

The Chief Public Health Officer's

REPORT ON THE STATE OF PUBLIC HEALTH IN CANADA

2014

Public Health in the Future



Canada 

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A MESSAGE FROM CANADA'S CHIEF PUBLIC HEALTH OFFICER

This year, the Public Health Agency of Canada marks its tenth anniversary and seventh annual report. While it's remarkable how much has changed in that short period, it's even more telling to consider, from a broader perspective, what the pace of that change means for our future.

This report looks forward on some of the challenges and opportunities influencing public health and Canada down the road. As with other reports it is not a compendium, nor does it address all the important future impacts, but rather some key ideas and evidence to generate debate, discussion and ultimately practical action. This report makes it clear that the issues we face impact us all directly. We know our population is aging. We know our environment is changing. And we know the pace of technological change is faster than ever. What does all of this mean for our health and well-being?

Some of our most pressing questions have no simple answers. As the world transitions, how can we best manage this change in a way that improves rather than diminishes health?

One thing is certain—we can't afford to consider any of these changes in isolation. That's why we must go beyond traditional public health borders and venture into some relatively new territory. This report examines what we know about what is changing, and includes examples of potential impacts moving forward.

At this time, I would like to express our sincere thanks to Dr. David Butler-Jones for his significant contribution to protecting and promoting the health and safety of Canadians over the past 10 years as Canada's first Chief Public Health Officer.



Dr. Gregory Taylor

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INTRODUCTION

Public health and Canada's Chief Public Health Officer

Public health is defined as the organized efforts of society to keep people healthy and prevent injury, illness and premature death and disability, improving health and well-being and reducing inequalities in health.

It focuses on preventing disease and optimizing the health of the population rather than the illnesses of individuals. It is the combination of programs, services and policies that protect and promote health. The Public Health Agency of Canada (the Agency) and the position of Canada's Chief Public Health Officer (CPHO) were established in 2004 to help protect and improve the health and safety of all Canadians. In 2006, the *Public Health Agency of Canada Act* (the *Act*) confirmed the Agency as a legal entity and further clarified the roles of the CPHO and the Agency.¹ Through the *Act*, the CPHO has a legislated responsibility to report annually to the public via the Minister of Health and Parliament on the state of public health in Canada.

The CPHO's reports are intended to highlight specific public health issues that the CPHO has determined warrant further discussion and action in Canada. As much as this report is a mechanism to increase awareness, it is also meant to inspire action to build upon existing health programs and initiatives and develop new solutions to promote, improve and maintain optimal health and well-being for all Canadians.

What this report is about

This report, rather than looking only at health status, particular disease outcomes or public health initiatives affecting Canadians today, considers how those issues may be affected by broader factors that are likely to influence public health in the future.

Public health in Canada has certainly come a long way from its early 18th century activities of quarantine measures to reduce the spread of disease.² Key innovations and milestones such as improvements in hygiene and sanitation late in the 19th century and the introduction of immunization programs early in the 20th century have had significant impacts on the increased life expectancy and improved health of Canadians over the last nearly 200 years.² More recently, events such as the outbreaks of severe acute respiratory syndrome (SARS) and H1N1 and the re-emergence of infectious diseases such as measles have shone a light on the important role public health plays in fostering the best possible health and well-being of Canadians. We have certainly learned from these events and will be able to apply our knowledge to help shape the direction public health will take in the future. However, there are also many unknowns that will also drive public health in the future.

Public health issues can emerge quickly and unexpectedly, and those working in public health must remain flexible and responsive to address any future challenges. Public health involves influencing the factors, inside and outside the health system, that impact health. These include income and social status, social support networks, education and literacy, employment and working conditions, social environments, physical environments, personal health practices and coping skills, healthy child development, biology and genetic endowment, health services, gender and culture. These determinants of health affect all Canadians throughout their lifecourse. When considering how public health will address these determinants in the future, we need to provide the context within which public health will be operating. Although it is impossible to know exactly what that context will be, we do know that public health will need to take into account, among other things, who is being helped, where those people are living and what tools they have at their disposal to carry out their efforts.

What this report covers

The *who*, *where* and *what* of public health in the future will encompass many things.

WHO: Changing demographics, aging and health

We know that the age distribution of the Canadian population is shifting. Canadians born during the baby boom will soon represent the largest proportion of the population as seniors. Public health needs to be concerned about this large and growing senior population as well as future generations of seniors. This section broadly explores Canada's changing demographics and their influence on select health and social issues. This section looks at both the current burden of disease for seniors that will continue to impact individuals and societies in the future, as well as troubling health trends among younger age groups that will have short and long term public health implications.

