens when a blockage or clot forms in a blood vessel in the brain. The blockage can be caused when plaque builds up on the inner wall of an artery, leading to a narrowed artery.<sup>[44]</sup>

Hemorrhagic stroke occurs when an artery in the brain ruptures.<sup>[44]</sup> This interruption in blood flow damages brain cells. A major cause of hemorrhagic stroke is elevated blood pressure (hypertension), which weakens arteries over time.<sup>[44]</sup>

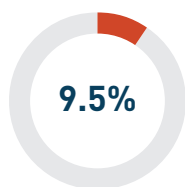
The leading modifiable metabolic and behavioural risk factors associated with the development of stroke are:<sup>[45]</sup>

- Hypertension;
- Physical inactivity;
- Smoking;
- Harmful use of alcohol;
- Abdominal obesity;
- Unhealthy diet;
- Diabetes (type 2);
- High blood cholesterol; and
- Psychosocial factors.

Other risk factors associated with the development of stroke include:<sup>[33,35,46,47]</sup>

- Age—the risk of stroke increases with age;
- Sex—although men have higher rates of stroke overall, women aged 80+ are more likely to have a stroke, in part due to their longer life expectancy;
- Ethnic or cultural origin—Indigenous peoples as well as South Asian and Black populations are at increased risk of stroke; and
- Family history of stroke.

## PREVALENCE

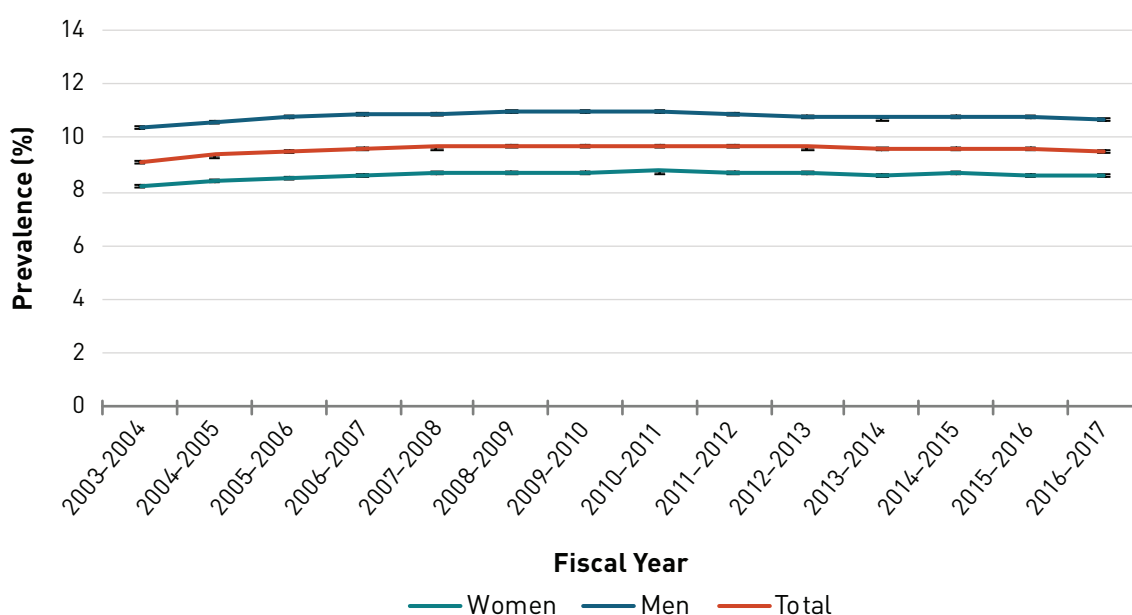


About **602,000** or **9.5%** of Canadian seniors (65+) had a stroke<sup>1</sup> in 2016–2017.

The age-standardized rate of stroke in seniors was somewhat stable, ranging from 9.1% in 2003–2004 to 9.5% in 2016–2017 (Figure 3.2.9).

**FIGURE 3.2.9.**

Age-standardized\* prevalence of diagnosed stroke, 65+ years, Canada<sup>†</sup>, 2003–2004 to 2016–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013 using 5-year age groups.

† Data from Nunavut were excluded before fiscal year 2005–2006. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

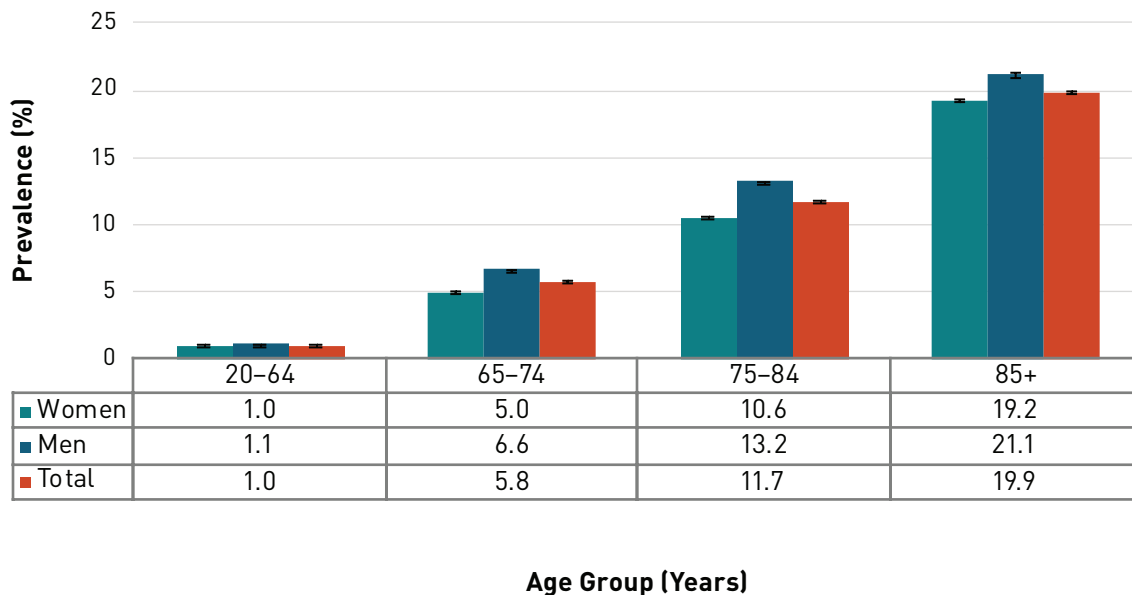
<sup>1</sup> The CCDSS refers to stroke as any type of stroke, including transient ischemic attacks. The CCDSS captures people who have had a stroke any time since the beginning of the surveillance period in 1996–1997.

In 2016–2017, men aged 65+ were 1.1 times more likely than women the same age to have had a stroke.

Stroke occurred more frequently with age, with the highest rate, 19.9%, among those aged 85+ years (Figure 3.2.10).

**FIGURE 3.2.10.**

Prevalence of diagnosed stroke, by sex and age group, Canada<sup>†</sup>, 2016–2017



<sup>†</sup> Data from Nunavut were excluded before fiscal year 2005–2006. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

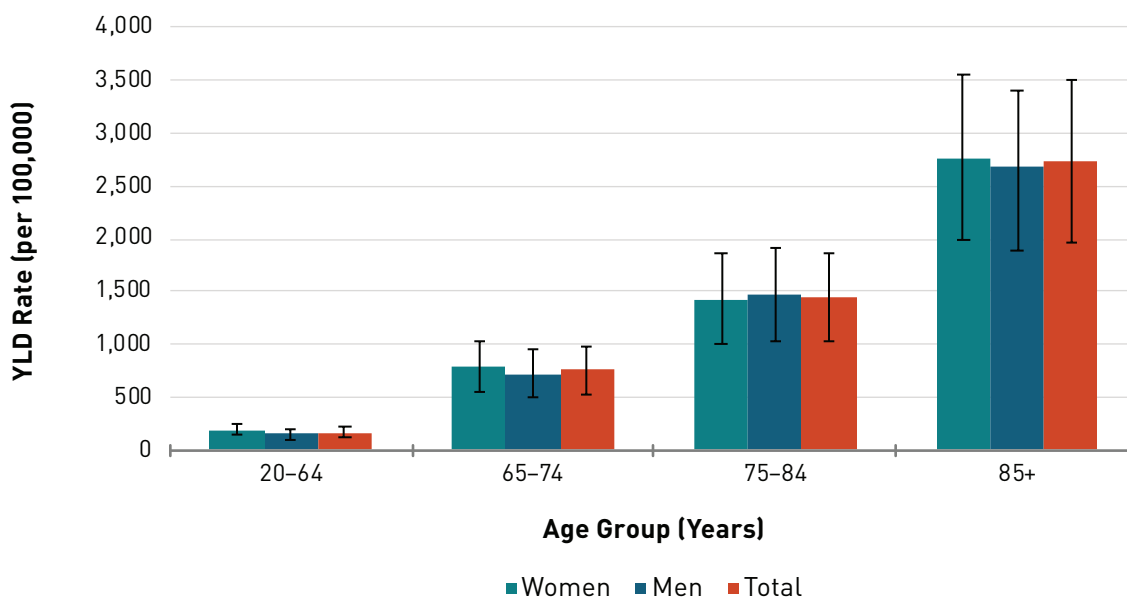
**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

## DISABILITY

For both sexes, the YLD rate due to stroke was 1,214.0 per 100,000 seniors in 2017. Rates increased with age and were 3.5 times higher in men and women aged 85+ than in those aged 65–74 (Figure 3.2.11).

**FIGURE 3.2.11.**

Years lived with disability due to stroke, rates per 100,000, by sex and age group, Canada, 2017



Abbreviation: YLD = years lived with disability.

Note: The error bars indicate 95% uncertainty interval. The 95% uncertainty interval is determined by the 25<sup>th</sup> and 975<sup>th</sup> value of the 1,000 values ordered from smallest to largest.

Source: Global Burden of Disease Collaborative Network, 2017.

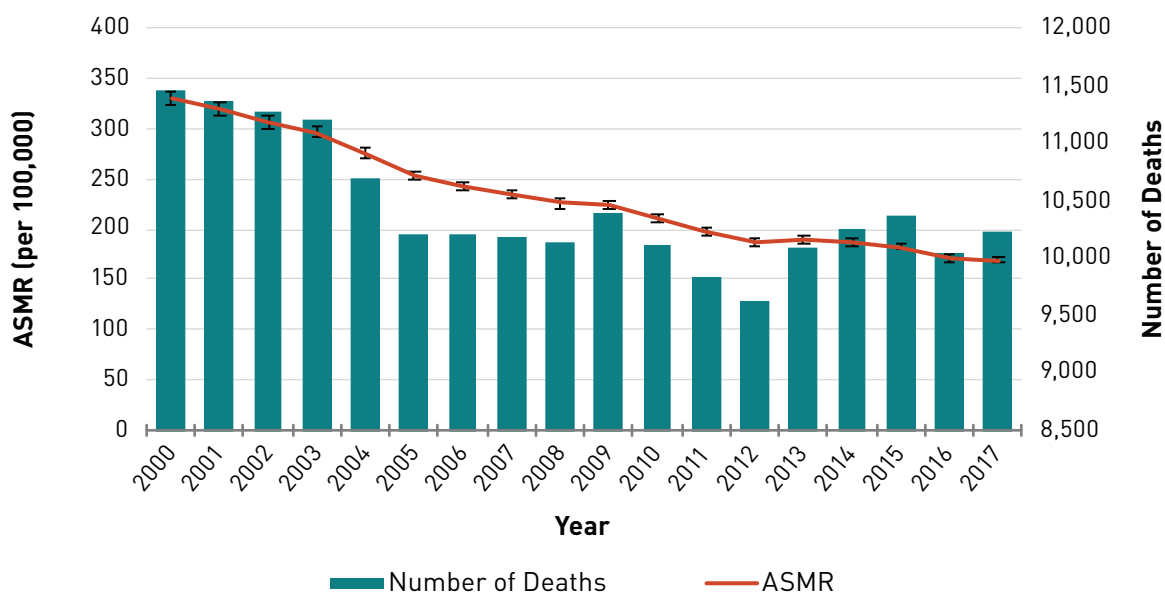


## MORTALITY

Among seniors, the ASMR (per 100,000) due to stroke decreased by 48.8% from 330.3 in 2000 to 169.0 in 2017. After a decline in the number of deaths due to stroke between 2000 and 2005, the number of deaths fluctuated over the remainder of the period (Figure 3.2.12).

**FIGURE 3.2.12.**

Age-standardized\* mortality rates and number of deaths due to stroke, 65+ years, Canada†, 2000–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013.

† 2017 mortality data are not available for Yukon.

Abbreviation: ASMR = age-standardized mortality rate.

Notes: The 95% confidence interval shows an estimated range of values which is likely to include the true value 19 times out of 20. ICD-10 codes: G45.x (exclude G45.4), H34.0, H34.1, I60.x, I61.x, I63.x (exclude I63.6), I64.

Source: Canadian Vital Statistics—Death Database, 2000–2017.

## 3.3

# DIABETES

Diabetes occurs when the body is unable to produce and/or use insulin. Insulin is a hormone that regulates blood glucose. There are three main types of diabetes: type 1 diabetes, type 2 diabetes and gestational diabetes.

About 90% of diabetes cases among Canadian adults are type 2; 9% are type 1 and less than 1% are of a different type.<sup>[48]</sup> Children and youth generally have type 1 diabetes.<sup>[49]</sup> About 1 in 10 women have gestational diabetes, that is, diabetes while pregnant.<sup>[50]</sup>

Type 1 diabetes, which usually begins in childhood, is an autoimmune disease. The risk factors for type 1 diabetes are not fully understood, but interactions between genetic and environmental factors are likely involved.<sup>[51]</sup>

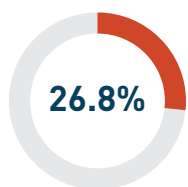
Type 2 diabetes is caused by a wide range of social, environmental and genetic factors. Some common modifiable metabolic and behavioural risk factors include:<sup>[51,52]</sup>

- Obesity;
- Physical inactivity;
- Unhealthy diet; and
- Smoking.

Other risk factors include:<sup>[51,53]</sup>

- Age—the risk of diabetes increases with age.
- Ethnic or cultural origin—In 2010–2013, diabetes was 2.3 and 2.1 times more common among South Asian and Black adults, respectively, than among White adults. Over the same period, the prevalence of diabetes among First Nations adults living off reserve and Métis adults was, respectively, 1.9 and 1.5 times higher than the prevalence among non-Indigenous adults.
- Family history of type 2 diabetes.

## PREVALENCE

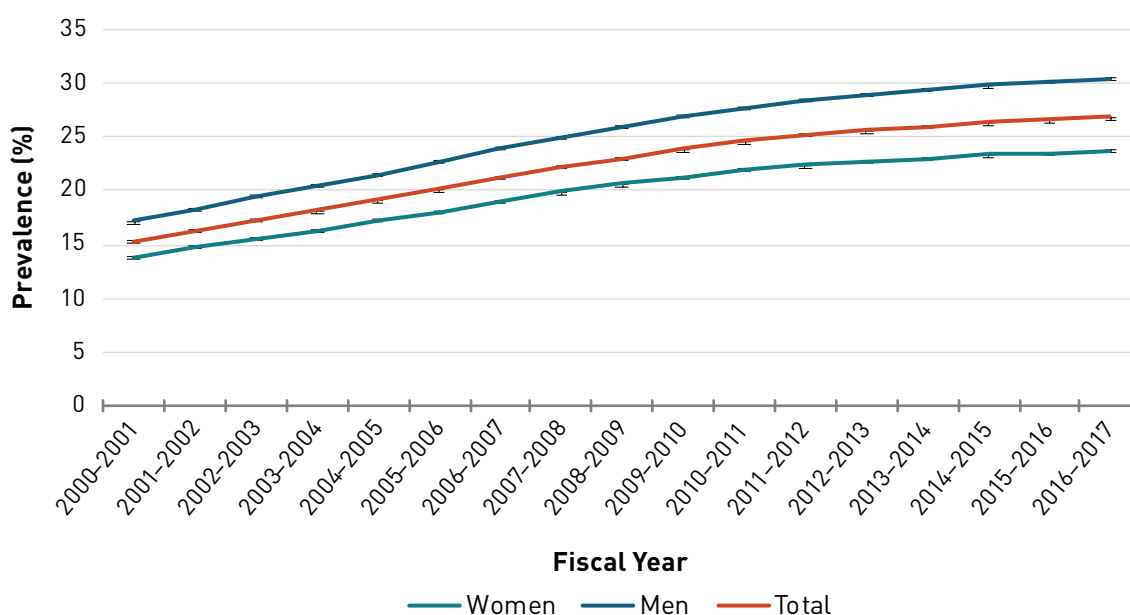


About **1.7 million** or **26.8%** of Canadian seniors (65+) were living with diagnosed diabetes<sup>2</sup> in 2016–2017.

Between 2000–2001 and 2016–2017, the age-standardized prevalence of diagnosed diabetes in seniors increased from 15.3% to 26.8% (Figure 3.3.1).

**FIGURE 3.3.1.**

Age-standardized\* prevalence of diagnosed diabetes, 65+ years, Canada<sup>†</sup>, 2000–2001 to 2016–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013 using 5-year age groups.

<sup>†</sup> Data from Nunavut were excluded before fiscal year 2005–2006. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

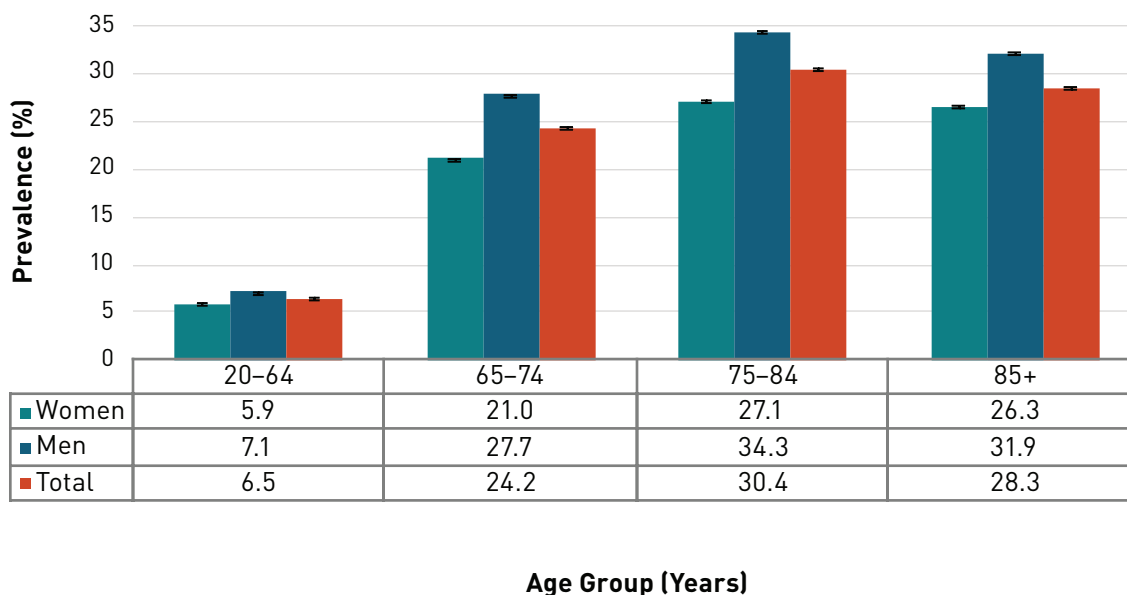
<sup>2</sup> Diagnosed diabetes is defined in the Canadian Chronic Disease Surveillance System as any diabetes types (type 1 or 2) and excludes women with gestational diabetes.

In 2016–2017, men aged 65+ were 1.3 times more likely than women of the same age to have diagnosed diabetes.

The prevalence of diagnosed diabetes generally increased with age and was highest, at 30.4%, among those aged 75–84 in 2016–2017 (Figure 3.3.2).

**FIGURE 3.3.2.**

Prevalence of diagnosed diabetes, by sex and age group, Canada<sup>†</sup>, 2016–2017



<sup>†</sup> Data from Nunavut were excluded before fiscal year 2005–2006. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

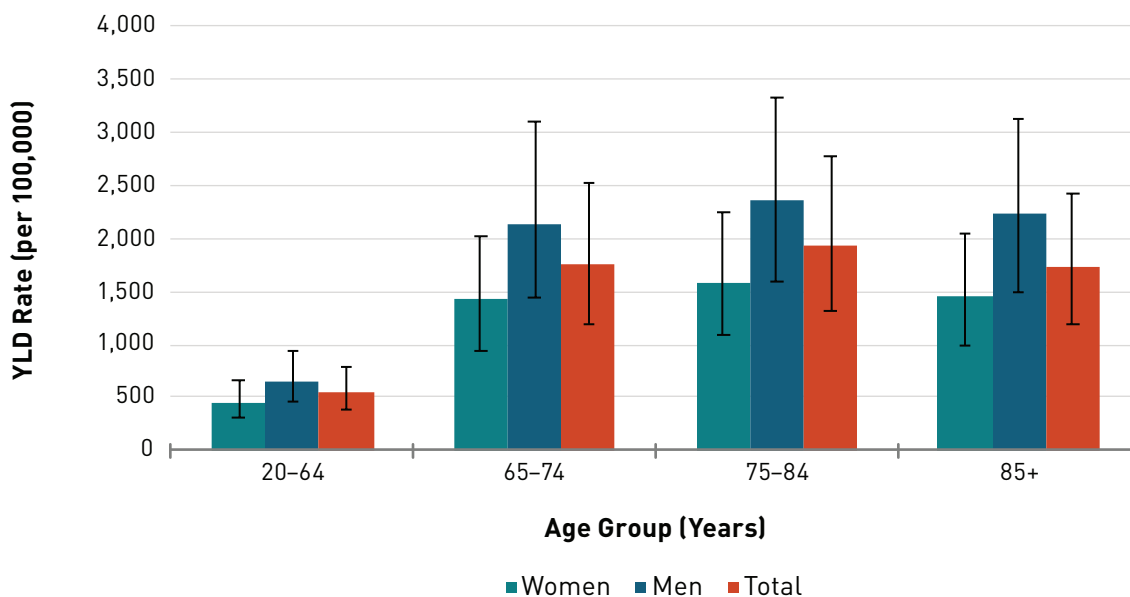
**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

## DISABILITY

For both sexes, the YLD rate due to diabetes was 1,809.5 per 100,000 seniors in 2017. Rates did not differ by age group among seniors (Figure 3.3.3).

**FIGURE 3.3.3.**

Years lived with disability due to diabetes, rates per 100,000, by sex and age group, Canada, 2017



**Abbreviation:** YLD = years lived with disability.

**Note:** The error bars indicate 95% uncertainty interval. The 95% uncertainty interval is determined by the 25<sup>th</sup> and 975<sup>th</sup> value of the 1,000 values ordered from smallest to largest.

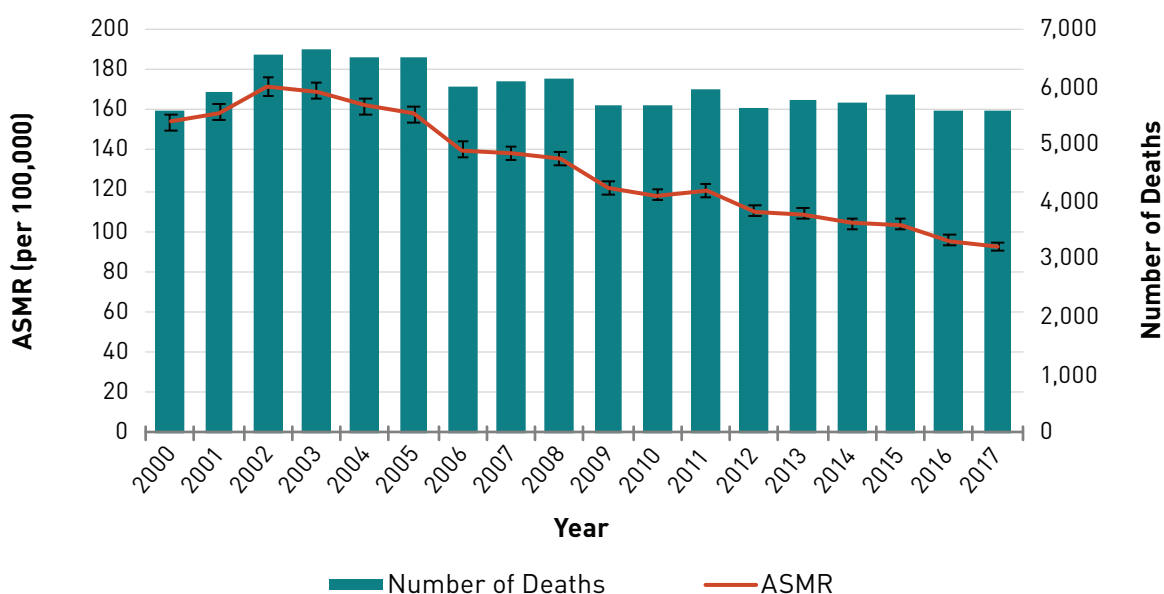
**Source:** Global Burden of Disease Collaborative Network, 2017.

## MORTALITY

Among Canadian seniors, the ASMR (per 100,000) due to diabetes decreased by 40.0% from 154.1 in 2000 to 92.3 in 2017. After an increase in the number of deaths due to diabetes from 5,585 in 2000 to 6,640 in 2003, the number of deaths fluctuated over the remainder of the period (Figure 3.3.4).

**FIGURE 3.3.4.**

Age-standardized\* mortality rates and number of deaths due to diabetes, 65+ years, Canada†, 2000–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013.

† 2017 mortality data are not available for Yukon.

**Abbreviation:** ASMR = age-standardized mortality rate.

**Notes:** The 95% confidence interval shows an estimated range of values which is likely to include the true value 19 times out of 20. ICD-10 codes: E10-E14.

**Source:** Canadian Vital Statistics—Death Database, 2000–2017.

## 3.4

# HYPERTENSION

Blood pressure is the force of the blood against the walls of the arteries. It is expressed as two numbers: systolic blood pressure (the top or higher number) is the pressure in the artery when the heart contracts, and diastolic blood pressure (the bottom or lower number) is the pressure in the artery when the heart relaxes between beats. A systolic blood pressure below 120 mmHg or a diastolic blood pressure below 80 mmHg is considered normal.<sup>[54]</sup>

Hypertension, or high blood pressure, occurs when blood pressure is too high for long periods of time. The risk of developing hypertension can be reduced by adopting a healthy lifestyle. For individuals diagnosed with hypertension, lifestyle modifications and/or use of blood pressure lowering medication can help maintain their blood pressure in a healthy range. When left uncontrolled, hypertension can lead to damage to the artery walls and decreased blood flow to the heart and other organs and lead to heart disease or stroke.<sup>[55,56]</sup>

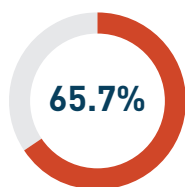
Modifiable metabolic and behavioural risk factors associated with the development of hypertension include:<sup>[57]</sup>

- Physical inactivity;
- Overweight and obesity;
- Unhealthy diet;
- High sodium intake;
- Harmful use of alcohol;
- Inadequate potassium intake; and
- Diabetes (type 2).

Other risk factors associated with the development of hypertension include:<sup>[35,58–61]</sup>

- Age—the risk of hypertension increases with age;
- Sex—men are more likely than women to suffer hypertension in early to mid-adulthood, however, hypertension is more prevalent in women after menopause;
- Ethnic or cultural origin—the prevalence of hypertension is higher in South Asian and Black populations; and
- Family history of hypertension.

## PREVALENCE

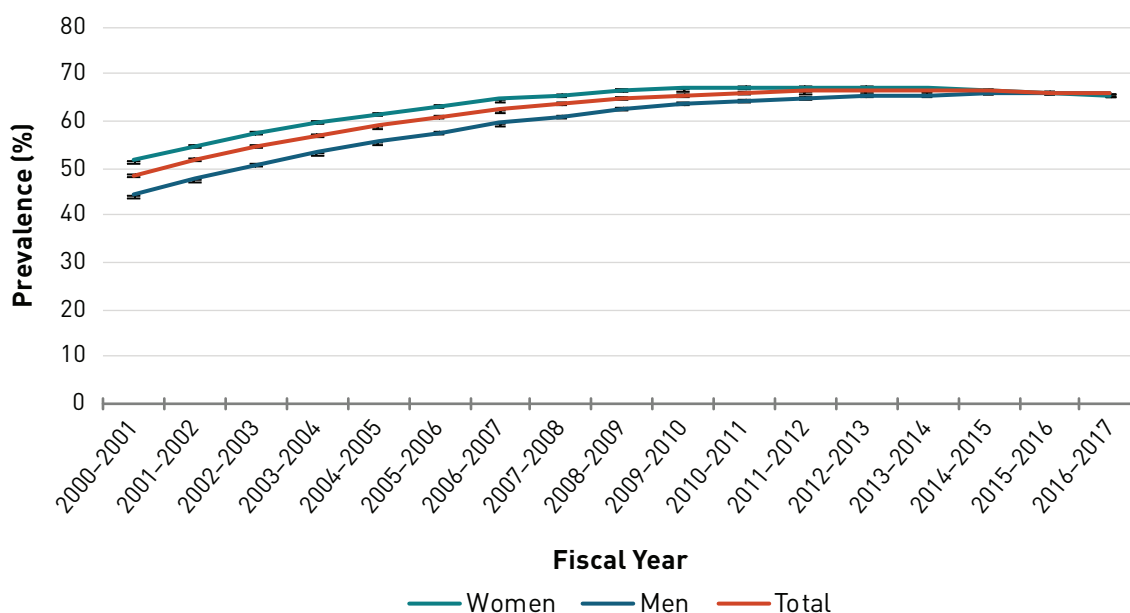


About **4.1 million** or **65.7%** of Canadian seniors (65+) were living with diagnosed hypertension in 2016–2017.

Between 2000–2001 and 2016–2017, the age-standardized prevalence of diagnosed hypertension in seniors increased from 48.6% to 65.7% (Figure 3.4.1).

**FIGURE 3.4.1.**

Age-standardized\* prevalence of diagnosed hypertension, 65+ years, Canada†, 2000–2001 to 2016–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013 using 5-year age groups.

† Data from Nunavut were excluded before fiscal year 2005–2006. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

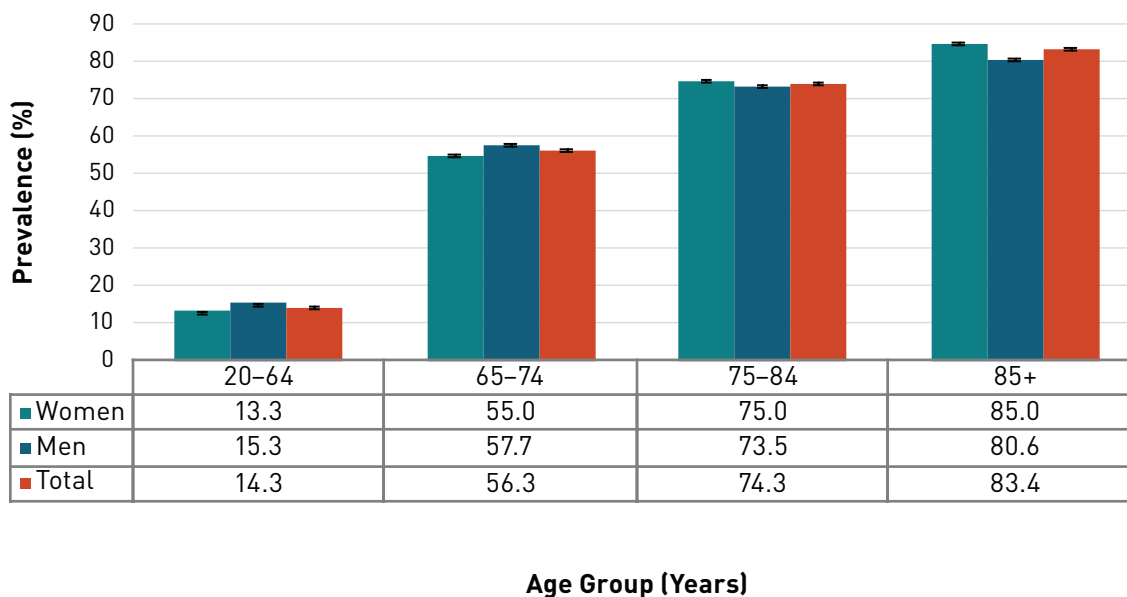


In 2016–2017, senior men and women were about equally likely to have diagnosed hypertension.

The prevalence of diagnosed hypertension increased with age and, at 83.4%, was the highest among those aged 85+ in 2016–2017 (Figure 3.4.2).

**FIGURE 3.4.2.**

Prevalence of diagnosed hypertension, by sex and age group, Canada<sup>†</sup>, 2016–2017



<sup>†</sup> Data from Nunavut were excluded before fiscal year 2005–2006. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

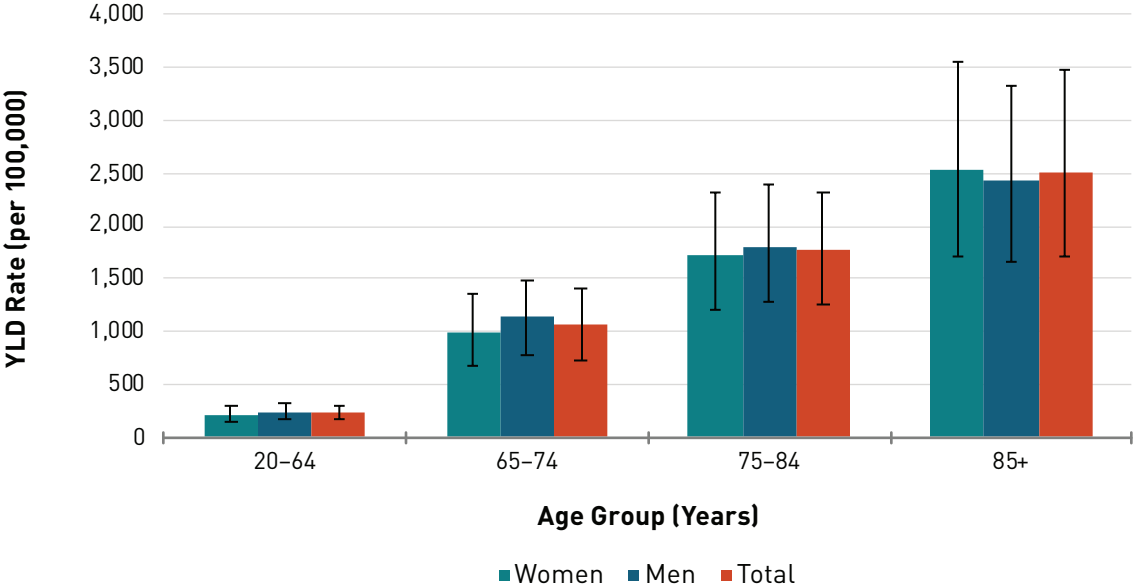
**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

# DISABILITY

For both sexes, the overall YLD rate due to high systolic blood pressure was 1,455.4 per 100,000 seniors in 2017. Rates increased with age and were 2.4 times higher in those aged 85+ than in those aged 65–74 (Figure 3.4.3).

**FIGURE 3.4.3.** Years lived with disability due to high systolic blood pressure, rates per 100,000, by sex and age group, Canada, 2017



Abbreviation: YLD = years lived with disability.

Note: The error bars indicate 95% uncertainty interval. The 95% uncertainty interval is determined by the 25<sup>th</sup> and 975<sup>th</sup> value of the 1,000 values ordered from smallest to largest.

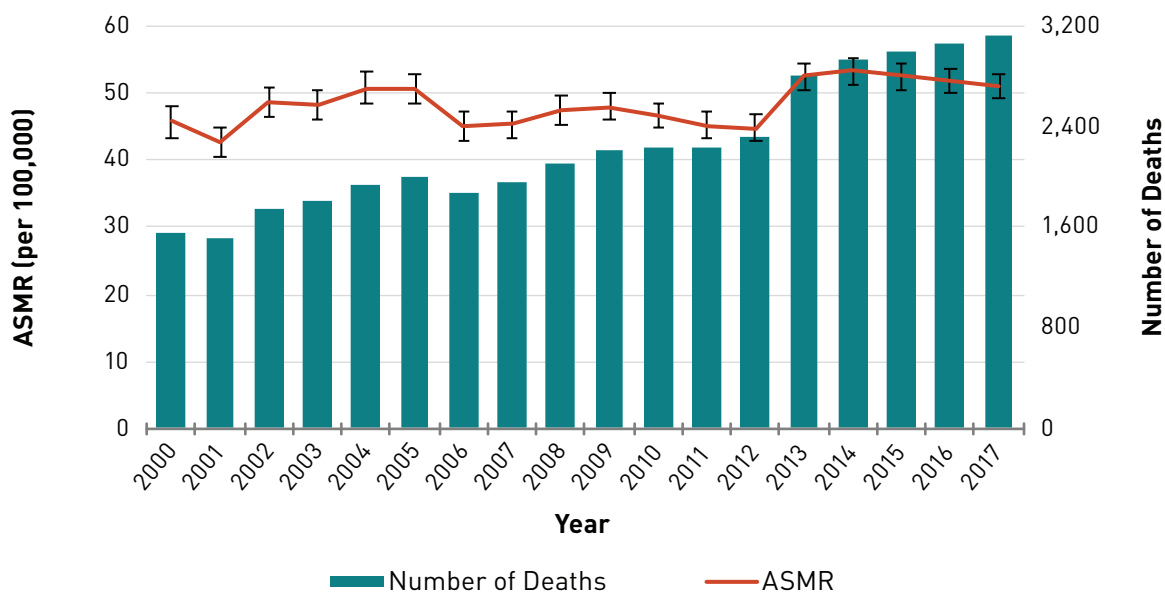
Source: Global Burden of Disease Collaborative Network, 2017.

## MORTALITY

Among seniors, the ASMR (per 100,000) due to hypertension increased by 11.8% from 45.7 in 2000 to 51.1 in 2017. The number of deaths due to hypertension increased from 1,560 in 2000 to 3,115 in 2017 (Figure 3.4.4).

**FIGURE 3.4.4.**

Age-standardized\* mortality rates and number of deaths due to hypertension, 65+ years, Canada†, 2000–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013.

† 2017 mortality data are not available for Yukon.

Abbreviation: ASMR = age-standardized mortality rate.

Notes: The 95% confidence interval shows an estimated range of values which is likely to include the true value 19 times out of 20. ICD-10 codes: I10-I13, I15.

Source: Canadian Vital Statistics—Death Database, 2000–2017.

## 3.5

# MENTAL ILLNESS AND SUICIDE

## MOOD AND ANXIETY DISORDERS

The most common mental illnesses among Canadian seniors are mood and anxiety disorders,<sup>[62]</sup> cognitive and mental disorders due to a medical condition (including dementia and delirium), substance misuse (including prescription drugs and alcohol) and psychotic disorders. Dementia is discussed in section 3.7 “Neurological diseases”.

Mood disorders are characterized by prolonged periods of excessive elevation or depression of mood or of both. According to the Diagnostic and Statistical Manual of Mental Disorders, 5<sup>th</sup> edition (DSM-5),<sup>[63]</sup> mood disorders include:

- Major depressive disorder;
- Bipolar disorder;
- Dysthymic disorder; and
- Perinatal/postpartum depression.

Anxiety disorders are characterized by excessive and persistent feelings of apprehension, worry and fear. According to the DSM-5, anxiety disorders include but are not limited to:<sup>[63]</sup>

- Generalized anxiety disorder;
- Social phobia / social anxiety disorder;
- Specific phobias;
- Post-traumatic stress disorder;
- Obsessive-compulsive disorder;
- Panic disorder; and
- Agoraphobia.

Both mood and anxiety disorders impact an individual’s everyday life for an extended time. This may lead to difficulties fulfilling professional, family and/or social obligations.<sup>[64,65]</sup>

Mood and anxiety disorders and other mental illnesses (e.g. substance abuse disorder) often co-occur.<sup>[66]</sup> Due to the complex interplay of various biological, genetic, socioeconomic, social and psychological factors that contribute to the development of mood and anxiety disorders, individuals often need lengthy treatment and health service use.<sup>[65,67,68]</sup> Professional care with active engagement in self-management strategies can foster recovery and improve the well-being of affected individuals.<sup>[67]</sup>

## PREVALENCE OF THE USE OF HEALTH SERVICES FOR MOOD OR ANXIETY DISORDERS<sup>3</sup>

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About **662,000** or **10.5%** of Canadian seniors (65+) used health services for mood and anxiety disorders in 2016–2017.

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Between 2000–2001 and 2016–2017, the age-standardized prevalence of the use of health services for mood and anxiety disorders in seniors decreased from 13.1% to 10.5% (Figure 3.5.1).

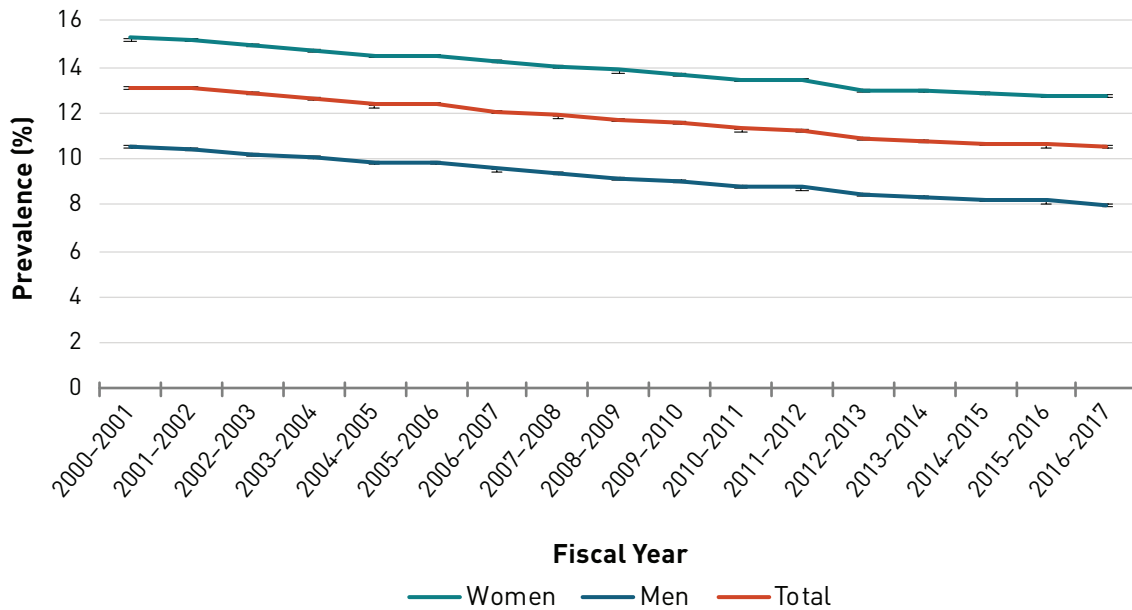


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<sup>3</sup> CCDSS estimates represent the prevalence of health service use for mood and anxiety disorders, rather than the prevalence of diagnosed mood and anxiety disorders. For more information on the limitations of the CCDSS, see Appendix 2.

**FIGURE 3.5.1.**

Age-standardized\* prevalence of the use of health services for mood and anxiety disorders, 65+ years, Canada†, 2000–2001 to 2016–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013 using 5-year age groups.