WHERE: Public health in a changing climate

People have become increasingly cognizant of their environment and its impact on their health. The environment section of the report addresses the *where* of public health in the future by exploring our changing

climate and its impact on health. This section briefly outlines the ways in which the climate is changing, followed by an examination of how those changes in climate and weather are influencing the health of Canadians. It also identifies broad areas of action that can be taken to prepare for and adapt to change in order to mitigate climate-related health risks.

WHAT: Digital technology as a tool for public health

Public health uses numerous tools to deliver its programs and services. In looking at what tools may be used in the future, technology seems an obvious choice for examining the *what* of public health in the future. Technology is constantly and rapidly changing, permeating all aspects of Canadians' lives. It has also become a tool for public health to inform and assist Canadians on health and safety issues. This section contains examples of how digital technology in particular can be and is being used to address several key functions of public health, including health promotion and protection, education and awareness, and surveillance. It also notes some of the challenges and opportunities around the use of certain technologies and how this may shape public health practices in the future.



HIGHLIGHTS

- Canada's population continues to change in ways that will influence public health in the future.
 - People 65 years old and over represent Canada's fastest growing age group. This trend is expected to continue for decades.
 - Most of Canada's current population growth stems from immigration rather than natural increase.
- Today's seniors face chronic, mental health and neurological conditions as well as injuries, and concerning trends are also evident among younger age groups.
- Demographic shifts have brought about societal change with implications for health including changes to work, retirement, pensions, families, caregiving and intergenerational relations.
- Continued research and investment in public health practices will be required to address demographic changes in the future.

CHANGING DEMOGRAPHICS, AGING AND HEALTH

The structure, composition and distribution of the population influences public health. Canada's population has—and continues to—change. This section explores Canada's population, looking specifically at the shift toward an older demographic and its influence on health. This section:

- includes a broad examination of demographic trends and how these will influence public health in the future; and
- discusses select health issues and other factors where public health attention or action can improve healthy aging.

A changing population

Canada's population continually undergoes changes in pattern and growth. From confederation until the turn of the 20th century, Canada's population grew slowly, at an annual growth rate of 1.3%, and this growth was primarily due to natural increase—more births than deaths.⁴⁻⁶

Between 1941 and 1971, the baby boom and increased immigration pushed Canada's annual population growth to about 2.1%.⁴ Since then, the rate of annual population growth has stabilized at slightly above 1%.^{4,5,7}

Since 2001, population increase has mostly been as a result of immigration.^{4,5} In 2011, Canada's overall foreign-born population represented 20.6% of Canada's total population (with varying length of residency in Canada).⁸ The majority of newcomers (those who immigrated in the past 5 years) migrated during their working years (median age is 31.7 years).⁸ While numbers of immigrants are increasing, their fertility rate (birth of second-generation immigrants) is similar to the overall Canadian rate.⁴ The global aging population may also influence Canadian migration patterns in the future.

Compared to the overall Canadian population, First Nations, Inuit and Métis populations are younger and growing at a faster rate.⁹⁻¹¹ Reasons for this population increase include an increased fertility rate, regional

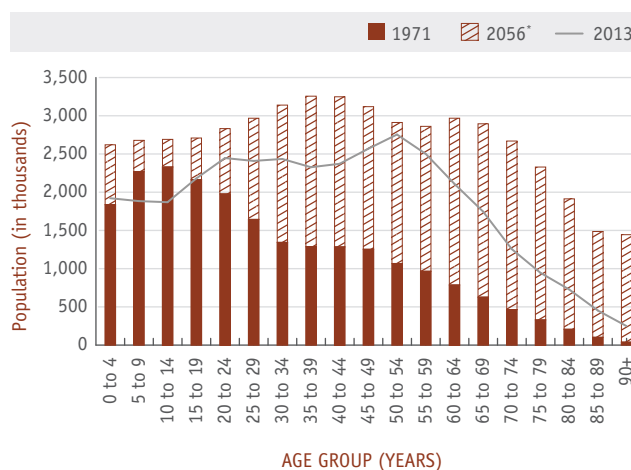
migration and legislative changes.¹⁰ A portion of population growth can be attributed to changes in self-reported ethnic identity (referred to as ethnic mobility).¹⁰⁻¹³ It is also important to note that there are significant variations between and among populations and across regions.^{9, 10} While projections indicate that First Nations, Inuit and Métis populations will continue to have higher fertility and growth rates than the overall Canadian rates in the near future, in the longer term, these rates will start to decrease due to a decline in fertility and effects of ethnic mobility and the larger proportion will also age.^{11, 12}

The higher fertility rates among some populations combined with the higher levels of immigration may be able to slow—but not prevent—the increasingly aging population.¹⁴ The first year that Canada’s baby boom generation (those born between 1946 and 1965) reached age 65 years was 2011. Since then the number of seniors (people aged 65 years and over) has begun to exceed other age groups. Canada will move toward zero or negative natural growth as the death rate exceeds the birth rate.^{4, 5} Public health must consider these demographic changes—the net result of an older population, their impacts on current and long-term health and how best to plan and address the public health needs of all populations in that context.