† Data from Nunavut were excluded before fiscal year 2005–2006. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

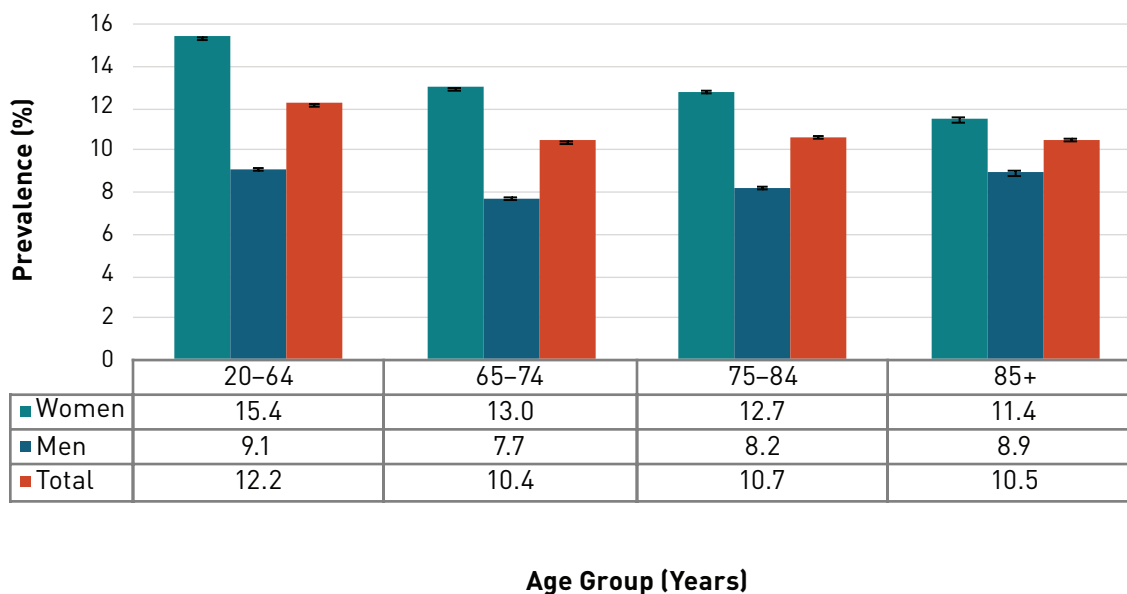
**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

In 2016–2017, women aged 65+ were 1.6 times more likely than men the same age to use health services for mood and anxiety disorders.

The prevalence of seniors' use of health services for mood and anxiety disorders was comparable across the age groups, varying from 10.4% to 10.7% (Figure 3.5.2).

**FIGURE 3.5.2.**

Prevalence of the use of health services for mood and anxiety disorders, by sex and age group, Canada†, 2016–2017



† Data from Nunavut were excluded before fiscal year 2005–2006. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

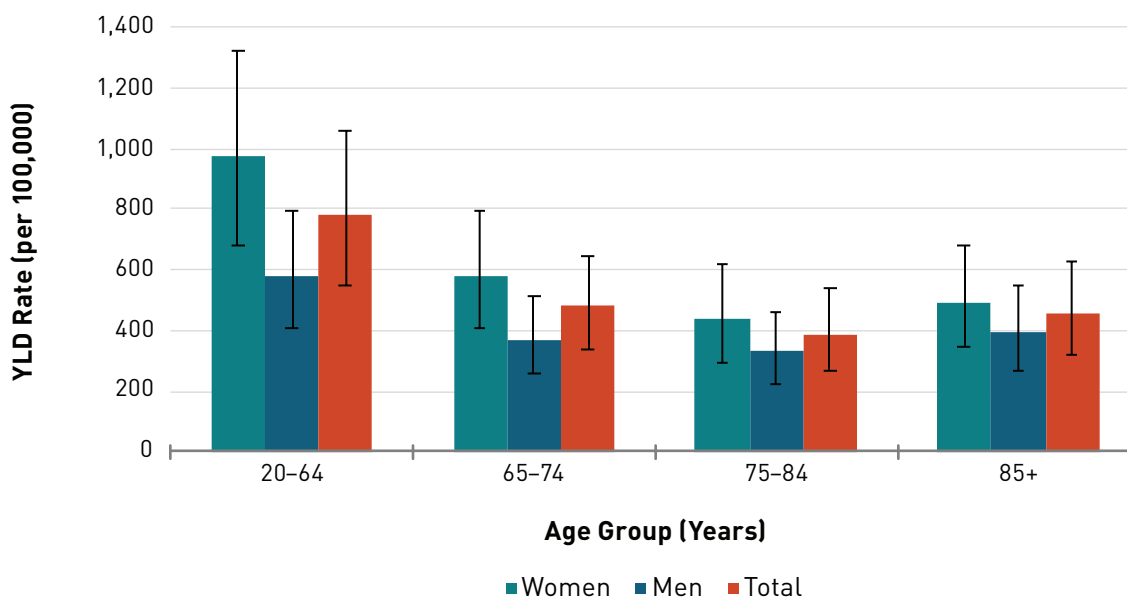
**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

## DISABILITY

For both sexes, the YLD rate due to depressive disorders was 449.9 per 100,000 seniors in 2017. Rates did not differ by age group among seniors (Figure 3.5.3).

**FIGURE 3.5.3.**

Years lived with disability due to depressive disorders, rates per 100,000, by sex and age group, Canada, 2017



**Abbreviation:** YLD = years lived with disability.

**Note:** The error bars indicate 95% uncertainty interval. The 95% uncertainty interval is determined by the 25<sup>th</sup> and 975<sup>th</sup> value of the 1,000 values ordered from smallest to largest.

**Source:** Global Burden of Disease Collaborative Network, 2017.

## MORTALITY

Mortality rates due to mental illness were not assessed; the available data are known to underestimate the impact of mental illness on mortality. Studies have demonstrated that mental illness is associated with higher mortality risk from other causes.<sup>[69,70]</sup>



# SUICIDE

Suicide is death caused by self-inflicted injury where the intent is to die.<sup>[71]</sup>

Suicide-related behaviours include:

- Deliberate self-inflicted injury, or intentional self-poisoning<sup>[72]</sup> with or without the intention to die;
- Suicidal thoughts or ideation (seriously considering suicide);
- Suicidal plans; and
- Suicidal attempts.

Preventing suicide is complex. Many risk factors are involved, for example, low socioeconomic status, having a mental illness, substance use and previous suicide attempts.<sup>[71,73-75]</sup>

Protective factors that may have a critical role in preventing suicide-related behaviours include:<sup>[74,75]</sup>

- A sense of community belonging;
- Satisfaction with frequency of communication with friends and family;
- Social, familial and cultural connections (religious, spiritual, cultural or social groups);
- Positive psychological factors, for example, a sense of meaning in life and having reasons for living; and
- Access to appropriate community-based mental health education, screening and outreach services.

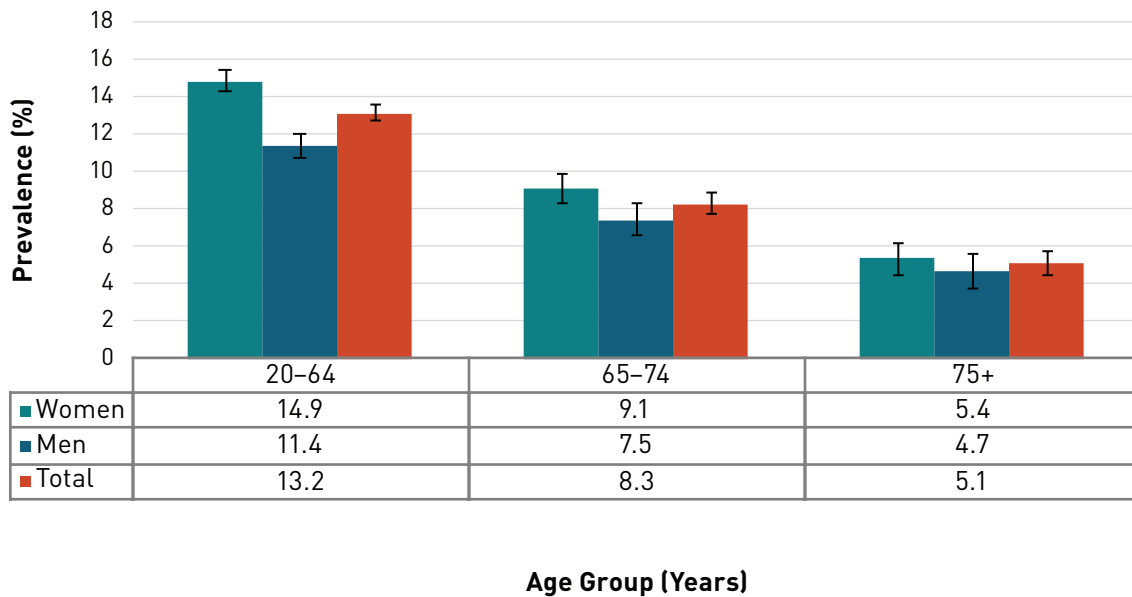


## PREVALENCE OF SUICIDAL IDEATION, PLANNING AND ATTEMPTS

In 2015–2016, the estimated prevalence of self-reported suicidal ideation decreased with increasing age: 8.3% of seniors aged 65–74 reported that they had considered suicide in their lifetime compared to 5.1% of those aged 75+ (Figure 3.5.4).

**FIGURE 3.5.4.**

Prevalence of adults self-reporting ever having serious thoughts of suicide (lifetime), household population aged 20+ years, by sex and age group, Canada, 2015–2016



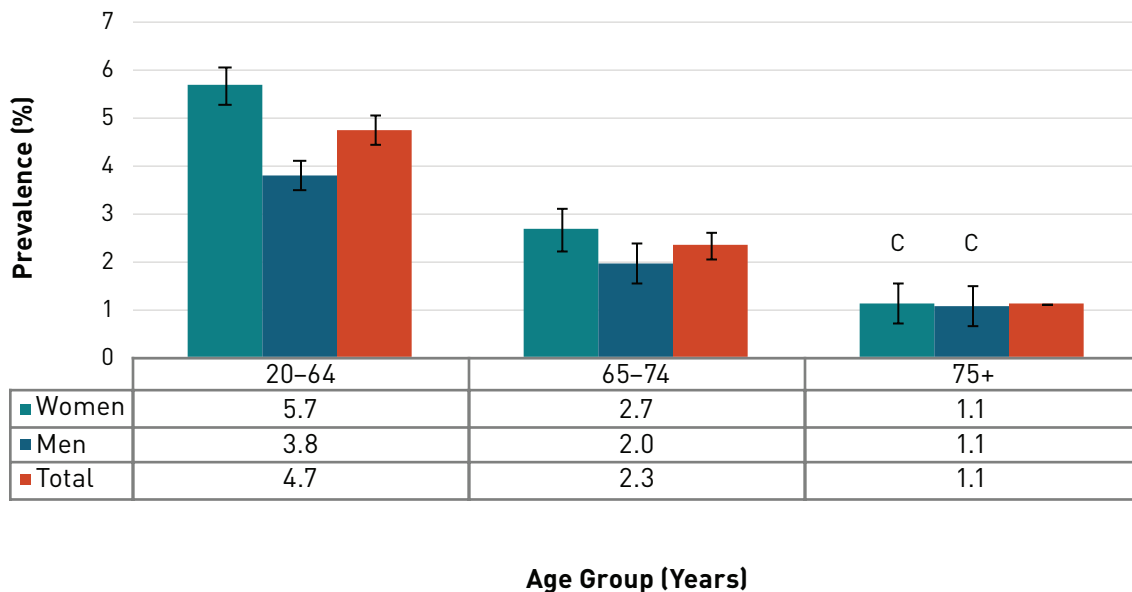
**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Canadian Community Health Survey, combined annual files 2015–2016.

Similarly, the estimated prevalence of self-reported suicidal plans and suicidal attempts decreased with age. Approximately 2.3% of seniors aged 65–74 reported that they had ever made a suicide plan in their lifetime compared to 1.1% of seniors aged 75+ (Figure 3.5.5), while 1.7% of the population aged 65–74 reported that they had ever attempted suicide in their lifetime compared to 0.9% of those aged 75+ (Figure 3.5.6). Women aged 65–74 were 2 times more likely to report ever attempting suicide than men the same age (Figure 3.5.6).

**FIGURE 3.5.5.**

Prevalence of adults self-reporting ever having made a suicide plan (lifetime), household population aged 20+ years, by sex and age group, Canada, 2015–2016



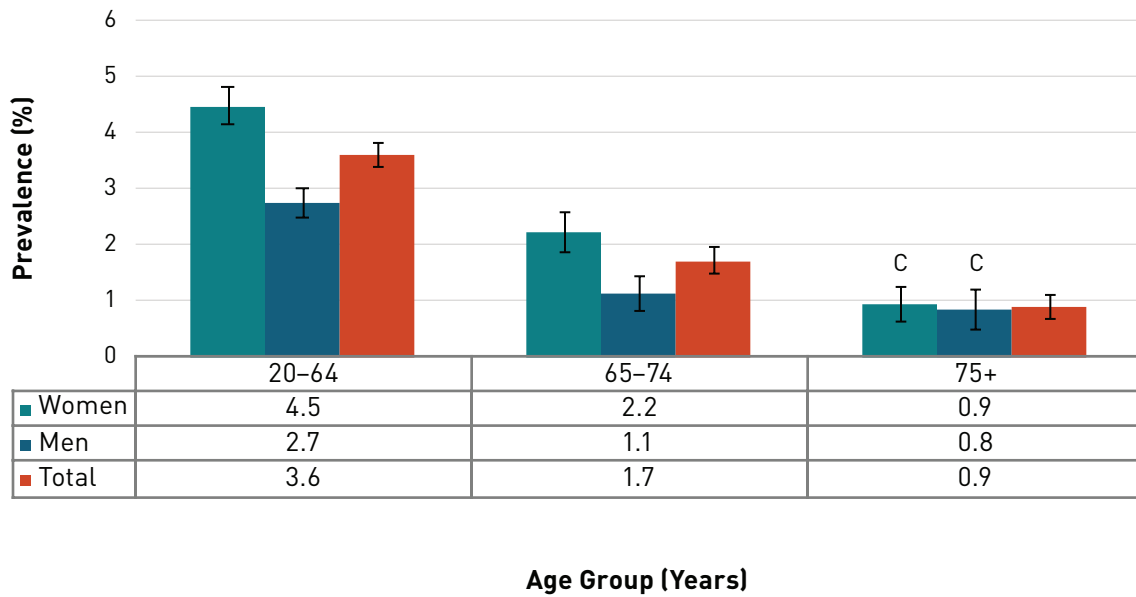
C = Interpret results with caution; coefficient of variation (CV) is between 15.0% and 25.0%.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Canadian Community Health Survey, combined annual files 2015–2016.

**FIGURE 3.5.6.**

Prevalence of adults self-reporting ever attempting suicide (lifetime), household population aged 20+ years, by sex and age group, Canada, 2015–2016



C = Interpret results with caution; coefficient of variation (CV) is between 15.0% and 25.0%.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Canadian Community Health Survey, combined annual files 2015–2016.

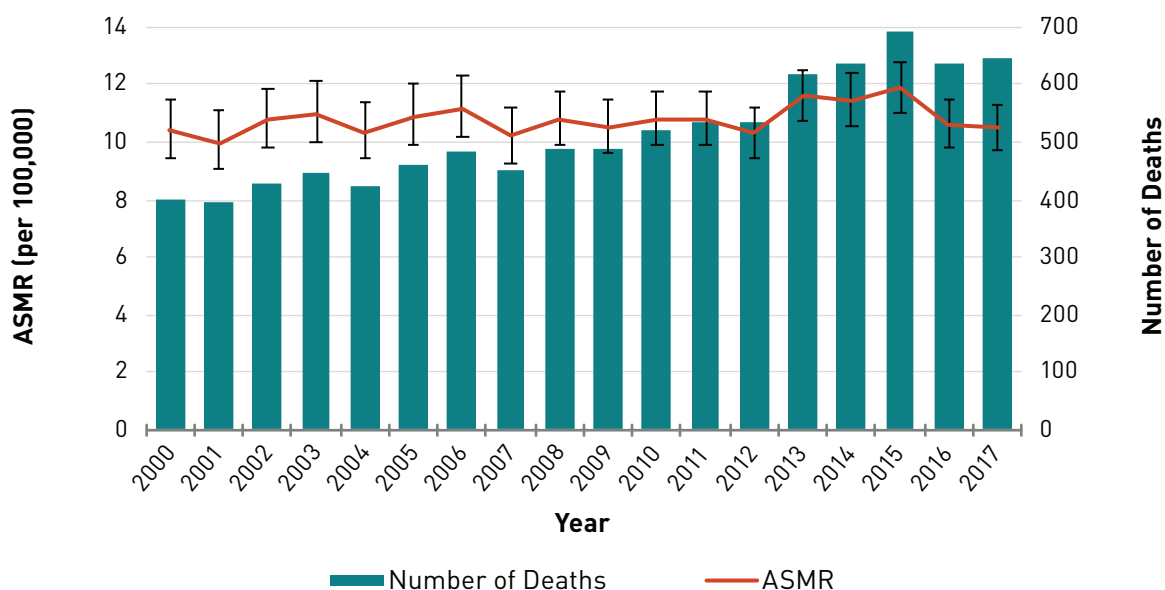
## MORTALITY

Mortality rates due to suicide were about 4 times higher among men aged 65–84 than women the same age. Among those aged 85+, rates were 6 times greater among men (26.1 per 100,000) than women the same age (4.3 per 100,000) and similar to that of men aged 20–64 (23.2 per 100,000) [data not shown].

Among Canadian seniors, the ASMR (per 100,000) due to suicide showed no consistent trend between 2000 and 2017, ranging from a low of 10.0 in 2001 to a high of 11.9 in 2015. The number of deaths by suicide increased from 400 in 2000 to 645 in 2017, peaking at 690 deaths in 2015 (Figure 3.5.7). It is important to note that deaths by suicide account for less than 1% of all deaths among seniors.

**FIGURE 3.5.7.**

Age-standardized\* mortality rates and number of deaths by suicide, 65+ years, Canada†, 2000–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013.

† 2017 mortality data are not available for Yukon.

**Abbreviation:** ASMR = age-standardized mortality rate.

**Notes:** These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20. ICD-10 codes: X60–X84, Y87.0.

**Source:** Canadian Vital Statistics—Death Database, 2000–2017.

## 3.6

# MUSCULOSKELETAL DISORDERS

## GOUT AND OTHER CRYSTAL ARTHROPATHIES

Crystal arthropathies are caused by small crystals that accumulate in the joints.<sup>[76]</sup> Gout and pseudogout are the two most common types of crystal arthropathies. Gout is characterized by the crystallization of uric acid within the joints. It is often associated with an excess of uric acid in the blood, or hyperuricemia. Pseudogout results from deposits of calcium pyrophosphate crystals in the joints. The body's immune system is triggered by these crystals, and the immune system activity can lead to pain, swelling and redness in the joint and surrounding tissues.

While gout can occur in any joint, it most often occurs at the base of the big toe.<sup>[77]</sup> Other joints commonly involved include the knees, ankles, elbows, wrists and fingers. Both gout and pseudogout are episodic in nature, with active and inactive periods. Active periods or "attacks" vary in length and severity. Repeated attacks of these conditions may become more frequent, last longer and affect more joints and can cause permanent joint damage.

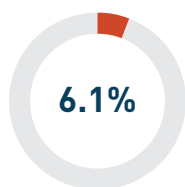
Although hyperuricemia is the primary risk factor for gout, only a minority of people with hyperuricemia develop gout and other crystal arthropathies because other factors affect risk.<sup>[78]</sup> Modifiable metabolic and behavioural risk factors associated with the development of gout and other crystal arthropathies include:<sup>[77-79]</sup>

- Obesity;
- A diet high in purines (e.g. red meat, organ meats, certain types of seafood);
- Consumption of alcohol (especially beer); and
- Consumption of beverages sweetened with fructose.

Other risk factors associated with the development of gout and other crystal arthropathies include:<sup>[77-80]</sup>

- Age—the risk increases with age;
- Sex—gout is more prevalent in men;
- Ethnic and cultural origin—gout and other crystal arthropathies are more prevalent among Black adults, particularly men, than their White counterparts; and
- Family history of gout and other crystal arthropathies.

## PREVALENCE

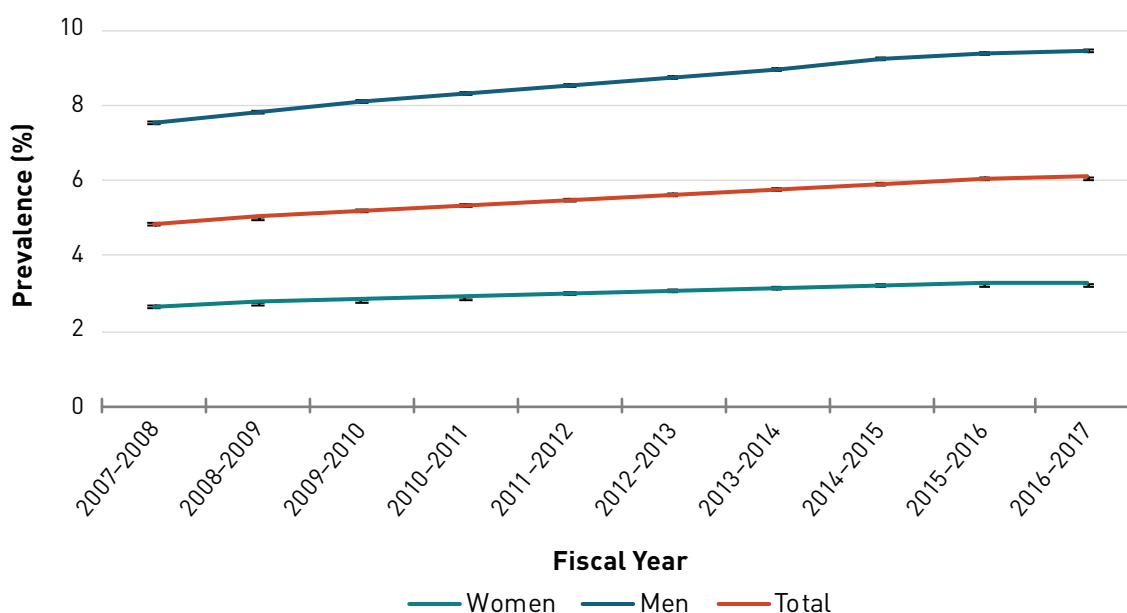


About **381,000** or **6.1%** of Canadian seniors (65+) were living with diagnosed gout and other crystal arthropathies in 2016–2017.

Between 2007–2008 and 2016–2017, the age-standardized prevalence of diagnosed gout and other crystal arthropathies in seniors increased from 4.8% to 6.1% (Figure 3.6.1).

**FIGURE 3.6.1.**

Age-standardized\* prevalence of diagnosed gout and other crystal arthropathies, 65+ years, Canada†, 2007–2008 to 2016–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013 using 5-year age groups.

† Data from Nunavut were excluded before fiscal year 2005–2006. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

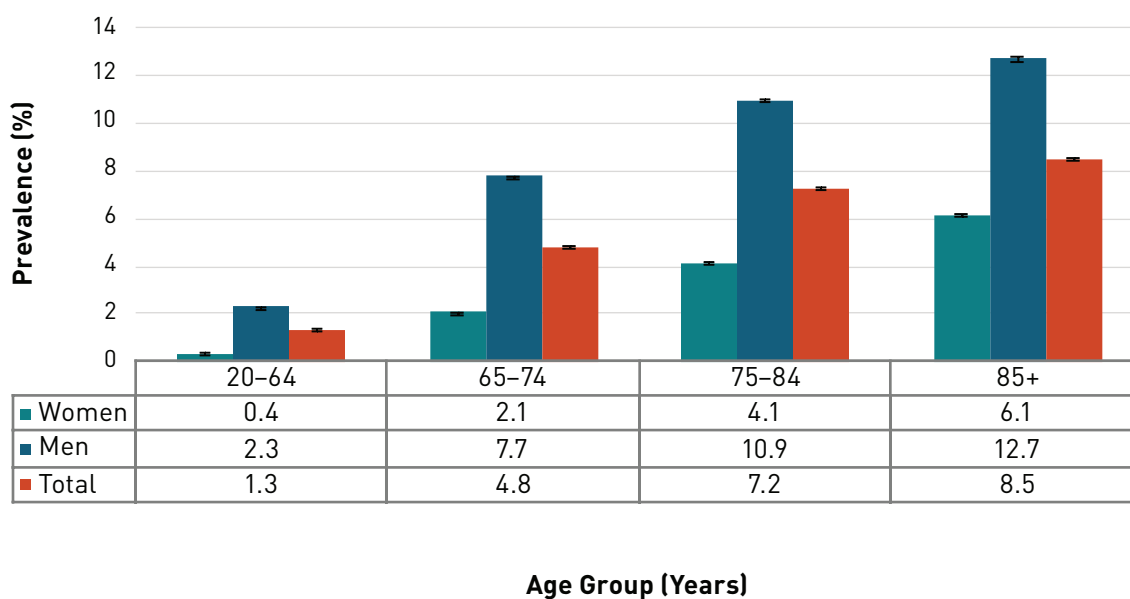
**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

In 2016–2017, men aged 65+ were 2.7 times more likely than women the same age to have diagnosed gout and other crystal arthropathies.

The prevalence of diagnosed gout and other crystal arthropathies increased with age; 8.5% of those aged 85+ were living with diagnosed gout and other crystal arthropathies in 2016–2017 (Figure 3.6.2).

**FIGURE 3.6.2.**

Prevalence of diagnosed gout and other crystal arthropathies, by sex and age group, Canada<sup>†</sup>, 2016–2017



<sup>†</sup> Data from Nunavut were excluded before fiscal year 2005–2006. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

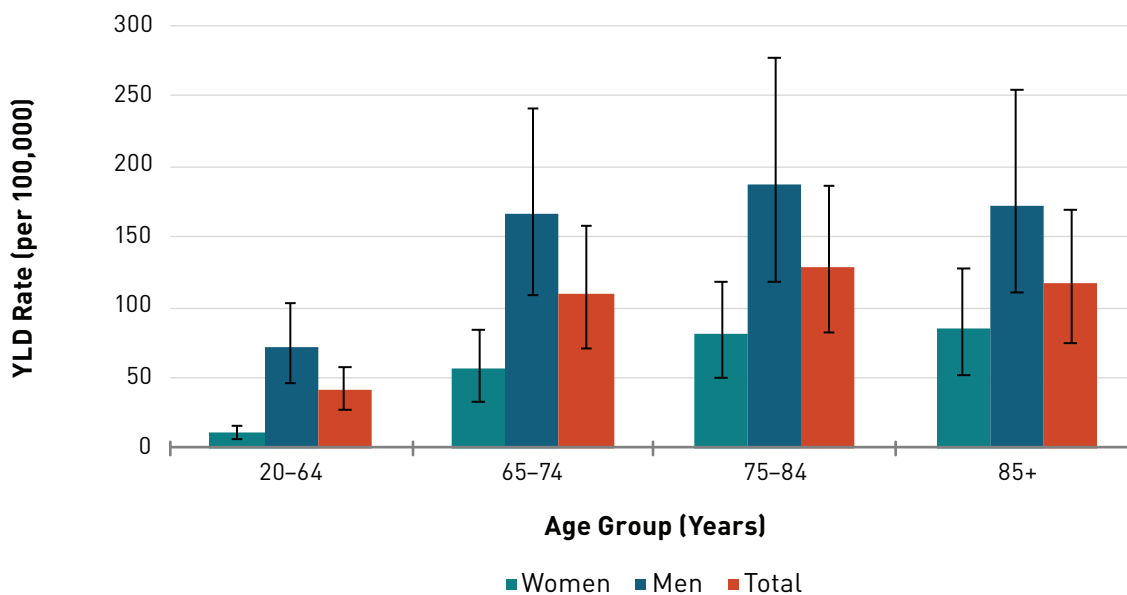


## DISABILITY

For both sexes, the YLD rate due to gout was 116.0 per 100,000 seniors in 2017. Rates did not differ by age group among seniors (Figure 3.6.3).

**FIGURE 3.6.3.**

Years lived with disability due to gout, rates per 100,000, by sex and age group, Canada, 2017



**Abbreviation:** YLD = years lived with disability.

**Note:** The error bars indicate 95% uncertainty interval. The 95% uncertainty interval is determined by the 25<sup>th</sup> and 975<sup>th</sup> value of the 1,000 values ordered from smallest to largest.

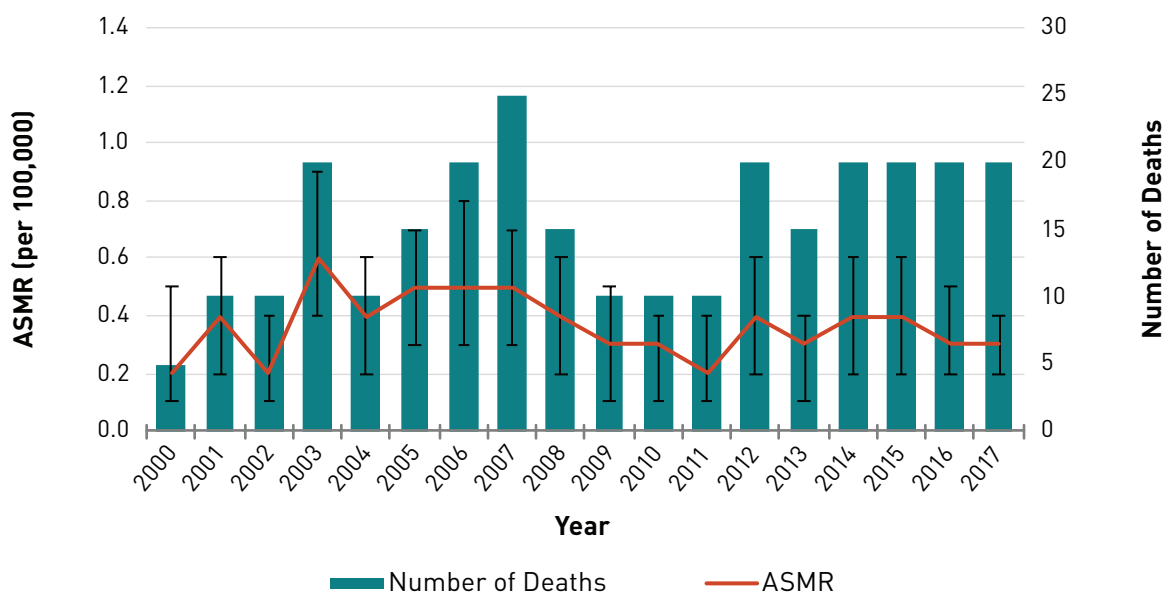
**Source:** Global Burden of Disease Collaborative Network, 2017.

## MORTALITY

Among seniors, the ASMR (per 100,000) due to gout and other crystal arthropathies showed no consistent trend, ranging from 0.2 to 0.6 over the period 2000 to 2017. Similarly, the number of deaths due to gout and other crystal arthropathies showed no consistent trend over this 15-year period, ranging from a high of 25 in 2007 to a low of 5 in 2000 (Figure 3.6.4).

**FIGURE 3.6.4.**

Age-standardized\* mortality rates and number of deaths\* due to gout and other crystal arthropathies, 65+ years, Canada†, 2000–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013.

† 2017 mortality data are not available for Yukon.

Abbreviation: ASMR = age-standardized mortality rate.

Notes: The 95% confidence interval shows an estimated range of values which is likely to include the true value 19 times out of 20. ICD-10 codes: M10-M11.

Source: Canadian Vital Statistics—Death Database, 2000–2017.

# OSTEOARTHRITIS

Osteoarthritis is the most common form of arthritis and a significant cause of disability.<sup>(81)</sup> Although once thought to be caused by the wear and tear of aging, we now know that osteoarthritis is a progressive disease of the synovial joints resulting from a failed attempt by the body to repair joint tissues that are damaged due to abnormal joint loading (from obesity and joint injury) with the influence of systemic factors (for example, genetic factors, inflammation, aging and sex).<sup>(82)</sup> All of these factors cause abnormal joint tissue metabolism, which is followed by the breakdown of the joint cartilage and underlying bone.

Osteoarthritis usually affects the joints of the hands, feet, hips, knees and spine. Signs and symptoms include joint stiffness, swelling, pain and loss of mobility. Although there is no cure for osteoarthritis, interventions (including lifestyle modifications) can reduce pain, improve function and, in some instances, delay disease progression.<sup>(83)</sup>

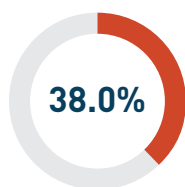
Modifiable risk factors associated with the development of osteoarthritis include:<sup>(83-85)</sup>

- Overweight and obesity;
- Joint injury; and
- Mechanical stress.

Other risk factors associated with the development of osteoarthritis include:<sup>(83-85)</sup>

- Age—although osteoarthritis is not an inevitable part of aging, the chance of developing this disease increases with age;
- Female sex (particularly post menopause); and
- Family history of osteoarthritis.

## PREVALENCE

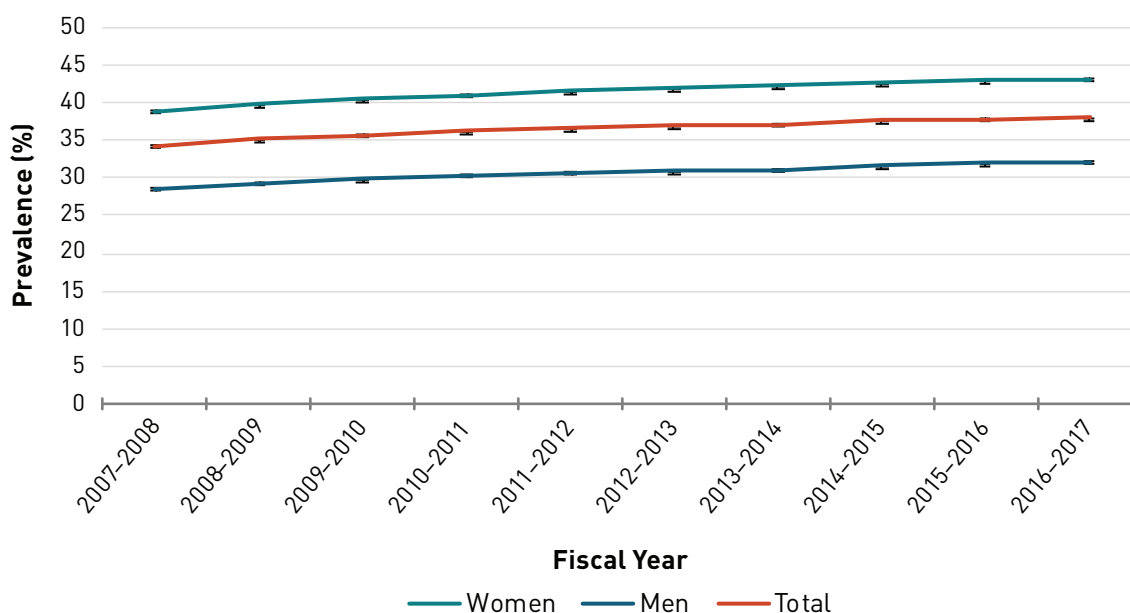


About **2.4 million** or **38.0%** of Canadian seniors (65+) were living with diagnosed osteoarthritis in 2016–2017.

Between 2007–2008 and 2016–2017, the age-standardized prevalence of diagnosed osteoarthritis in seniors increased from 34.2% to 38.0% (Figure 3.6.5).

**FIGURE 3.6.5.**

Age-standardized\* prevalence of diagnosed osteoarthritis, 65+ years, Canada†, 2007–2008 to 2016–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013 using 5-year age groups.

† Data from Nunavut were excluded before fiscal year 2005–2006. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

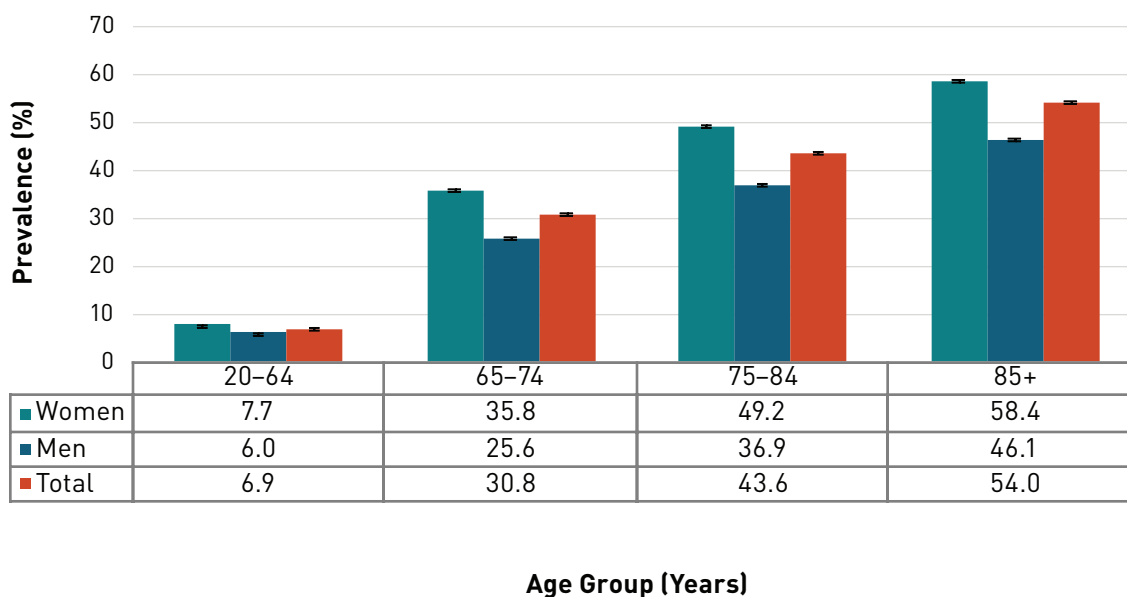
**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

In 2016–2017, women aged 65+ were 1.4 times more likely than men the same age to have diagnosed osteoarthritis.

The prevalence of diagnosed osteoarthritis increased with age, with the highest prevalence, 54.0%, among those aged 85+ in 2016–2017 (Figure 3.6.6).

**FIGURE 3.6.6.**

Prevalence of diagnosed osteoarthritis, by age group and sex, Canada<sup>†</sup>, 2016–2017



<sup>†</sup> Data from Nunavut were excluded before fiscal year 2005–2006. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

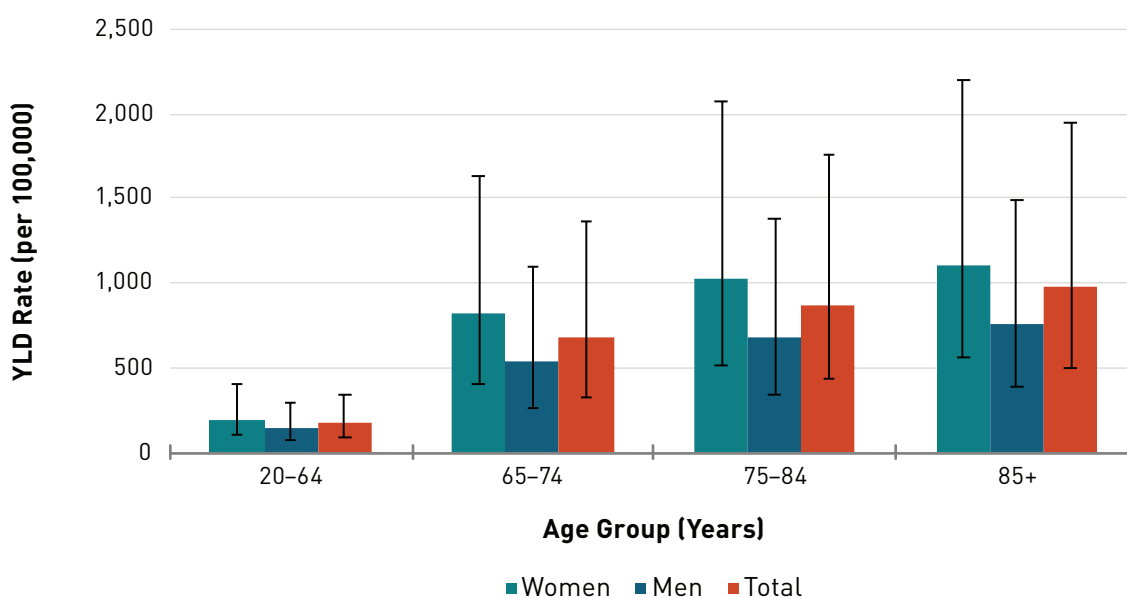
**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

## DISABILITY

For both sexes, the YLD rate due to osteoarthritis was 777.9 per 100,000 seniors in 2017. Rates did not differ by age group among seniors (Figure 3.6.7).

**FIGURE 3.6.7.**

Years lived with disability due to osteoarthritis, rates per 100,000, by sex and age group, Canada, 2017



**Abbreviation:** YLD = years lived with disability.

**Note:** The error bars indicate 95% uncertainty interval. The 95% uncertainty interval is determined by the 25<sup>th</sup> and 975<sup>th</sup> value of the 1,000 values ordered from smallest to largest.

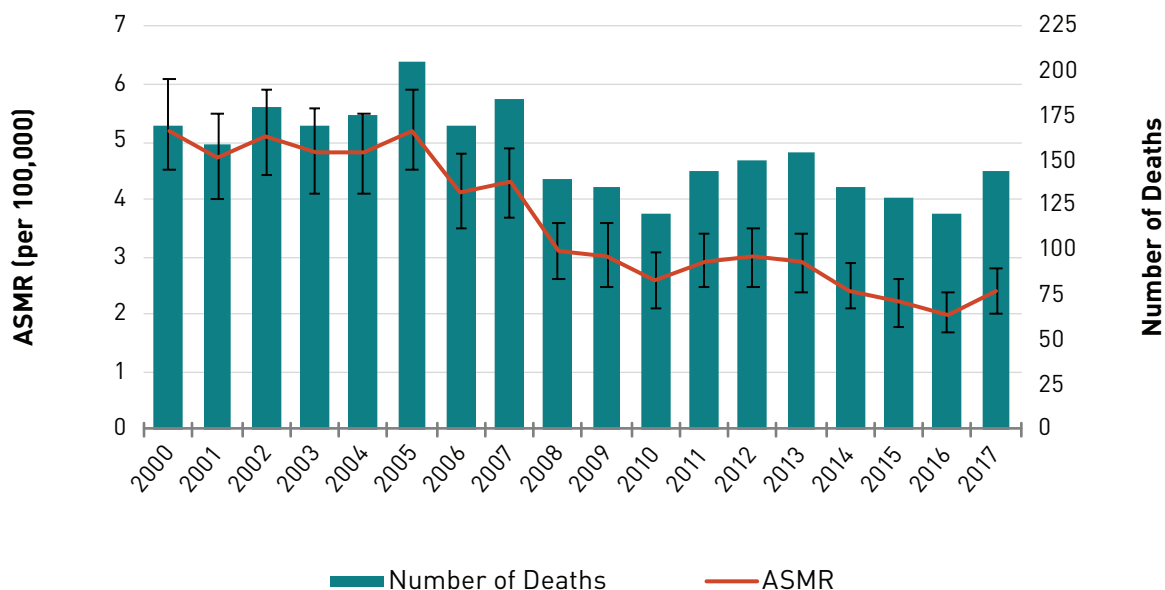
**Source:** Global Burden of Disease Collaborative Network, 2017.

## MORTALITY

Among seniors the ASMR (per 100,000) due to osteoarthritis decreased by 53.8% from 5.2 in 2000 to 2.4 in 2017. The number of deaths due to osteoarthritis fluctuated over the period from a high of 205 in 2005 to a low of 120 in 2010 (Figure 3.6.8).

**FIGURE 3.6.8.**

Age-standardized\* mortality rates and number of deaths due to osteoarthritis, 65+ years, Canada†, 2000–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013.

† 2017 mortality data are not available for Yukon.

**Abbreviation:** ASMR = age-standardized mortality rate.

**Notes:** The 95% confidence interval shows an estimated range of values which is likely to include the true value 19 times out of 20. ICD-10 codes: M15-M19.

**Source:** Canadian Vital Statistics—Death Database, 2000–2017.

# RHEUMATOID ARTHRITIS

Rheumatoid arthritis, a common type of inflammatory arthritis, is an autoimmune disease where the body's immune system mistakenly attacks the lining of the joints and other tissues.<sup>(86,87)</sup> Inflammation in the joints causes swelling, pain and stiffness. Left untreated, such inflammation can lead to joint damage. Rheumatoid arthritis can affect multiple joints in the body and most commonly the joints of the hands, wrists and feet. The inflammation may also affect other organs, such as the eyes, skin, lungs or heart.

While there is no cure for rheumatoid arthritis, effective treatment options can alleviate symptoms and improve function of the joints. Medication is often prescribed as a first line of treatment. Other treatments include physical therapy, occupational therapy and lifestyle modification.<sup>(88)</sup> Individuals who are diagnosed and treated early are less likely to have severe symptoms, joint damage and functional impairments.

The specific causes of rheumatoid arthritis are unknown, but a number of factors are associated with the increased risk of developing the disease. Modifiable risk factors that may play a role in the development of rheumatoid arthritis include:<sup>(89,90)</sup>

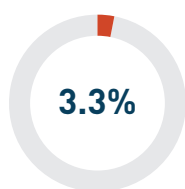
- Smoking;
- Obesity;
- Occupational exposures; and
- Infection.

Other risk factors associated with the development of rheumatoid arthritis include:<sup>(91)</sup>

- Age—the risk increases with age;
- Sex—rheumatoid arthritis is more prevalent in women;
- Ethnic or cultural origin—the prevalence of rheumatoid arthritis is higher among Indigenous people (First Nations, Métis and Inuit populations); and
- Family history of rheumatoid arthritis.



## PREVALENCE

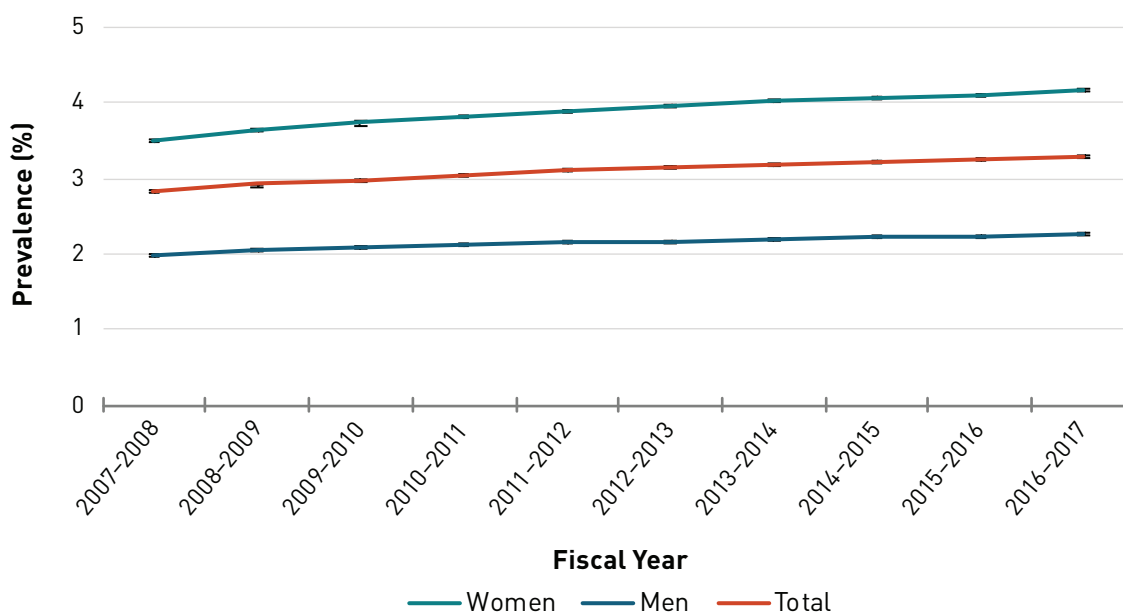


About **203,000** or **3.3%** of Canadian seniors (65+) were living with diagnosed rheumatoid arthritis in 2016–2017.

Between 2007–2008 and 2016–2017, the age-standardized prevalence of diagnosed rheumatoid arthritis in seniors increased from 2.8% to 3.3% (Figure 3.6.9).

**FIGURE 3.6.9.**

Age-standardized\* prevalence of diagnosed rheumatoid arthritis, 65+ years, Canada†, 2007–2008 to 2016–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013 using 5-year age groups.

† Data from Nunavut were excluded. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

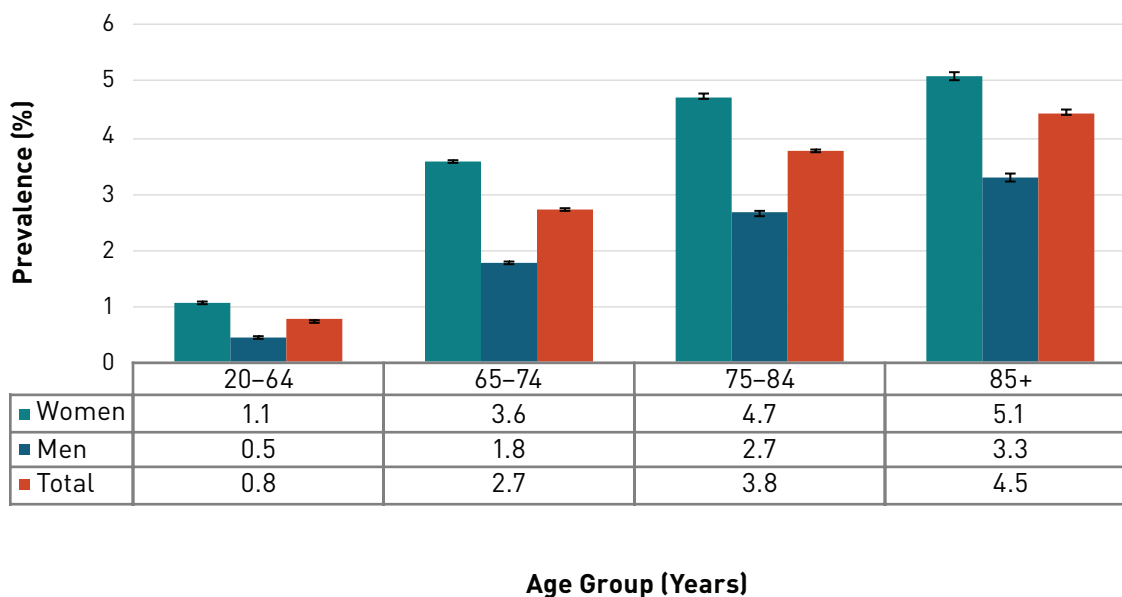
**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

In 2016–2017, women aged 65+ were 1.9 times more likely than men the same age to have diagnosed rheumatoid arthritis.

The prevalence of diagnosed rheumatoid arthritis increased with age, with 4.5% of those aged 85+ living with diagnosed rheumatoid arthritis in 2016–2017 (Figure 3.6.10).

**FIGURE 3.6.10.**

Prevalence of diagnosed rheumatoid arthritis, by sex and age group, Canada<sup>†</sup>, 2016–2017



<sup>†</sup> Data from Nunavut were excluded. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

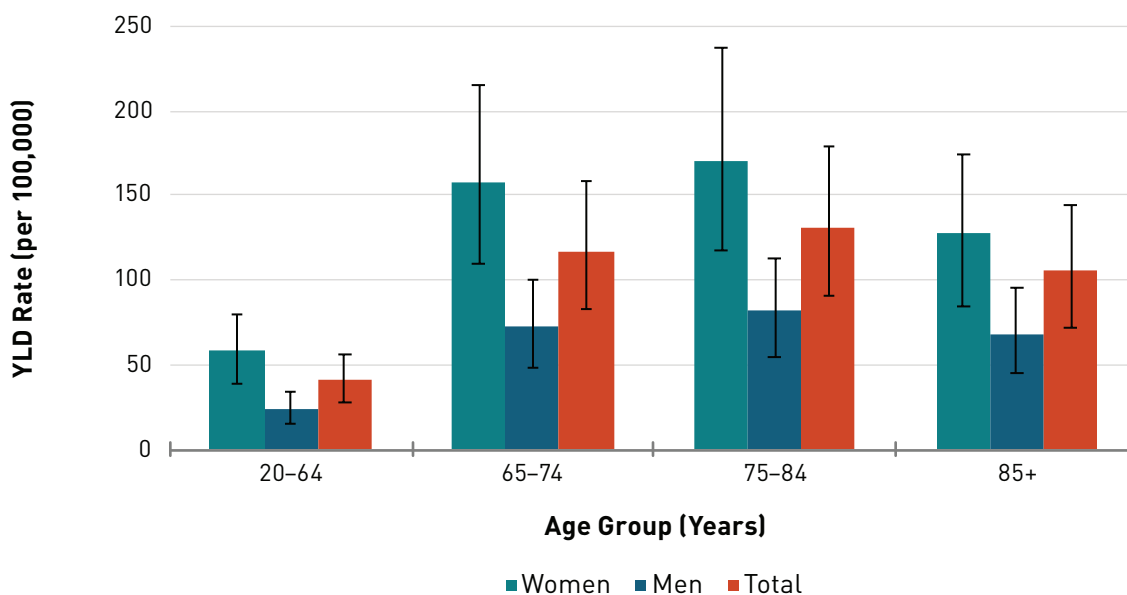
**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

## DISABILITY

For both sexes, the YLD rate due to rheumatoid arthritis was 119.7 per 100,000 seniors in 2017. Rates did not differ by age group among seniors (Figure 3.6.11).

**FIGURE 3.6.11.**

Years lived with disability due to rheumatoid arthritis, rates per 100,000, by sex and age group, Canada, 2017



**Abbreviation:** YLD = years lived with disability.

**Note:** The error bars indicate 95% uncertainty interval. The 95% uncertainty interval is determined by the 25<sup>th</sup> and 975<sup>th</sup> value of the 1,000 values ordered from smallest to largest.

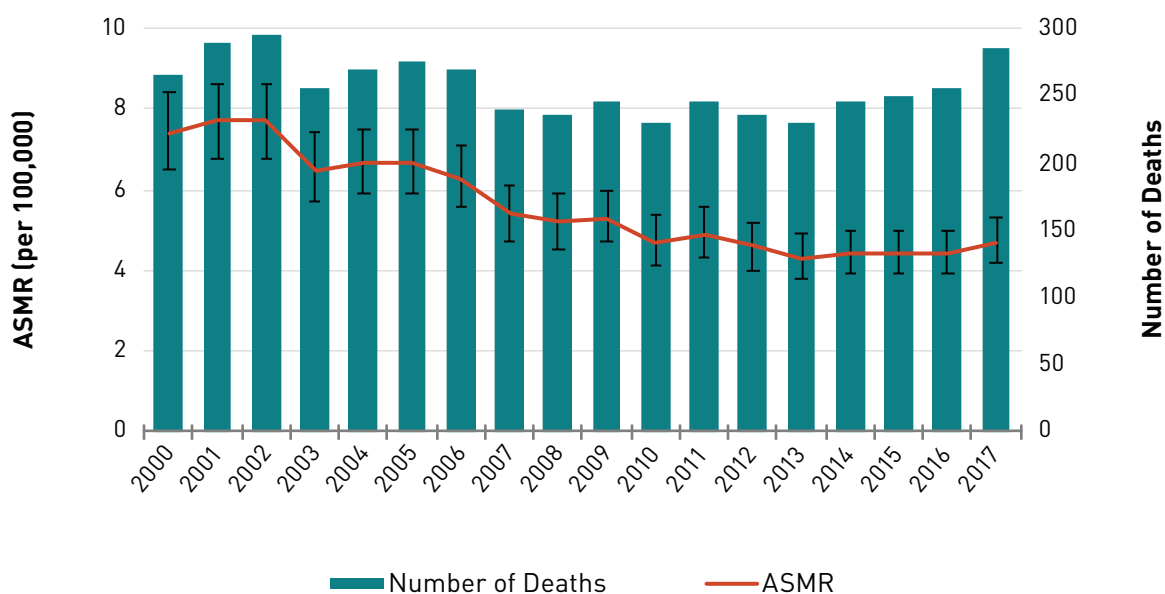
**Source:** Global Burden of Disease Collaborative Network, 2017.

## MORTALITY

Among Canadian seniors, the ASMR (per 100,000) due to rheumatoid arthritis decreased by 36.5% from 7.4 in 2000 to 4.7 in 2017. The number of deaths due to rheumatoid arthritis showed no consistent trend between 2000 and 2017, ranging from a high of 295 in 2002 to a low of 230 in 2010 and 2013 (Figure 3.6.12).

**FIGURE 3.6.12.**

Age-standardized\* mortality rates and number of deaths due to rheumatoid arthritis, 65+ years, Canada†, 2000–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013.

† 2017 mortality data are not available for Yukon.

**Abbreviation:** ASMR = age-standardized mortality rate.

**Notes:** The 95% confidence interval shows an estimated range of values which is likely to include the true value 19 times out of 20. ICD-10 codes: M05-M06.

**Source:** Canadian Vital Statistics – Death Database, 2000–2017.

# OSTEOPOROSIS

Osteoporosis is a metabolic bone disease characterized by low bone density and an elevated risk of fracture. Although more common among older individuals and among women, osteoporosis can affect people of all ages.<sup>[92]</sup>

Many people are not aware they have osteoporosis until they have a fracture, often the consequence of a fall. The most common fracture sites are the wrist, shoulder, spine, pelvis and hip.<sup>[93,94]</sup> Hip fractures are the most serious due to the life-threatening complications.

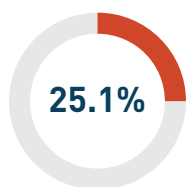
Several factors play a role in the development of osteoporosis. The more risk factors individuals have, the greater their risk. Modifiable risk factors associated with development of osteoporosis include:<sup>[95]</sup>

- Physical inactivity;
- A diet low in calcium, vitamin D and other important nutrients related to bone health;
- Low body weight (<60 kg) or major weight loss (>10% of body weight at age 25);
- Harmful use of alcohol; and
- Smoking.

Other risk factors associated with the development of osteoporosis include:<sup>[95]</sup>

- Age—the risk of osteoporosis increases with age;
- Sex—osteoporosis is more prevalent in women;
- A family history of osteoporosis or fracture (parental hip fracture);
- Hormonal deficits, for example, in the case of hypogonadism or premature menopause (<45 years);
- Specific medications (e.g. glucocorticoids); and
- Certain medical conditions (e.g. primary hypothyroidism, chronic inflammatory conditions, malabsorption syndromes).

## PREVALENCE

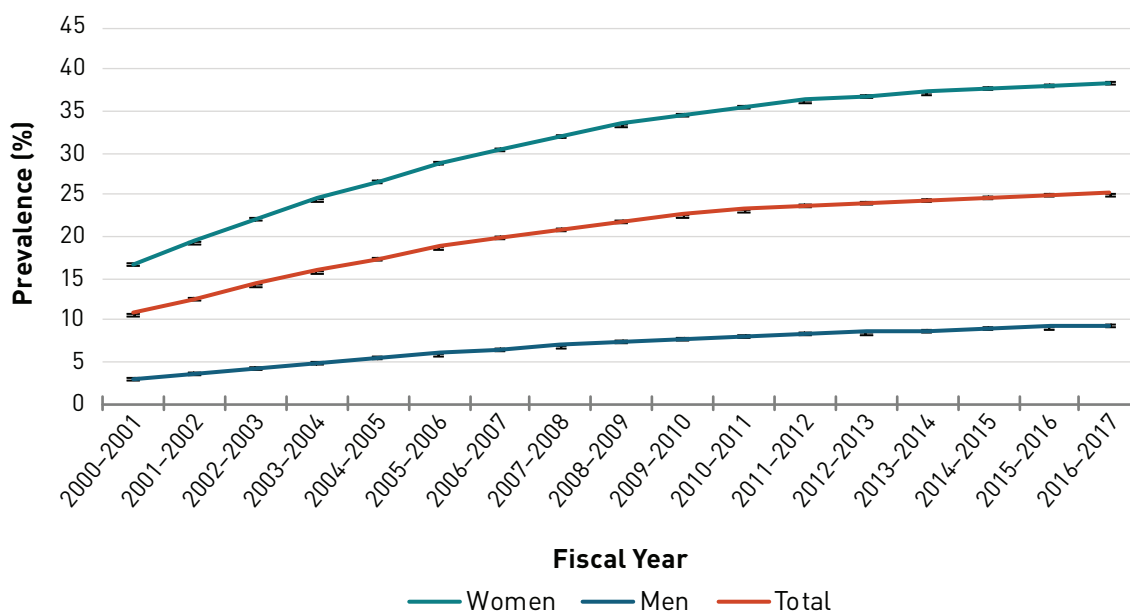


About **1.6 million** or **25.1%** of Canadian seniors (65+) were living with diagnosed osteoporosis in 2016–2017.

Between 2000–2001 and 2016–2017, the age-standardized prevalence of diagnosed osteoporosis in seniors increased from 10.8% to 25.1% (Figure 3.6.13).

**FIGURE 3.6.13.**

Age-standardized\* prevalence of diagnosed osteoporosis, 65+ years, Canada†, 2000–2001 to 2016–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013 using 5-year age groups.

† Data from Nunavut were excluded before fiscal year 2005–2006. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

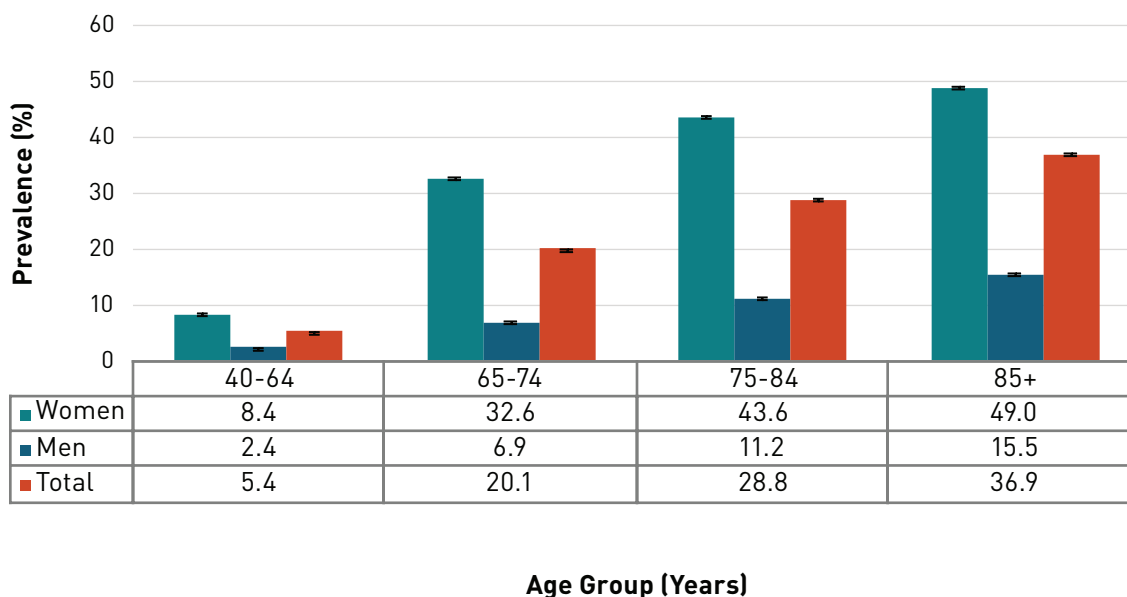
**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

In 2016–2017, women aged 65+ were 4.2 times more likely than men the same age to have diagnosed osteoporosis.

The prevalence of diagnosed osteoporosis increased with age, with the highest prevalence, 36.9%, among those aged 85+ years in 2016–2017 (Figure 3.6.14).

**FIGURE 3.6.14.**

Prevalence of diagnosed osteoporosis, by sex and age group, Canada<sup>†</sup>, 2016–2017



<sup>†</sup> Data from Nunavut were excluded before fiscal year 2005–2006. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

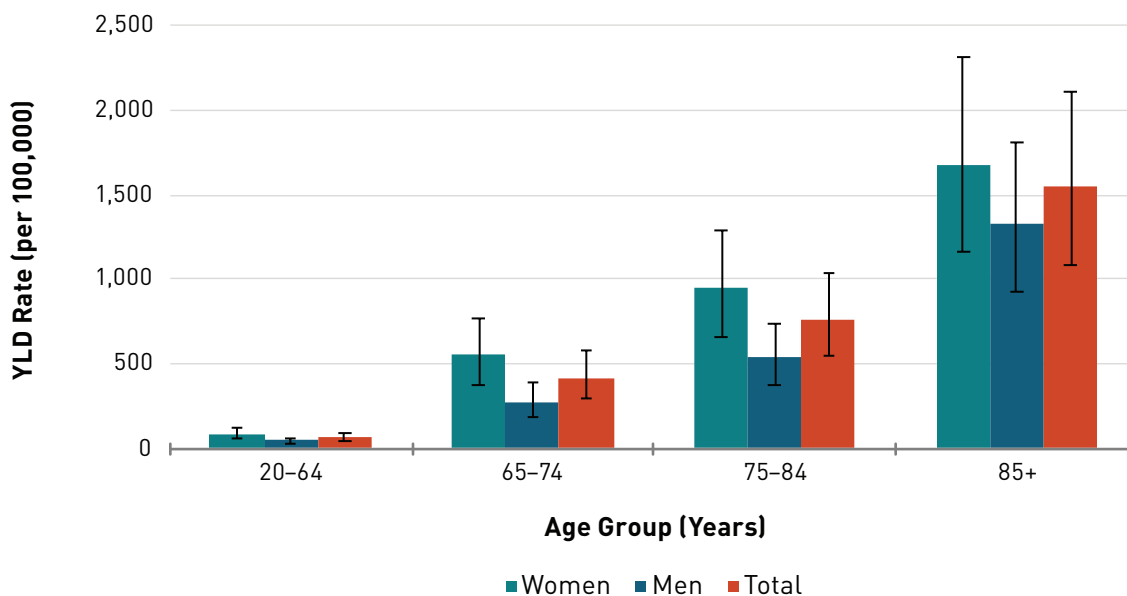
**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

## DISABILITY

For both sexes, the YLD rate due to low bone mineral density (a proxy for osteoporosis) was 670.9 per 100,000 seniors in 2017. Rates did not differ by age group among women but were higher among men aged 85+ than among younger men (Figure 3.6.15).

**FIGURE 3.6.15.**

Years lived with disability due to low bone mineral density (a proxy for osteoporosis), rates per 100,000, by sex and age group, Canada, 2017



Abbreviation: YLD = years lived with disability.

Note: The error bars indicate 95% uncertainty interval. The 95% uncertainty interval is determined by the 25<sup>th</sup> and 975<sup>th</sup> value of the 1,000 values ordered from smallest to largest.

Source: Global Burden of Disease Collaborative Network, 2017.

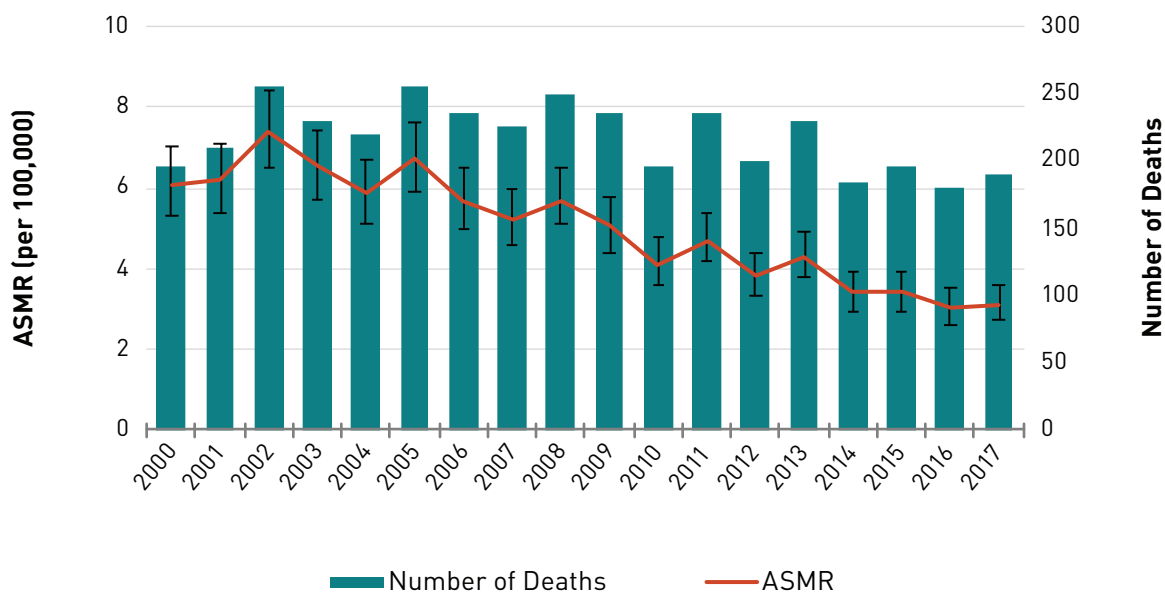


## MORTALITY

Among seniors, the ASMR (per 100,000) due to osteoporosis decreased by 49.2% from 6.1 in 2000 to 3.1 in 2017. The number of deaths due to osteoporosis showed no consistent trend between 2000 and 2015, ranging from a high of 255 in 2005 to a low of 180 in 2016 (Figure 3.6.16).

**FIGURE 3.6.16.**

Age-standardized\* mortality rates and number of deaths due to osteoporosis, 65+ years, Canada†, 2000–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013.

† 2017 mortality data are not available for Yukon.

Abbreviation: ASMR = age-standardized mortality rate.

Notes: The 95% confidence interval shows an estimated range of values which is likely to include the true value 19 times out of 20. ICD-10 codes: M80-M81.

Source: Canadian Vital Statistics—Death Database, 2000–2017.

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## OSTEOPOROSIS AND RELATED FRACTURES

In 2015–2016, there were a total of 130,000 osteoporosis-related fractures, most commonly in the forearm, hip, spine, humerus and pelvis. Among those aged 80+ years, hip fractures were the most common type. These also resulted in the most serious complications. Women were more likely to fracture a hip than men, but men with a hip fracture were more likely to die of any cause within the following year.<sup>(94)</sup>

Prevention and appropriate care are essential to reducing the number of osteoporosis-related fractures. However, less than 20% of those with a fracture received an osteoporosis diagnosis, underwent a bone mineral density test or received a prescription for an osteoporosis-related medication within one year. Men were less likely than women to receive one of these interventions following a fracture.<sup>(94)</sup>

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## 3.7

# NEUROLOGICAL DISEASES

## DEMENTIA (including Alzheimer disease)

Dementia is an umbrella term used to describe a set of symptoms affecting brain function that are caused by neurodegenerative and vascular diseases or injuries. Alzheimer disease is the most common cause of the condition. Dementia is characterized by a decline in cognitive abilities (including memory; awareness of person, place, and time; language, basic math skills; judgment; and planning) and can affect mood and behaviour. Over time, it reduces the ability to independently maintain activities of daily life, such as eating, bathing, toileting and dressing.<sup>[96]</sup>

Although all the causes of dementia are not known, research suggests the following possible modifiable risk factors:<sup>[97]</sup>

- Physical inactivity;
- Obesity;
- Unhealthy diet;
- Smoking;
- Harmful use of alcohol;
- Social isolation;
- Lack of cognitively stimulating activities; and
- Diabetes (type 2), hypertension and/or depression.

Other risk factors for dementia include:<sup>[97,98]</sup>

- Age—although not a normal part of aging, age is a key risk factor for dementia. However, early onset dementia can develop at younger ages; and
- Sex—women are at an increased risk of developing dementia.

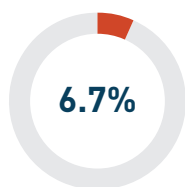
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Dementia is not a normal part of aging.<sup>[96]</sup>

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## PREVALENCE

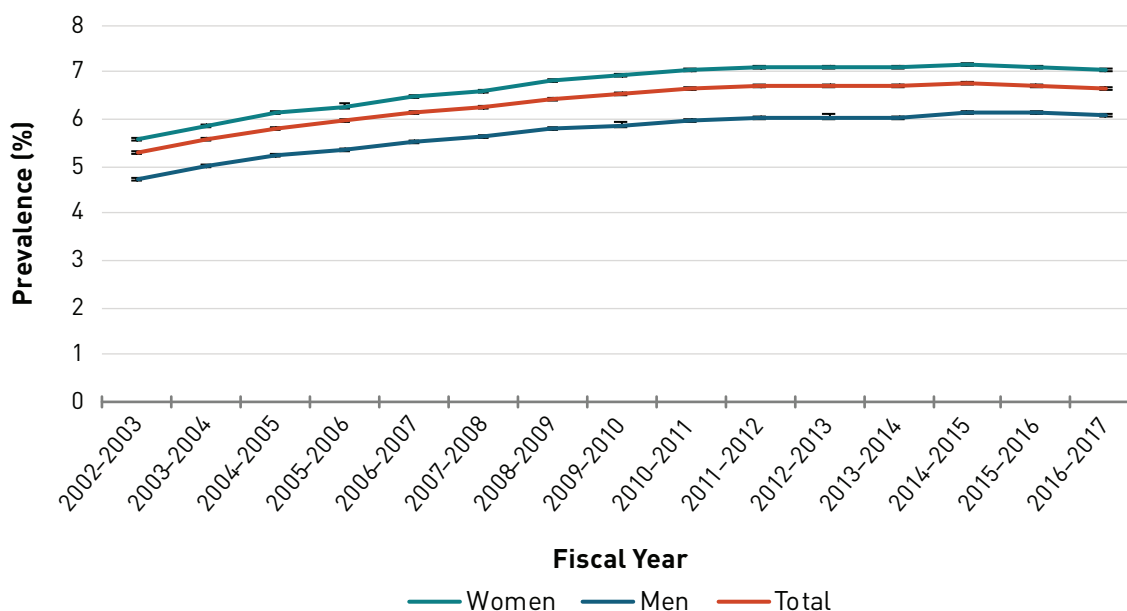


Over **432,000** or **6.7%** of Canadian seniors (65+) were living with diagnosed dementia in 2016–2017.

Between 2002–2003 and 2016–2017, the age-standardized prevalence of diagnosed dementia in seniors increased from 5.3% to 6.7% (Figure 3.7.1).

**FIGURE 3.7.1.**

Age-standardized\* prevalence of diagnosed dementia, 65+ years, Canada†, 2002–2003 to 2016–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013 using 5-year age groups.

† Data from Nunavut were excluded before fiscal year 2005–2006. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

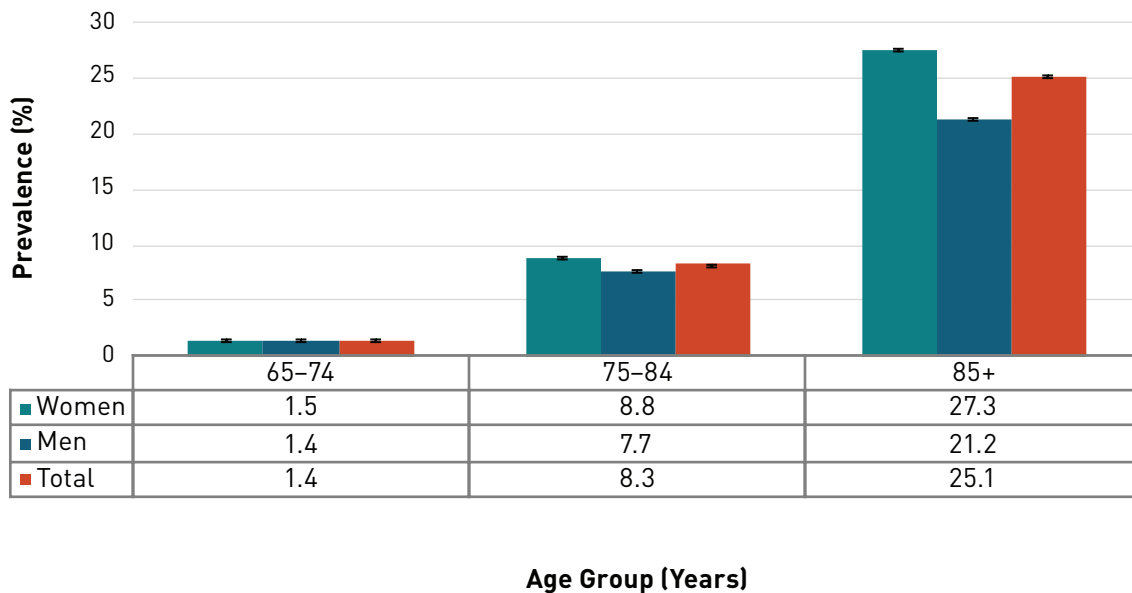
**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

In 2016–2017, women aged 65+ were 1.5 times more likely than men the same age to have diagnosed dementia.

The prevalence of diagnosed dementia increased with age, with the highest prevalence, 25.1%, among those aged 85+ in 2016–2017 (Figure 3.7.2).

**FIGURE 3.7.2.**

Prevalence of diagnosed dementia, by sex and age group, Canada†, 2016–2017



† Data from Nunavut were excluded before fiscal year 2005–2006. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

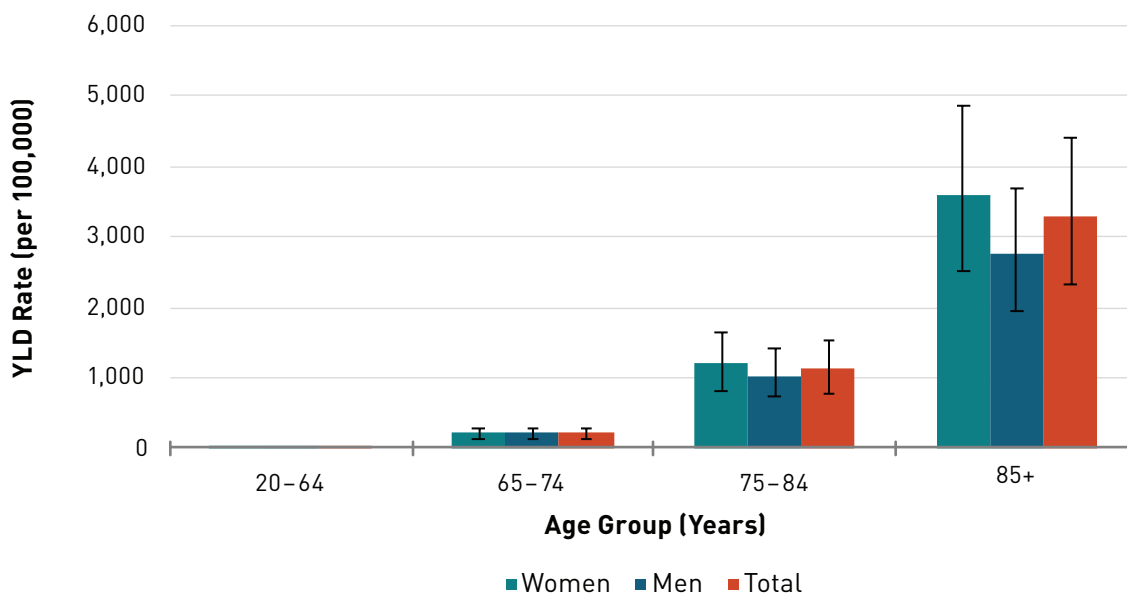
**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

## DISABILITY

For both sexes, the YLD rate due to Alzheimer disease and other dementias was 880.9 per 100,000 seniors in 2017. The rate reached a high of 3,301.3 in those aged 85+, over 15 times greater than among seniors aged 65–74 years, with a rate of 212.0 (Figure 3.7.3).

**FIGURE 3.7.3.**

Years lived with disability due to Alzheimer disease and other dementias, rates per 100,000, by sex and age group, Canada, 2017



Abbreviation: YLD = years lived with disability.

Note: The error bars indicate 95% uncertainty interval. The 95% uncertainty interval is determined by the 25<sup>th</sup> and 975<sup>th</sup> value of the 1,000 values ordered from smallest to largest.

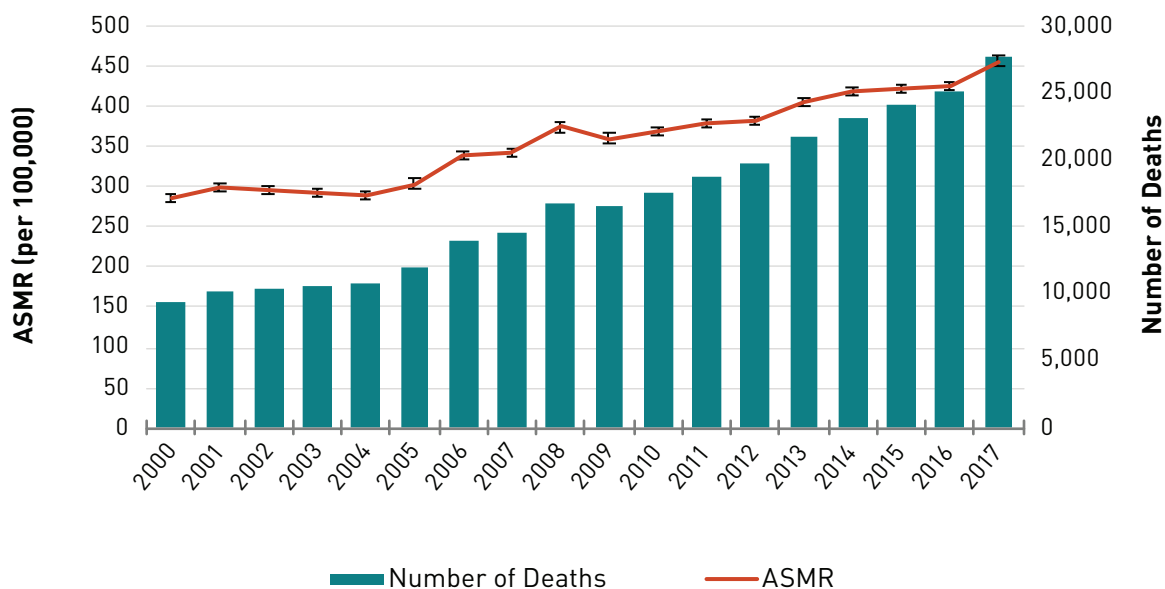
Source: Global Burden of Disease Collaborative Network, 2017.

## MORTALITY

Among Canadian seniors, the ASMR (per 100,000) due to dementia increased by 59.4% from 285.8 in 2000 to 455.6 in 2017. The number of deaths due to dementia increased from 9,465 in 2000 to 27,650 in 2017 (Figure 3.7.4).

**FIGURE 3.7.4.**

Age-standardized\* mortality rates and number of deaths due to dementia, 65+ years, Canada†, 2000–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013.

† 2017 mortality data are not available for Yukon.

**Abbreviation:** ASMR = age-standardized mortality rate

**Notes:** The 95% confidence interval shows an estimated range of values which is likely to include the true value 19 times out of 20. ICD-10 codes: G30, F00, F01, F02, F03.

**Source:** Canadian Vital Statistics—Death Database, 2000–2017.

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## DEPRESSION, DELIRIUM AND DEMENTIA

Sometimes referred to as the three D's in geriatric psychiatry, depression, delirium and dementia are three diseases that often co-occur in geriatric populations. The symptoms overlap and may be difficult to diagnose.

**Depression** is characterized by lowered mood or diminished pleasure in activities, as well as somatic symptoms such as diminished ability to concentrate and suicidal thoughts or plans.<sup>(63)</sup> Depression can reduce quality of life and life expectancy.<sup>(99)</sup>

Self-reported information from the 2012 CCHS indicates that the proportion of community-dwelling seniors who met criteria for a major depressive episode within the past year was 1.6% (72,350 individuals).<sup>(100)</sup> A more recent survey conducted in 2017 reported that 14% of Canadian seniors have depression.<sup>(101)</sup> A study of seniors living in residential care facilities (e.g. long-term care, nursing or personal care homes), using 2008–2009 data, showed that 44% had a diagnosis and/or symptoms of depression.<sup>(102)</sup> As depression affects many Canadian seniors, it is important to raise awareness for routine screening and early interventions. Refer to Section 3.5, “Mental Illness and Suicide”, for information on the use of health services for mood or anxiety disorders.

**Dementia** is an umbrella term used to describe a set of symptoms affecting brain function that are caused by neurodegenerative and vascular diseases or injuries. Alzheimer's disease is the most common cause of the condition. Dementia is characterized by a decline in cognitive abilities (including memory; awareness of person, place, and time; language, basic math skills; judgment; and planning) and can affect mood and behaviour. Over time, it reduces the ability to independently maintain activities of daily life, such as eating, bathing, toileting and dressing.<sup>(96)</sup> Approximately 6.9% of seniors were living with dementia in 2016–2017, with women 1.5 times more likely to be diagnosed. Refer to section 3.7, “Neurological diseases”, for further information.

**Delirium** has an acute onset (with changes occurring over hours or days) and is characterized by inattention, disorganized thinking and altered level of consciousness. It usually resolves within days or weeks. It is often unrecognized and can be misdiagnosed as dementia. Although the prevalence of delirium in the community is low, between 4% and 12%, it varies between approximately 7% and 73% on admission to palliative care.<sup>(103)</sup> Cognitive impairment, including dementia, is one of the most important risk factors for delirium. Other important factors include functional impairment, vision impairment, history of alcohol abuse and older age.<sup>(104)</sup> Vulnerable patients exposed to certain precipitating factors (e.g. major surgery, hip fracture, medication) are at increased risk of developing delirium and increased risk of morbidity and mortality.<sup>(104)</sup> Nonpharmalogical interventions targeting specific risk factors have been shown to be successful in the primary prevention of delirium. Nevertheless, delirium is still poorly understood and the pathways between depression, dementia and delirium remain unclear.

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## PARKINSONISM (including Parkinson disease)

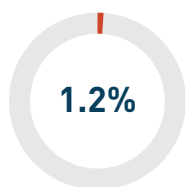
Parkinsonism is an umbrella term that includes Parkinson disease, secondary parkinsonism and atypical parkinsonism. While the majority of parkinsonism cases are due to Parkinson disease, cases also arise due to other neurological disorders, medication side effects or toxins.<sup>(105-107)</sup> Rates are higher among men than women, and the risk of developing parkinsonism increases with age.