Canada’s aging population

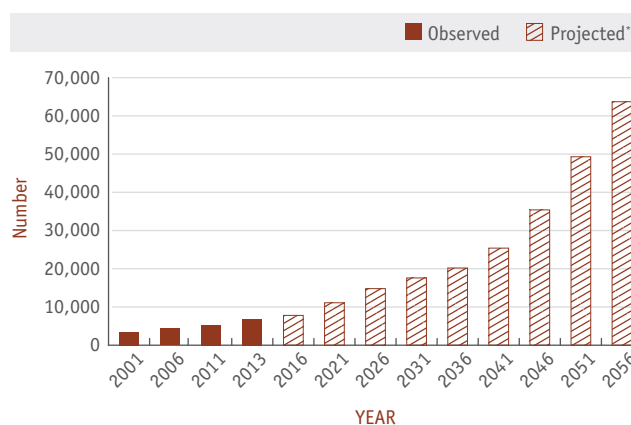
The proportion of the Canadian population who are seniors is increasing (see Figure 1).^{15, 16} Canadians are living longer and life expectancy has increased dramatically for both men and women (see Appendix A).^{17, 18} In 2013, the number of seniors rose to an all-time high of 5.4 million—15.3% of the total population; by 2056 it is estimated that one quarter of the population (13 million) will be aged 65 years and older.^{15, 16} In particular, people aged 85 years and over make up the fastest growing age group in Canada—from 309,000 in 1993 to 702,000 in 2013 (an increase of 127%).¹⁵ This age group is projected to grow to 2.9 million by 2056.¹⁶ In 2013, the number of centenarians (those aged 100 years and over) was almost 7,000, nearly double the 2001 total.¹⁵ This population is estimated to increase to 64,000 by 2056 (see Figure 2).¹⁶

FIGURE 1. Population by age group, Canada, 1971, 2013 and 2056^{15, 16}



* Projection based on medium growth scenario (M1).

FIGURE 2. Number of centenarians, Canada, 2001 to 2056^{15, 16}



* Projection based on medium growth scenario (M1).

Global aging perspectives: setting directions for public health

Canada is not alone in planning for an aging population.¹⁹ Both developed and developing countries are experiencing an increase in the number of people aged 60 years and over.²⁰⁻²² The United Nations (UN) estimates the global population of people over 60 years old will increase from 765 million in 2010 to 2 billion by 2050 and the population aged over 80 years will reach nearly 400 million by then.²³ This shift has encouraged global planning for an aging population (see the textbox “Setting a global agenda for aging”).¹⁹

Setting a global agenda for aging

The global aging population was first considered an area of interest among academic and policy communities over three decades ago.^{19, 21, 24} The UN Vienna International Plan of Action on Ageing was established at the first World Assembly on Ageing in 1982.²⁴ The Plan raised awareness about global longevity and offered broad guidelines and general principles to meet the challenge of progressively aging societies.²⁴ The language used in the document focused on dependence and protection of older people.²⁵

By 2002, the Second World Assembly on Ageing took a markedly different approach by focusing on and recognizing the potential of older people's contributions to societal development.^{19, 25, 26} Focusing on three policy areas, the Madrid International Plan of Action on Ageing (MIPAA) called for changes in attitudes, policies and programs across the following domains: i) older people and development, ii) advancing health and well-being into old age, and iii) ensuring enabling and supportive environments.²⁶ The Plan also called for "mainstreaming aging," that is, integrating aging into existing processes and programs as well as including seniors in policy development, implementation and evaluation.^{19, 26, 27}

In 2012, member states were asked to evaluate their progress on implementing the MIPAA. Canada's report notes that various policies and programs to support seniors had been put in place, but that challenges remained. These included increasing demands on care and healthcare, stress on public pensions, rates of poverty among seniors and issues with affordability of housing.²⁸

Public health and the aging population

The long-term impact of an aging population on society is largely unknown, but public health professionals must plan for future health issues associated with an aging population and the expected increase in demand for programs and practices. Public health has a role to play in:

- *optimizing health and well-being for all ages* by contributing to reducing the impact of disease and injury through prevention and health promotion activities across the lifecycle;
- *addressing risk factors and the determinants of health* by advocating change to address the root causes of disease as well as differences in health between populations;
- *factoring complex health problems into planning* by considering those living with multiple health conditions (comorbidities) and developing broad policies as well as individual and population interventions that tackle these conditions; and
- *creating a society for all ages* by taking into account the needs of all populations and intergenerational issues, as well as promoting healthy behaviours from birth to old age as well as encouraging age-friendly universally accessible environments.

Health issues and an aging population

An aging population indicates that society has met many of the requirements needed for people to live longer and healthier lives.^{29, 30} Still, many health trends and issues that are of concern have their foundation in younger age groups, suggesting that more can be done to ensure healthy aging in younger age groups. As well, many of today's seniors live with one or more chronic diseases, have a mobility issue, or experience a mental health problem.²⁹⁻³¹ Key health issues are highlighted here because they represent:

- trends among younger age groups that can adversely affect health over the long term; and/or
- a significant burden of disease for seniors, with rates that are of concern and/or increasing and a related cost that will continue to impact individuals and societies.



Chronic conditions

The incidence and impact of chronic conditions in the later years can be influenced by experiences and health issues from earlier in the lifecourse.³² These include being overweight or obese, healthy diet and physical activity, mental health problems or injuries.^{29, 33-36} Yet, apart from an overall decrease in smoking rates, younger age groups have less healthy behaviours and less healthy weights and are living longer with chronic diseases and mental health concerns than previous generations.³⁷⁻⁴⁴ While the causes of some diseases are unknown, healthy behaviours such as participating in physical activity can positively influence healthy aging.^{29, 45}

A range or combination of health issues such as living with one or more chronic diseases, having an acute disease or condition and/or experiencing a loss of cognition or mobility can adversely influence quality of life. Comorbidities also increase demands on the

healthcare system.^{30, 46, 47} In 2012, 85% of seniors aged 65 to 79 years and 90% of seniors aged over 80 years reported having at least one chronic condition.^{38, 48} About 24% of seniors have three or more chronic diseases and account for 40% of all healthcare use among seniors.³⁰ Currently, people aged 85 years or older with no chronic disease use half as many health services as people aged 65 to 74 years who have three or more chronic diseases.³⁰ Public health can help alleviate this by focusing on the earlier, pre-senior years and upstream efforts to protect younger Canadians from disease and injury and promote healthier practices.

Living with chronic conditions can also weaken the immune system and increases the likelihood of complications due to interactions between medications. This vulnerability can increase susceptibility to infectious diseases such as seasonal influenza, food and water-borne infections as well as healthcare-associated infections.^{49, 50}

About 76% of Canadian seniors in private households reported using at least one medication (prescription and/or over-the-counter) to manage chronic diseases, decrease pain and increase physiological function, and 13% had used five or more medications in the past two days.⁵¹ The proportions are even higher among seniors living in institutions, where 97% used one medication and 53% used five or more.⁵¹ Problems associated with multiple or frequent use of medications can result in reduced effectiveness, more side-effects or dependency and increased risk of falls.^{51, 52} It is estimated that about 50% of prescriptions are not taken properly by seniors, and about 20% of hospitalizations of people who are 50 years and over are the result of problems with medications.⁵²

Medication use (and associated drug-related spending) is projected to continue to increase based on an expected increased use among seniors and current medication practices among younger populations.⁵³ Some of these medications may be taken because of physician-patient miscommunication, inaccessibility to other therapies, lack of medication reviews and reliance on multiple pharmacies or physicians.⁵⁴ In particular, as the baby boom generation ages, a substantial increase in substance misuse is anticipated as this age group uses more medications than did previous generations.⁵⁵ To help address this issue, Health Canada, through the Drug Strategy Community Institute Fund (DSCIF), has called for proposals to improve prescriber education through the development of guidelines, training and tools.^{56, 57}

The aging First Nations, Inuit and Métis populations and chronic conditions

Compared to the overall population, First Nations, Inuit and Métis populations are generally younger and experience higher rates of certain health conditions including diabetes, heart disease, tuberculosis, HIV infection and AIDS.^{9, 39, 58-61} Aging has not been the primary focus for First Nations, Inuit and Métis public health, given the higher infant mortality rates and lower life expectancies compared with the general population.^{9, 62} However, as the relative size of the senior population is growing and the age of onset for chronic diseases among First Nations, Inuit and Métis is generally earlier than that in the non-Aboriginal population attention needs to be paid to health conditions of seniors.⁵⁹ Among First Nations adults aged 60 years and over living on a reserve, about 90% reported living with one or more chronic diseases and about 47% reported living with four or more chronic conditions in 2008/2010.^{63, 64}

The health needs of First Nations, Inuit and Métis seniors are magnified by determinants of health such as living in poverty or inadequate housing, and experiencing discrimination and challenges with language and cultural differences.^{59, 65} First Nations, Inuit and Métis seniors are also more likely than the younger generations to live in rural and remote areas with limited access to healthcare, home care and support.⁶⁵ Research also shows that seniors living with one or more chronic diseases tend to cluster regionally, suggesting that more can be done to maintain health and prevent illness and injury within those regions as well as earlier in the lifecourse.⁵⁹