Parkinsonism refers to a set of signs and symptoms usually characterized by: rigidity, tremors, bradykinesia (abnormal slowness of movement) and/or postural instability.<sup>(105-107)</sup>

Individuals with parkinsonism also often experience non-motor symptoms such as pain, mood disorders, sleep problems, cognitive impairment or dementia, constipation, urinary incontinence, sexual dysfunction and/or reduced sense of smell.<sup>(108,109)</sup>



## PREVALENCE

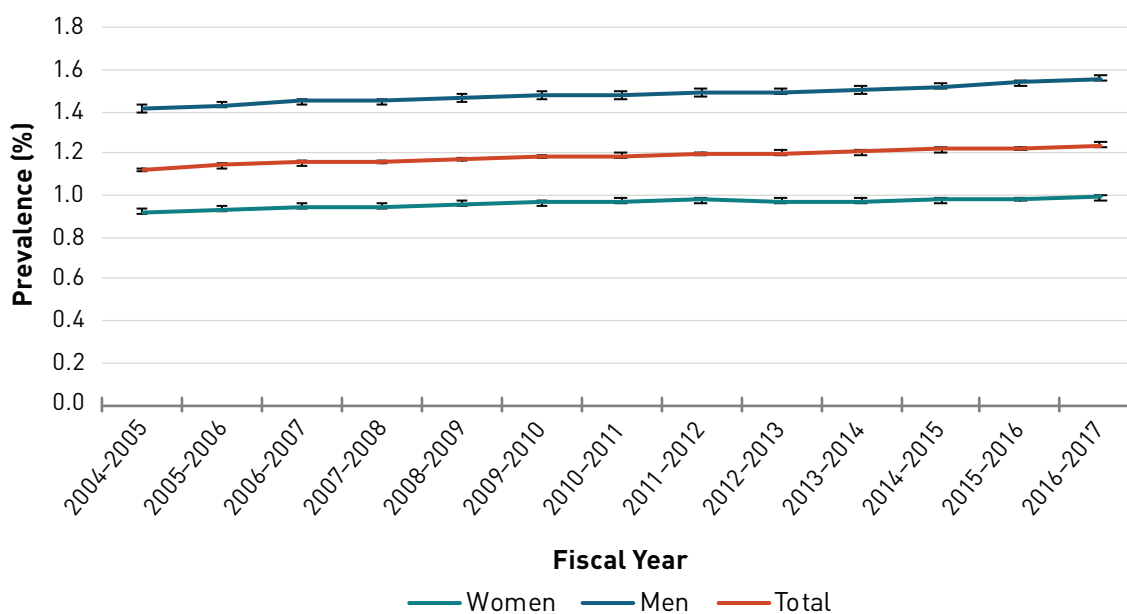


About **77,000** or **1.2%** of Canadian seniors (65+) were living with diagnosed parkinsonism in 2016–2017.

Between 2004–2005 and 2016–2017, the age-standardized prevalence of diagnosed parkinsonism in seniors was generally stable, ranging from 1.1% in 2004–2005 to 1.2% in 2016–2017 (Figure 3.7.5).

**FIGURE 3.7.5.**

Age-standardized\* prevalence of diagnosed parkinsonism (including Parkinson disease), 65+ years, Canada†, 2004–2005 to 2016–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013 using 5-year age groups.

† Data from Nunavut were excluded before fiscal year 2005–2006. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

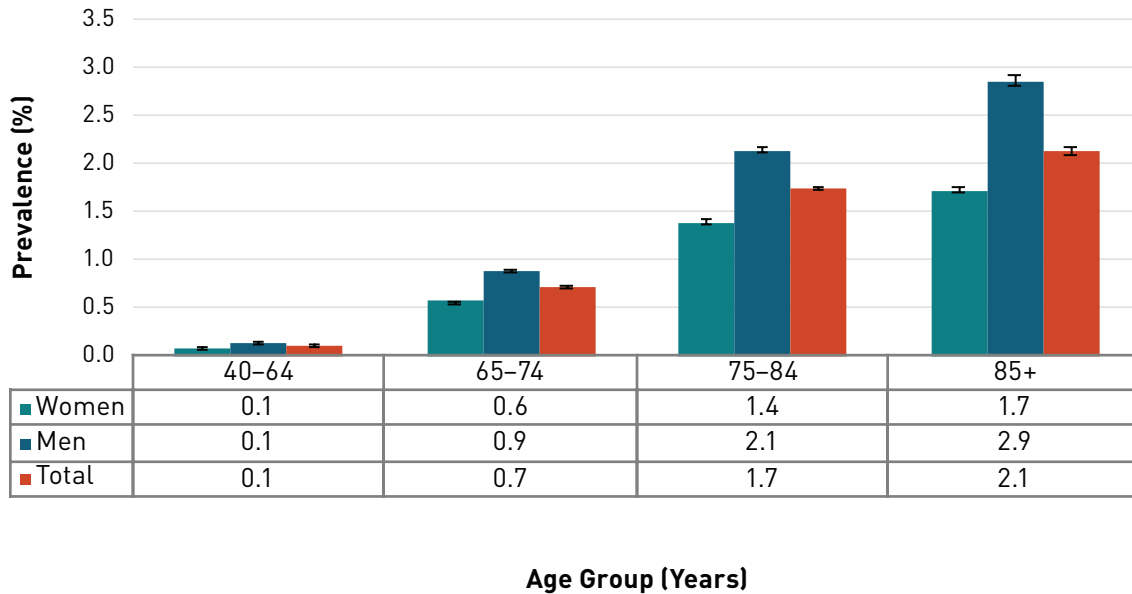
**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

In 2016–2017, men aged 65+ were 1.5 times more likely than women the same age to live with diagnosed parkinsonism.

The prevalence of diagnosed parkinsonism increased with age and was highest, at 2.1%, among those aged 85+ in 2016–2017 (Figure 3.7.6).

**FIGURE 3.7.6.**  
Prevalence of diagnosed parkinsonism (including Parkinson disease), by sex and age group, Canada†, 2016–2017



† Data from Nunavut were excluded before fiscal year 2005–2006. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

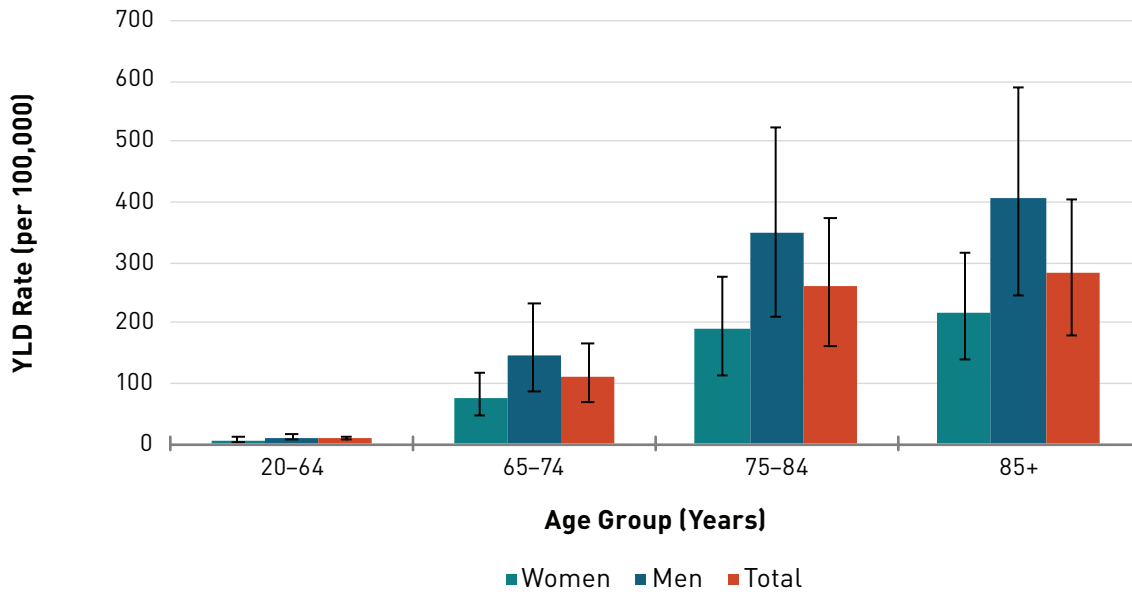
**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

## DISABILITY

For both sexes, the YLD rate due to Parkinson disease (excluding individuals with other types of parkinsonism) was 177.9 per 100,000 seniors in 2017. Rates did not differ by age group among seniors (Figure 3.7.7).

**FIGURE 3.7.7.**

Years lived with disability due to Parkinson disease, rates per 100,000, by sex and age group, Canada, 2017



Abbreviation: YLD = years lived with disability.

Note: The error bars indicate 95% uncertainty interval. The 95% uncertainty interval is determined by the 25<sup>th</sup> and 975<sup>th</sup> value of the 1,000 values ordered from smallest to largest.

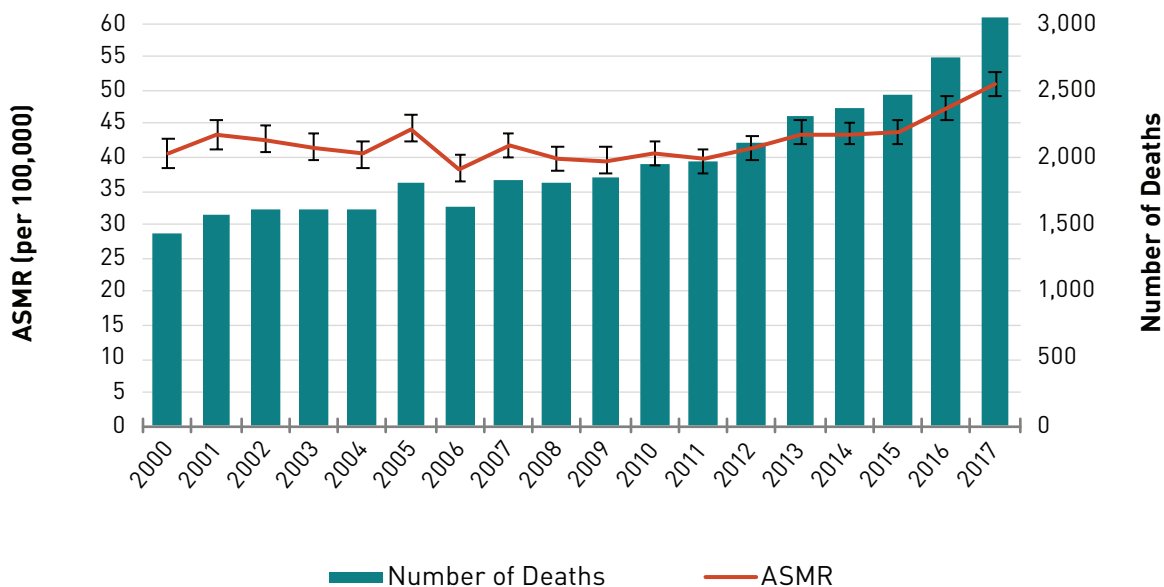
Source: Global Burden of Disease Collaborative Network, 2017.

## MORTALITY

Among Canadian seniors, the ASMR (per 100,000) due to Parkinson disease fluctuated over the time period but generally increased since 2011 to reach 51.0 in 2017. The number of deaths due to Parkinson disease increased from 1,440 in 2000 to 3,045 in 2017 (Figure 3.7.8).

**FIGURE 3.7.8.**

Age-standardized\* mortality rates and number of deaths due to Parkinson disease, 65+ years, Canada†, 2000–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013.

† 2017 mortality data are not available for Yukon.

Abbreviation: ASMR = age-standardized mortality rate.

Notes: The 95% confidence interval shows an estimated range of values which is likely to include the true value 19 times out of 20. ICD-10 code: G20.

Source: Canadian Vital Statistics—Death Database, 2000–2017.

# 3.8

## ORAL DISEASES

The primary types of oral diseases are tooth decay (cavities), gum (periodontal) disease, and oral cancer. These diseases are largely preventable and although usually considered in isolation from other chronic conditions, are often inter-related.

Poor oral hygiene, a diet low in fruits and vegetables and high in sugars, smoking and harmful use of alcohol can increase a person’s risk of developing an oral disease. Oral diseases can affect the mouth and other parts of the body. A growing body of evidence shows a link between oral and general health. For example, periodontal disease, which affected 52.0% of seniors aged 65–79 in 2007–2009, has been associated with type 2 diabetes, chronic respiratory diseases, cardiovascular diseases and cancer.<sup>(110–113)</sup> Additional research to shed more light on these oral and systemic diseases associations, especially among seniors, is necessary given the high prevalence of chronic disease comorbidity or multimorbidity in this population.

Seniors are at greater risk of poor oral health.<sup>(114)</sup> Data from the 2007–2009 CHMS, the most recent national data available, indicate that adults aged 60–79 have a greater mean number of missing teeth (5.57, on average) and are more likely to have no natural teeth (i.e. edentulism, 21.7%) than adults aged 40–59 (2.42 missing teeth on average; 4.4% with complete edentulism) (Table 2). Those aged 60–79 are also 1.8 times more likely to have moderate-to-severe periodontal disease compared to their younger counterparts.

**TABLE 2.** Mean number of decayed, missing and filled teeth and prevalence of edentulism, root caries and periodontal disease per age group, Canada, 2007–2009

CONDITION	ADULTS		
	20–39 YEARS	40–59 YEARS	60–79 YEARS
Decayed teeth (mean number)	0.81	0.45	0.37
Missing teeth (mean number)	0.39	2.42	5.57
Filled teeth (mean number)	5.65	9.43	9.72
Complete edentulism (%)	F	4.4 <sup>E</sup>	21.7
Untreated root caries (%)	3.6	8.0	11.2
Periodontal disease (%)	F	26.1 <sup>E</sup>	47.1

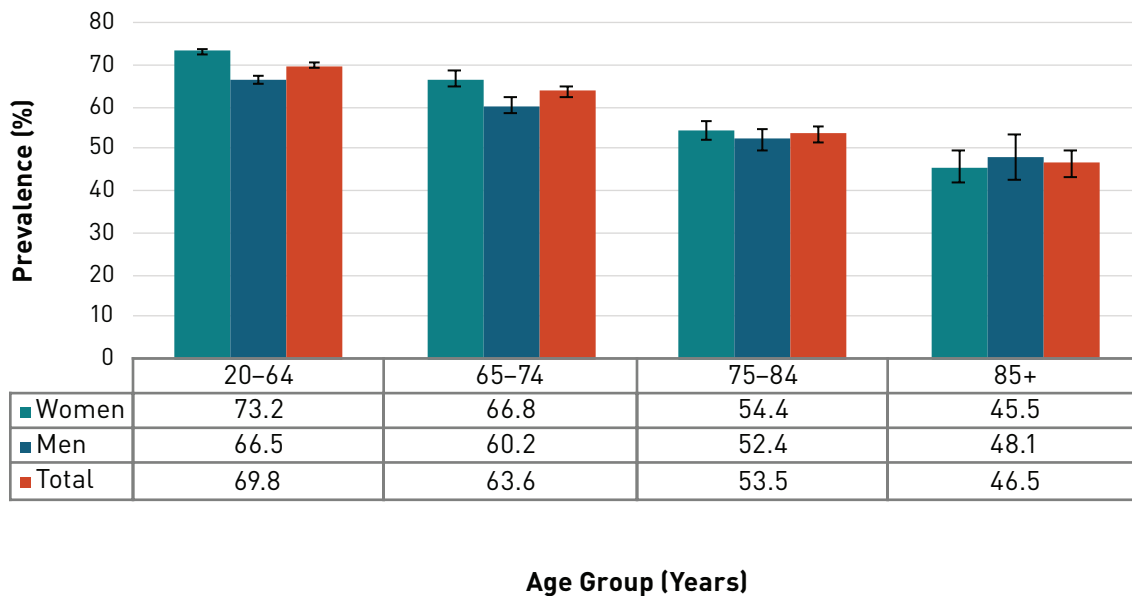
F Results not reported, coefficient of variation is greater than 33.3%.

<sup>E</sup> Interpret results with caution; coefficient of variation is between 16.6% and 33.3%.

Sources: Canadian Health Measures Survey, 2007–2009.

In 2015–2016, compared to 69.8% of Canadians aged 20–64, 59.1% of Canadian seniors self-reported consulting a dentist, a dental hygienist, a denturologist or another oral health professional in the past 12 months. The proportion decreased with age, with less than 47% of seniors aged 85+ self-reporting having consulted an oral health professional in the last year (Figure 3.8.1).

**FIGURE 3.8.1.** Prevalence of adults self-reporting consulting an oral health professional in the last 12 months, household population aged 20+ years, Canada, by sex and age group, 2015–2016

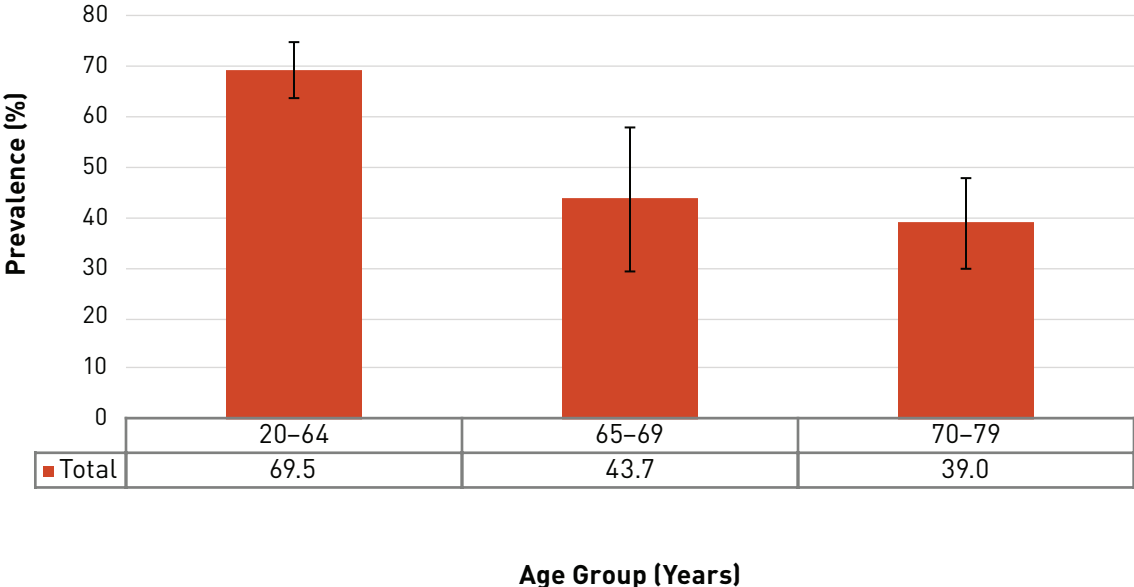


**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Canadian Community Health Survey, combined annual files 2015–2016.

Seniors face barriers accessing oral health care in part due to loss of dental insurance coverage upon retirement. The percentage of individuals with a private dental insurance decreases with age. In 2007–2009, 69.5% of those aged 20–64 self-reported having private dental insurance, while only 43.7% of those aged 65–69 and 39.0% of those aged 70–79 reported having private dental care insurance (Figure 3.8.2).

**FIGURE 3.8.2.** Prevalence of adults self-reporting having private dental insurance, household population aged 20+ years, by age group, Canada, 2007–2009



**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Canadian Health Measures Survey, 2007–2009.

Seniors living in long-term care facilities have poorer oral health status than those who live independently in the community.<sup>(115)</sup> They are also more likely to have a chronic oral condition that affects their overall health and quality of life.<sup>(116)</sup> While approximately 42% of Canadian adults aged 60–79 have fewer than 21 teeth,<sup>(117)</sup> that proportion is likely an underestimate as the population assessed does not include seniors living in long-term care facilities.



## 3.9

# RESPIRATORY DISEASES

## ASTHMA

Asthma is a complex chronic lung disease characterized by the inflammation and narrowing of the airways. Symptoms of asthma include cough, shortness of breath, chest tightness and wheezing.<sup>(118)</sup>

Asthma symptoms and attacks can be triggered by exercise, exposure to allergens or irritants, changes in the weather or viral respiratory infections. Although the causes of asthma are not well understood and there is no cure, asthma can be easily controlled with medication as well as by eliminating or minimizing risk factors and triggers.<sup>(118)</sup>

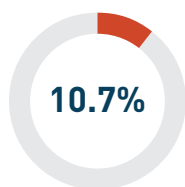
Modifiable risk factors associated with the development of asthma include:<sup>(119-126)</sup>

- Smoking and/or exposure to tobacco smoke;
- Occupational exposures;
- Environmental exposure (e.g. air pollution);
- Viral infection;
- Obesity; and
- Sedentary lifestyle.

Other risk factors associated with asthma include:<sup>(119,127-131)</sup>

- Age—prevalence is higher among younger people;
- Sex—in children, asthma is more prevalent in boys than in girls, but in adults, women have a higher prevalence of asthma than men; and
- Family history of asthma.

## PREVALENCE

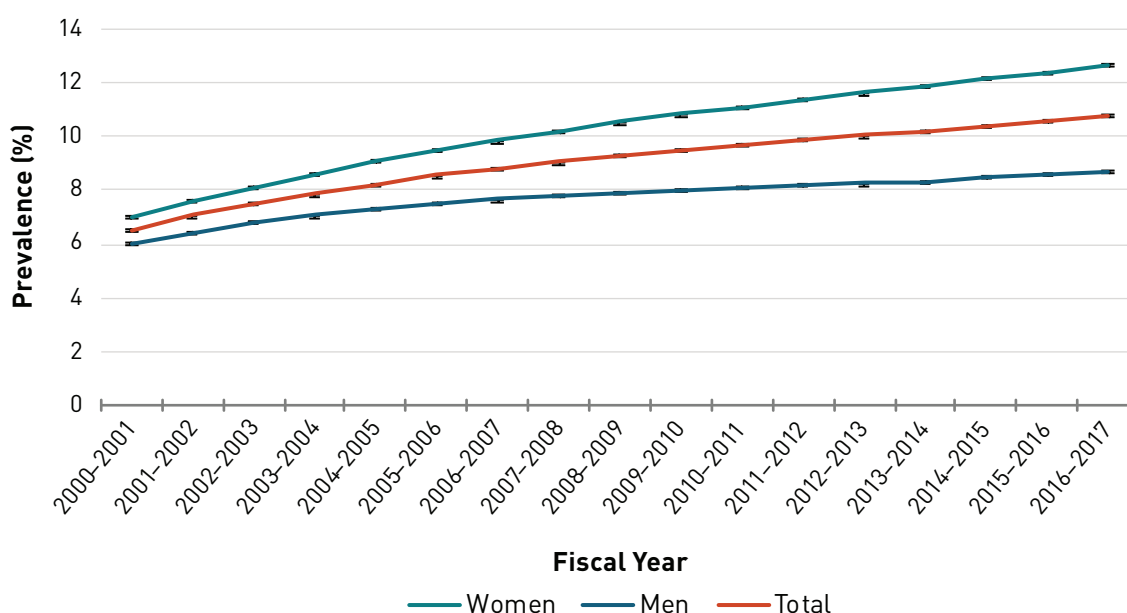


About **675,000** or **10.7%** of Canadian seniors were living with diagnosed asthma in 2016–2017.

Between 2000–2001 and 2016–2017, the age-standardized prevalence of diagnosed asthma in seniors increased from 6.5% to 10.7% (Figure 3.9.1).

**FIGURE 3.9.1.**

Age-standardized\* prevalence of diagnosed asthma, 65+ years, Canada†, 2000–2001 to 2016–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013 using 5-year age groups.

† Data from Nunavut were excluded before fiscal year 2005–2006. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

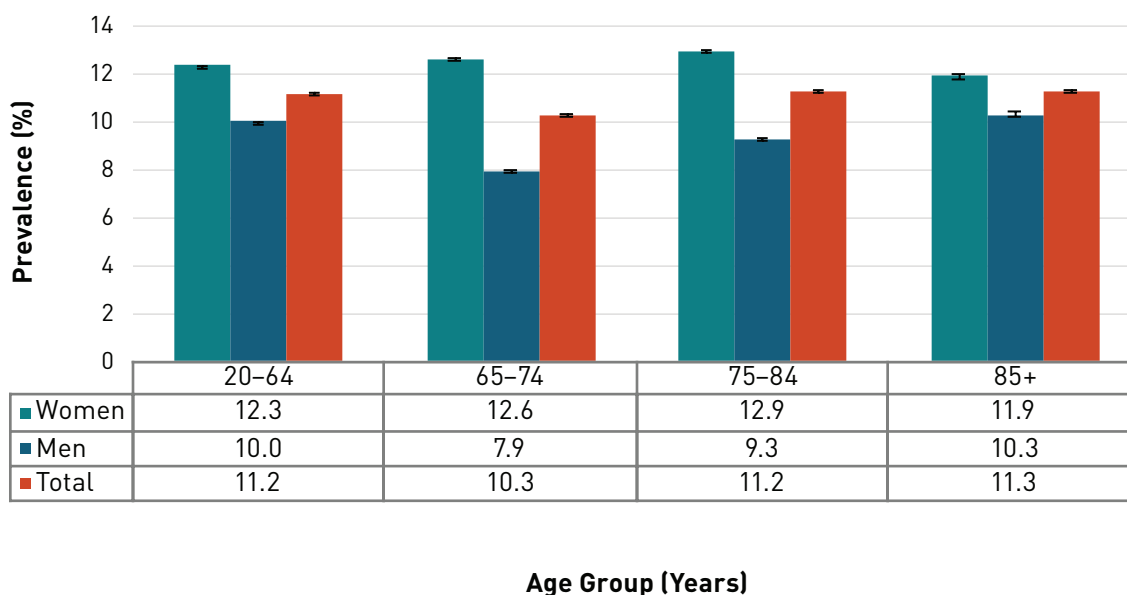
**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

In 2016–2017, women aged 65+ were 1.5 times more likely than men the same age to have diagnosed asthma.

Among seniors, the prevalence of diagnosed asthma increased with age, from 10.3% among those aged 65–74 to 11.2% and 11.3% among those aged 75–84 and 85+, respectively (Figure 3.9.2).

**FIGURE 3.9.2.**

Prevalence of diagnosed asthma, by sex and age group, Canada<sup>†</sup>, 2016–2017



<sup>†</sup> Data from Nunavut were excluded before fiscal year 2005–2006. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

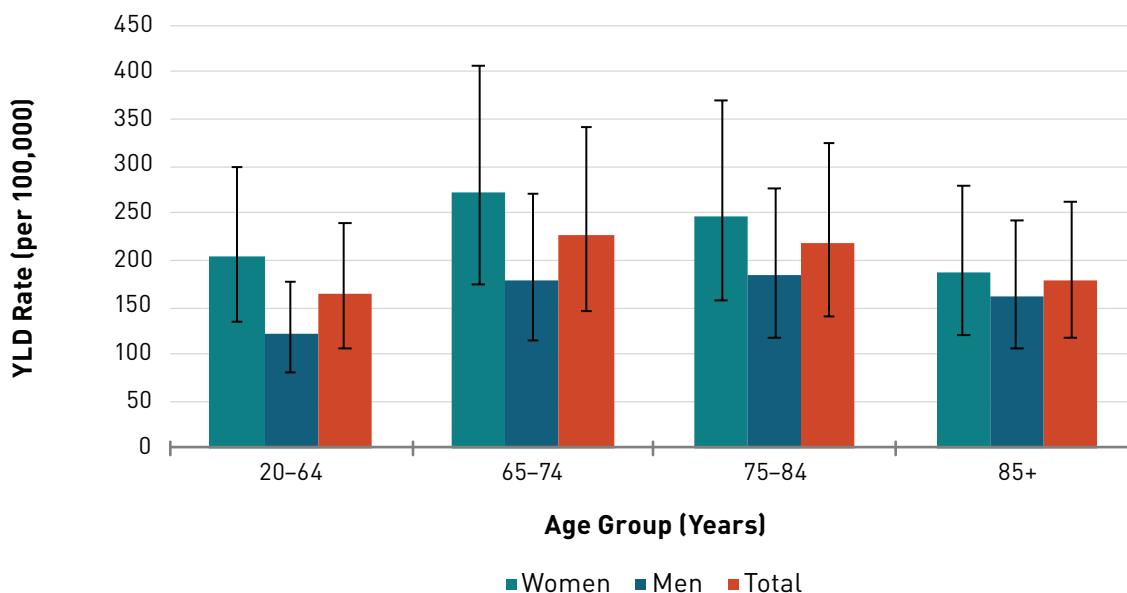
**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

## DISABILITY

For both sexes, the YLD rate due to asthma was 218.8 per 100,000 seniors in 2017. Rates did not differ by age group among seniors (Figure 3.9.3).

**FIGURE 3.9.3.**

Years lived with disability due to asthma, rates per 100,000, by sex and age group, Canada, 2017



**Abbreviation:** YLD = years lived with disability.

**Note:** The error bars indicate 95% uncertainty interval. The 95% uncertainty interval is determined by the 25<sup>th</sup> and 975<sup>th</sup> value of the 1,000 values ordered from smallest to largest.

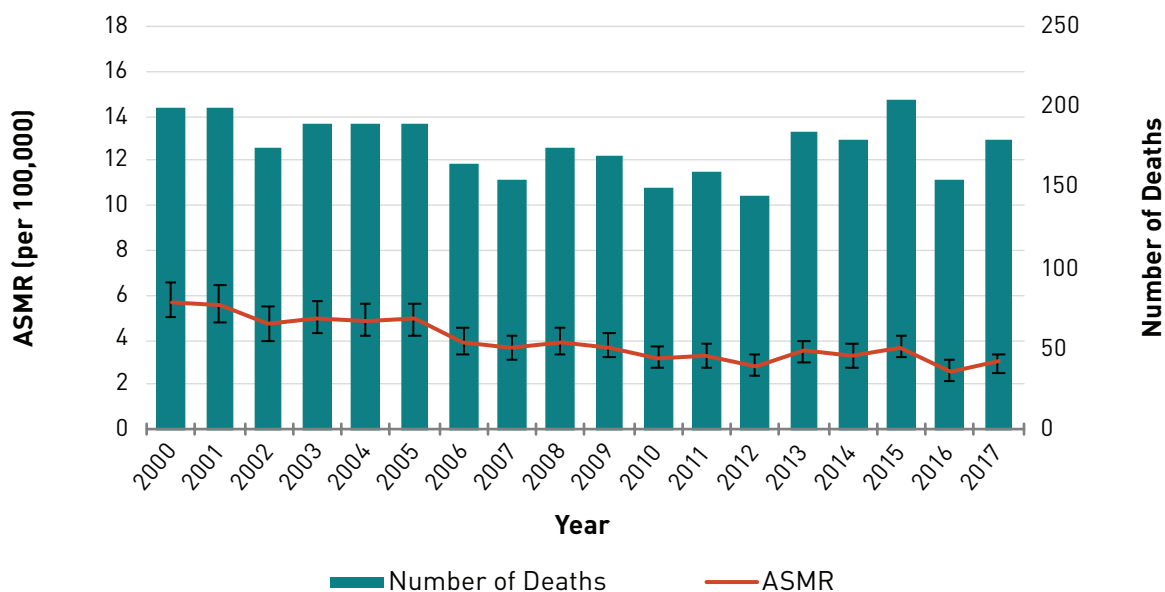
**Source:** Global Burden of Disease Collaborative Network, 2017.

## MORTALITY

Among Canadian seniors, the ASMR (per 100,000) due to asthma decreased by 47.4% from 5.7 in 2000 to 3.0 in 2017. The number of deaths due to asthma fluctuated over this period with a high of 205 in 2015 and a low of 145 in 2012 (Figure 3.9.4).

**FIGURE 3.9.4.**

Age-standardized\* mortality rates and number of deaths due to asthma, 65+ years, Canada†, 2000–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013.

† 2017 mortality data are not available for Yukon.

**Abbreviation:** ASMR = age-standardized mortality rate.

**Notes:** The 95% confidence interval shows an estimated range of values which is likely to include the true value 19 times out of 20. ICD-10 codes: J45, J46.

**Source:** Canadian Vital Statistics—Death Database, 2000–2017.

# CHRONIC OBSTRUCTIVE PULMONARY DISEASE

Chronic obstructive pulmonary disease (COPD) is a chronic, progressive lung disease that causes limitations in airflow. It is a common, often preventable and treatable disease associated with an enhanced chronic inflammatory response in the airways. This inflammatory response results in structural changes and the narrowing of small airways in the lungs. Symptoms of COPD include shortness of breath, cough and/or sputum production.<sup>(132)</sup>

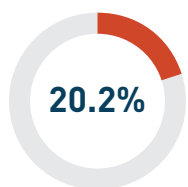
The development and progression of COPD is a complex interaction between various risk factors.<sup>(132)</sup> Modifiable risk factors associated with the development and progression of COPD include:<sup>(132-135)</sup>

- Smoking—cigarette smoking is the leading modifiable risk factor for COPD;
- Occupational exposure to dust, vapour and fumes;
- Indoor or outdoor air pollutants;
- Infection; and
- Asthma.

Other risk factors associated with the development and progression of COPD include:<sup>(131-134,136)</sup>

- Age—lung function declines with age, leaving older adults more susceptible to developing lung disorders such as COPD;
- Sex—COPD is more common in men than women, although this gap narrows with age; and
- Family history of COPD.

## PREVALENCE

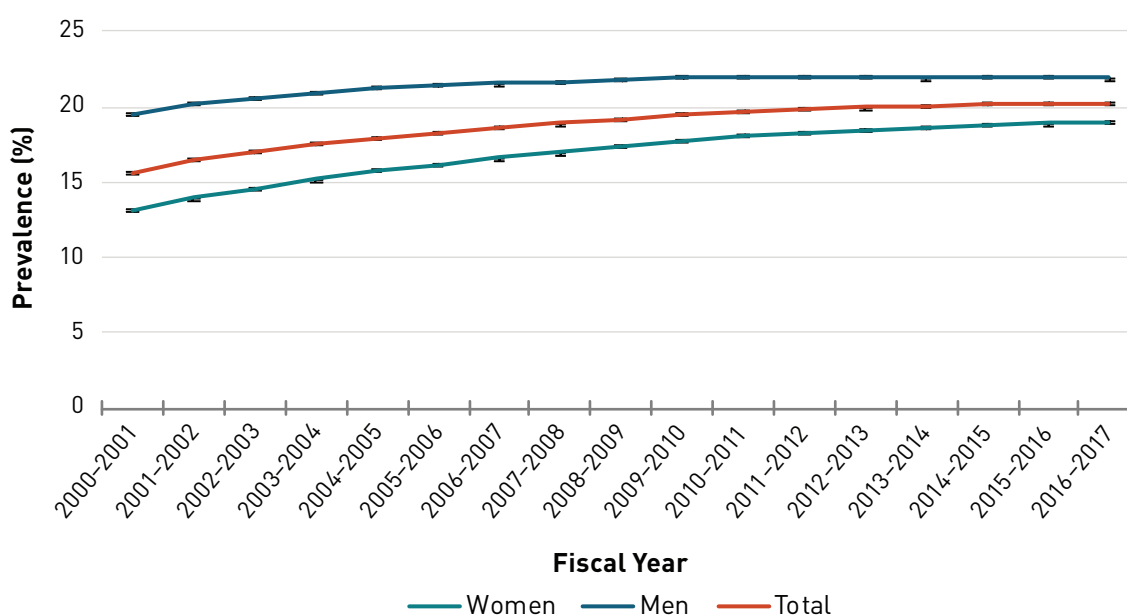


About **1.3 million** or **20.2%** of Canadian seniors (65+) were living with diagnosed COPD in 2016–2017.

Between 2000–2001 and 2016–2017, the age-standardized prevalence of diagnosed COPD in seniors increased from 15.7% to 20.2% (Figure 3.9.5).

**FIGURE 3.9.5.**

Age-standardized\* prevalence of diagnosed COPD, 65+ years, Canada†, 2000–2001 to 2016–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013 using 5-year age groups.

† Data from Nunavut were excluded before fiscal year 2005–2006. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

**Abbreviation:** COPD = chronic obstructive pulmonary disease.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

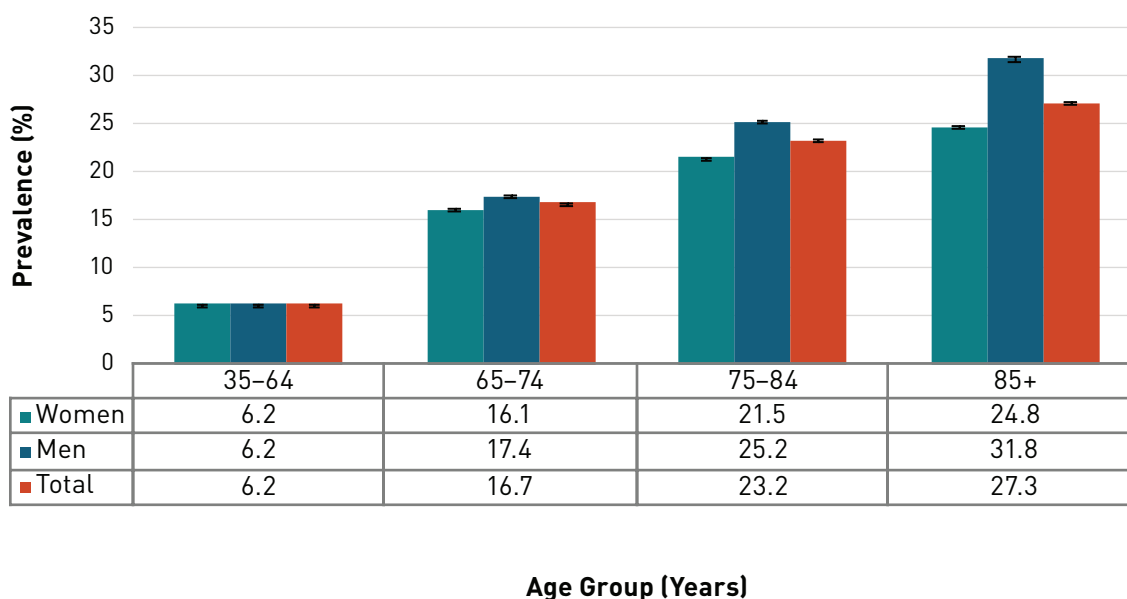
**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

In 2016–2017, men aged 65+ were 1.1 times more likely than women the same age to have diagnosed COPD.

The prevalence of diagnosed COPD increased with age and was the highest, at 27.3%, among those aged 85+ (Figure 3.9.6).

**FIGURE 3.9.6.**

Prevalence of diagnosed COPD, by sex and age group, Canada<sup>†</sup>, 2016–2017



<sup>†</sup> Data from Nunavut were excluded before fiscal year 2005–2006. Data from Yukon were excluded before fiscal year 2010–2011. Data from Saskatchewan were not available for fiscal year 2016–2017.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

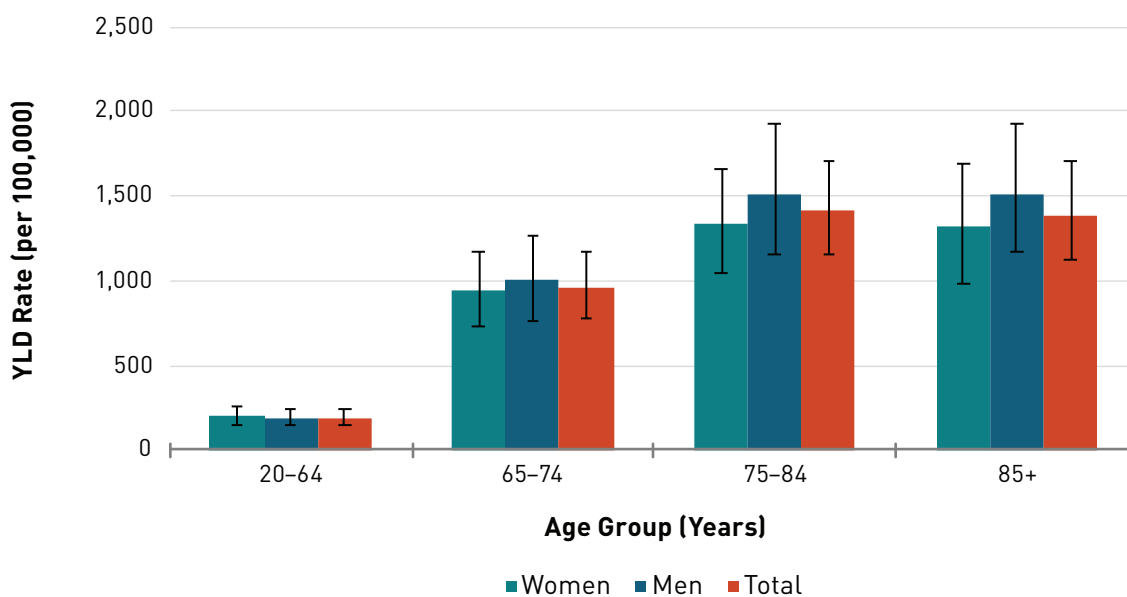


## DISABILITY

For both sexes, the YLD rate due to COPD was 1,154.6 per 100,000 seniors in 2017. Rates did not differ by age group among seniors (Figure 3.9.7).

**FIGURE 3.9.7.**

Years lived with disability due to COPD, rates per 100,000, by sex and age group, Canada, 2017



**Abbreviations:** COPD = chronic obstructive pulmonary disease; YLD = years lived with disability.

**Note:** The error bars indicate 95% uncertainty interval. The 95% uncertainty interval is determined by the 25<sup>th</sup> and 975<sup>th</sup> value of the 1,000 values ordered from smallest to largest.

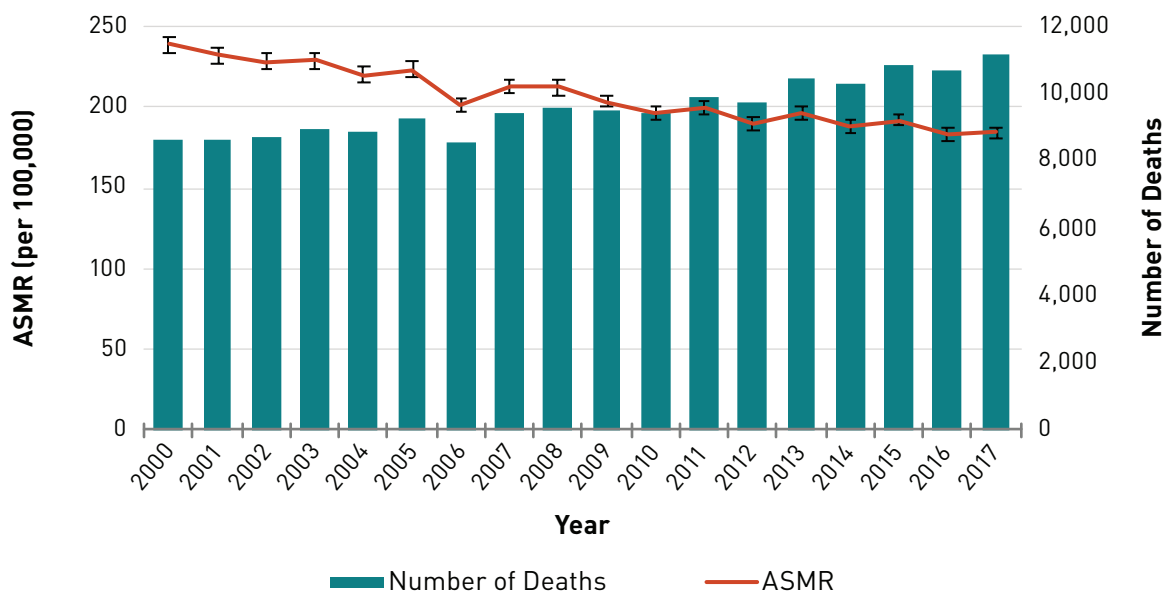
**Source:** Global Burden of Disease Collaborative Network, 2017.

## MORTALITY

Among seniors, the ASMR (per 100,000) due to COPD decreased by 22.7% from 238.8 in 2000 to 184.7 in 2017. The number of deaths due to COPD increased from 8,620 in 2000 to 11,180 in 2017 (Figure 3.9.8).