Researchers suggest that traditional public health research that focuses on addressing disease within First Nations, Inuit and Métis populations is limited if it does not move beyond describing problems to attempting solutions.⁵⁹ Such research focuses mostly on ill health and disability rather than the underlying determinants of health.⁵⁹ Opportunities exist for public health professionals to develop global networks of indigenous research and collaborative practices to address unique challenges and implement solutions that build on the strengths of indigenous populations.⁶⁶

Mental health across the lifecourse

Mental health problems and mental illness can occur at any point in the lifecourse.^{67, 68} The current mental health status of younger generations will be an important indicator for aging in the future. Those living with poor mental health or a mental illness are at greater risk of developing physical and mental health problems later in life. For example, depression raises the risk of heart disease and stroke and reduced longevity.^{34, 69}

Certain risk factors for poor mental health tend to increase with age.^{22, 67} These risk factors include recurrent or chronic mental illnesses that were ineffectively addressed earlier in life; late onset disease; chronic diseases with known mental health complications (e.g. cerebrovascular disease, chronic obstructive lung disease and Parkinson's disease); and cognitive, behavioural and psychological symptoms associated with dementia or other neurological condition.⁶⁷ As well, seniors who have experienced trauma or distress earlier in life, such as First Nations, Inuit and Métis seniors who had attended residential schools, have been shown to have poorer mental health outcomes later in life.⁷⁰

One in four Canadian seniors have a mental health problem or a mental illness.⁷¹ The most common mental health issues were mood and anxiety disorders, cognitive and mental disorders due to a medical condition (including dementia and delirium), substance misuse (including prescription drugs and alcohol) and psychotic disorders.⁶⁷ Between 2008 and 2009, 44% of Canadian seniors living in long-term care facilities were diagnosed with or showed symptoms of depression.⁷² Seniors had the highest rate of reported symptoms for anxiety disorders with about 5% to 10% of adults 65 years and over affected.^{67, 73}

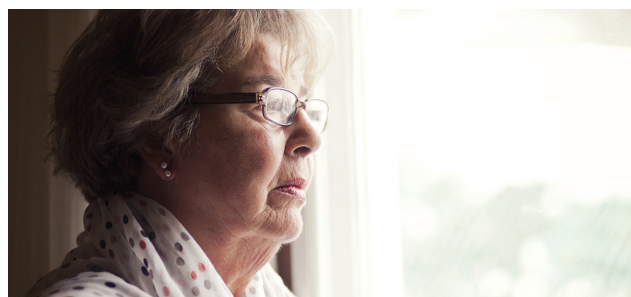
Older adults may face serious and undertreated mental health issues. Often the diagnoses of age-related health conditions focus on cognitive decline and do not acknowledge possible mental health problems.⁶⁷ Underlying health issues and/or their treatment can also mask symptoms of mental illness.⁶⁷ *Changing Directions, Changing Lives: The Mental Strategy for Canada* (2012) made a number of recommendations related to changing outcomes for seniors' mental health in the future.⁷⁴ These included countering the impact of age discrimination on mental health; helping older adults participate in

meaningful activities, sustain relationships and maintain good physical health; and increasing the capacity of older adults and those who support them to identify mental illnesses, dementia, elder abuse and risk of suicide and the importance of intervening when signs first emerge.⁷⁴ Public health can focus efforts upstream by developing early identification and intervention programs.⁶⁷ Interventions such as the Seniors' Mental Health Policy Lens are intended to facilitate environments that promote and support the mental health of older adults.⁷⁵

Considering dementia and other neurological conditions

The number of Canadians who experience and live with neurological conditions is expected to increase as will the costs of these conditions for individuals, families, healthcare and society.⁷⁶ However, difficulties in diagnosis, data accuracy and capture (particularly in institutional settings) creates gaps in information which makes forecasting the future prevalence, duration and potential impacts of these diseases complex.⁷⁶ Still, these information challenges do not diminish the importance of these issues.