**FIGURE 3.9.8.**

Age-standardized\* mortality rates and number of deaths due to COPD, 65+ years, Canada†, 2000–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013.

† 2017 mortality data are not available for Yukon.

**Abbreviations:** COPD = chronic obstructive pulmonary disease; ASMR = age-standardized mortality rate.

**Notes:** The 95% confidence interval shows an estimated range of values which is likely to include the true value 19 times out of 20. ICD-10 codes: J41, J42, J43, J44.

**Source:** Canadian Vital Statistics—Death Database, 2000–2017.

## 3.10

# FALLS

Falls are preventable but require multifactorial and evidence-based interventions.<sup>(137)</sup> Data from the 2009 CCHS—Healthy Aging indicate that 19.8% of seniors reported falling in the previous year. Of these, 63.3% reported falling once while 36.7% reported falling more than once in the previous year.<sup>(138)</sup>

Fall-related injuries may affect quality of life and lead to loss of independence, hospitalization and sometimes death.<sup>(139)</sup> Seniors who are hospitalized for a fall stay in hospital an average of 14.3 days compared to 7.5 days for those hospitalized for any other cause.<sup>(140)</sup>

Falls and injuries are influenced by several risk factors that are a combination of both intrinsic and extrinsic factors. Intrinsic risk factors for falls include older age, having a chronic disease, medication use, impaired mobility, fear of falling and prior falls. A history of falls is a strong predictor of future falls.<sup>(137,141–143)</sup> Seniors who have had a fall are 3 times more likely than those who never fell to have another fall within the following year.<sup>(137)</sup>

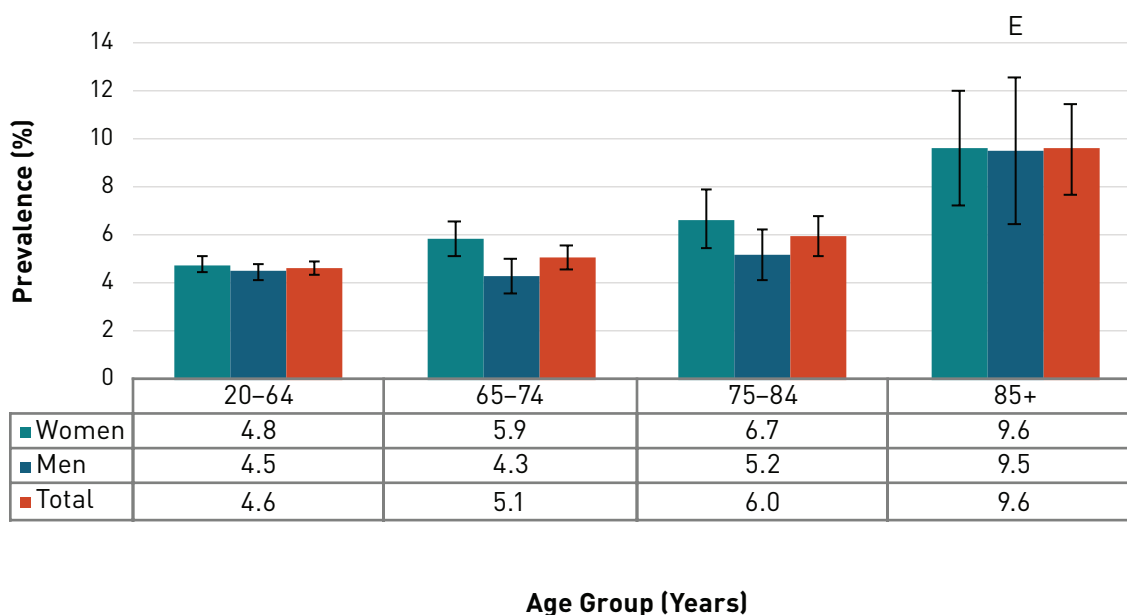
The presence of multiple chronic conditions is also an important predictor of falls among community-dwelling seniors. Data from the 2009 CCHS—Healthy Aging reveal that risk of falling increases with number of chronic conditions, with risk of falling at least 2 times higher in seniors with four or more chronic conditions.<sup>(138)</sup>

Extrinsic risk factors for falls include factors in the community (e.g. hazards related to design standards and building codes), factors in the living environment, and weather and climate. Other factors are unfitting footwear and clothing and inappropriate assistive devices.<sup>(137,141,142)</sup> Social isolation and low socioeconomic status have also been shown to increase the risk of falls.<sup>(137,144)</sup>

According to the 2017–2018 CCHS, about 5.8% (or 350,000) of seniors reported a fall-related injury that was serious enough to limit their normal activity for at least 24 hours in the last 12 months. Of these, 63.5% were women (data not shown). The percentage of respondents reporting a fall-related injury in the last 12 months varied from 5.9% among women aged 65–74 to 9.6% among women aged 85+ and from 4.3% in men aged 65–74 to 9.5% in men aged 85+ (Figure 3.10.1).

**FIGURE 3.10.1.**

Prevalence of adults self-reporting a fall-related injury in the last 12 months, household population aged 20+ years, by sex and age group, Canada, 2017–2018



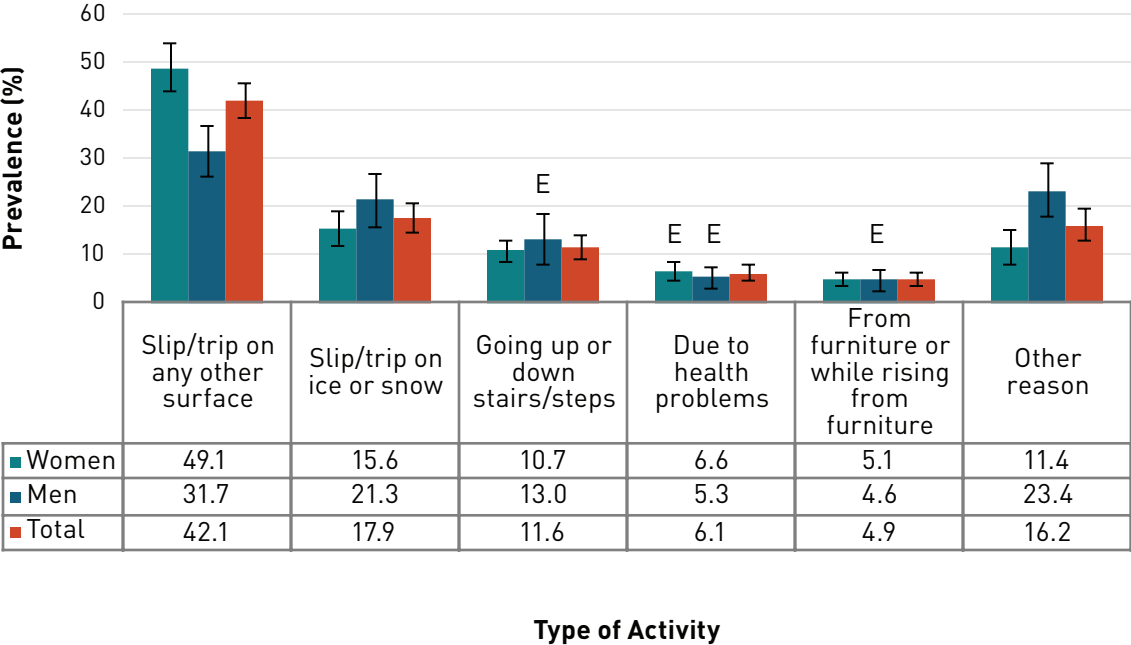
E Interpret results with caution; coefficient of variation (CV) is between 15.0% and 35.0%.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Canadian Community Health Survey, combined annual files 2017–2018.

Figure 3.10.2 shows that 49.1% of women and 31.7% of men aged 65+ reported the cause of their fall-related injury as a slip while walking on any surface other than those specified in the question. Other reasons commonly reported were slipping on ice or snow and while going up or down the stairs. These results are comparable to data presented in the Senior' Falls in Canada: Second Report, which stated that 45% of fall-related injuries among Canadians aged 65+ were attributable to “slips while walking on any other surface” and about 16% were attributable to a “slips while walking on snow or ice.”<sup>(137)</sup>

**FIGURE 3.10.2.** Prevalence of adults self-reporting the type of activity associated with a fall-related injury in the last 12 months, household population aged 65+ years, by sex, Canada, 2017–2018



E Interpret results with caution; coefficient of variation (CV) is between 15.0% and 35.0%.

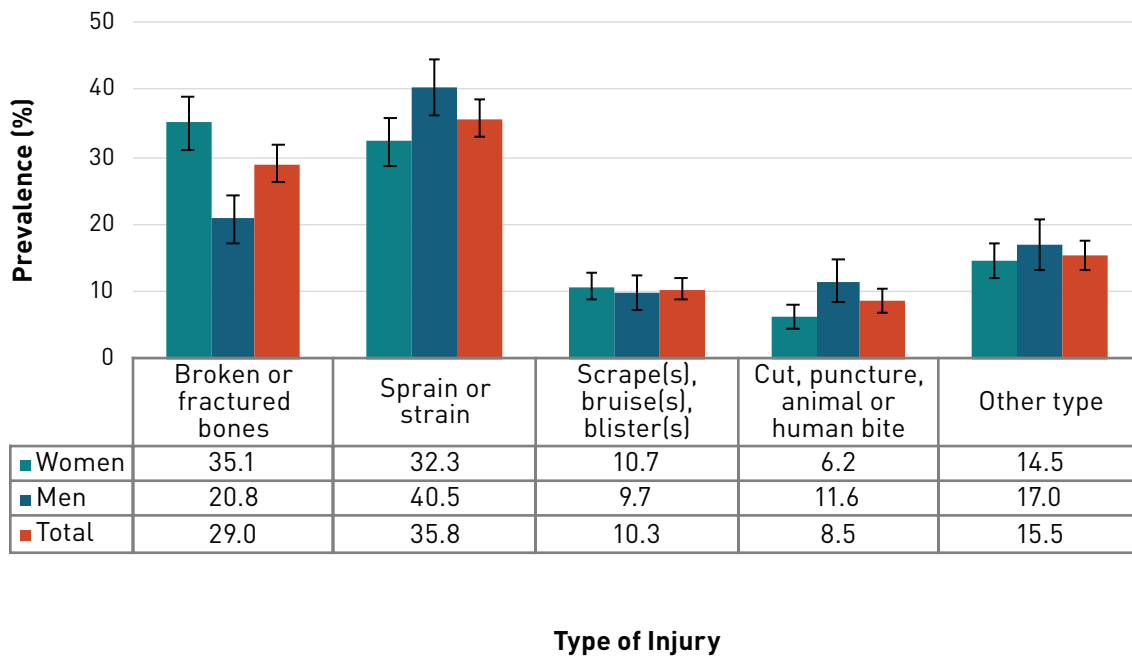
**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Canadian Community Health Survey, combined annual files 2017–2018.

Women most frequently reported their fall-related injuries as “broken or fractured bones” (35.1%) and “sprain or strain” (32.3%) (Figure 3.10.3). More men reported having a “sprain or strain” (40.5%) than “broken or fractured bones” (20.8%).

**FIGURE 3.10.3.**

Prevalence of adults self-reporting types of injuries resulting from a fall in the last 12 months, household population aged 65+ years, by sex, Canada, 2017–2018



**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Canadian Community Health Survey, combined annual files 2017–2018.

## 3.11

# MULTIMORBIDITY

In this report, multimorbidity is defined as the co-occurrence in the same individual of two or more of ten common chronic diseases, including heart disease, stroke, cancer (lifetime), asthma, COPD, diabetes, arthritis, Alzheimer disease or other dementia, mood and anxiety disorders.<sup>[53]</sup>

Multimorbidity is associated with impaired quality of life, increased use of health care resources, institutionalization, adverse health effects, disability and premature death.<sup>[145]</sup>

Living with multiple chronic diseases can introduce additional challenges that affect overall health. Chronic diseases are often associated with chronic pain (pain that lasts for at least 3 months). About 36.7% of seniors living in private dwellings and 40.9% of seniors living in institutions who reported having at least two chronic conditions reported chronic pain.<sup>[146]</sup> Opioids are commonly used to relieve and manage pain, and one in five Canadian seniors received a prescription for opioids between 2015 and 2016.<sup>[147]</sup> Despite low rates of chronic use of opioids among seniors in 2016 (3.5%), this population experienced one of the highest rates of hospitalizations due to opioid poisoning; 63% of these cases were accidental.<sup>[148]</sup> Seniors using opioids are also more likely to have constipation, balance impairment that increases the risk of falls and other adverse effects.<sup>[149]</sup>

Polypharmacy (i.e. concurrent use of multiple medications by an individual) is independently associated with having multiple chronic conditions. Seniors with two or more chronic diseases are about 3 times more likely to report multiple medications use than those with none or only one chronic disease.<sup>[150]</sup> In 2016, Canadian seniors were prescribed an average of 6.9 different drug classes annually.<sup>[151]</sup> The use of multiple medications has been linked to an increased risk of inappropriate drug use and adverse drug events.<sup>[151]</sup>

### **More than one senior out of three have multimorbidity.**

Over one-third of women (38.1%) and men (36.0%) aged 65+ had at least two of the common chronic conditions (2017–2018 CCHS).

### **Multimorbidity increases with age and affects almost half (48%) of Canadians aged 85+.**

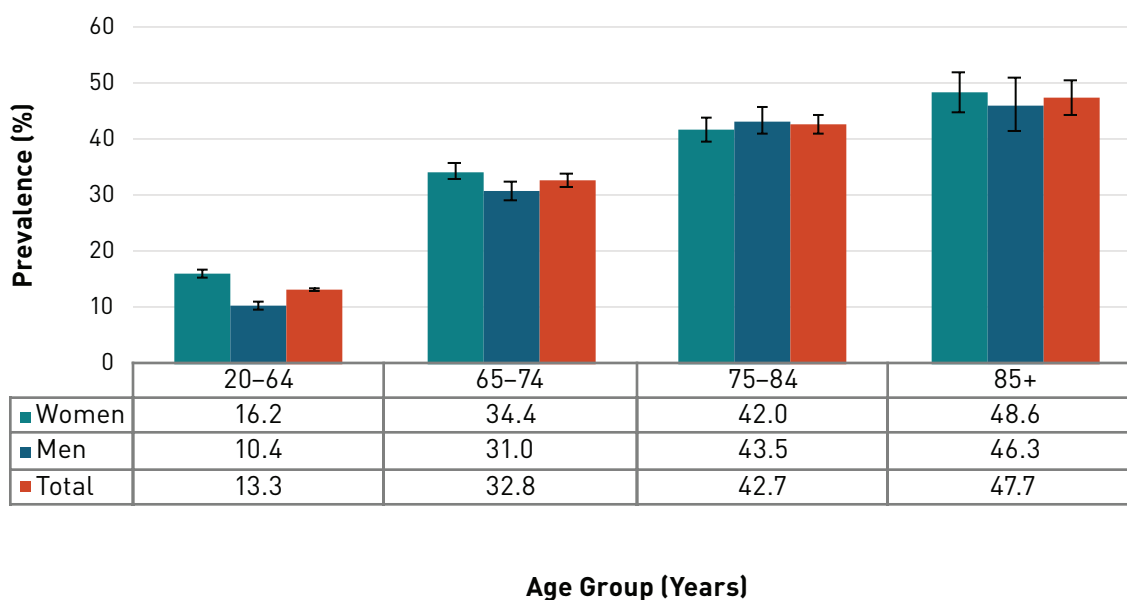
The proportion of seniors with multimorbidity increased with age (Figure 3.11.1), affecting about 32.8% aged 65–74, 42.7% aged 75–84 and 47.7% aged 85+ years. Only 13.3% of those aged 20–64 had multimorbidity.

### Women younger than 75 are more likely than men to have multimorbidity.

The proportion of Canadians with multimorbidity increased with age and was higher in women aged less than 75 years than men the same age (Figure 3.11.1). No such sex differences were observed among women and men aged 75+.

**FIGURE 3.11.1.**

Prevalence of multimorbidity, by sex and age group, Canada, 2017–2018



**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Canadian Community Health Survey, combined annual files 2017–2018.

The true prevalence of multimorbidity is likely underestimated as it is based on self-reported information from the CCHS and only includes individuals living in the community. The definition of multimorbidity may also differ between studies. A recent review suggested that the term multimorbidity may include as few as two diseases, and as many as 114.<sup>(152)</sup> The types of diseases included may also differ. Population-based surveys in the United States and Israel that used similar definitions of multimorbidity to the one used in this report found the prevalence of multimorbidity to be 61.6% and 64.1%, respectively, among seniors aged 65+, much higher than the findings presented in this report.<sup>(153,154)</sup> This suggests that multimorbidity results should be interpreted with caution. Future work will refine the definition and assessment methods for multimorbidity, and consider alternate data sources such as the use of administrative health data from the CCDSS.



## SUMMARY

The chronic diseases and conditions discussed in this report were selected based on their prevalence, their impact on the lives of seniors and the availability of data. Other common chronic conditions were outside the scope of this report. Prevalence estimates from the 2015–2016 and 2017–2018 CCHS for these conditions can be found in Appendix 4, Tables A and B.

Although many individuals living with one or more chronic diseases maintain a high level of functioning, the consequences can be significant as they can affect activities of daily living, reduce quality of life and increase mortality risk.

Certain diseases have significant impacts on seniors. Hypertension is one of the main risk factors for the development of heart disease and the most important risk factor for stroke. It is also largely preventable, yet two-thirds of seniors are living with diagnosed hypertension.

Oral diseases are associated with many chronic diseases, and about half (52.0%) of seniors aged 65–79 have moderate-to-severe periodontal diseases. Osteoarthritis, the most common form of arthritis, affecting about one-third (38.0%) of those aged 65+, cannot be cured, but interventions (including lifestyle modifications) can reduce pain, improve function and, in some instances, delay the progression of the disease.

Seniors are also affected by the following highly prevalent chronic diseases:

- 27.0% were living with diagnosed IHD;
- 26.8% were living with diagnosed diabetes;
- 25.1% were living with diagnosed osteoporosis;
- 21.5% reported ever receiving a diagnosis of cancer in their lifetime;
- 20.2% were living with diagnosed COPD;
- 10.7% were living with diagnosed asthma;
- 9.5% have had a stroke;
- 9.1% were living with diagnosed heart failure; and
- 6.9% were living with diagnosed dementia.

In addition, 10.7% had used health services for mood and anxiety disorders.

About 20% of seniors fall each year. Further, about 5.8% (or 350,000) of seniors reported a fall-related injury in the 12 months prior to 2017–2018; almost two-thirds (63.5%) of these were women. Falls can have serious consequences, from loss of mobility, to hospitalization, to death. However, they can be prevented through injury prevention initiatives that target risk factors.

Some diseases are more common among women and others are more common among men.

Compared to men the same age, **WOMEN** aged 65+ are:



4.2x more likely to have diagnosed **osteoporosis**



1.9x more likely to have diagnosed **rheumatoid arthritis**



1.6x more likely to use health services for **mood and anxiety disorders**



1.5x times more likely to have diagnosed **dementia**



1.5x more likely to have diagnosed **asthma**



1.4x more likely to have diagnosed **osteoarthritis**

Compared to women the same age, **MEN** aged 65+ are:



2.7x more likely to have diagnosed **gout**



1.5x more likely to have diagnosed **IHD**



1.5x more likely to have diagnosed **parkinsonism**



1.3x more likely to have diagnosed **diabetes**



1.2x more likely to have diagnosed **cancer**



1.2x more likely to have diagnosed **heart failure**

### The prevalence of most chronic diseases increases with age and over time

The prevalence of most chronic diseases and conditions increases with age. Among those aged 85+, the five diseases with the highest prevalence were hypertension (83.4%), osteoarthritis (54.0%), IHD (42.0%), osteoporosis (36.9%) and COPD (27.3%). The prevalence of the use of health services for mood and anxiety disorders remained stable whereas the prevalence of self-reported suicidal ideation decreased with age.

Although the age-standardized prevalence of the use of health services for mood and anxiety disorders declined from 13.1% in 2000–2001 to 10.5% in 2016–2017, it increased for the majority of the other diseases. The largest increases were seen for osteoporosis, diabetes, asthma, cancer and hypertension. After an increase in the age-standardized prevalence of IHD, heart failure and stroke, the prevalence either stabilized or started to decline in the most recent years (see also Appendix 3, Figure A).

### Years lived with disability increase sharply with age for Alzheimer disease and other dementias as well as for cardiovascular diseases.

YLD rates (per 100,000 seniors) were highest for diabetes (1,809.5), high systolic blood pressure (1,455.4), stroke (1,214.0), heart failure (1,178.2) and COPD (1,154.6) (see also Appendix 3, Figure B, for trends).

YLD rate (per 100,000) due to Alzheimer disease and other dementias increased sharply with age and was 15 times greater in those aged 85+ (3,301.3) than those aged 65–74 years (212.0). YLD rates also increased rapidly with age for stroke, heart failure, high systolic blood pressure and IHD. Sex patterns could not be established due to the wide uncertainty intervals.

### **Mortality rates have declined drastically for most chronic diseases.**

Of the diseases included in the report, the five leading causes of death due to a chronic disease in seniors in 2017 were cancer, IHD, dementia, COPD and stroke.

Advances in disease management and treatment as well as reduction in smoking rates over the last few decades have likely contributed to the decline in mortality rates for many chronic diseases. In fact, since 2000, age-standardized mortality rates have declined by about 50% for IHD, osteoarthritis, osteoporosis, stroke and asthma and by at least 35% for rheumatoid arthritis, heart failure and diabetes. Cancer and COPD mortality rates have also declined but less rapidly.

In contrast, mortality rates due to dementia have increased by 59% since 2000, while mortality rates due to Parkinson disease and hypertension have increased by about 26% and 12%, respectively (see also Appendix 3, Figure C). The increase in dementia-related deaths is likely attributable to the growth of the population aged 65+, but may also be the result of a decline in other competing causes of death, such as cardiovascular diseases and cancer.<sup>(155)</sup> The rise in hypertension-related deaths is also likely attributable to the aging of the population but other factors may be responsible and will need to be further explored.<sup>(156)</sup>

Although deaths by suicide account for less than 1% of all deaths among seniors, mortality rates due to suicide are much higher among men 65+ than women the same age, and peak in those aged 85+ (26.1 per 100,000 in men vs. 4.3 per 100,000 in women).

### **Over one-third of seniors have two or more chronic diseases.**

Conservative estimates indicate that about 37% of seniors reported having at least two of the ten common chronic diseases (i.e. multimorbidity) and almost half of those aged 85+ report living with multimorbidity. Women younger than 75 years were more likely than men the same age to report multimorbidity. No such difference was observed among women and men older than the age of 75.

Living with multiple chronic diseases can lead to additional challenges that can affect the overall health of seniors, including chronic pain and the use of multiple medications (i.e. polypharmacy). Multiple medication use, in turn, has been linked to an increased risk of inappropriate drug use and adverse drug events.



4

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# DETERMINANTS OF HEALTH

Age, ethnic ancestry, genetic predispositions, and sex are common factors that increase the risk of developing chronic diseases. These factors interact with other factors such as lifestyle behaviours and, more broadly, with the physical, social and economic environment in determining health.

Not all Canadians can expect to live past the age of 80 or can expect to live in good health for their whole life. Inequalities in health persist, and some groups are more vulnerable.<sup>[157]</sup>

Adopting and maintaining a healthy lifestyle is important to prevent and manage chronic diseases.<sup>[158]</sup> Specifically, exercising regularly and having a healthy, balanced diet, are important protective factors for type 2 diabetes, dementia and stroke.<sup>[96,159-161]</sup> Likewise, these lifestyle interventions are also important in the management of these diseases once they have been diagnosed. For example, regular physical activity can improve blood glucose control, reduce cardiovascular risk factors and result in weight loss among people with type 2 diabetes.<sup>[162]</sup> It can also improve cognition among those with dementia<sup>[163]</sup>, aid in the functional recovery of people who have had a stroke and help reduce the risk of future stroke.<sup>[164]</sup> Smoking cessation also has many health benefits, including for cancer patients and survivors.<sup>[165]</sup> Similarly, reducing alcohol drinking or complete cessation have been shown to improve outcomes in those with established cardiovascular diseases.<sup>[166]</sup>

This section addresses key modifiable risk factors, namely tobacco use, physical inactivity, unhealthy diet, harmful use of alcohol, and elevated body mass index (BMI). Sleep patterns and sleep quality are also explored. Finally, broader social determinants of health are discussed. Data are self-reported from the Canadian Community Health Survey (CCHS) and the Canadian Health Measures Survey (CHMS).



## 4.1

# TOBACCO USE

Of the 84 risk factors assessed in the Global Burden of Diseases study, smoking is the leading risk factor for death in Canada.<sup>[167]</sup> Deaths associated with smoking are most commonly due to three main groups of diseases: cancer, cardiovascular diseases and respiratory diseases. But smoking has been linked to diseases affecting nearly all organs of the body.<sup>[165]</sup> Smoking is also associated with lower self-reported health and increased health care utilization.<sup>[165]</sup>

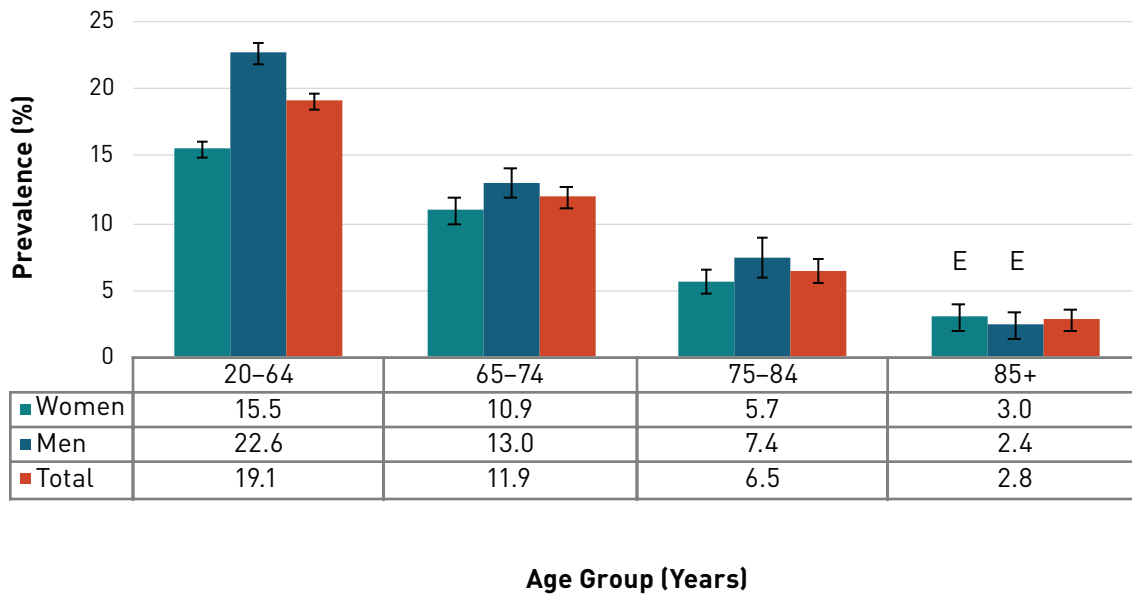
Exposure to second-hand smoke (by non-smokers) has also been associated with the development of lung cancer, cardiovascular diseases and respiratory diseases as well as excess mortality.<sup>[165,168]</sup>

Although adverse health outcomes are still greater among people who stopped smoking than people who never smoked, quitting smoking at any age has a positive impact on overall health, life expectancy and the prognosis of cancer patients. Early cessation has the most benefits.<sup>[165,169,170]</sup>

In 2017–2018, the prevalence of Canadians who reported smoking (daily or occasional) was highest among those aged 20–64, at 19.1%, and lowest among those aged 85+, at 2.8% (Figure 4.1.1). The lower rates of smoking observed in adults aged 75+ may be a reflection of a greater likelihood of quitting at that age, in part due to illness, a commonly reported reason for stopping smoking.<sup>[170,171]</sup> With a prevalence of 10.5%, men aged 65+ were 1.2 times more likely to report smoking (daily or occasional) than senior women the same age (10.5% vs 8.6%).

**FIGURE 4.1.1.**

Prevalence of adults self-reporting smoking (daily or occasional), household population aged 20+ years, by sex and age group, Canada, 2017–2018



E Interpret results with caution; coefficient of variation (CV) is between 15.0% and 35.0%.

**Notes:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Canadian Community Health Survey, combined annual files 2017–2018.

## 4.2

# PHYSICAL ACTIVITY

Maintaining a healthy lifestyle, which includes being physically active, can help prevent the development or delay the onset of chronic diseases.<sup>(172-175)</sup> Physical activity also plays a vital role in reducing depression, anxiety and chronic stress while enhancing cognitive functions.<sup>(173)</sup> Physical activity is not only protective for those who were active throughout their lives, but is also beneficial for those who become active later in life.<sup>(176)</sup> It has been shown to delay functional loss and improve survival and help improve outcomes in those living with chronic diseases.<sup>(172,176)</sup> Seniors with decreased fitness are more likely to have poorer health-related quality of life and moderate-to-severe levels of frailty, which increases their risk of institutionalization and death.<sup>(172,177,178)</sup>

According to the Canadian Physical Activity Guidelines, to achieve health benefits and improve functional abilities, adults aged 65+ should undertake moderate-to-vigorous aerobic physical activity for at least 150 minutes per week, in bouts of 10 minutes or longer.<sup>(179)</sup>

The prevalence of Canadians who self-reported levels of physical activity that met the physical activity guidelines decreased with age. While 57.1% of women and 64.0% of men aged 20–64 self-reported meeting guideline levels, 42.8% of women and 50.5% of men aged 65–74 and 13.2% of women and 18.4% of men aged 85+ self-reported meeting the guideline levels (Figure 4.2.1). This decline in physical activity with age may be due to loss of lean body mass, strength and balance and an increase in joint dysfunction and arthritis.<sup>(180)</sup>

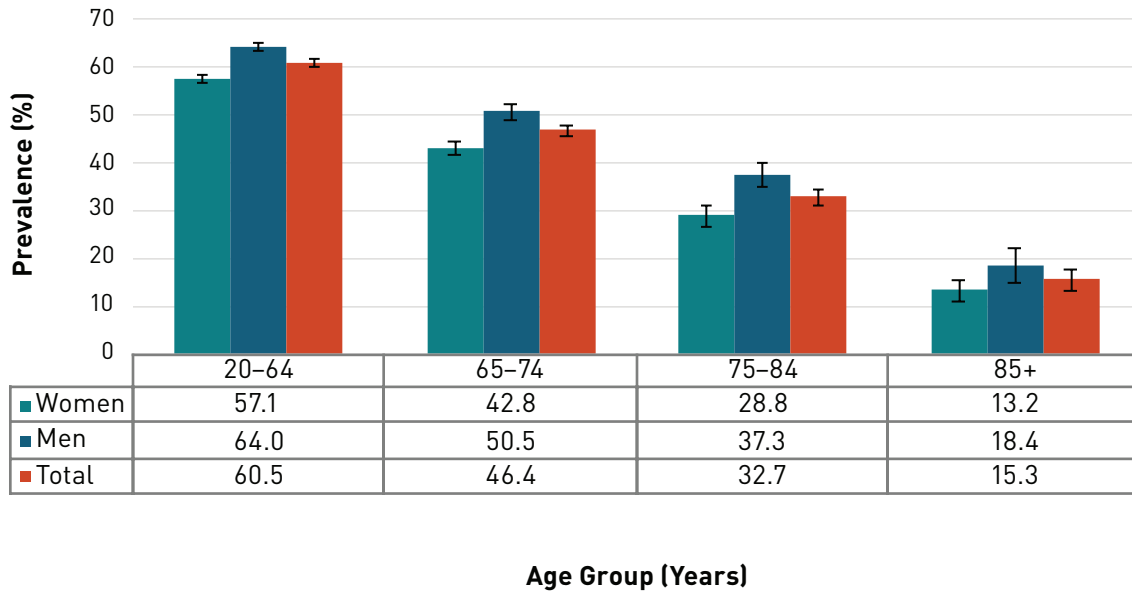
In 2017–2018, men aged 65+ (43.9%) were 1.2 times more likely to report meeting the physical activity guidelines than women the same age (35.6%) (data not shown).

People tend to over-report their activity levels due to social desirability bias, and self-reported physical activity levels are often overestimated.<sup>(181)</sup> Objective measurements of physical activity provide a more valid assessment.<sup>(182)</sup> Activity monitor data from the 2016–2017 CHMS indicated that only 15.2% of seniors aged 65–79 met the physical activity guidelines.<sup>(53)</sup> Objective measurements are not collected for people aged 80+ years, although that would be helpful in better understanding activity levels of older seniors.



**FIGURE 4.2.1.**

Prevalence of adults self-reporting levels of physical activity equivalent to meeting the Canadian Physical Activity Guidelines\*, household population aged 20+ years, by sex and age group, Canada, 2017–2018



\* At least 150 minutes of moderate-to-vigorous physical activity each week, in bouts of 10 minutes.

**Note:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Canadian Community Health Survey, combined annual files 2017–2018.

## 4.3

# NUTRITION

Nutritional risk refers to the risk of developing nutritional deficits as a result of poor nutrient intake. Nutrient intake may be poor due to either under-nutrition or over-nutrition.<sup>[183]</sup>

Nutritional risk is often assessed by looking at whether an individual has gained or lost more than 4.5 kilograms in the past 6 months and whether a person regularly skips meals, eats alone, or finds cooking a chore.<sup>[184]</sup>

Various factors can affect a senior's dietary intake. Physiological changes associated with aging that affect dietary intake include, for example, changes in body composition which may result in a reduced metabolic rate, oral health problems, diminished sense of taste and smell and having chronic diseases.<sup>[185]</sup>

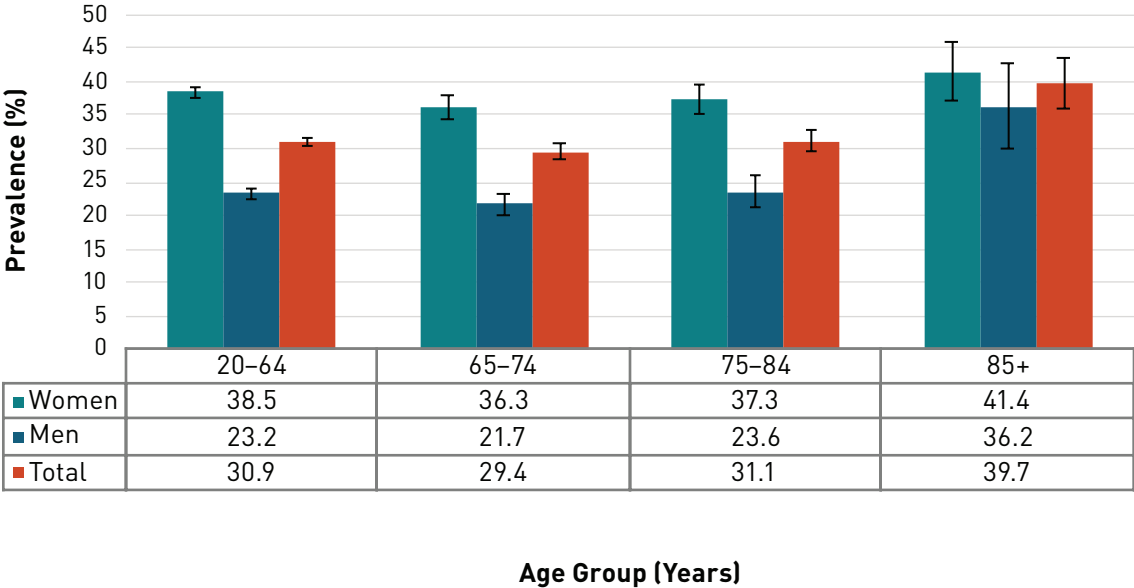
Social, socioeconomic and psychosocial factors may also contribute to the development of nutritional risk. These factors include (but are not limited to) social isolation, loneliness, economic constraints and lack of social support, including help with activities of daily living such as shopping and cooking.<sup>[184,186]</sup>

Based on data from the 2008–2009 Canadian Community Health Survey, 34% of seniors aged 65+ (37% of women and 29% of men) were at nutritional risk.<sup>[184,186]</sup> Canadians at nutritional risk are more likely to experience frailty, falls, functional limitations, poor quality of life and a decreased ability to recover from illness and surgery.<sup>[184,186–188]</sup>

Almost one-fifth (18%) of seniors at nutritional risk reported eating fewer than two servings of fruit and vegetables per day.<sup>[184]</sup> A diet low in fruit and/or vegetables increases the risk of developing several major chronic diseases including ischemic heart disease (IHD), stroke, type 2 diabetes, esophageal cancer and lung cancer.<sup>[167]</sup> In contrast, a diet high in fruit and/or vegetables is associated with a decrease in waist circumference and in BMI, and an overall lower weight gain.<sup>[167]</sup>

At 39.7%, the prevalence of Canadians who reported eating fruit and vegetables at least 5 times per day was highest in those aged 85+ in 2015–2016 (Figure 4.3.1). Women aged 65–84 were about 1.6 times more likely than men the same age to report eating fruit and vegetables at least 5 times per day. No such difference was observed in the oldest age group.

**FIGURE 4.3.1.** Prevalence of adults self-reporting consuming fruit and vegetables at least 5 times per day, household population aged 20+ years, by sex and age group, Canada, 2015–2016



**Note:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Canadian Community Health Survey, combined annual files 2015–2016.

## 4.4

# ALCOHOL USE

Canada's Low-Risk Alcohol Drinking Guidelines recommend that senior men should not exceed 3 drinks per day or 15 drinks per week while senior women should not exceed 2 drinks per day or 10 drinks per week. Non-drinking days are also recommended each week to avoid developing a habit.<sup>(189)</sup>

Light to moderate alcohol consumption (i.e. 1 drink or less per day for women and 1 to 2 drinks per day for men) has been shown to be protective for ischemic heart disease, heart failure, stroke, type 2 diabetes and all-cause mortality.<sup>(166)</sup> In contrast, heavy drinking (i.e. on a single occasion, 4 or more drinks for women and 5 or more drinks for men) increases the risk of developing many cancers (e.g. oral cavity and pharynx, oral esophagus, colon, rectum, liver, larynx), digestive diseases (e.g. liver cirrhosis), pancreatitis, diabetes, cardiovascular diseases and injuries.<sup>(190)</sup>

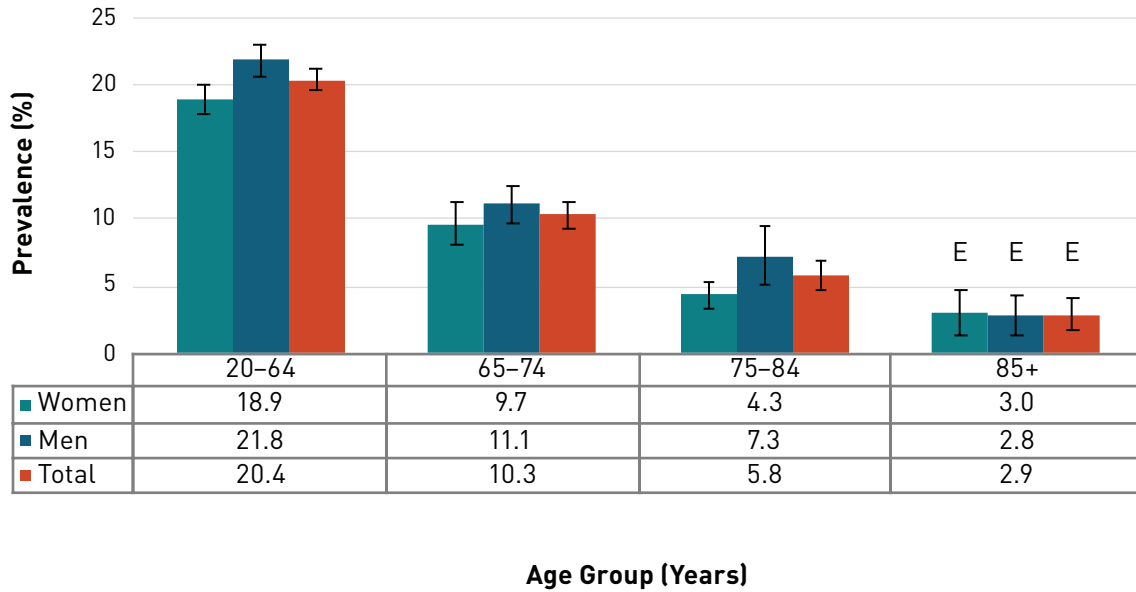
The toxic effects of alcohol may be more pronounced in seniors since the body's ability to metabolize and eliminate alcohol slows down with age.<sup>(191)</sup> Alcohol intake can sometimes adversely interact with medications. As seniors are often prescribed multiple drugs—with the majority prescribed at least five different drug classes<sup>(151)</sup>—to manage their chronic health conditions, those who drink alcohol are at increased risk of adverse effects. Alcohol consumption alone or in conjunction with medications has also been linked to falls.<sup>(192,193)</sup> Moderate-to-heavy drinking has also been associated with an increased risk of motor vehicle accidents and suicide among seniors.<sup>(193)</sup>

Data from the 2017–2018 CCHS for those living in British Columbia, Ontario and Prince Edward Island show that the prevalence of those who report exceeding the low-risk alcohol drinking guidelines was highest in the 20–64 year age group (20.4%) and lowest among seniors aged 85+ (2.9%) [Figure 4.4.1]. With a prevalence of 9.1%, men aged 65+ were 1.2 times more likely than women the same age (7.5%) to exceed the guidelines (data not shown).

New guidelines published in 2019, and specific to seniors, rather recommend that men aged 65+ should not exceed 1 to 2 drinks per day or 7 drinks per week while senior women aged 65+ should not exceed 1 drink per day or 5 drinks per week.<sup>(194)</sup> A retrospective analysis of the 2017–2018 CCHS data on low-risk alcohol drinking using the new guidelines demonstrates that over 20% of seniors exceed the new recommendations (data not shown).

**FIGURE 4.4.1.**

Prevalence of adults self-reporting exceeding low-risk alcohol drinking guidelines, household population aged 20+ years in British Columbia, Ontario and Prince Edward Island, by sex and age group, Canada, 2017–2018



E Interpret results with caution; coefficient of variation (CV) is between 15.0% and 35.0%.

**Note:** Estimates represent Canadians living in British Columbia, Ontario and Prince Edward Island. Data were not available for the other provinces and territories. The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Canadian Community Health Survey, combined annual files 2017–2018.

## 4.5

# BODY MASS INDEX

Body mass index (BMI), an indirect measure of an individual's body fat, is used to classify people according to potential health risks associated with underweight and overweight. BMI is calculated as a person's weight in kilograms divided by their height in metres squared— $\text{kg}/\text{m}^2$ .<sup>(195)</sup>

Individuals classified as overweight (BMI = 25.0–29.9) or obese (BMI  $\geq$  30) are at increased risk of developing type 2 diabetes, ischemic heart disease, stroke, osteoarthritis, colorectal cancer, breast cancer and other chronic diseases or conditions.<sup>(167,196,197)</sup> Women and men classified as obese are more likely to have impairments in functional health compared to those who are not categorized as obese.<sup>(198)</sup> Further, women over 55 years who are living with obesity tend to report reduced social participation.<sup>(198)</sup> Other studies have found that underweight (BMI < 18.5) and obesity are both associated with a lower health-related quality of life—specifically decreased health perception and poorer physical functioning—among women and men aged 65+.<sup>(178,199)</sup>

Despite these known risks, an obesity paradox is often apparent among seniors: increased weight or a high BMI can be protective against bone loss, fractures and cognitive decline.<sup>(180,200)</sup> An elevated BMI ( $\geq$  25) in advanced age may also be a protective factor against the development of malnutrition when seniors have temporary trouble eating or absorbing nutrients.<sup>(180,200)</sup>

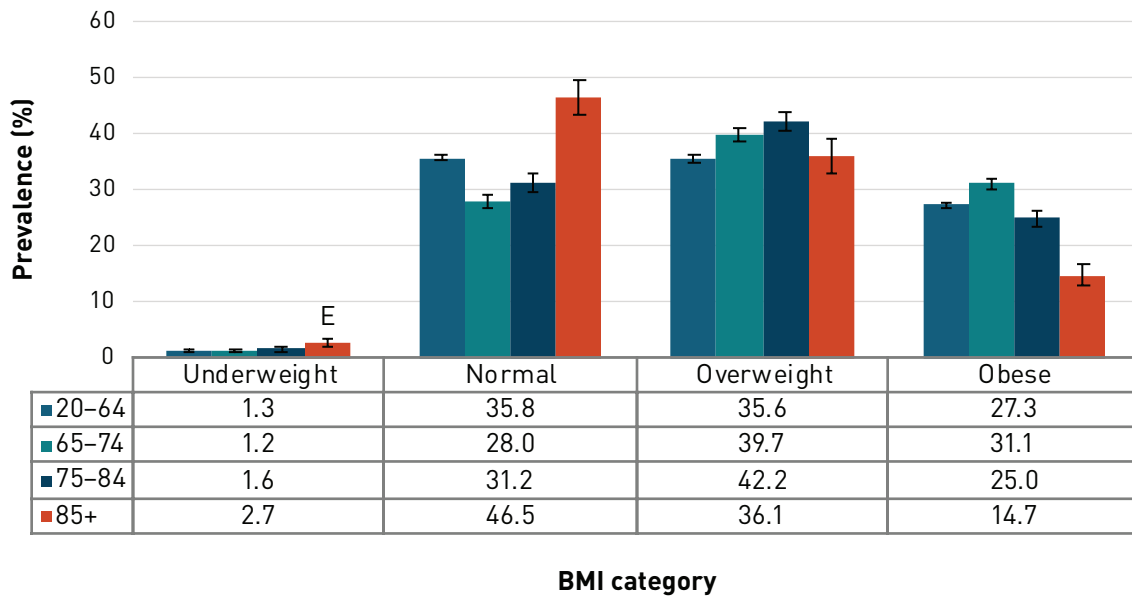
Overall, about 30.3% of seniors self-reported having a normal weight (adjusted<sup>4</sup> BMI of 18.5–24.5) in 2017–2018, with the highest proportion in those aged 85+ (46.5%) (Figure 4.5.1). The prevalence of adjusted BMI peaked in the overweight category for seniors aged 65–74 (39.7%) and 75–84 (42.2%). About 31.1% of seniors aged 65–74 had an adjusted BMI in the obese category (BMI  $\geq$  30), a proportion considerably higher than in any other age group.

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<sup>4</sup> An adjustment factor was applied to BMI values calculated from self-reported height and weight to account for known biases in self-reporting.<sup>(201)</sup>

**FIGURE 4.5.1.**

Prevalence of adjusted BMI\*, household population aged 20+ years, by age group, Canada, 2017–2018



\* An adjustment factor was applied to BMI values calculated from self-reported height and weight to account for known biases in self-reporting.<sup>[201]</sup>

E Interpret results with caution; coefficient of variation (CV) is between 15.0% and 35.0%.

**Abbreviation:** BMI = body mass index.

**Notes:** Underweight (BMI < 18.5), normal weight (BMI = 18.5–24.9), overweight (BMI = 25.0–29.9), obese (BMI ≥ 30).

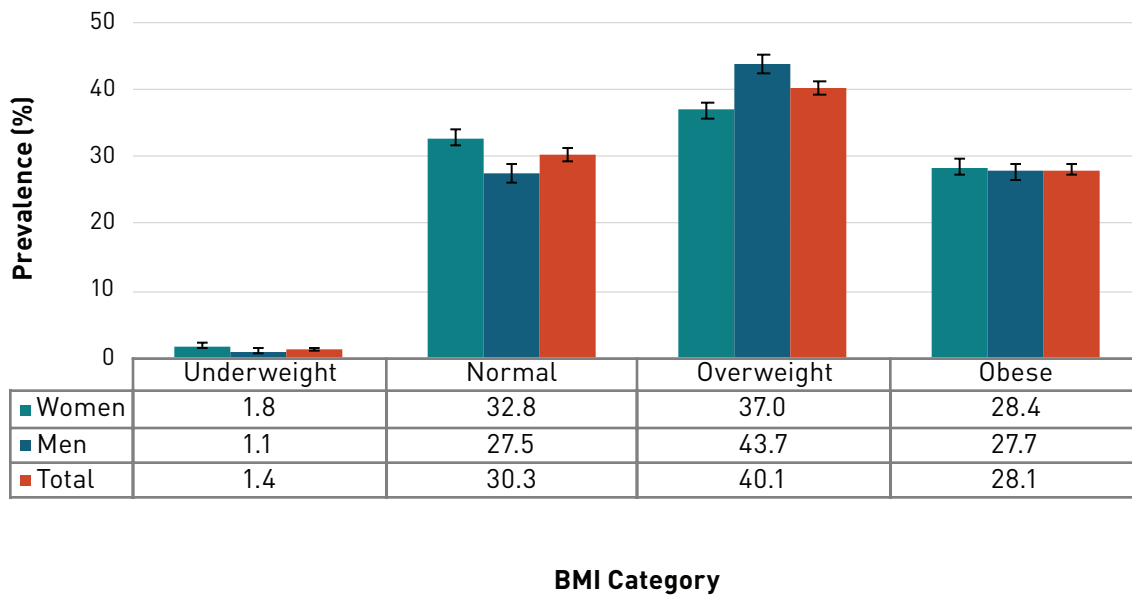
The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Canadian Community Health Survey, combined annual files 2017–2018.

In 2017–2018, a larger proportion of men aged 65+ than of women the same age was classified as overweight (43.7% vs. 37.0%). The proportions of men and women classified as obese (BMI  $\geq 30$ ) were similar (27.7% vs. 28.4%). However, senior women were 1.6 times more likely than senior men to have an adjusted BMI in the underweight category (BMI  $< 18.5$ ) (Figure 4.5.2).

**FIGURE 4.5.2.**

Prevalence of adjusted BMI\*, household population aged 65+, by sex, Canada, 2017–2018



\* An adjustment factor was applied to BMI values calculated from self-reported height and weight to account for known biases in self-reporting.<sup>(201)</sup>

**Abbreviation:** BMI = body mass index.

**Notes:** Underweight (BMI  $< 18.5$ ), normal weight (BMI = 18.5–24.9), overweight (BMI = 25.0–29.9), obese (BMI  $\geq 30$ ).

The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Canadian Community Health Survey, combined annual files 2017–2018.



## 4.6

# SLEEP

Sleep is important for overall health and well-being, including cognitive, emotional well-being and physical health.<sup>[202]</sup> Sleep disturbances such as sleep apnea, insomnia, fragmented sleep and early awakening are common in seniors.<sup>[203]</sup> Sleep quality can be improved by having healthy sleep habits, including having regular meals and exercise, avoiding caffeine, nicotine and alcohol before bedtime, and reducing noise and light in the sleeping environment.<sup>[203]</sup>

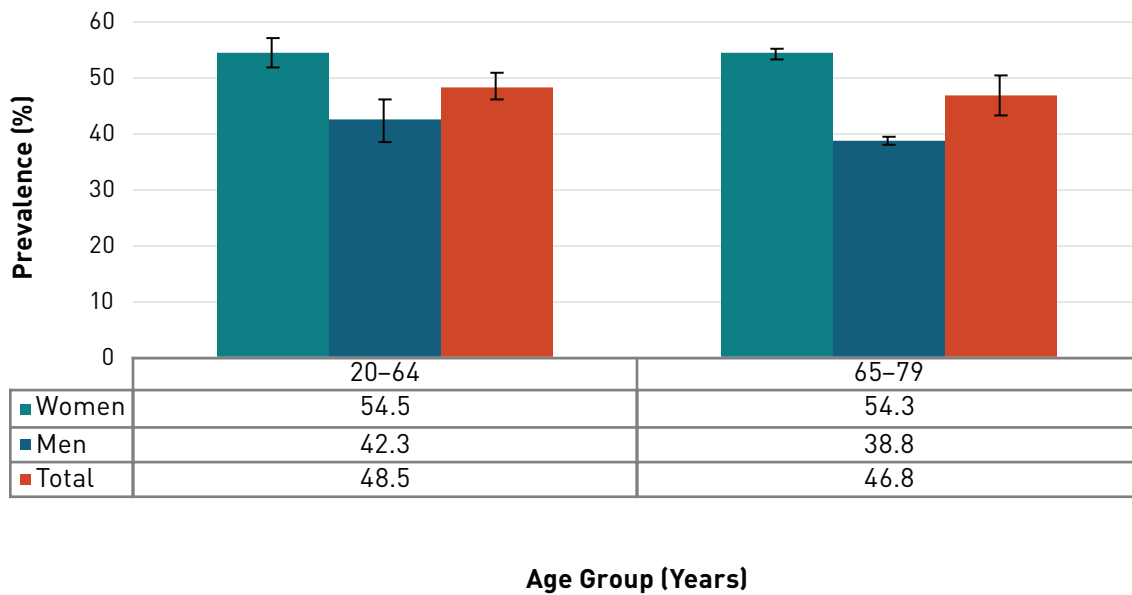
The National Sleep Foundation recommends that people aged 65+ get 7 to 8 hours of sleep per day.<sup>[202]</sup> Seniors meeting these guidelines have better cognitive functioning, lower rates of mental illness and chronic diseases and conditions, and improved quality of life compared to those who do not meet these guidelines.<sup>[202]</sup> Based on data from the CHMS (2007–2015), 55.3% of seniors aged 65–79 met the recommended sleep guidelines, with an average of 7.3 hours per day. On the other hand, 15.1% of seniors slept longer than the recommended maximum of 8 hours per day. Exceeding the recommended sleep guidelines is associated with increased risk of mortality and morbidity including hypertension, type 2 diabetes, and atrial fibrillation.<sup>[202]</sup>

Even though the majority of seniors met the recommended sleep guidelines, short sleep duration and poor sleep quality were commonly reported. Data from the CHMS (2007–2015) indicate that 29.6% of seniors aged 65–79 slept less than the recommended 7 to 8 hours per day. Short duration and poor quality of sleep increase the risk of developing several major chronic diseases and conditions including type 2 diabetes, cardiovascular disease, depression and obesity.<sup>[204]</sup> Further, short sleep duration and poor sleep quality are associated with reduced quality of life, irritability, injuries and all-cause mortality.<sup>[204]</sup>

According to data from the CHMS (2007–2015), about 46.8% of seniors reported having trouble falling asleep at least some of the time, with a higher proportion of women than men affected (Figure 4.6.1). Both women and men reported their sleep to be refreshing (91.7%) at least some of the time (Figure 4.6.2), while 28.6% of seniors reported difficulty staying awake during normal waking hours at least some of the time (Figure 4.6.3).

**FIGURE 4.6.1.**

Prevalence of adults self-reporting having trouble getting to sleep, by sex and age group, Canada, 2007–2015

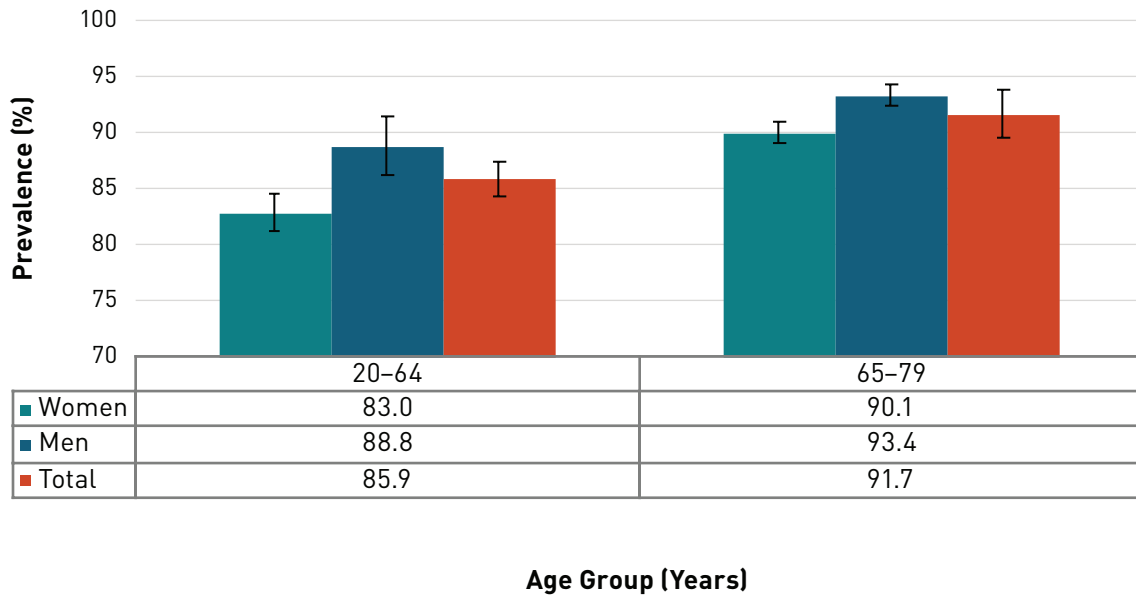


**Note:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Canadian Health Measures Survey (Cycle 1 to Cycle 4, 2007 to 2015).

**FIGURE 4.6.2.**

Prevalence of adults self-reporting that their sleep is refreshing, by sex and age group, Canada, 2007–2015

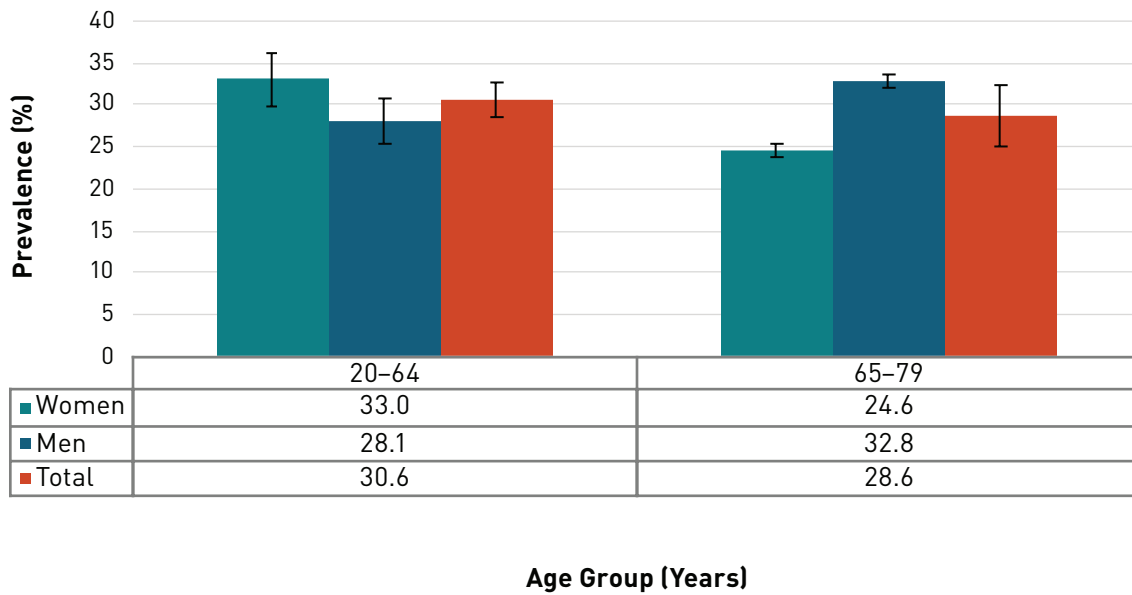


**Note:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Canadian Health Measures Survey (Cycle 1 to Cycle 4, 2007 to 2015).

**FIGURE 4.6.3.**

Prevalence of adults self-reporting having difficulty staying awake, by sex and age group, Canada, 2007–2015



**Note:** The error bars indicate 95% confidence intervals. These 95% confidence intervals show an estimated range of values that is likely to include the true value 19 times out of 20.

**Source:** Canadian Health Measures Survey (Cycle 1 to Cycle 4, 2007 to 2015).

## 4.7

# OTHER DETERMINANTS OF HEALTH

Individual lifestyle choices undoubtedly influence health, but broader societal factors are also at play. Social determinants of health refer to “the conditions in which people are born, grow, work, live, and age”.<sup>[205]</sup> The social determinants of health, such as early childhood experiences, educational attainment, employment status and income influence a person’s health, life expectancy and health outcomes. People with lower education or income, or lower-status occupations, for example, are more likely to have worse health outcomes than those who are more socially advantaged.<sup>[157]</sup>

Based on a conceptual framework developed by the World Health Organization<sup>[206]</sup>, the Pan-Canadian Health Inequalities Reporting Initiative, a collaborative undertaking by the Public Health Agency of Canada, the Pan-Canadian Public Health Network, Statistics Canada and the Canadian Institute for Health Information, has documented socioeconomic gradients and differences in health among Canadians. Inequalities are widespread and persistent in Canadian society across virtually all measures of health, including life expectancy and mortality indicators, mental health and mental illness as well as the prevalence of arthritis, asthma, diabetes, obesity and other diseases and health conditions.<sup>[157]</sup>

## SOCIAL SUPPORT, SOCIAL NETWORKS AND SOCIAL PARTICIPATION

Within the social environment, social support (including caregiving), social networks and social participation are distinct but related factors that influence the health of older adults.<sup>[207]</sup>

High levels of social support have been shown to be protective against mortality and predictive of healthy aging. Most seniors report high levels of social support (93.7%) and describe their neighbourhood as a place where people help each other (88.5%).<sup>[208]</sup>

Seniors also enjoy social networks of family and friends. In 2017–2018, 72.1% of seniors lived with others (with a partner, children, relatives and/or nonrelatives). However, 27.9% reported living alone, and of these, more than half were women.

Social participation, including engagement in work, voluntary activities and leisure activities, are all associated with better health among older adults. In 2015, 75% of Canadian seniors were socially active, for an average of 3.5 hours on a typical day, exercising, socializing and using technology.<sup>[209]</sup>

## SOCIAL ISOLATION

Social isolation can occur as a result of low quantity and quality of contact with others, few social roles and few or no mutually rewarding relationships.<sup>[207]</sup> Social isolation is associated with poor physical and mental health, including increased emotional distress and prevalence of depression, increased number of falls and use of health and support services,<sup>[207]</sup> and premature death.<sup>[210]</sup>

About 16% of seniors experience social isolation<sup>[211]</sup>, while about 30% are at risk of becoming socially isolated.<sup>[212]</sup> Numerous factors may place seniors at risk of social isolation and loneliness including living alone, being age 80+, having compromised health status or multiple chronic health problems, having no children or contact with family, lacking access to transportation and living in low income.<sup>[207]</sup> In addition, women are more likely than men to be socially isolated.<sup>[211]</sup>

## PHYSICAL ENVIRONMENT

The physical environment is also related to health outcomes as seniors can be particularly vulnerable to any hazards in the built environment. Mobility limitations, which can be a consequence of living with chronic diseases, can create unique challenges in crossing a busy intersection, for example, dealing with cracked sidewalks or entering a building that can only be accessed by steps. Older people with chronic diseases may also be vulnerable to the effects of heat waves and develop heat-related illness or injury.<sup>[213]</sup>

## AGE-FRIENDLY ENVIRONMENTS

Age-friendly environments are designed to foster health and well-being and the participation of people as they age. Such environments are accessible, equitable, inclusive, safe and secure, and supportive. They promote health and prevent or delay the onset of disease and functional decline.<sup>[212]</sup> Creating age-friendly environments can be an effective way to address the social, economic and physical needs that help determine health.

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## AGE-FRIENDLY COMMUNITIES

The World Health Organization defines an age-friendly community as one that provides support and opportunities in the physical and social environments to enable older adults to be safe and healthy to participate in society.<sup>(214)</sup> The age-friendly model for cities and communities, which was developed in 2006, addresses the social and physical determinants of health in eight areas: outdoor spaces and buildings; transportation; housing; social participation; respect and social inclusion; civic participation and employment; communication and information; and community support and health services.

Canada has been a leader in the age-friendly movement since its beginnings, particularly in expanding the project to smaller towns, and rural and remote areas. Communities across Canada are working towards becoming age-friendly.

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## SUMMARY

Certain risk factors, such as age, biological sex, family history and ethnic ancestry increase the risk of developing chronic diseases. Further, the majority of chronic diseases and conditions share four modifiable behavioural risk factors. These are tobacco use, physical inactivity, unhealthy diet and harmful use of alcohol.

While 19.1% of Canadians aged 20–64 years reported smoking daily or occasionally, only 9.5% of seniors reported smoking in 2017–2018. Men aged 65+ were 1.2 times more likely to report smoking than women the same age.

Canadians aged 20–64 years were 1.5 times more likely than seniors to self-report meeting the Canadian Physical Activity Guidelines (60.5% vs. 39.4%) in 2017–2018. In actuality, activity monitor data showed that only 15.2% of seniors aged 65–79 met the guidelines in 2016–2017 indicating that people tend to over-report their activity levels. At this time, physical activity levels based on objectively measured data are not available in Canada for people 80+ years.

Women aged 65+ (37%) were more likely than men the same age (29%) to report poor nutritional intake. Physiological changes associated with increasing age as well as social, economic and psychological factors may contribute to nutritional risk. About 30.6% of seniors reported eating fruits and vegetables at least 5 times per day. Women aged 65–84 reported doing so about 1.6 times more often than men the same age.

Of those living in British Columbia, Ontario and Prince Edward Island, fewer seniors (8.3%) than those aged 20–64 years (20.4%) reported exceeding low-risk alcohol drinking guidelines. Nonetheless, men aged 65+ were 1.2 times more likely than women the same age to report exceeding the guidelines.

Senior women were 1.6 times more likely than senior men to have an adjusted BMI in the underweight category (BMI < 18.5). Approximately 44.7% of senior men and 37.0% of senior women were classified as overweight (BMI of 25.0–29.9) while 31.1% of seniors aged 65–74 were classified as obese (BMI ≥ 30). Although a BMI of 25 or over is associated with deleterious health effects, increased weight or a high BMI can be protective against bone loss, fractures and cognitive decline and the development of malnutrition among seniors.

Seniors aged 65–79 reported sleeping 7.3 hours per day on average, and over half (55.3%) reported meeting the recommended sleep guidelines. But 29.6% of seniors slept less than the recommended 7 to 8 hours per day. About 46.8%, and in particular women (54.3%) rather than men (38.8%), reported having trouble getting to sleep at least some of the time. Conversely, 28.6% of seniors reported difficulty staying awake during normal waking hours at least some of the time.



Social determinants of health refer to “the conditions in which people are born, grow, work, live, and age.”<sup>(205)</sup> People with lower education or income or lower-status occupations, for example, are more likely to have worse health outcomes than those who are more socially advantaged.

Seniors with low social support, a lack of social networks and low levels of social engagement as well as those who are socially isolated are also less likely to be in good health. What’s more, seniors can be particularly vulnerable to hazards in the built and natural physical environment.

Age-friendly environments can address the social determinants of health. The policies, services and structures related to the physical and social environments are designed, in an age-friendly community, to foster well-being and the participation of people as they age and to prevent or delay the onset of disease and functional decline.



## CONCLUDING REMARKS

This report suggests some key messages and considerations as we move forward on advancing knowledge on chronic diseases in seniors.

In interpreting the following key messages, it is important to remember that the findings in this report are based on administrative health data and self-reported information from cross-sectional surveys. Although the coverage of the Canadian Chronic Disease Surveillance System is near universal, only data of those individuals who have sought care during the capture period are included. As for the Canadian Community Health Survey and the Canadian Health Measures Survey, these only capture people living independently in the community and do not include the 8% of seniors who live in residential care facilities who are generally older and in poorer health.



# KEY MESSAGES

**Seniors' life expectancy is increasing. Canadians are living longer—the average 65-year-old Canadian can expect to live an additional 21 years—and most experience overall good health.**

In 2017–2018, almost half of Canadian seniors (46.5% of men and 48.3% of women) perceived their health as very good or excellent, and over two-thirds (72.0%) reported their mental health as very good or excellent. However, changes in health-related quality of life and increased risk for developing chronic diseases and conditions often come with aging.

**The risk of developing chronic diseases and having multiple chronic conditions increases with age.**

Therefore, population aging along with advances in the diagnosis and management of diseases will likely result in a greater number of Canadian seniors living with multiple chronic diseases for a longer time.

**Over one-third of seniors have two or more chronic diseases.**

Conservative estimates from 2017–2018 indicate that about 37% of seniors report having at least two of the ten chronic diseases described in this report, with almost half of those aged 85+ reporting multimorbidity. Women younger than 75 years old were more likely to report multimorbidity than men the same age.

**Certain chronic diseases are more common among women while others are more common among men.**

Compared to men, women were about:

- 4.2 times more likely to be living with diagnosed osteoporosis;
- 1.9 times more likely to be living with diagnosed rheumatoid arthritis;
- 1.6 times more likely to use health services for mood and anxiety disorders;
- 1.5 times more likely to be living with diagnosed dementia (including Alzheimer disease) and asthma; and
- 1.4 times more likely to be living with diagnosed osteoarthritis.

Compared to women, men were about:

- 2.7 times more likely to be living with diagnosed gout;
- 1.5 times more likely to be living with diagnosed Parkinsonism (including Parkinson disease) or more likely to be living with diagnosed ischemic heart disease (IHD);
- 1.3 times more likely to be living with diabetes; and
- 1.2 times more likely to have diagnosed cancer and to have diagnosed heart failure.

### **Years lived with disability (YLD) increase sharply with age for people with Alzheimer disease and other dementias as well as cardiovascular diseases.**

Leading causes of YLD among seniors were diabetes, high systolic blood pressure, stroke, heart failure and chronic obstructive pulmonary disorder (COPD). The highest YLD in those aged 85+ was among those with Alzheimer disease and other dementias, followed by those with stroke, heart failure, high systolic blood pressure and IHD.

### **While mortality rates have declined for most chronic diseases and conditions, some have increased.**

In 2017, the five leading causes of death due to a chronic disease were cancer, IHD, dementia, COPD and stroke.

Since 2000, age-standardized mortality rates have declined by over 30% for most of the diseases described in this report and likely reflect advances in disease management and treatment and reduction in smoking rates. However, since 2000, mortality rates due to dementia have increased by 59% while mortality rates due to Parkinson disease and hypertension have increased by about 26% and 12%, respectively. The aging of the population and corresponding declines in competing causes of death might explain these increases.

### **Oral diseases are largely preventable and associated with many chronic diseases.**

Conservative estimates have shown that over half (52%) of those aged 65–79 have moderate-to-severe periodontal diseases. Seniors face barriers accessing care in part because they lose their dental insurance coverage upon retirement and are less likely to have consulted a dentist or another oral health professional in the last 12 months.

### **Falls are a major cause of injury, hospitalization, disability and premature mortality.**

In 2017–2018, approximately 350,000 or 5.8% of seniors reported a fall-related injury in the past 12 months; almost two-thirds were women. Falls can affect a person's quality of life and lead to loss of mobility, hospitalization, longer hospital stay and death. Falls are preventable and their consequences can be avoided through multifactorial interventions that target multiple risk factors.

### **Individual behavioural risk factors interact with broader social determinants of health in determining health.**

Four behavioural risk factors—tobacco use, harmful use of alcohol, unhealthy diets and physical inactivity—increase the risk of developing chronic diseases. This risk is further increased in those with low socioeconomic status.

Compared to younger adults aged 20–64, seniors reported low rates of smoking. However, senior men were 1.2 times more likely to report smoking compared to women the same age.

Similarly, senior men were also 1.2 times more likely than senior women to report exceeding low-risk alcohol drinking guidelines.

Women aged 65–84 were about 1.6 times more likely than men the same age to report consuming fruit and vegetables at least 5 times per day in 2017–2018.

Just over 30% of seniors reported having a normal weight, but 40.1% reported having an adjusted BMI categorized as overweight (43.7% of men vs 37.0% of women), and 28.1% were categorized as obese.

Very few seniors (15.2%) aged 65–79 were physically active in 2016–2017, according to activity monitor data, yet 39.4% reported meeting the Canadian Physical Activity Guidelines, suggesting that these results should be interpreted with caution.

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### **MOVING FORWARD ON HEALTHY AGING**

The current report aims to advance knowledge of chronic diseases among Canada’s seniors. It also points to gaps and areas where data could be enhanced, such as for Indigenous seniors, newcomers to Canada, seniors living in low income and with mental and physical challenges and those living in long-term care facilities (most of whom are in the oldest age groups and require care that cannot be met in the community).

Although the prevalence of most chronic diseases and conditions increases with age, many can be prevented, delayed or mitigated through the development of age-friendly, safe and socially supportive environments, reducing health inequities faced by vulnerable seniors, supporting healthy behaviours and choices and focusing on effective health promotion and disease prevention activities.

Enhancing data on the health and illness status of vulnerable seniors will support and inform public health policy, programs and practices that promote healthy aging and well-being among Canadian seniors.

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# BIBLIOGRAPHY

- [1] Statistics Canada. Table 17–10–0005–01 Population estimates on July 1<sup>st</sup>, by age and sex [Internet]. Ottawa (ON): Statistics Canada; 2019 [cited 2019 May 8]. Available from [www.150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1710000501](http://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1710000501).
- [2] Statistics Canada. Table 17–10–0057–01 Projected population, by projection scenario, age and sex, as of July 1 (x 1,000) [Internet]. Ottawa (ON): Statistics Canada; 2019 [cited 2019 July 31]. Available from: [www.150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1710005701](http://www.150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1710005701).
- [3] Statistics Canada. Demographic change [Internet]. Ottawa (ON): Statistics Canada; 2016 [cited 2019 May 29]. Available from: [www150.statcan.gc.ca/n1/pub/82-229-x/2009001/demo/int1-eng.htm#n3](http://www150.statcan.gc.ca/n1/pub/82-229-x/2009001/demo/int1-eng.htm#n3).
- [4] Statistics Canada. Total fertility rate, Canada, 1926 to 2011 [Internet]. Ottawa (ON): Statistics Canada; 2015 [cited May 29, 2019]. Available from: [www.150.statcan.gc.ca/n1/pub/11-630-x/2014002/c-g/desc1-eng.htm](http://www.150.statcan.gc.ca/n1/pub/11-630-x/2014002/c-g/desc1-eng.htm).
- [5] Statistics Canada. Fertility: Overview, 2012 to 2016 [Internet]. Ottawa (ON): Statistics Canada; 2018 [cited 2019 May 29]. Available from: [www.150.statcan.gc.ca/n1/pub/91-209-x/2018001/article/54956-eng.htm](http://www.150.statcan.gc.ca/n1/pub/91-209-x/2018001/article/54956-eng.htm).
- [6] Statistics Canada. Table 13–10–0370–01—Health-adjusted life expectancy, by sex [Internet]. Ottawa (ON): Statistics Canada; 2020 [cited 2020 Jan 22]. Available at: [www.150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=1310037001](http://www.150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=1310037001).
- [7] Statistics Canada. The Daily. Canada's population estimates: Age and sex, July 1, 2019 [Internet]. Ottawa (ON): Statistics Canada; 2019 [cited 2019 Oct 8]. Available from: [www.150.statcan.gc.ca/n1/daily-quotidien/190930/dq190930a-eng.htm](http://www.150.statcan.gc.ca/n1/daily-quotidien/190930/dq190930a-eng.htm).
- [8] Statistics Canada. Population Projections for Canada (2018 to 2068), Provinces and Territories (2018 to 2043) [Internet]. Ottawa (ON): Statistics Canada; 2019 [cited 2020 Feb 28]. Available from: [www.150.statcan.gc.ca/n1/pub/91-520-x/91-520-x2019001-eng.htm](http://www.150.statcan.gc.ca/n1/pub/91-520-x/91-520-x2019001-eng.htm).
- [9] Statistics Canada. Table 11–10–0135–01. Low income statistics by age, sex and economic family type [Internet]. Ottawa (ON): Statistics Canada; 2019 June 6 [cited 2019 May 29]. Available from: [www.150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1110013501](http://www.150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1110013501).
- [10] Statistics Canada. The Daily. Labour in Canada: Key results from the 2016 Census [Internet]. Ottawa (ON): Statistics Canada; 2017 [cited 2020 Jan 28]. Available from: [www.150.statcan.gc.ca/n1/daily-quotidien/171129/dq171129b-eng.htm](http://www.150.statcan.gc.ca/n1/daily-quotidien/171129/dq171129b-eng.htm).
- [11] Statistics Canada. Population centre (POPCTR). Dictionary, Census of Population, 2016 [Internet]. Ottawa (ON): Statistics Canada; 2019 [cited 2020 Feb 28]. Available from: [www12.statcan.gc.ca/census-recensement/2016/ref/dict/geo049a-eng.cfm](http://www12.statcan.gc.ca/census-recensement/2016/ref/dict/geo049a-eng.cfm).
- [12] Public Health Agency of Canada. The Chief Public Health Officer's Report on the State of Public Health in Canada, 2010—Growing older: Adding life to years [Internet]. Ottawa (ON): Public Health Agency of Canada; [cited 2019 Feb 22]. Available from: [www.canada.ca/en/public-health/corporate/publications/chief-public-health-officer-reports-state-public-health-canada/annual-report-on-state-public-health-canada-2010.html](http://www.canada.ca/en/public-health/corporate/publications/chief-public-health-officer-reports-state-public-health-canada/annual-report-on-state-public-health-canada-2010.html).
- [13] Statistics Canada. First Nations People, Métis and Inuit in Canada: Diverse and Growing Populations [Internet]. Ottawa (ON): Statistics Canada; 2018 [cited 2020 Feb 27]. Available from: [www.150.statcan.gc.ca/n1/pub/89-659-x/89-659-x2018001-eng.htm](http://www.150.statcan.gc.ca/n1/pub/89-659-x/89-659-x2018001-eng.htm).
- [14] Statistics Canada. Living arrangements of seniors [Internet]. Ottawa (ON): Statistics Canada; 2018 [cited 2019 May 29]. Available from: [www12.statcan.gc.ca/census-recensement/2011/as-sa/98-312-x/98-312-x2011003\\_4-eng.cfm](http://www12.statcan.gc.ca/census-recensement/2011/as-sa/98-312-x/98-312-x2011003_4-eng.cfm).
- [15] Public Health Agency of Canada. How Healthy are Canadians? A trend analysis of the health of Canadians from a healthy living and chronic disease perspective [Internet]. Ottawa (ON): Public Health Agency of Canada; 2017 [cited 2019 May 29]. Available from: [www.canada.ca/en/public-health/services/publications/healthy-living/how-healthy-canadians.html](http://www.canada.ca/en/public-health/services/publications/healthy-living/how-healthy-canadians.html).
- [16] Bushnik T, Tjepkema M, Martel L. Health-adjusted life expectancy in Canada. *Health Rep* 2018 Apr 18;29(4):14–22.
- [17] Steensma C, Loukine L, Choi BC. Evaluating compression or expansion of morbidity in Canada: trends in life expectancy and health-adjusted life expectancy from 1994 to 2010. *Health Promot Chronic Dis Prev Can* 2017 Mar;37(3):68–76.

- [18] World Health Organization. Constitution [Internet]. Geneva: World Health Organization; 2020 [cited 2020 Jan 28]. Available from: [www.who.int/about/who-we-are/constitution](http://www.who.int/about/who-we-are/constitution).
- [19] Public Health Agency of Canada. Positive Mental Health Surveillance Indicator Framework [Internet]. Ottawa (ON): Public Health Agency of Canada; 2019 [cited 2020 Jan 28]. Available from: [health-infobase.canada.ca/positive-mental-health/Index](http://health-infobase.canada.ca/positive-mental-health/Index).
- [20] MacCourt P., Wilson K., Tourigny-Rivard M-F. Guidelines for Comprehensive Mental Health Services for Older Adults in Canada [Internet]. Calgary (AB), Alberta: Mental Health Commission of Canada; 2011 [cited 2019 Feb 28]. Available from: [www.mentalhealthcommission.ca](http://www.mentalhealthcommission.ca).
- [21] Kaleta D, Polanska K, Dziankowska-Zaborszczyk E, Hanke W, Drygas W. Factors influencing self-perception of health status. *Cent Eur J Public Health* 2009 Sep;17(3):122–127.
- [22] Marengoni A, Angleman S, Melis R, Mangialasche F, Karp A, Garmen A, *et al.* Aging with multimorbidity: A systematic review of the literature. *Ageing Res Rev* 2011 Sep;10(4):430–439.
- [23] Rodriguez-Blazquez C, Damian J, Andres-Prado MJ, Almazan-Isla J, Alcalde-Cabero E, Forjaz MJ, *et al.* Associations between chronic conditions, body functions, activity limitations and participation restrictions: a cross-sectional approach in Spanish non-clinical populations. *BMJ Open* 2016 Jun 14;6(6):e010446–2015–010446.
- [24] Liotta LA, Liu ET. Essentials of Molecular Biology: Genomics and Cancer. In: DeVita VT, Hellman S, Rosenberg SA, editors. *Cancer: Principles and Practice of Oncology*. 6<sup>th</sup> edition. Philadelphia (PA): Lippincott Williams & Wilkins; 2001.
- [25] Canadian Cancer Society, Government of Canada. Canadian Cancer Statistics 2019 [Internet]. Toronto (ON): Canadian Cancer Society; Government of Canada; 2019 [cited 2019 Oct 22]. Available from: [www.cancer.ca/en/support-and-services/resources/publications/?region=on](http://www.cancer.ca/en/support-and-services/resources/publications/?region=on).
- [26] Pedersen JK, Engholm G, Skytthe A, Christensen K. Cancer and aging: Epidemiology and methodological challenges. *Acta Oncol* 2016;55(Suppl 1):7–12.
- [27] Stewart B, Wild C, editors. *World Cancer Report 2014*. Lyon (France): International Agency for Research on Cancer 2014.
- [28] Lusis AJ. Atherosclerosis. *Nature* 2000 Sep 14;407(6801):233–241.
- [29] Yusuf S, Hawken S, Ounpuu S, Dans T, Avezum A, Lanas F, *et al.* Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. *Lancet* 2004 Sep 11–17;364(9438):937–952.
- [30] Dhingra R, Vasan RS. Age as a risk factor. *Med Clin North Am* 2012 Jan;96(1):87–91.
- [31] EUGenMed Cardiovascular Clinical Study Group, Regitz-Zagrosek V, Oertelt-Prigione S, Prescott E, Franconi F, Gerdtts E, *et al.* Gender in cardiovascular diseases: impact on clinical manifestations, management, and outcomes. *Eur Heart J* 2016 Jan 1;37(1):24–34.
- [32] Prince SA, McDonnell LA, Turek MA, Visintini S, Nahwegahbow A, Kandasamy S, *et al.* The State of Affairs for Cardiovascular Health Research in Indigenous Women in Canada: A Scoping Review. *Can J Cardiol* 2018 Apr;34(4):437–449.
- [33] Reading J. Confronting the Growing Crisis of Cardiovascular Disease and Heart Health Among Aboriginal Peoples in Canada. *Can J Cardiol* 2015 Sep;31(9):1077–1080.
- [34] Canadian Institute for Health Information. Hospital Care for Heart Attacks Among First Nations, Inuit and Métis [Internet]. Ottawa (ON): Canadian Institute for Health Information; 2013 [cited 2019 June 25]. Available from: <https://secure.cihi.ca/estore/productFamily.htm?locale=en&pf=PFC2048>.
- [35] Tu JV, Chu A, Rezai MR, Guo H, Maclagan LC, Austin PC, *et al.* The incidence of major cardiovascular events in immigrants to Ontario, Canada: The CANHEART Immigrant Study. *Circulation* 2015 Oct 20;132(16):1549–1559.
- [36] Lloyd-Jones DM, Nam BH, D'Agostino RB S, Levy D, Murabito JM, Wang TJ, *et al.* Parental cardiovascular disease as a risk factor for cardiovascular disease in middle-aged adults: a prospective study of parents and offspring. *JAMA* 2004 May 12;291(18):2204–2211.
- [37] Public Health Agency of Canada. Report from the Canadian Chronic Disease Surveillance System: Heart Disease in Canada, 2018 [Internet]. Ottawa (ON): Public Health Agency of Canada; 2019 [cited 2019 Mar 20]. Available from: [www.canada.ca/en/public-health/services/publications/diseases-conditions/report-heart-disease-Canada-2018.html](http://www.canada.ca/en/public-health/services/publications/diseases-conditions/report-heart-disease-Canada-2018.html).