Globally, the significant burden of dementia (an umbrella term for a variety of brain disorders including Alzheimer's disease) for families, societies, and health systems is expected to grow substantially.^{22, 77, 78} The World Health Organization estimated that 35.6 million people lived with dementia worldwide in 2010, and predicts this number will double by 2030 and more than triple by 2050.⁷⁹ Although the risk of developing dementia increases with age, it is not a normal part of the aging process. In 2011, an estimated 340,200 (2%) of Canadians 40 years and over had Alzheimer's disease and other dementias and this number is expected to double in 20 years.⁷⁶ The rate at which new cases of Alzheimer's disease and other dementias are diagnosed is also expected to increase. In 2011, the incidence rate for Canadians 40 years and over was 3.6 cases per 1,000, and this is expected to rise to 5.3 cases per 1,000 by 2031.⁷⁶ Increasing numbers of other neurological conditions more prevalent among older age groups, such as Parkinson's disease, will also need to be considered by public health professionals in the context of Canada's aging population. Parkinson's disease affected 84,700 Canadians in 2011 and, like dementias, this number is expected to double by 2031.⁷⁶



Increases in the number of those diagnosed or living with a neurological or related disability will impact direct (e.g. healthcare) and indirect costs (e.g. lost income) in Canada.⁷⁶ Most people with dementia will require some level of care—from assisted daily living to residential nursing care.⁷⁹ Canadian institutional long-term care demands in 30 years' time are projected to be 10 times the current demand solely based on increases in dementia need and decreasing supply of caregivers.⁸⁰ The estimated costs of these demands do not include the social and mental burden of illness on individuals and their families, which cannot be adequately measured based on calculations focusing solely on money or time.^{31, 80} Informal dementia care is projected to rise from a current estimate of 19 million unpaid hours per week to 39 million unpaid hours per week over the next 20 years.⁸¹

Planning for an increase in demand for care will require more research and the identification of disease and best practices on meeting needs including interventions that support people with dementia and their caregivers.^{22, 30, 80} A new research hub, the Canadian Consortium on Neurodegeneration in Aging, aims to bring together research on improving the quality of life and services for those living with the effects of neurodegenerative diseases and their caregivers.⁸²

In 2010, the estimated global costs—including direct and indirect—of dementia were estimated to be approximately US \$604 billion.⁷⁹ The 2013 G8 Summit Global Action against Dementia focused on research and the growing public health and economic impacts of dementia (see the textbox "Global Action against Dementia").⁸³ Canada endorsed the declaration released at the Summit and, as part of the 12 commitments it outlines, is co-leading one of the Legacy Events that aims to foster collaborative efforts between academia and industry.^{83, 84}

Global Action against Dementia

On December 11, 2013, the United Kingdom hosted Global Action against Dementia to acknowledge the burden facing many countries and to build upon relevant research. Summit members committed to approaching the problem together and called for more research and innovation to determine how to improve the quality of life of people with dementia and their caregivers. Members were encouraged to invest in research and work towards finding a disease-modifying therapy (and ultimately a cure) by 2025. Sharing information and data from dementia research across involved countries will achieve the best return on investment in research.⁸³ As part of global efforts, a World Dementia Council has been created to provide independent non-governmental leadership for research, innovation, development and care.⁸⁵

One step in reducing the impact of dementia is to increase public understanding of the diseases and their risk factors.⁷⁷ Evidence suggests that engaging in healthy behaviours (particularly nutrition and physical activity) as well as reducing comorbidity can decrease the risk of dementia, delay onset and reduce the severity of its impacts.^{77, 80, 86, 87} In addition, underlying chronic diseases and conditions such as type 2 diabetes, hypertension and obesity can influence the risk for Alzheimer's disease and other dementias, preventing and managing chronic diseases is important.^{77, 80, 86, 88}

Preventing injuries and falls

Across all age groups, injuries are a major cause of disability and death and are one of the leading causes of hospitalization in Canada.^{89, 90} Residual effects of injuries suffered earlier in life or new injuries during the senior years can significantly impact aging, mobility and independence.^{89, 91} Of particular concern to seniors are injuries as a result of falls.⁹² Such injuries will continue to be a public health issue in Canada in the future.⁸⁹

Between 20% and 30% of Canadian seniors will experience a fall in any given year.⁸⁹ Almost half of these falls result in a minor injury, and 5% to 25% cause serious injury.⁹² Considering the current rate of falls and projected population growth, estimates show Canada could expect between 2.1 and 3.1 million falls among seniors in 2036.^{16, 89}

Falls among seniors can result in acute injury, traumatic brain injury, chronic pain, reduced quality of life, precipitation of long-term care and even death.^{89, 91-93} Although preventable, most falls are a result of a combination of compounding factors (including biological, behavioural, environmental and/or socioeconomic factors).⁸⁹ These factors can interact to influence a person's ability to keep or regain balance.⁸⁹ Having underlying health conditions or disabilities can increase the likelihood of sustaining injuries with falls.^{89, 93} Falls can result in painful fractures that often require surgery and can have long-term health consequences including increased vulnerability to other health conditions.^{89, 94} Recovery from a fall involves not just physical healing but also psychological adjustment.⁹¹⁻⁹³ Periods of immobility can lead to further frailty and increased loss of autonomy. Post-fall syndrome can lead to fear and anxiety of additional falls, loss of independence and immobility.^{89, 91} While older people's falls are of concern, the increase in chronic conditions among younger people, as well as less healthy behaviours, can affect their future mobility and increase their risk for falls during their senior years.⁹³⁻⁹⁵