- [38] Rich MW. Chapter 78. Heart Failure. In: Halter JB, Ouslander JG, Tinetti ME, Studenski S, High KP, Asthana S. eds. *Hazzard's Geriatric Medicine and Gerontology* [Internet]. 6<sup>th</sup> ed. New York (NY): McGraw-Hill; 2009 [cited 2019 June 25]. Available from: <https://accessmedicine.mhmedical.com/content.aspx?bookid=371&sectionid=41587693>.
- [39] Bui AL, Horwich TB, Fonarow GC. Epidemiology and risk profile of heart failure. *Nat Rev Cardiol* 2011 Jan;8(1):30–41.
- [40] Savarese G, D'Amario D. Sex Differences in Heart Failure. *Adv Exp Med Biol* 2018;1065:529–544.
- [41] Ziaeeian B, Kominski GF, Ong MK, Mays VM, Brook RH, Fonarow GC. National Differences in Trends for Heart Failure Hospitalizations by Sex and Race/Ethnicity. *Circ Cardiovasc Qual Outcomes* 2017 Jul;10(7):10.1161/CIRCOUTCOMES.116.003552.
- [42] Di Giuseppe G, Chu A, Tu JV, Shanmugasegaram S, Liu P, Lee DS. Incidence of Heart Failure Among Immigrants to Ontario, Canada: A CANHEART Immigrant Study. *J Card Fail* 2019 Jun;25(6):425–435.
- [43] Government of Canada. Stroke [Internet]. Ottawa (ON): Government of Canada; 2018 [cited 2019 July 8]. Available from: [www.canada.ca/en/public-health/services/diseases/heart-health/stroke.html](http://www.canada.ca/en/public-health/services/diseases/heart-health/stroke.html).
- [44] Heart and Stroke Foundation of Canada. Stroke [Internet]. Ottawa (ON): Heart and Stroke Foundation of Canada; [cited 2020 Jan 28]. Available from: [www.heartandstroke.ca/stroke](http://www.heartandstroke.ca/stroke).
- [45] O'Donnell MJ, Chin SL, Rangarajan S, Xavier D, Liu L, Zhang H, *et al*. Global and regional effects of potentially modifiable risk factors associated with acute stroke in 32 countries (INTERSTROKE): a case-control study. *Lancet* 2016 Aug 20;388(10046):761–775.
- [46] Public Health Agency of Canada. Stroke in Canada: Highlights from the Canadian Chronic Disease Surveillance System [Internet]. Ottawa (ON): Public Health Agency of Canada; 2017 [cited 2019 Feb 28]. Available from: [www.canada.ca/en/public-health/services/publications/diseases-conditions/stroke-canada-fact-sheet.html](http://www.canada.ca/en/public-health/services/publications/diseases-conditions/stroke-canada-fact-sheet.html).
- [47] Goldstein LB, Adams R, Alberts MJ, Appel LJ, Brass LM, Bushnell CD, *et al*. Primary prevention of ischemic stroke: a guideline from the American Heart Association/American Stroke Association Stroke Council: cosponsored by the Atherosclerotic Peripheral Vascular Disease Interdisciplinary Working Group; Cardiovascular Nursing Council; Clinical Cardiology Council; Nutrition, Physical Activity, and Metabolism Council; and the Quality of Care and Outcomes Research Interdisciplinary Working Group: the American Academy of Neurology affirms the value of this guideline. *Stroke* 2006 Jun;37(6):1583–1633.
- [48] Public Health Agency of Canada. Fast facts about diabetes 2011 [Internet]. Ottawa (ON): Public Health Agency of Canada; 2019 [cited 2020 Jan 28]. Available from: [www.canada.ca/en/public-health/services/chronic-diseases/reports-publications/diabetes/fast-facts-about-diabetes-2011.html](http://www.canada.ca/en/public-health/services/chronic-diseases/reports-publications/diabetes/fast-facts-about-diabetes-2011.html).
- [49] Public Health Agency of Canada. Diabetes in Canada: Facts and figures from a public health perspective [Internet]. Ottawa (ON): Public Health Agency of Canada; 2012 [cited 2020 Jan 28]. Available from: [www.canada.ca/en/public-health/services/chronic-diseases/reports-publications/diabetes/diabetes-canada-facts-figures-a-public-health-perspective.html](http://www.canada.ca/en/public-health/services/chronic-diseases/reports-publications/diabetes/diabetes-canada-facts-figures-a-public-health-perspective.html).
- [50] Public Health Agency of Canada. Twenty Years of Diabetes surveillance using the Canadian Chronic Disease Surveillance System [Internet]. Ottawa (ON): Public Health Agency of Canada; 2019 [cited 2020 Feb 3]. Available from: [www.canada.ca/en/public-health/services/publications/diseases-conditions/20-years-diabetes-surveillance.html#fn4](http://www.canada.ca/en/public-health/services/publications/diseases-conditions/20-years-diabetes-surveillance.html#fn4).
- [51] Diabetes Canada Clinical Practice Guidelines Expert Committee. Diabetes Canada 2018 clinical practice guidelines for the prevention and management of diabetes in Canada. *Can J Diabetes* 2018;42(Suppl 1):S1–S325.
- [52] World Health Organization. Diabetes [Internet]. Geneva (CH): World Health Organization; 2018 [cited 2019 June 25] Available from: [www.who.int/news-room/fact-sheets/detail/diabetes](http://www.who.int/news-room/fact-sheets/detail/diabetes).
- [53] Public Health Agency of Canada. Canadian Chronic Disease Indicators (CCDI) [Internet]. Ottawa (ON): Public Health Agency of Canada; 2019 [cited 2020 Jan 28]. Available from: <https://health-infobase.canada.ca/ccdi/Index>.
- [54] Government of Canada. High blood pressure [Internet]. Ottawa (ON): Government of Canada; 2017 [cited 2019 June 25]. Available from: [www.canada.ca/en/public-health/services/diseases/heart-health/high-blood-pressure.html](http://www.canada.ca/en/public-health/services/diseases/heart-health/high-blood-pressure.html).
- [55] Lewington S, Clarke R, Qizilbash N, Peto R, Collins R, Prospective Studies Collaboration. Age-specific relevance of usual blood pressure to vascular mortality: a meta-analysis of individual data for one million adults in 61 prospective studies. *Lancet* 2002 Dec 14;360(9349):1903–1913.
- [56] Lawes CM, Vander Hoorn S, Rodgers A, International Society of Hypertension. Global burden of blood-pressure-related disease, 2001. *Lancet* 2008 May 3;371(9623):1513–1518.



- [57] Nerenberg KA, Zarnke KB, Leung AA, Dasgupta K, Butalia S, *et al.* Hypertension Canada's 2018 guidelines for diagnosis, risk assessment, prevention, and treatment of hypertension in adults and children. *Can J Cardiol* 2018 May;34(5):506–525.
- [58] Dannenberg AL, Garrison RJ, Kannel WB. Incidence of hypertension in the Framingham Study. *Am J Public Health* 1988 Jun;78(6):676–679.
- [59] Franklin SS. Ageing and hypertension: the assessment of blood pressure indices in predicting coronary heart disease. *J Hypertens Suppl* 1999 Dec;17(5):S29–36.
- [60] Williams RR, Hunt SC, Hopkins PN, Wu LL, Hasstedt SJ, Berry TD, *et al.* Genetic basis of familial dyslipidemia and hypertension: 15-year results from Utah. *Am J Hypertens* 1993 Nov;6(11 Pt 2):319S–327S.
- [61] Chiu M, Austin PC, Manuel DG, Tu JV. Comparison of cardiovascular risk profiles among ethnic groups using population health surveys between 1996 and 2007. *CMAJ* 2010 May 18;182(8):E301–10.
- [62] Public Health Agency of Canada. Report from the Canadian Chronic Disease Surveillance System: Mood and Anxiety Disorders in Canada [Internet]. Ottawa (ON): Public Health Agency of Canada; 2016 [cited 2019 Feb 22]. Available from: [www.canada.ca/en/public-health/services/publications/diseases-conditions/report-canadian-chronic-disease-surveillance-system-mood-anxiety-disorders-canada-2016.html](http://www.canada.ca/en/public-health/services/publications/diseases-conditions/report-canadian-chronic-disease-surveillance-system-mood-anxiety-disorders-canada-2016.html).
- [63] American Psychiatric Association, Diagnostic and Statistical Manual of Mental Disorders. Diagnostic and Statistical Manual of Mental Disorders. 5<sup>th</sup> ed. Arlington (VA): American Psychiatric Association; 2013.
- [64] Government of Canada. The Human Face of Mental Health and Mental Illness in Canada [Internet]. Ottawa (ON): Minister of Public Works and Government Services Canada; 2006 [cited 2020 Jan 28]. Available from: [www.canada.ca/en/public-health/services/chronic-diseases/mental-illness.html](http://www.canada.ca/en/public-health/services/chronic-diseases/mental-illness.html).
- [65] O'Donnell S, Cheung R, Bennett K, Lagace C. The 2014 survey on living with chronic diseases in Canada on mood and anxiety disorders: A methodological overview. *Health Promot Chronic Dis Prev Can* 2016 Dec;36(12):275–288.
- [66] Lai HM, Cleary M, Sitharthan T, Hunt GE. Prevalence of comorbid substance use, anxiety and mood disorders in epidemiological surveys, 1990–2014: A systematic review and meta-analysis. *Drug Alcohol Depend* 2015 Sep 1;154:1–13.
- [67] Mental Health Commission of Canada. Changing directions, changing lives: The mental health strategy for Canada [Internet]. Calgary (AB): Mental Health Commission of Canada; [cited 2019 Feb 22]. Available from: [www.mentalhealthcommission.ca/English/resources/mhcc-reports/mental-health-strategy-canada](http://www.mentalhealthcommission.ca/English/resources/mhcc-reports/mental-health-strategy-canada).
- [68] Canadian Institute for Health Information. Hospital Mental Health Database Metadata (HMHDB) [Internet]. Ottawa (ON): Canadian Institute for Health Information; [cited 2020 Jan 28]. Available from: [www.cihi.ca/en/hospital-mental-health-database-metadata-hmhdb](http://www.cihi.ca/en/hospital-mental-health-database-metadata-hmhdb).
- [69] Lawrence D, Kisely S, Pais J. The epidemiology of excess mortality in people with mental illness. *Can J Psychiatry* 2010 Dec;55(12):752–760.
- [70] Lesage A, Rochette L, Emond V, Pelletier E, St-Laurent D, Diallo FB, *et al.* A Surveillance System to Monitor Excess Mortality of People With Mental Illness in Canada. *Can J Psychiatry* 2015 Dec;60(12):571–579.
- [71] Skinner R, Irvine B, Williams G, Pearson C, Kaur J, Yao X, *et al.* A contextual analysis of the suicide surveillance indicators. *Health Promot Chronic Dis Prev Can* 2017 Aug;37(8):257–260.
- [72] Hawton K, Bergen H, Casey D, Simkin S, Palmer B, Cooper J, *et al.* Self-harm in England: A tale of three cities. Multicentre study of self-harm. *Soc Psychiatry Psychiatr Epidemiol* 2007 Jul;42(7):513–521.
- [73] Cooper J, Kapur N, Webb R, Lawlor M, Guthrie E, Mackway-Jones K, *et al.* Suicide after deliberate self-harm: A 4-year cohort study. *AM J Psychiatry* 2005;162(2):297–303.
- [74] Skegg K. Self-harm. *Lancet* 2005 Oct 22–28;366(9495):1471–1483.
- [75] Patel V, Chisholm D, Dua T editors. Mental, Neurological, and Substance Use Disorders: Disease Control Priorities. 3<sup>rd</sup> edition ed. Washington (DC): The International Bank for Reconstruction and Development / The World Bank; 2016.
- [76] Kuo CF, Grainge MJ, Zhang W, Doherty M. Global epidemiology of gout: prevalence, incidence and risk factors. *Nat Rev Rheumatol* 2015 Nov;11(11):649–662.
- [77] Public Health Agency of Canada. Life with Arthritis in Canada: A personal and public health challenge [Internet]. Ottawa (ON): Public Health Agency of Canada; 2011 [cited 2019 Aug 21]. Available from: [www.canada.ca/en/public-health/services/chronic-diseases/arthritis/life-arthritis-canada-a-personal-public-health-challenge.html](http://www.canada.ca/en/public-health/services/chronic-diseases/arthritis/life-arthritis-canada-a-personal-public-health-challenge.html).

- [78] Neogi T. Gout. *Ann Intern Med* 2016 Jul 5;165(1):ITC1-ITC16.
- [79] MacFarlane LA, Kim SC. Gout: A review of nonmodifiable and modifiable risk factors. *Rheum Dis Clin North Am* 2014 Nov;40(4):581–604.
- [80] Singh JA. Racial and gender disparities among patients with gout. *Curr Rheumatol Rep* 2013 Feb;15(2):307–012–0307-x.
- [81] Woolf AD. Global burden of osteoarthritis and musculoskeletal diseases. *BMC Musculoskelet Disord* 2015 Dec 1;16(Suppl 1):S3.
- [82] Kraus VB, Blanco FJ, Englund M, Karsdal MA, Lohmander LS. Call for Standardized Definitions of Osteoarthritis and Risk Stratification for Clinical Trials and Clinical Use. *Osteoarthritis Cartilage* 2015 Aug;23(8):1233–1241.
- [83] Glyn-Jones S, Palmer AJ, Agricola R, Price AJ, Vincent TL, Weinans H, *et al.* Osteoarthritis. *Lancet* 2015 Jul 25;386(9991):376–387.
- [84] Musumeci G, Aiello FC, Szychlinska MA, Di Rosa M, Castrogiovanni P, Mobasher A. Osteoarthritis in the XXIst century: risk factors and behaviours that influence disease onset and progression. *Int J Mol Sci* 2015 Mar 16;16(3):6093–6112.
- [85] Litwic A, Edwards MH, Dennison EM, Cooper C. Epidemiology and burden of osteoarthritis. *Br Med Bull* 2013;105:185–199.
- [86] Smolen JS, Aletaha D, McInnes IB. Rheumatoid arthritis. *Lancet* 2016 Oct 22;388(10055):2023–2038.
- [87] Arthritis Society. Rheumatoid Arthritis [Internet]. Toronto: Arthritis Society; 2017 [cited 2019 Mar 14]. Available from: [https://arthritis.ca/about-arthritis/arthritis-types-\(a-z\)/types/rheumatoid-arthritis](https://arthritis.ca/about-arthritis/arthritis-types-(a-z)/types/rheumatoid-arthritis).
- [88] Burmester GR, Pope JE. Novel treatment strategies in rheumatoid arthritis. *Lancet* 2017 Jun 10;389(10086):2338–2348.
- [89] Di Giuseppe D, Discacciati A, Orsini N, Wolk A. Cigarette smoking and risk of rheumatoid arthritis: A dose-response meta-analysis. *Arthritis Res Ther* 2014 Mar 5;16(2):R61.
- [90] Turk SA, van Beers-Tas MH, van Schaardenburg D. Prediction of future rheumatoid arthritis. *Rheum Dis Clin North Am* 2014 Nov;40(4):753–770.
- [91] Hurd K, Barnabe C. Systematic review of rheumatic disease phenotypes and outcomes in the Indigenous populations of Canada, the USA, Australia and New Zealand. *Rheumatol Int* 2017 Apr;37(4):503–521.
- [92] Melton LJ. Epidemiology worldwide. *Endocrinol Metab Clin North Am* 2003;32(1):1–13.
- [93] Cummings SR, Melton LJ. Epidemiology and outcomes of osteoporotic fractures. *Lancet* 2002 May 18;359(9319):1761–1767.
- [94] Public Health Agency of Canada. Report from the Canadian Chronic Disease Surveillance System: Osteoporosis and Related Fractures in Canada, 2020 [Internet]. Ottawa (ON): Public Health Agency of Canada; 2020 [cited 2020 Nov 30]. Available from: [www.canada.ca/en/public-health/services/publications/diseases-conditions/osteoporosis-related-fractures-2020.html](http://www.canada.ca/en/public-health/services/publications/diseases-conditions/osteoporosis-related-fractures-2020.html).
- [95] Papaioannou A, Morin S, Cheun AM, Atkinson S, Brown JP, Feldman S, *et al.* 2010 clinical practice guidelines for the diagnosis and management of osteoporosis in Canada: Summary. *CMAJ* 2010;182(17):1864–73.
- [96] Public Health Agency of Canada. A Dementia Strategy for Canada: Together We Aspire [Internet]. Ottawa (ON): Public Health Agency of Canada; 2019 [cited 2019 July 29]. Available from: [www.canada.ca/en/public-health/services/publications/diseases-conditions/dementia-strategy.html](http://www.canada.ca/en/public-health/services/publications/diseases-conditions/dementia-strategy.html).
- [97] World Health Organization. Global action plan on the public health response to dementia 2017–2025 [Internet]. Geneva (CH): World Health Organization; 2017 [cited 2020 Jan 28] Available from: [www.who.int/mental\\_health/neurology/dementia/action\\_plan\\_2017\\_2025/en](http://www.who.int/mental_health/neurology/dementia/action_plan_2017_2025/en).
- [98] Canadian Institute for Health Information. Young-onset dementia [Internet]. Toronto (ON): Canadian Institute for Health Information; [cited 2020 Jan 28]. Available from: [www.cihi.ca/en/dementia-in-canada/spotlight-on-dementia-issues/young-onset-dementia](http://www.cihi.ca/en/dementia-in-canada/spotlight-on-dementia-issues/young-onset-dementia).
- [99] Steensma C, Loukine L, Orpana H, McRae L, Vachon J, Mo F, *et al.* Describing the population health burden of depression: health-adjusted life expectancy by depression status in Canada. *Health Promot Chronic Dis Prev Can* 2016 Oct;36(10):205–213.

- (100) Statistics Canada. Table 13–10–0465–01. Mental health indicators [Internet]. Ottawa (ON): Statistics Canada; 2020 [cited 2020 Feb 27]. Available from: [www.150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310046501](http://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310046501).
- (101) Canadian Institute for Health Information. How Canada Compares: Results From The Commonwealth Fund's 2017 International Health Policy Survey of Seniors [Internet]. Ottawa (ON): Canadian Institute for Health Information; [cited 2020 Jan 28]. Available from: [www.cihi.ca/en/commonwealth-fund-survey-2017](http://www.cihi.ca/en/commonwealth-fund-survey-2017).
- (102) Canadian Institute for Health Information. Depression Among Seniors in Residential Care [Internet]. Ottawa (ON): Canadian Institute for Health Information; [cited 2020 Feb 27]. Available from: [https://secure.cihi.ca/free\\_products/ccrs\\_depression\\_among\\_seniors\\_e.pdf](https://secure.cihi.ca/free_products/ccrs_depression_among_seniors_e.pdf).
- (103) Watt CL, Momoli F, Ansari MT, Sikora L, Bush SH, Hosie A, *et al*. The incidence and prevalence of delirium across palliative care settings: A systematic review. *Palliat Med* 2019 Sep;33(8):865–877.
- (104) Inouye SK, Westendorp RG, Saczynski JS. Delirium in elderly people. *Lancet* 2014 Mar 8;383(9920):911–922.
- (105) Gonzalez-Usigli H. Secondary and Atypical Parkinsonism. In: Merck Manual (Professional Version) [Internet]. Kenilworth (NJ): Merck Sharp & Dohme Corp; 2018 [cited 2020 Jan 28]. Available from: [www.merckmanuals.com/en-ca/professional/neurologic-disorders/movement-and-cerebellar-disorders/secondary-and-atypical-parkinsonism](http://www.merckmanuals.com/en-ca/professional/neurologic-disorders/movement-and-cerebellar-disorders/secondary-and-atypical-parkinsonism).
- (106) Gonzalez-Usigli H. Parkinson Disease (Parkinson's Disease). In: Merck Manual (Professional Version) [Internet]. Kenilworth (NJ): Merck Sharp & Dohme Corp; 2018 [cited 2020 Jan 28]. Available from: [www.merckmanuals.com/en-ca/professional/neurologic-disorders/movement-and-cerebellar-disorders/parkinson-disease](http://www.merckmanuals.com/en-ca/professional/neurologic-disorders/movement-and-cerebellar-disorders/parkinson-disease).
- (107) Alvarez MV, Evidente VG, Driver-Dunckley ED. Differentiating Parkinson's disease from other parkinsonian disorders. *Semin Neurol* 2007 Sep;27(4):356–362.
- (108) Kalia LV, Lang A.E. Parkinson's disease. *Lancet* 2015;386(9996):896–12.
- (109) Colosimo C, Morgante L, Antonini A, Barone P, Avarello TP, Bottacchi E, *et al*. Non-motor symptoms in atypical and secondary parkinsonism: The PRIAMO study. *J Neurol* 2010 Jan;257(1):5–14.
- (110) Teeuw WJ, Gerdes VE, Loos BG. Effect of periodontal treatment on glycemic control of diabetic patients: A systematic review and meta-analysis. *Diabetes Care* 2010 Feb;33(2):421–427.
- (111) El-Solh AA. Association between pneumonia and oral care in nursing home residents. *Lung* 2011 Jun;189(3):173–180.
- (112) Roca-Millan E, Gonzalez-Navarro B, Sabater-Recolons MM, Mari-Roig A, Jane-Salas E, Lopez-Lopez J. Periodontal treatment on patients with cardiovascular disease: Systematic review and meta-analysis. *Med Oral Patol Oral Cir Bucal* 2018 Nov 1;23(6):e681–e690.
- (113) Bracci PM. Oral health and the oral microbiome in pancreatic cancer: An overview of epidemiological studies. *Cancer J* 2017 Nov/Dec;23(6):310–314.
- (114) Canadian Dental Association. The State of Oral Health in Canada [Internet]. Ottawa (ON): Canadian Dental Association; 2017 [cited 2020 Jan 28]. Available from: [www.cda-adc.ca/stateoforalhealth](http://www.cda-adc.ca/stateoforalhealth).
- (115) Berg R, Berkey DB, Tang JM, Baine C, Altman DS. Oral health status of older adults in Arizona: Results from the Arizona Elder Study. *Spec Care Dentist* 2000 Nov-Dec;20(6):226–233.
- (116) Haumschild MS, Haumschild RJ. The importance of oral health in long-term care. *J Am Med Dir Assoc* 2009 Nov;10(9):667–671.
- (117) Health Canada. Report on the findings of the oral health component of the Canadian Health Measures Survey, 2007–2009 [Internet]. Ottawa (ON): Health Canada; 2013 [cited 2020 Jan 28]. Available from: <http://publications.gc.ca/site/eng/369649/publication.html>.
- (118) Global Initiative for Asthma (GINA). Global Strategy for Asthma Management and Prevention, 2019 [Internet]. Fontana (WI): GINA; [updated 2018; cited 2020 Jan 28]. Available from: <https://ginasthma.org>.
- (119) Beasley R, Semprini A, Mitchell EA. Risk factors for asthma: Is prevention possible? *Lancet* 2015 Sep 12;386(9998):1075–1085.
- (120) Gilliland FD, Islam T, Berhane K, Gauderman WJ, McConnell R, Avol E, *et al*. Regular smoking and asthma incidence in adolescents. *Am J Respir Crit Care Med* 2006 Nov 15;174(10):1094–1100.
- (121) Mitchell EA, Beasley R, Keil U, Montefort S, Odhiambo J, ISAAC Phase Three Study Group. The association

between tobacco and the risk of asthma, rhinoconjunctivitis and eczema in children and adolescents: Analyses from Phase Three of the ISAAC programme. *Thorax* 2012 Nov;67(11):941–949.

(122) Kogevinas M, Zock JP, Jarvis D, Kromhout H, Lillienberg L, Plana E, *et al.* Exposure to substances in the workplace and new-onset asthma: An international prospective population-based study (ECRHS-II). *Lancet* 2007 Jul 28;370(9584):336–341.

(123) Kusel MM, de Klerk NH, Keadze T, Vohma V, Holt PG, Johnston SL, *et al.* Early-life respiratory viral infections, atopic sensitization, and risk of subsequent development of persistent asthma. *J Allergy Clin Immunol* 2007 May;119(5):1105–1110.

(124) Weinmayr G, Forastiere F, Buchele G, Jaensch A, Strachan DP, Nagel G, *et al.* Overweight/obesity and respiratory and allergic disease in children: International study of asthma and allergies in childhood (ISAAC) phase two. *PLoS One* 2014 Dec 4;9(12):e113996.

(125) Peters U, Dixon AE, Forno E. Obesity and asthma. *J Allergy Clin Immunol* 2018 Apr;141(4):1169–1179.

(126) Mitchell EA, Beasley R, Bjorksten B, Crane J, Garcia-Marcos L, Keil U, *et al.* The association between BMI, vigorous physical activity and television viewing and the risk of symptoms of asthma, rhinoconjunctivitis and eczema in children and adolescents: ISAAC Phase Three. *Clin Exp Allergy* 2013 Jan;43(1):73–84.

(127) Subbarao P, Mandhane PJ, Sears MR. Asthma: Epidemiology, etiology and risk factors. *CMAJ* 2009 Oct 27;181(9):E181–90.

(128) Burke W, Fesinmeyer M, Reed K, Hampson L, Carlsten C. Family history as a predictor of asthma risk. *Am J Prev Med* 2003 Feb;24(2):160–169.

(129) Melgert BN, Ray A, Hylkema MN, Timens W, Postma DS. Are there reasons why adult asthma is more common in females? *Curr Allergy Asthma Rep* 2007 May;7(2):143–150.

(130) Zein JG, Erzurum SC. Asthma is different in women. *Curr Allergy Asthma Rep* 2015 Jun;15(6):28.

(131) Public Health Agency of Canada. Report from the Canadian Chronic Disease Surveillance System: Asthma and Chronic Obstructive Pulmonary Disease (COPD) in Canada, 2018 [Internet]. Ottawa (ON): Public Health Agency of Canada; 2019 [cited 2019 Feb 22]. Available from: [www.canada.ca/en/public-health/services/publications/diseases-conditions/asthma-chronic-obstructive-pulmonary-disease-canada-2018.html](http://www.canada.ca/en/public-health/services/publications/diseases-conditions/asthma-chronic-obstructive-pulmonary-disease-canada-2018.html).

(132) Global Initiative for Chronic Obstructive Lung Disease (GOLD). Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease (2019 Report) [Internet]. Fontana (WI): GOLD; 2019 [cited 2019 Feb 22]. Available from: <https://goldcopd.org/gold-reports>.

(133) Rosenberg SR, Kalhan R, Mannino DM. Epidemiology of chronic obstructive pulmonary disease: Prevalence, morbidity, mortality, and risk factors. *Semin Respir Crit Care Med* 2015 Aug;36(4):457–469.

(134) Mannino DM, Buist AS. Global burden of COPD: Risk factors, prevalence, and future trends. *Lancet* 2007 Sep 1;370(9589):765–773.

(135) Silva GE, Sherrill DL, Guerra S, Barbee RA. Asthma as a risk factor for COPD in a longitudinal study. *Chest* 2004 Jul;126(1):59–65.

(136) Mercado N, Ito K, Barnes PJ. Accelerated ageing of the lung in COPD: New concepts. *Thorax* 2015 May;70(5):482–489.

(137) Public Health Agency of Canada. Senior's falls in Canada: Second report [Internet]. Ottawa (ON): Public Health Agency of Canada; 2014 [cited 2019 May 31]. Available from: [www.canada.ca/en/public-health/services/health-promotion/aging-seniors/publications/publications-general-public/seniors-falls-canada-second-report.html#s3-1](http://www.canada.ca/en/public-health/services/health-promotion/aging-seniors/publications/publications-general-public/seniors-falls-canada-second-report.html#s3-1).

(138) Sibley KM, Voth J, Munce SE, Straus SE, Jaglal SB. Chronic disease and falls in community-dwelling Canadians over 65 years old: a population-based study exploring associations with number and pattern of chronic conditions. *BMC Geriatr* 2014 Feb 14;14:22–2318–14–22.

(139) Registered Nurses' Association of Ontario. Preventing Falls and Reducing Injury from Falls—Fourth Edition [Internet]. Toronto (ON): Registered Nurses' Association of Ontario; [cited 2019 Jun 6]. Available from: <https://rnao.ca/bpg/guidelines/prevention-falls-and-fall-injuries>.

(140) Canadian Institute for Health Information. Exercise caution: Canadians frequently injured in falls. Ottawa (ON): Canadian Institute for Health Information; [cited 2020 Jan 28]. Exercise caution: Canadians frequently injured in falls. Available from: [www.cihi.ca/en/exercise-caution-canadians-frequently-injured-in-falls](http://www.cihi.ca/en/exercise-caution-canadians-frequently-injured-in-falls).

- [141] Panel on Fall Prevention in Older Persons, American Geriatrics Society and British Geriatrics Society. Summary of the updated American Geriatrics Society/British Geriatrics Society clinical practice guideline for the prevention of falls in older persons. *J Am Geriatr Soc* 2011;59(1):148–157.
- [142] Todd C, Skelton D. What are the main risk factors for falls among older people and what are the most effective interventions to prevent these falls? [Internet]. Copenhagen (DK): WHO Regional Office for Europe (Health Evidence Network Report); [cited 2020 Jan 28]. Available from: [www.euro.who.int/en/health-topics/Life-stages/healthy-ageing/publications/pre-2009/what-are-the-main-risk-factors-for-falls-amongst-older-people-and-what-are-the-most-effective-interventions-to-prevent-these-falls](http://www.euro.who.int/en/health-topics/Life-stages/healthy-ageing/publications/pre-2009/what-are-the-main-risk-factors-for-falls-amongst-older-people-and-what-are-the-most-effective-interventions-to-prevent-these-falls).
- [143] de Jong MR, Van der Elst M, Hartholt KA. Drug-related falls in older patients: Implicated drugs, consequences, and possible prevention strategies. *Ther Adv Drug Saf* 2013 Aug;4(4):147–154.
- [144] West J, Hippisley-Cox J, Coupland CA, Price GM, Groom LM, Kendrick D, *et al*. Do rates of hospital admission for falls and hip fracture in elderly people vary by socio-economic status? *Public Health* 2004 Dec;118(8):576–581.
- [145] Gijzen R, Hoeymans N, Schellevis FG, Ruwaard D, Satariano WA, van den Bos GA. Causes and consequences of comorbidity: A review. *J Clin Epidemiol* 2001 Jul;54(7):661–674.
- [146] Ramage-Morin PL. Chronic pain in Canadian seniors. *Health Rep* 2008 Mar;19(1):37–52.
- [147] Canadian Institute for Health Information. Pan-Canadian Trends in the Prescribing of Opioids, 2012 to 2016 [Internet]. Ottawa (ON): Canadian Institute for Health Information; [cited 2020 Jan 28]. Available from: [https://secure.cihi.ca/free\\_products/pan-canadian-trends-opioid-prescribing-2017-en-web.pdf](https://secure.cihi.ca/free_products/pan-canadian-trends-opioid-prescribing-2017-en-web.pdf).
- [148] Canadian Institute for Health Information. Opioid-Related Harms in Canada [Internet]. Ottawa (ON): Canadian Institute for Health Information; [cited 2020 Jan 28]. Available from: [www.cihi.ca/en/opioids-in-canada/2018/opioid-related-harms-in-canada](http://www.cihi.ca/en/opioids-in-canada/2018/opioid-related-harms-in-canada).
- [149] Galicia-Castillo M. Opioids for persistent pain in older adults. *Cleve Clin J Med* 2016 Jun;83(6):443–451.
- [150] Ramage-Morin PL. Medication use among senior Canadians. *Health Rep* 2009 Mar;20(1):37–44.
- [151] Canadian Institute for Health Information. Drug Use Among Seniors in Canada, 2016 [Internet]. Ottawa (ON): Canadian Institute of Health Information; [cited 2020 Jan 28]. Available from: [www.cihi.ca/en/drug-use-among-seniors-in-canada](http://www.cihi.ca/en/drug-use-among-seniors-in-canada).
- [152] Plebon-Huff S, Leblanc AG, Desjardins S. Contextualization of multimorbidity: A rapid review. Forthcoming 2021.
- [153] Ward BW, Black LI. State and Regional Prevalence of Diagnosed Multiple Chronic Conditions Among Adults Aged  $\geq 18$  Years—United States, 2014. *MMWR Morb Mortal Wkly Rep* 2016 Jul 29;65(29):735–738.
- [154] Hayek S, Ifrah A, Enav T, Shohat T. Prevalence, Correlates, and Time Trends of Multiple Chronic Conditions Among Israeli Adults: Estimates From the Israeli National Health Interview Survey, 2014–2015. *Prev Chronic Dis* 2017 Aug 10;14:E64.
- [155] Taylor CA, Greenlund SF, McGuire LC, Lu H, Croft JB. Deaths from Alzheimer’s Disease—United States, 1999–2014. *MMWR Morb Mortal Wkly Rep* 2017 May 26;66(20):521–526.
- [156] Nambiar L, LeWinter MM, VanBuren PC, Dauerman HL. Decade Long Temporal Trends in U.S. Hypertension Related Cardiovascular Mortality. *J Am Coll Cardiol* 2020 Mar 13.
- [157] Public Health Agency of Canada. Key health inequalities in Canada: A national portrait [Internet]. Ottawa (ON): Public Health Agency of Canada; 2019 [cited 2019 Mar 14]. Available from: [www.canada.ca/en/public-health/services/publications/science-research-data/key-health-inequalities-canada-national-portrait-executive-summary.html](http://www.canada.ca/en/public-health/services/publications/science-research-data/key-health-inequalities-canada-national-portrait-executive-summary.html).
- [158] Roberts CK, Barnard RJ. Effects of exercise and diet on chronic disease. *J Appl Physiol* (1985) 2005 Jan;98(1):3–30.
- [159] Schellenberg ES, Dryden DM, Vandermeer B, Ha C, Korownyk C. Lifestyle interventions for patients with and at risk for type 2 diabetes: a systematic review and meta-analysis. *Ann Intern Med* 2013 Oct 15;159(8):543–551.
- [160] Howard VJ, McDonnell MN. Physical activity in primary stroke prevention: just do it! *Stroke* 2015 Jun;46(6):1735–1739.
- [161] Prior PL, Suskin N. Exercise for stroke prevention. *Stroke Vasc Neurol* 2018 Jun 26;3(2):59–68.
- [162] Colberg SR, Sigal RJ, Yardley JE, Riddell MC, Dunstan DW, Dempsey PC, *et al*. Physical Activity/Exercise and Diabetes: A Position Statement of the American Diabetes Association. *Diabetes Care* 2016 Nov;39(11):2065–2079.
- [163] Ahlskog JE, Geda YE, Graff-Radford NR, Petersen RC. Physical exercise as a preventive or disease-modifying

treatment of dementia and brain aging. *Mayo Clin Proc* 2011 Sep;86(9):876–884.

[164] Kramer SF, Hung SH, Brodtmann A. The Impact of Physical Activity Before and After Stroke on Stroke Risk and Recovery: a Narrative Review. *Curr Neurol Neurosci Rep* 2019 Apr 22;19(6):28–019–0949–4.

[165] U.S. Department of Health and Human Services. The Health Consequences of Smoking: 50 Years of Progress. A Report of the Surgeon General. Atlanta (GA): U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2014. Printed with corrections, January 2014; 2019 [cited 2020 Jan 28]. Available from: [www.cdc.gov/tobacco/data\\_statistics/sgr/50th-anniversary/index.htm](http://www.cdc.gov/tobacco/data_statistics/sgr/50th-anniversary/index.htm).

[166] O’Keefe EL, DiNicolantonio JJ, O’Keefe JH, Lavie CJ. Alcohol and CV Health: Jekyll and Hyde J-Curves. *Prog Cardiovasc Dis* 2018 May–Jun;61(1):68–75.

[167] GBD 2017 Risk Factor Collaborators. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks for 195 countries and territories, 1990–2017: A systematic analysis for the Global Burden of Disease Study 2017. *Lancet* 2018 Nov 10;392(10159):1923–1994.

[168] Fischer F, Kraemer A. Meta-analysis of the association between second-hand smoke exposure and ischaemic heart diseases, COPD and stroke. *BMC Public Health* 2015 Dec 1;15:1202–015–2489–4.

[169] Pirie K, Peto R, Reeves GK, Green J, Beral V, Million Women Study Collaborators. The 21<sup>st</sup> century hazards of smoking and benefits of stopping: a prospective study of one million women in the UK. *Lancet* 2013 Jan 12;381(9861):133–141.

[170] Doll R, Peto R, Boreham J, Sutherland I. Mortality in relation to smoking: 50 years’ observations on male British doctors. *BMJ* 2004 Jun 26;328(7455):1519.

[171] Lugo A, La Vecchia C, Boccia S, Murisic B, Gallus S. Patterns of smoking prevalence among the elderly in Europe. *Int J Environ Res Public Health* 2013 Sep 17;10(9):4418–4431.

[172] Warburton DE, Nicol CW, Bredin SS. Health benefits of physical activity: the evidence. *CMAJ* 2006 Mar 14;174(6):801–809.

[173] Bherer L, Erickson KI, Liu-Ambrose T. A review of the effects of physical activity and exercise on cognitive and brain functions in older adults. *J Aging Res* 2013;2013:657508.

[174] Blondell SJ, Hammersley-Mather R, Veerman JL. Does physical activity prevent cognitive decline and dementia?: A systematic review and meta-analysis of longitudinal studies. *BMC Public Health* 2014 May 27;14:510–2458–14–510.

[175] Kyu HH, Bachman VF, Alexander LT, Mumford JE, Afshin A, Estep K, *et al*. Physical activity and risk of breast cancer, colon cancer, diabetes, ischemic heart disease, and ischemic stroke events: systematic review and dose-response meta-analysis for the Global Burden of Disease Study 2013. *BMJ* 2016 Aug 9;354:i3857.

[176] Stessman J, Hammerman-Rozenberg R, Cohen A, Ein-Mor E, Jacobs JM. Physical activity, function, and longevity among the very old. *Arch Intern Med* 2009 Sep 14;169(16):1476–1483.

[177] Rockwood K, Howlett SE, MacKnight C, Beattie BL, Bergman H, Hebert R, *et al*. Prevalence, attributes, and outcomes of fitness and frailty in community-dwelling older adults: report from the Canadian study of health and aging. *J Gerontol A Biol Sci Med Sci* 2004 Dec;59(12):1310–1317.

[178] Cohen A, Baker J, Ardern CI. Association Between Body Mass Index, Physical Activity, and Health-Related Quality of Life in Canadian Adults. *J Aging Phys Act* 2016 Jan;24(1):32–38.

[179] Canadian Society for Exercise Physiology. Canadian Physical Activity Guidelines for Older Adults (65 years and older) [Internet]. Ottawa (ON): Canadian Society for Exercise Physiology; [cited 2020 Jan 28]. Available from: <https://csepguidelines.ca/adults-65>.

[180] Oreopoulos A, Kalantar-Zadeh K, Sharma AM, Fonarow GC. The obesity paradox in the elderly: Potential mechanisms and clinical implications. *Clinics in Geriatric Medicine* 2009 Nov 1;25(4):643–659.

[181] Adams SA, Matthews CE, Ebbeling CB, Moore CG, Cunningham JE, Fulton J, *et al*. The effect of social desirability and social approval on self-reports of physical activity. *Am J Epidemiol* 2005 Feb 15;161(4):389–398.

- [182] Silfee VJ, Haughton CF, Jake-Schoffman DE, Lopez-Cepero A, May CN, Sreedhara M, *et al.* Objective measurement of physical activity outcomes in lifestyle interventions among adults: A systematic review. *Prev Med Rep* 2018 May 10;11:74–80.
- [183] Leslie W, Hankey C. Aging, Nutritional Status and Health. *Healthcare (Basel)* 2015 Jul 30;3(3):648–658.
- [184] Ramage-Morin PL, Garriguet D. Nutritional risk among older Canadians. *Health Rep* 2013 Mar;24(3):3–13.
- [185] Brownie S. Why are elderly individuals at risk of nutritional deficiency? *Int J Nurs Pract* 2006 Apr;12(2):110–118.
- [186] Ramage-Morin PL, Gilmour H, Rotermann M. Nutritional risk, hospitalization and mortality among community-dwelling Canadians aged 65 or older. *Health Rep* 2017 Sep 20;28(9):17–27.
- [187] Keller HH, Østbye T, Goy R. Nutritional risk predicts quality of life in elderly community-living Canadians. *J Gerontol A Biol Sci Med Sci* 2004;59(1):68–74.
- [188] Ahmed T, Haboubi N. Assessment and management of nutrition in older people and its importance to health. *Clin Interv Aging* 2010 Aug 9;5:207–216.
- [189] Canadian Centre on Substance Use and Addiction. Canada’s Low-Risk Alcohol Drinking Guidelines [brochure] [Internet]. Ottawa (ON): Canadian Centre on Substance Use and Addiction; [cited 2020 Jan 28]. Available from: [www.ccsa.ca/canadas-low-risk-alcohol-drinking-guidelines-brochure](http://www.ccsa.ca/canadas-low-risk-alcohol-drinking-guidelines-brochure).
- [190] World Health Organization. Global status report on alcohol and health 2018. Geneva (CH): World Health Organization; 2018 [cited 2020 Feb 28]. Available from: [www.who.int/publications-detail/global-status-report-on-alcohol-and-health-2018](http://www.who.int/publications-detail/global-status-report-on-alcohol-and-health-2018).
- [191] Meier P, Seitz HK. Age, alcohol metabolism and liver disease. *Curr Opin Clin Nutr Metab Care* 2008 Jan;11(1):21–26.
- [192] Chang VC, Do MT. Risk factors for falls among seniors: Implications of gender. *Am J Epidemiol* 2015;181(7):521–531.
- [193] Sorock GS, Chen LH, Gonzalgo SR, Baker SP. Alcohol-drinking history and fatal injury in older adults. *Alcohol* 2006 Nov;40(3):193–199.
- [194] Canadian Coalition for Seniors’ Mental Health. Canadian Guidelines on Alcohol Use Disorder Among Older Adults [Internet]. Markham (ON): Canadian Coalition for Seniors’ Mental Health; [cited 2020 Feb 27]. Available from: <https://ccsmh.ca/alcohol-guidelines>.
- [195] Health Canada. Canadian Guidelines for Body Weight Classification in Adults—Quick Reference Tool for Professionals [Internet]. Ottawa (ON): Health Canada;2016 [cited 2020 Jan 28]. Available from: [www.canada.ca/en/health-canada/services/food-nutrition/healthy-eating/healthy-weights/canadian-guidelines-body-weight-classification-adults/quick-reference-tool-professionals.html](http://www.canada.ca/en/health-canada/services/food-nutrition/healthy-eating/healthy-weights/canadian-guidelines-body-weight-classification-adults/quick-reference-tool-professionals.html).
- [196] GBD 2016 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet* 2017 Sep 16;390(10100):1211–1259.
- [197] GBD 2015 Obesity Collaborators, Afshin A, Forouzanfar MH, Reitsma MB, Sur P, Estep K, *et al.* Health effects of overweight and obesity in 195 countries over 25 years. *N Engl J Med* 2017 Jul 6;377(1):13–27.
- [198] Rao DP, Patel P, Roberts KC, Thompson W. Obesity and healthy aging: Social, functional and mental well-being among older Canadians. *Health Promotion and Chronic Disease Prevention in Canada* 2018 Dec;38(12):437–444.
- [199] Yan LL, Daviglus ML, Liu K, Pirzada A, Garside DB, Schiffer L, *et al.* BMI and health-related quality of life in adults 65 years and older. *Obesity Research* 2004;12(1):69–76.
- [200] Decaria JE, Sharp C, Petrella RJ. Scoping review report: Obesity in older adults. *Int J Obes (Lond)* 2012 Sep;36(9):1141–1150.
- [201] Connor Gorber S, Shields M, Tremblay MS, McDowell I. The feasibility of establishing correction factors to adjust self-reported estimates of obesity. *Health Rep* 2008 Sep;19(3):71–82.
- [202] Hirshkowitz M, Whiton K, Albert SM, Alessi C, Bruni O, DonCarlos L, *et al.* National Sleep Foundation’s updated sleep duration recommendations: Final report. *Sleep Health* 2015 Dec;1(4):233–243.
- [203] Suzuki K, Miyamoto M, Hirata K. Sleep disorders in the elderly: Diagnosis and management. *J Gen Fam Med* 2017 Mar;18(2):61–71.