Research on fall prevention has increased over the last decade, and there are a number of ways known to reduce the risk of falls.⁸⁹ Broad population-based practices such as falls prevention guidelines, education and awareness programs have been shown to reduce falls.^{89, 96} As well, individual risk assessment practices have been effective.⁸⁹ Creating accessible and encouraging environments can also make a difference.^{26, 97, 98} Many seniors live in environments that fail to meet their physical and mental health, transport and social needs.^{29, 31, 99} In response, an international age-friendly movement has evolved to identify community-based factors, such as land use planning and urban design, that can improve the health outcomes for seniors.^{97, 98} The goal of adopting the age-friendly approach is to ensure that seniors are involved in community-level decision making that allow programs and policies to facilitate seniors aging in a place of their choice and independent living.^{97, 98} Ensuring that infrastructure, housing, services and technologies are universally accessible can create a safer environment for all ages.^{26, 100} By applying principles of universal design (creation of environments and products are inclusive to the largest number of people without requiring modifications) there are opportunities to support all populations.^{29, 99-101}

Changing demographics, aging and society

As the population changes, how societies organize themselves and relate also changes. With an aging population there are expected issues with supply and demand of select services such as health services.^{29, 30} There are also changes in relationships including families and society.

Shifting views on aging

With a changing population the structure of elements of society such as family, work and other social networks also evolve. These elements are important determinants of health, and how they change and interact for individuals and within populations will also shape future health outcomes. Planning for changing demographics involves challenging attitudes and perceptions about aging and the roles of seniors, family and societal organizations (see the textbox “Myths associated with an aging population”).^{102, 103}

Myths associated with an aging population

There are several myths associated with an aging population including that:

- mental and physical deterioration can be expected;
- healthcare is a primary issue for older persons;
- investment in older people is a waste of resources;
- older workers take away jobs from younger people; and
- all older people have similar needs.^{102, 103}

Valuing aging starts with challenging these myths and changing attitudes.^{29, 31, 104} With aging, as with most life transitions, there are changes but not all are negative. Also, disease is not driven by age alone. Healthcare is an important component for all populations, and while seniors can be larger users, other issues such as staying active and living independently are more often a focus.¹⁰² In addition, evidence suggests that investments into healthy aging can reduce healthcare and related costs.^{29, 105}

Tackling ageism is a global priority and efforts have been made to establish positive ways to view aging.^{31, 106} One component of these efforts is to empower seniors to fully and effectively participate in the economic, political and social lives of their communities through income-generating and voluntary contributions.^{26, 29, 104} In 2009, the Canadian Federal/Provincial/Territorial Ministers Responsible for Seniors created *The Seniors’ Policy Handbook: A guide for developing and evaluating policies and programs for seniors* to help policy planners consider seniors’ perspectives, diversity, and current and future issues.¹⁰⁷ Work still can be done to develop national programs to address ageism and promote societies for all ages.

Securing a future

With the portion of the population aged 65 and older increasing, concern for health issues associated with not meeting basic needs may arise.^{29, 108} Without meeting seniors’ basic needs—adequate food, shelter, security and healthcare—seniors’ health could be compromised.⁹⁶ Over the last two decades, Canada has been effective at reducing overall poverty among people 65 years and over.¹⁰⁹ Still, 5.2% of seniors live in low-income after-tax households (see Appendix A).¹⁰⁹ As well, with an increasing proportion of seniors in the population there is some question about the state of pensions and economic security in the future. Although the debate continues across jurisdictions, efforts are being made to ensure that Canada’s retirement income system is sustainable, reflects demographic change and continues to meet the seniors’ needs.¹¹⁰ For example, age of eligibility for the Old Age Security (OAS) program has been increased from 65 to 67 years (effective 2023) and Canadians can now defer OAS pension for up to five years to receive a higher pension.¹¹⁰ Changes were also made to the Canada Pension Plan (CPP) to increase flexibility and sustainability in the future. As well, the Guaranteed Income Supplement was increased to assist low-income seniors.^{110–114} Additional annual targeted tax relief has been created by increasing the Age Credit and Pension Income Credit, raising the age limit for maturing savings in Registered Retirement Savings Plans and introducing pension income splitting.¹¹⁵