- [204] Institute of Medicine (US) Committee on Sleep Medicine and Research. Sleep disorders and sleep deprivation: An unmet public health problem [Internet]. Colten HR, Altevogt BM, editors. Washington (DC): National Academies Press (US); 2006 [cited 2019 Mar 17]. Available from: [www.ncbi.nlm.nih.gov/books/NBK19960](http://www.ncbi.nlm.nih.gov/books/NBK19960).
- [205] Commission on Social Determinants of Health. Closing the gap in a generation: health equity through action on the social determinants of health. Final Report of the Commission on Social Determinants of Health [Internet]. Geneva (CH): World Health Organization; [cited 2020 Jan 28]. Available from: [www.who.int/social\\_determinants/thecommission/finalreport/en](http://www.who.int/social_determinants/thecommission/finalreport/en).
- [206] Solar O, Irwin A. A conceptual framework for action on the social determinants of health. Social Determinants of Health Discussion Paper 2 (Policy and Practice) [Internet]. Geneva (CH): World Health Organization; [cited 2020 Jan 28]. Available from: [www.who.int/social\\_determinants/publications/9789241500852/en](http://www.who.int/social_determinants/publications/9789241500852/en).
- [207] Government of Canada. Report on the Social Isolation of Seniors [Internet]. Ottawa (ON): Government of Canada; 2017 [cited 2020 Jan 28]. Available from: [www.canada.ca/en/national-seniors-council/programs/publications-reports/2014/social-isolation-seniors.html](http://www.canada.ca/en/national-seniors-council/programs/publications-reports/2014/social-isolation-seniors.html).
- [208] Public Health Agency of Canada. Positive Mental Health Surveillance Indicator Framework [Internet]. Ottawa (ON): Public Health Agency of Canada; 2019 [cited 2020 Jan 28]. Available from: <https://health-infobase.canada.ca/positive-mental-health>.
- [209] Arriagada P. A day in the life: How do older Canadians spend their time? [Internet]. Ottawa (ON): Statistics Canada; 2018 [cited 2019 Mar 17]. Available from: [www150.statcan.gc.ca/n1/pub/75-006-x/2018001/article/54947-eng.htm](http://www150.statcan.gc.ca/n1/pub/75-006-x/2018001/article/54947-eng.htm).
- [210] Holt-Lunstad J, Smith TB, Layton JB. Social relationships and mortality risk: a meta-analytic review. *PLoS Med* 2010 Jul 27;7(7):e1000316.
- [211] Ramage-Morin PL. Hearing difficulties and feelings of social isolation among Canadians aged 45 or older. *Health Rep* 2016 Nov 16;27(11):3–12.
- [212] Keefe J, Andrew M, Fancey P, Hall M. Final Report: A Profile of Social Isolation in Canada. Submitted to the Chair of the F/P/T Working Group on Social Isolation [Internet]. Halifax (NS): 2006 [cited 2020 Jan 28]. Available from: [www.health.gov.bc.ca/library/publications/year/2006/keefe\\_social\\_isolation\\_final\\_report\\_may\\_2006.pdf](http://www.health.gov.bc.ca/library/publications/year/2006/keefe_social_isolation_final_report_may_2006.pdf).
- [213] Kenny GP, Yardley J, Brown C, Sigal RJ, Jay O. Heat stress in older individuals and patients with common chronic diseases. *CMAJ* 2010 Jul 13;182(10):1053–1060.
- [214] World Health Organization. Global age-friendly cities: a guide [Internet]. Geneva (CH): World Health Organization; 2007 [cited 2020 Jan 28]. Available from: [www.who.int/ageing/age\\_friendly\\_cities\\_guide/en](http://www.who.int/ageing/age_friendly_cities_guide/en).
- [215] Statistics Canada. Age-standardized Rates [Internet]. Ottawa (ON): Statistics Canada; 2017 [cited 2020 Jan 28]. Available from: [www.statcan.gc.ca/eng/dai/btd/asr](http://www.statcan.gc.ca/eng/dai/btd/asr).
- [216] Morley JE, Vellas B, van Kan GA, Anker SD, Bauer JM, Bernabei R, *et al*. Frailty consensus: a call to action. *J Am Med Dir Assoc* 2013 Jun;14(6):392–397.
- [217] World Health Organization. Global strategy to reduce the harmful use of alcohol [Internet]. Geneva (CH): World Health Organization; 2010 [cited 2020 Jan 28]. Available from: [www.who.int/substance\\_abuse/publications/global\\_strategy\\_reduce\\_harmful\\_use\\_alcohol/en](http://www.who.int/substance_abuse/publications/global_strategy_reduce_harmful_use_alcohol/en).
- [218] World Health Organization. What is Healthy Ageing? [Internet]. Geneva (CH): World Health Organization; [cited 2020 Jan 28]. Available from: [www.who.int/ageing/healthy-ageing/en](http://www.who.int/ageing/healthy-ageing/en).
- [219] Canadian Centre on Substance Use and Addiction. Reducing alcohol-related harm in Canada: Toward a culture of moderation: Recommendations for a national alcohol strategy [Internet]. Ottawa (ON): Canadian Centre on Substance Use and Addiction; 2020 [cited 2020 Jan 29]. Available from: [www.ccsa.ca/reducing-alcohol-related-harm-canada-toward-culture-moderation](http://www.ccsa.ca/reducing-alcohol-related-harm-canada-toward-culture-moderation).
- [220] The Free Dictionary. “neoplasm” [Internet]. Miller-Keane Encyclopedia and Dictionary of Medicine, Nursing, and Allied Health, Seventh Edition, Saunders, an imprint of Elsevier, Inc, 2003 [cited 2020 Jan 28]. Available from: <https://medical-dictionary.thefreedictionary.com/neoplasm>.
- [221] Keyes CLM, Shapiro AD. Social Well-Being in the United States: A Descriptive Epidemiology. Chicago, IL, US: University of Chicago Press; 2004. p. 350–372.



[222] Institute for Health Metrics and Evaluation. Global Burden of Disease Study 2017 (GBD 2017) Data Resources [Internet]. Seattle (WA): Institute for Health Metrics and Evaluation; [cited 2020 Jan 28]. Available from: <http://ghdx.healthdata.org/gbd-2017>.

[223] Health Canada. Canada's Food Guide [Internet]. Ottawa (ON): Health Canada; 2020 [cited 2020 Jan 28]. Available from: <https://food-guide.canada.ca/en>.

[224] Public Health Agency of Canada. The Canadian Chronic Disease Surveillance System—An Overview [Internet]. Ottawa (ON): Public Health Agency of Canada; 2018 [cited 2020 Jan 28]. Available from: [www.canada.ca/en/public-health/services/publications/canadian-chronic-disease-surveillance-system-factsheet.html](http://www.canada.ca/en/public-health/services/publications/canadian-chronic-disease-surveillance-system-factsheet.html).

[225] Statistics Canada. Canadian Community Health Survey—Annual Component (CCHS) [Internet]. Ottawa (ON): Statistics Canada; 2020 [cited 2020 Jan 28]. Available from: [www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3226#a1](http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3226#a1).

[226] Statistics Canada. Canadian Health Measures Survey (CHMS) [Internet]. Ottawa (ON): Statistics Canada; 2019 [cited 2020 Jan 28]. Available from: [www23.statcan.gc.ca/imdb/p2SV.pl?Function=getInstanceList&Id=10263](http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getInstanceList&Id=10263).

[227] Statistics Canada. Vital Statistics—Death Database (CVSD) [Internet]. Ottawa (ON): Statistics Canada; 2019 [cited 2020 Jan 28]. Available from: [www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3233](http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3233).

[228] Institute for Health Metrics and Evaluation. Global Burden of Disease (GBD) [Internet]. Seattle (WA): Institute for Health Metrics and Evaluation; [cited 2020 Jan 28]. Available from: [www.healthdata.org/node/835](http://www.healthdata.org/node/835).

# APPENDIX 1: GLOSSARY

**Age-standardized rate:** Age-standardized rates “account for the differences in the age structure of the populations being compared. In the calculation of the age-standardized rate, either one population is mathematically adjusted to have the same age structure as the other; or both populations are mathematically adjusted to have the same age structure as a third population, called the standard population. In this way, the two groups are given the same age distribution structure so that a more representative picture of the characteristic in question is provided.”<sup>(215)</sup>

**Aging:** In biology, aging is the process of growing older. Organs and tissues age, apparently because the clones of cells they are constituted of have finite life spans. In demography and vital statistics, aging of the population refers to a population in which there is an increasing proportion of people in older age groups.

**Asthma:** Asthma is a complex chronic lung disease characterised by the inflammation and narrowing of the airways. Asthma symptoms are typically episodic and can be effectively controlled with medication and proper preventive measures.

**Cancer:** Cancer, also called malignancy, is disease in which abnormal cells divide without control and can invade nearby tissues and spread to other parts. There are more than 100 types of cancer but the four most common types (lung, colorectal, breast and prostate cancer) account for about half of all cases diagnosed in Canada.

**Cardiovascular disease:** Any disease of the circulatory system, namely the heart (cardio) or blood vessels (vascular). Cardiovascular diseases include heart attacks, stroke, heart failure and others. Cardiovascular disease is also known as circulatory disease.

**Chronic disease:** A physical or mental health disease that tends to be long-lasting and persistent in its symptoms or development. Although these features also apply to some communicable diseases (such as HIV), the term is often used interchangeably with non-communicable disease.

**Chronic obstructive pulmonary disease (COPD):** COPD is a chronic and progressive lung disease, that causes shortness of breath, coughing and sputum production. COPD primarily affects people aged 35+ years.

**Coefficient of variation (CV):** The CV is a measure used to describe the precision of an estimate, for example, an estimated total, an estimated proportion, an estimated mean, etc. More specifically, the CV of an estimate is the ratio of the standard error of the estimate to the estimate itself. The standard error is an estimate and therefore the CV is an estimate. The smaller the CV, the more precise the estimate.

**Comorbidity:** A comorbidity is a condition or disease that coexists with an index disease.

**Confidence interval:** A statistical measurement of the reliability of an estimate. The size of the confidence interval relates to the precision of the estimate. Narrow confidence intervals indicate greater reliability than those that are wide. The 95% confidence interval indicates the ranges of values that are likely to include the true value 19 times out of 20.

**Dementia (including Alzheimer disease):** Dementia is an umbrella term used to describe a set of symptoms affecting brain function that are caused by neurodegenerative and vascular diseases or injuries. Alzheimer disease is the most common cause of the condition.

**Determinants of health:** The range of personal, social, economic and environmental factors that influence the health status of an individual or a population.

**Diabetes:** Diabetes occurs when the body is unable to produce and/or use insulin. Insulin is a hormone that regulates blood glucose. There are three main types of diabetes: type 1, type 2 and gestational diabetes.

**Disability:** Reduced capacity of a person to perform usual functions, usually as a consequence of impairment, for example, impaired mobility or intellectual impairment.

**Excess mortality:** Extra number of deaths observed, beyond that expected.

**Frailty:** “A clinical state in which there is an increase in an individual’s vulnerability for developing increased dependency and/or mortality when exposed to a stressor.”<sup>(216)</sup>

**Gout and other crystal arthropathies:** The term crystal arthropathies is referring to diseases of the joint(s) caused by microcrystals that accumulate in the joints. The body’s immune system is triggered by these crystals leading to episodes of pain, swelling and redness in the joint and surrounding soft tissues. Repeated episodes can result in permanent joint damage. Gout and pseudogout are the two most common types of crystal arthropathies. Gout is caused by uric acid crystals often associated with hyperuricemia and often affects the joint at the base of the big toe; while pseudogout is caused by calcium pyrophosphate crystals and commonly affects the knees and the wrists.

**Harmful use of alcohol:** A broad concept that “encompasses the drinking that causes detrimental health and social consequences for the drinker, the people around the drinker and society at large, as well as the patterns of drinking that are associated with increased risk of adverse health outcomes.”<sup>(217)</sup>

**Health:** According to the World Health Organization, health is defined as “... a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.”<sup>(18)</sup>

**Health-adjusted life expectancy (HALE):** Health-adjusted life expectancy represents the number of expected years of life equivalent to years lived in full health, based on the average experience in a population.<sup>(53)</sup>

**Healthy aging:** According to the World Health Organization, healthy aging refers to “... the process of developing and maintaining the functional ability that enables well-being in older age.”<sup>(218)</sup>

**Heart failure:** A chronic disease occurring when the pumping action of the heart cannot provide enough blood to the rest of the body as it is needed.

**Heavy drinking:** Men reporting consuming five or more drinks on a single occasion and women reporting consuming four or more drinks on a single occasion, at least once a month during the past year.<sup>(219)</sup>

**High sodium intake:** Sodium (or salt) intake above 2,000 mg per day.

**Hypertension:** Hypertension occurs when blood pressure is consistently high for long periods of time. It is usually defined as a systolic blood pressure of 140 millimeters of mercury (mm Hg) or higher or a diastolic blood pressure of 90 millimeters of mercury (mm Hg) or higher.

**Ischemic heart disease (IHD):** A chronic disease in which the heart muscle is damaged or works inefficiently due to the absence or relative deficiency of its blood supply. It is also referred to as coronary heart disease or coronary artery disease.

**Life expectancy:** Life expectancy measures the average number of years a person would be expected to live, based on a set of age-specific death rates in a given observation period. Life expectancy at age 65 years measures the average number of years remaining to be lived by those surviving to the age of 65, based on a set of age-specific death rates in a given period.<sup>(53)</sup>

**Mood and anxiety disorders:** Mood disorders are characterized by the lowering or elevation of a person's mood, while anxiety disorders are characterized by excessive and persistent feelings of nervousness, anxiety and even fear.

**Morbidity:** Refers to the ill health in an individual and to the levels of ill health in a population or group.

**Multimorbidity:** Two or more conditions or diseases that coexist in the same individual.

**Neoplasm:** Any new and abnormal growth, specifically where cell multiplication is uncontrolled and progressive.<sup>(220)</sup>

**Osteoarthritis:** Osteoarthritis is the breakdown of joint cartilage and underlying bone as a result of the body's failed attempt to repair joint tissues that are damaged due to abnormal joint loading (from obesity and joint injury) and systemic factors (such as genes, inflammation, aging, and sex). It usually affects the joints of the hands, feet, hips, knees, and spine.

**Opioid poisoning:** Occurs when an opioid is taken incorrectly and results in harm. Incorrect use includes wrong dosage, self-prescribing, taking in combination with another prescribed drug or alcohol and not taking as recommended.

**Oral diseases:** Oral diseases include tooth decay (cavities), gum (periodontal) disease, and oral cancer. These diseases are largely preventable and, while usually considered in isolation from other chronic conditions, are often inter-related.

**Osteoporosis:** Osteoporosis (i.e. thin or brittle bones) is a metabolic bone disorder characterized by low bone density and an elevated risk of fracture, particularly of the wrist, hip, spine, humerus and pelvis.

**Parkinsonism (including Parkinson disease):** The terms parkinsonism or parkinsonian syndrome are used to describe the motor features (rigidity, tremor, bradykinesia, or postural instability), whether they are due to Parkinson disease, other brain diseases, or the side effects of certain medications.

**Physical inactivity:** Generally speaking, physical inactivity refers to the lack of physical activity. The definition varies across studies. In this report, self-reported physical inactivity refers to seniors engaging in less than 150 minutes of moderate-to-vigorous intensity aerobic physical activity per week, in bouts of 10 minutes or more.

**Polypharmacy:** Concurrent use of multiple medications by an individual.

**Premature death:** Death occurring a considerable number of years before average life expectancy is achieved.

**Prevalence:** The frequency of a disease or condition in a population during a defined period of time expressed as the proportion of that population that has the disease or condition. Prevalence provides a measure of the burden of the disease or condition in the population.

**Protective factor:** Protective factors reduce the likelihood of a disease developing or an adverse health outcome occurring.

**Psychological well-being:** An individual self-reporting that 20 days out of 28 days he/she feels that he/she likes most parts of his/her personality, that he/she is good at managing daily life responsibilities, that he/she has warm and trusting relationships, that he/she faces experiences that challenge him/her to grow and become a better person, that he/she is confident to think and express ideas and that life has a sense of direction.

**Quality of life:** A subjective judgment of the way people perceive themselves as contented and happy or otherwise, and able to function physically, emotionally and socially. Various standardized measuring instruments exist to assess individuals' quality of life.

**Rheumatoid arthritis:** An autoimmune disease that causes inflammation in the joints. This inflammation leads to swelling, pain, and stiffness, which left untreated, can cause joint damage. Rheumatoid arthritis most commonly affects the joints of the hands, wrists and feet.

**Risk factor:** A risk factor is any factor (genetic, behavioural, etc.) that increases the likelihood of developing a disease or a specified health outcome.

**Seniors:** In this report, "seniors" refers to individuals aged 65 years and older (65+).

**Social isolation:** Low quantity and quality of contact or interaction with others.

**Social networks:** Number and structure of an individual's social relationships, including number of friends, family members and neighbours who may provide social interaction or social support.

**Social participation:** The degree to which an individual is able to participate in a broad range of activities within their community.

**Social support:** Help such as emotional or tangible support provided by an individual's social network.

**Social well-being:** An individual's self-reported perception of their relationships with other people, the neighbourhood and the community.<sup>[221]</sup>

**Stroke:** A sudden loss of brain function caused by an interruption of the flow of blood to the brain (ischemic stroke) or the rupture of blood vessels in the brain (haemorrhagic stroke). A stroke can result in one-sided arm and leg weakness, known as hemiplegia, or can cause other impairments of movement, coordination, vision, speech, memory, or in the capacity to think.

**Uncertainty interval:** "A range of values that reflects the certainty of an estimate. In [Global Burden of Disease], every estimate is calculated 1,000 times, each time sampling from distributions rather than point estimates for data inputs, data transformations and model choice. The 95% uncertainty interval is determined by the 25<sup>th</sup> and 975<sup>th</sup> value of the 1,000 values after ordering them from smallest to largest. Larger uncertainty intervals can result from limited data availability, small studies, and conflicting data, while smaller uncertainty intervals can result from extensive data availability, large studies, and data that are consistent across sources."<sup>[222]</sup>

**Unhealthy diet:** Broad concept that encompasses a diet low in vegetables, fruits, whole grain and protein foods and high in highly processed foods that contain sugars, salt and saturated fats.<sup>[223]</sup>

**Years lived with disability (YLD):** Years of life lived with any short-term or long-term health loss. YLD rates are obtained by multiplying the prevalence of a disease by its corresponding disability weight.

# APPENDIX 2: METHODOLOGY AND DATA SOURCES

## DATA SOURCES OVERVIEW

### CANADIAN CHRONIC DISEASE SURVEILLANCE SYSTEM

The Canadian Chronic Disease Surveillance System (CCDSS) is a collaborative network of provincial and territorial chronic disease surveillance systems supported by the Public Health Agency of Canada (PHAC). The CCDSS collects data on all residents who are eligible for provincial or territorial health insurance and provides national estimates and trends over time on 20 chronic diseases.

To identify chronic diseases cases, provincial and territorial health insurance registry records are linked using a unique personal identifier to the corresponding physician billing claims, hospital discharge abstract records and prescription drug records. Case definitions—a set of rules that enables the identification of cases of a disease in a given population—are then applied to those linked databases. Individual-level data are then aggregated at the provincial and territorial level before being submitted to PHAC.

For the different chronic disease case definitions in the CCDSS, refer to the following document: [https://health-infobase.canada.ca/ccdss/publication/CCDSS\\_Case\\_Definitions\\_DataCubes\\_v2018\\_en.xlsx](https://health-infobase.canada.ca/ccdss/publication/CCDSS_Case_Definitions_DataCubes_v2018_en.xlsx)

For detailed data, refer to the Public Health Infobase CCDSS online tool: <https://health-infobase.canada.ca/ccdss/data-tool>.

### CANADIAN COMMUNITY HEALTH SURVEY

The Canadian Community Health Survey (CCHS) is conducted by Statistics Canada. It is a cross-sectional survey that collects information related to health status, health care utilization and health determinants from Canadian respondents aged 12 years and older. The CCHS has been administered annually since 2001.

For further information, refer to: [www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3226#a1](http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3226#a1)

## CANADIAN HEALTH MEASURES SURVEY

The Canadian Health Measures Survey (CHMS) is conducted by Statistics Canada. It is a cross-sectional survey composed of two parts. The first part is a household interview that covers many health topics. The second part involves a visit to a mobile examination centre for direct physical measurements such as blood pressure, height and weight, bone density and vision tests. Data are collected every two years since 2007–2009.

For further information, refer to:

[www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&Id=10263](http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&Id=10263)

## VITAL STATISTICS—DEATH DATABASE

Data on all deaths in Canada are collected annually from all provincial and territorial vital statistics registries. The cause of death variable is classified according to the World Health Organization International Statistical Classification of Diseases and Related Health Problems (ICD). ICD-10 has been used since 2000 to classify causes of deaths.

For further information, refer to:

[www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3233](http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3233)

## GLOBAL BURDEN OF DISEASE

The Global Burden of Diseases, Injuries, and Risk Factors Study (GBD), led by the Institute for Health Metrics and Evaluation (IHME) at the University of Washington, is a large international study that describes diseases, injuries, and risk factors across age groups, sexes, countries, regions and time.

Years lived with disability (YLD) were obtained online through Data Visualizations:

[www.healthdata.org/node/835](http://www.healthdata.org/node/835). The last available data are for 2017.



# DATA SOURCES STRENGTHS, LIMITATIONS AND YEARS OF DATA

DATA SOURCE, TYPE OF DATA	STRENGTHS/LIMITATIONS/ EXCLUSIONS	YEAR OF DATA	SECTION OF REPORT/ DISEASE IT PERTAINS TO
<b>Canadian Chronic Disease Surveillance System (CCDSS)<sup>[224]</sup></b> , Administrative data	<b>Strengths:</b> <ul style="list-style-type: none"> <li>• Case definitions informed by validation studies;</li> <li>• Coverage near universal;</li> <li>• Incidence and time trends available;</li> <li>• Medically/clinically diagnosed conditions; and</li> <li>• Ongoing enhancement possible given retroactive data collection.</li> </ul> <b>Limitations:</b> <ul style="list-style-type: none"> <li>• No individual level data available for analysis by PHAC;</li> <li>• Does not capture all eligible individuals due to a variety of reasons including:               <ul style="list-style-type: none"> <li>▪ people who did not seek care and remain undiagnosed;</li> <li>▪ those who were diagnosed prior to the observation period but did not seek care during the observation period;</li> <li>▪ those who sought care but did not receive a relevant diagnostic code;</li> <li>▪ those seen by a salaried physician who is not required to submit service provision information using provincial and territorial fee codes; and</li> <li>▪ those who exclusively sought privately-funded care.</li> </ul> </li> </ul> <b>Exclusions:</b> <ul style="list-style-type: none"> <li>• Individuals covered under federal health programs, such as full-time members of the Canadian Armed Forces, eligible veterans, Royal Canadian Mounted Police, federal and provincial penitentiary inmates, First Nations on reserve, Inuit, refugee claimants and persons with a study or work permit are not captured in the CCDSS.</li> </ul>	2000–2001 to 2016–2017	Chapter 3: All years of data for the age standardized prevalence of hypertension, ischemic heart disease, diabetes, osteoporosis, asthma, chronic obstructive pulmonary disorder  Start year for data reporting differs for the following diseases: Alzheimer disease and associated dementias (2002–2003); stroke (2003–2004); parkinsonism (2004–2005); and gout, osteoarthritis and rheumatoid arthritis (2007–2008)
		2016–2017	Chapter 3: Crude prevalence of selected chronic diseases and conditions by age group.

DATA SOURCE, TYPE OF DATA	STRENGTHS/LIMITATIONS/ EXCLUSIONS	YEAR OF DATA	SECTION OF REPORT/ DISEASE IT PERTAINS TO
<b>Canadian Community Health Survey (CCHS)</b> <sup>[225]</sup> , Self-reported data	<b>Strengths:</b> <ul style="list-style-type: none"> <li>• Large representative sample of the household population;</li> <li>• Survey administered by trained personnel using structured format; and</li> <li>• Includes additional health-related information such as health determinants &amp; lifestyle behaviours.</li> </ul> <b>Limitations:</b> <ul style="list-style-type: none"> <li>• Cross-sectional survey design limits the causal inferences that can be drawn; and</li> <li>• Self-reported data are susceptible to social desirability bias, recall bias or reporting bias.</li> </ul> <b>Exclusions:</b> The survey does not include the following individuals: <ul style="list-style-type: none"> <li>• Persons living on reserves and other Aboriginal settlements;</li> <li>• Full-time members of the Canadian Forces;</li> <li>• Youth aged 12–17 living in foster homes;</li> <li>• The institutionalized population; and</li> <li>• Persons living in the Quebec health regions of Région du Nunavik and Région des Terres-Cries-de-la-Baie-James.</li> </ul>	2017–2018	Chapter 2: Selected demographic characteristics  Chapter 3: Falls & injuries and multimorbidity  Chapter 4: Physical activity, body mass index, alcohol use and tobacco use
		2015–2016	Chapter 3: Suicidal thoughts, plans and attempts and consulting a dental care professional  Chapter 4: Fruit and vegetable consumption
		2005–2006 to 2017–2018	Chapter 3: Cancer prevalence

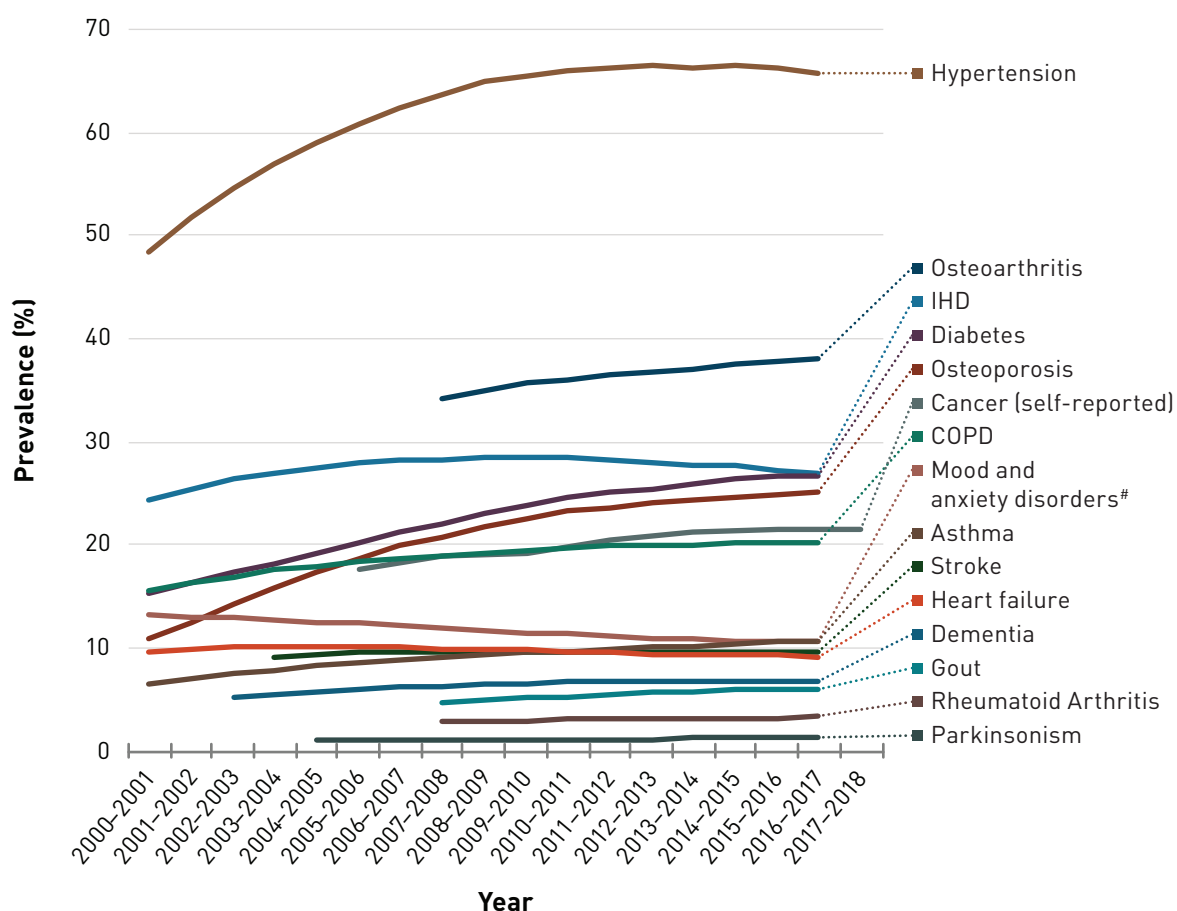
DATA SOURCE, TYPE OF DATA	STRENGTHS/LIMITATIONS/ EXCLUSIONS	YEAR OF DATA	SECTION OF REPORT/ DISEASE IT PERTAINS TO
<b>Canadian Health Measures Survey (CHMS)<sup>[226]</sup></b> , Self-reported and directly measured data	<b>Strengths:</b> <ul style="list-style-type: none"> <li>• Large representative sample of the household population;</li> <li>• Collection of direct physical measures; and</li> <li>• Survey administered by trained personnel using structured format.</li> </ul> <b>Limitations:</b> <ul style="list-style-type: none"> <li>• Cross-sectional survey design limits the causal inferences that can be drawn;</li> <li>• Self-reported data are susceptible to social desirability bias, recall bias or reporting bias; and</li> <li>• Does not collect data on Canadians 80+.</li> </ul> <b>Exclusions:</b> The survey does not include the following individuals: <ul style="list-style-type: none"> <li>• Persons living on reserves and other Aboriginal settlements;</li> <li>• Full-time members of the Canadian Forces;</li> <li>• The institutionalized population; and</li> <li>• Residents of certain remote regions.</li> </ul> As of Cycle 3, residents living in the three territories are also excluded.	2007–2009 (Cycle 1)	Chapter 3: Oral disease
		2007–2015 (Cycle 1 to Cycle 4)	Chapter 4: Sleep

DATA SOURCE, TYPE OF DATA	STRENGTHS/LIMITATIONS/ EXCLUSIONS	YEAR OF DATA	SECTION OF REPORT/ DISEASE IT PERTAINS TO
<p><b>Vital Statistics— Death Database</b><sup>[227]</sup>, Administrative data</p>	<p><b>Strengths:</b></p> <ul style="list-style-type: none"> <li>• Coverage is close to complete for all deaths occurring in Canada;</li> <li>• The underlying cause of death is based on medically/clinically diagnosed diseases and conditions, as well as fatal injuries and the circumstances leading to them; and</li> <li>• The underlying cause of death is classified by an application of international rules and guidelines promulgated by the World Health Organization (WHO) in the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10).</li> </ul> <p><b>Limitation:</b></p> <ul style="list-style-type: none"> <li>• Data from 2016 and 2017 are considered preliminary due to improvements in methodology and timeliness.</li> </ul>	<p>2000–2017</p>	<p>Chapter 3: Mortality sections: cancer, cardiovascular diseases, diabetes, hypertension, musculoskeletal disorders, neurological diseases, respiratory diseases and suicide.</p>
<p><b>Global Burden of Disease</b><sup>[228]</sup>, Mathematical modelling</p>	<p><b>Strength:</b></p> <ul style="list-style-type: none"> <li>• Ability to compare data across countries and time.</li> </ul> <p><b>Limitations:</b></p> <ul style="list-style-type: none"> <li>• YLD calculation is based on severity distributions obtained from the Medical Expenditure Panel Survey in the USA. These distributions may not be generalizable to Canada; and</li> <li>• YLD calculations were not available for hypertension, osteoporosis, mood and anxiety disorders and parkinsonism. Instead, YLD rates were obtained respectively for the following conditions: high systolic blood pressure, low bone mineral density (a proxy for osteoporosis), depressive disorders and Parkinson disease</li> </ul>	<p>2017</p>	<p>Chapter 3: Disability sections: cancer, cardiovascular diseases, diabetes, mood &amp; anxiety disorders, musculoskeletal disorders, neurological diseases and respiratory diseases</p>

# APPENDIX 3: TRENDS IN CHRONIC DISEASES PREVALENCE, YEARS LIVED WITH DISABILITY AND MORTALITY

**FIGURE A.**

Age-standardized\* prevalence of common chronic diseases and conditions, 65+ years, both sexes, Canada, 2000–2001 to 2017–2018



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013.

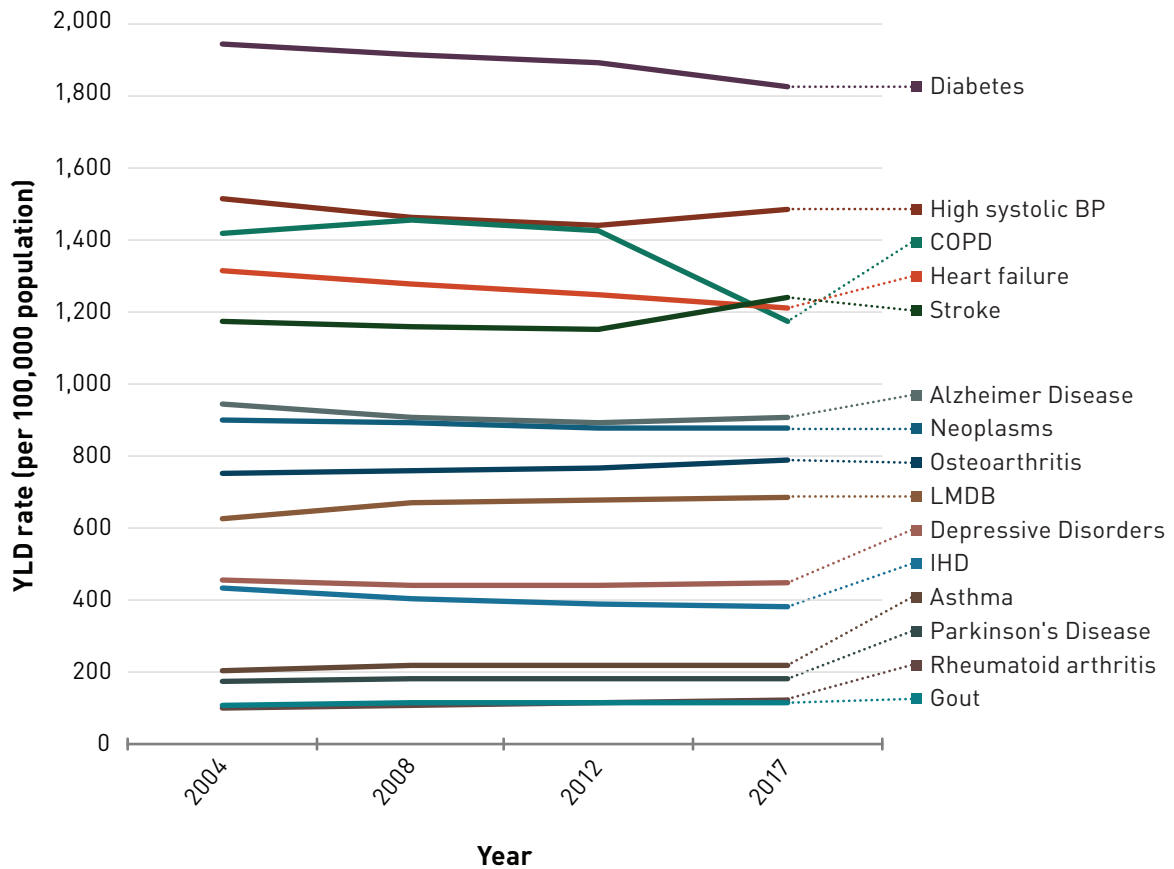
# These estimates represent the prevalence of health service use for mood and anxiety disorders, rather than the prevalence of diagnosed mood and anxiety disorders.

**Abbreviations:** COPD = chronic obstructive pulmonary disease; IHD = ischemic heart disease.

**Source:** Cancer: Canadian Community Health Survey combined annual files 2005–2006 to 2017–2018. All other diseases: Public Health Agency of Canada, using Canadian Chronic Disease Surveillance System data files contributed by provinces and territories, August 2019.

**FIGURE B.**

Age-standardized\* years lived with disability rates (per 100,000) of common chronic diseases and conditions, 65+ years, both sexes, Canada, 2004, 2008, 2012, 2017



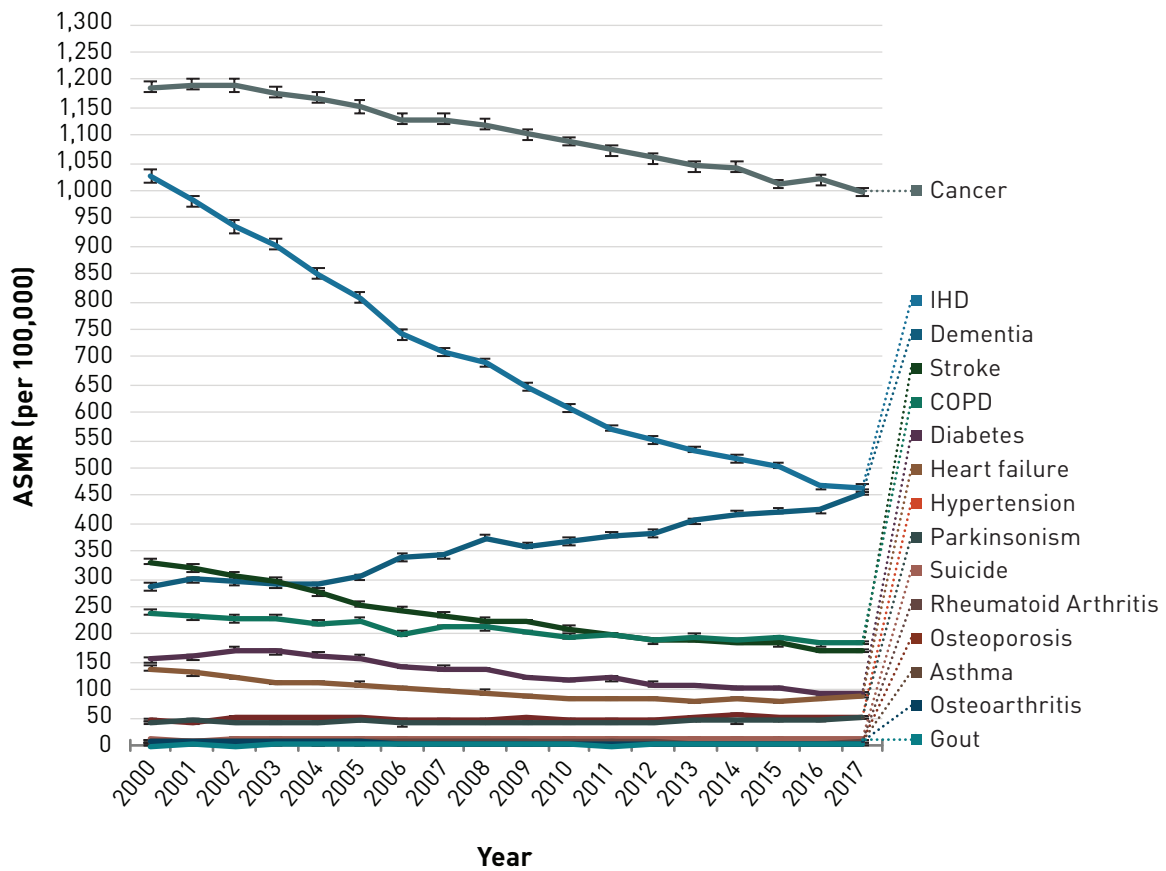
\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013.

**Abbreviations:** YLD = years lived with disability; BP= blood pressure COPD = chronic obstructive pulmonary disease; IHD = ischemic heart disease; LMDB = low bone mineral density (proxy for osteoporosis).

**Source:** Global Burden of Disease Collaborative Network, 2017.

**FIGURE C.**

Age-standardized\* mortality rates (per 100,000) of common chronic diseases and conditions, 65+ years, both sexes, Canada, 2000–2017



\* Estimates were age-standardized to the 2011 final postcensal Canada population released in 2013.

**Abbreviations:** ASMR = age-standardized mortality rate; COPD = chronic obstructive pulmonary disease; IHD = ischemic heart disease.

**Source:** Canadian Vital Statistics—Death Database, 2000–2017.

# APPENDIX 4: CHRONIC DISEASES PREVALENCE BY SEX AND AGE GROUP

**TABLE A.**

Crude prevalence (%) of common chronic diseases and conditions, 65+ years, by sex, Canada

	PREVALENCE PER SEX (%)		
	TOTAL	WOMEN	MEN
<b>CANADIAN CHRONIC DISEASE SURVEILLANCE SYSTEM, 2016–2017</b>			
Hypertension	65.5	66.0	64.9
Osteoarthritis	37.9	43.6	31.3
Ischemic heart disease	26.9	22.2	32.4
Diabetes	26.6	23.7	30.1
Mental illness	15.2	17.1	13.1
Chronic obstructive pulmonary disease	20.2	19.2	21.4
Stroke	9.6	9.0	10.2
Heart failure	9.2	8.5	10.0
Osteoporosis	25.1	38.6	9.1
Asthma	10.7	12.6	8.6
Mood and anxiety disorders <sup>#</sup>	10.5	12.6	8.0
Gout	6.0	3.4	9.2
Dementia	6.9	8.0	5.5
Rheumatoid arthritis	3.3	4.2	2.2
Parkinsonism (including Parkinson disease)	1.2	1.0	1.5
<b>CANADIAN COMMUNITY HEALTH SURVEY, 2015–2016</b>			
Back problems (excluding scoliosis, fibromyalgia, arthritis)	25.4	26.4	24.3
Sleep apnea	8.1	5.7	11.0
Migraine headache	5.5	7.4	3.4
Scoliosis	3.8	5.3	2.1
Fibromyalgia	3.3	4.8	1.6
Chronic fatigue syndrome / myalgic encephalomyelitis	2.8	3.4	2.1
<b>CANADIAN COMMUNITY HEALTH SURVEY, 2017–2018</b>			
Cancer	21.0	20.7	21.2
Bowel disorders (including Crohn disease, ulcerative colitis, irritable bowel syndrome, bowel incontinence)	6.3	8.6	3.5
Urinary incontinence	10.6	12.6	8.3

<sup>#</sup> These estimates represent the prevalence of health service use for mood and anxiety disorders, rather than the prevalence of diagnosed mood and anxiety disorders.

**Sources:** Canadian Chronic Disease Surveillance System 2016–2017, Canadian Community Health Survey 2015–2016 and 2017–2018.



**TABLE B.**

Crude prevalence (%) of common chronic diseases and conditions, 20+ years, by age group, both sexes, Canada

	PREVALENCE (%)			
	≤65	65-74 YEARS	75-84 YEARS	85+ YEARS
<b>CANADIAN CHRONIC DISEASE SURVEILLANCE SYSTEM, 2016-2017</b>				
Hypertension	14.3*	56.3	74.3	83.4
Osteoarthritis	6.9*	30.8	43.6	54.0
Ischemic heart disease	3.4*	20.1	32.6	42.0
Diabetes	6.5*	24.2	30.4	28.3
Mental illness	16.5*	14.7	15.2	17.1
Chronic obstructive pulmonary disease	6.2†	16.8	23.2	27.3
Stroke	1.0*	5.8	11.7	19.9
Heart failure	1.0§	4.7	11.0	22.9
Osteoporosis	5.4§	20.1	28.8	36.9
Asthma	11.2*	10.3	11.2	11.3
Mood and anxiety disorders#	12.2*	10.4	10.7	10.5
Gout	1.3*	4.8	7.2	8.5
Dementia	NA	1.4	8.3	25.1
Rheumatoid arthritis	0.8*	2.7	3.8	4.5
Parkinsonism (including Parkinson disease)	0.1§	0.7	1.7	2.1
<b>CANADIAN COMMUNITY HEALTH SURVEY, 2015-2016</b>				
Back problems (excluding scoliosis, fibromyalgia, arthritis)	19.0*	24.9	26.7	24.8
Sleep apnea	5.0*	9.3	6.9	3.7 <sup>c</sup>
Migraine headache	11.8*	6.4	4.1	4.5 <sup>c</sup>
Scoliosis	3.4*	3.8	3.7	4.7
Fibromyalgia	1.5*	3.6	3.3	1.8 <sup>c</sup>
Chronic fatigue syndrome / myalgic encephalomyelitis	1.8*	2.6	3.0	3.7 <sup>c</sup>
<b>CANADIAN COMMUNITY HEALTH SURVEY, 2017-2018</b>				
Cancer	4.5*	18.4	24.6	26.1
Urinary incontinence	2.5†	7.4	13.5	22.0
Bowel disorders (including Crohn disease, ulcerative colitis, irritable bowel syndrome, bowel incontinence)	5.1*	6.3	6.1	6.6

Abbreviation: NA = not applicable

\* Ages 20-64; †Ages 35-64; §Ages 40-64; ‡Ages 25-64.

# These estimates represent the prevalence of health service use for mood and anxiety disorders, rather than the prevalence of diagnosed mood and anxiety disorders.

<sup>c</sup> Estimates should be interpreted with caution because of the high sampling variability ( $0.15 < CV \leq 25.0$ ).

Sources: Canadian Chronic Disease Surveillance System 2016-2017, Canadian Community Health Survey 2015-2016 and 2017-2018.

## APPENDIX 5: ACKNOWLEDGEMENTS

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