The ability to meet future economic needs in years to come will be influenced by the composition of the senior population. The senior population will continue to be diverse and vulnerable segments—the very old, unattached, Aboriginal seniors, and those with disabilities—will require further consideration. In light of the current demographic composition and projected change, a significant proportion of future seniors will clearly be foreign-born.^{4, 8} Although variation exists, the low-income rate among senior immigrants has declined and was halved between 1980 and 2005.¹¹⁶ The longer immigrant seniors live in Canada, the more their economic situation converges with the trends of the overall population.^{117–119} Also, issues may go under-detected given that recent immigrant seniors tend to live with extended family, act as parent/grandparent caregivers or rely on support networks.¹¹⁷

Access to economic supports and the benefits typically eligible for seniors often require having been previously employed and having made long-term contributions to earnings and pension programs. This is often not the case or exists at a reduced level for recent immigrant seniors.^{117, 119} Canada has developed over 50 social security arrangements with other countries to facilitate benefits for immigrant seniors; however, other barriers can be experienced.^{117, 120} Further investigation into the well-being of this population will help guide policies for public health and other sectors and identify future health needs.¹¹⁷

Families and partnerships and society

Demographic changes have created complex, multi-generational and diverse families and communities.¹²¹ Changes in partnerships, number of children and increased social activity among seniors have altered the roles of older people in Canadian families and partnerships.^{104, 121}

In 2011, most Canadian seniors (92%) lived in private households and some lived in collective dwellings (8%), however of those collective dwellings almost half were 85 years and over.¹²² The number of seniors who live with a spouse or a partner increased between 1981 and 2011.^{122, 123} As the life expectancy of men and women has begun to converge, the number of years in a partnership and living in private households has increased. Still, a significant number of seniors—35% of women and 17% of men—live alone.¹²³ Living alone does not necessarily mean living in isolation, however, level of social

engagement or marginalization can depend on an individual's access to community facilities, transportation and affordable activities as well as having meaningful roles in the community.^{29, 96, 98, 124}

Intergenerational relations have also shifted as a result of demographic change.^{31, 121} On the one hand, familial relations and obligations have changed and distance between family members changed and widened.¹²¹ On the other, there have been societal shifts in attitudes about the important role of external factors such as primary and institutional care and assistance with daily living.^{104, 121} Despite these changes, middle generations, commonly referred to as the “sandwich generation,” who support both younger and older family members in some capacity are reporting growing stress.^{125, 126}

Intergenerational tensions are often seen as a risk of demographic change. Within society, sharing resources between generations raises debate as to who pays when and how much.^{22, 105} With a larger proportion of the population in one age group questions remain as to whether public investments should focus on the needs of one population at the expense of others. Policy makers will need to achieve intergenerational equity to not polarize generations and/or populations.²² A focus on healthy aging should investigate younger populations, those who are foreign-born as well as those living in remote communities.

Focusing on care

As the demand for support services from informal and formal networks is expected to double over the next 30 years, the question for public health is how to best meet the needs of Canada's seniors and their caregivers now and in the future.^{125, 128} Age-related care can be complex and involve both formal (healthcare, home and long-term care) and informal (non-paid, often family care) practices.¹²⁹ While many types of care require attention, this section only discusses informal care.

CAREGIVING involves a number of tasks, some of which are done in combination. These include transportation, housework, house maintenance and outdoor work, scheduling and coordinating appointments, managing finances, helping with medical treatments and providing personal care.^{125, 127}

At some point, almost half of Canadians will have provided care to someone with a long-term health, disability or age-related need.¹²⁵ Spouses/partners provide the most care hours per week (14 hours), followed by children caring for a parent (10 hours).¹²⁵ In 2012, almost half of all caregivers over the previous year were providing some care for a parent or parent-in-law.¹²⁵ When asked, caregivers identify age and specific diseases (such as cancer, cardiovascular disease, mental illness and Alzheimer's disease and dementia) as the most common reasons for needed care.^{125, 127}

As the population ages and population distributions change, the availability of adult-child caregivers may decrease.^{128, 130} Meeting future demands will require consideration of the next generations' needs and the supply of caregivers.¹³¹ Factors that influence the caregiving supply are living spouses and an increase in senior volunteers since the large majority of caregivers are seniors.^{128, 132, 133} As well, the decline in births and survivor children (especially among the elderly seniors) means that there will be fewer children to provide parental care.¹³² In many communities, especially those in remote and rural areas, over-dependence on a few local caregivers (primarily women) and an out-migration of younger family members and volunteers, can contribute to resource deficits in areas where formal care services may also be less available and/or adequate.¹³⁴ Given these changes, in the future Canada may need to rely more on a formal care system paid for by individuals and/or society.^{128, 131}

Despite the demands of caregiving, many (73% of employed caregivers) report that they are satisfied with the current balance between their work and home life.¹²⁵ Still, caregivers also report feeling tired, stressed, worried or anxious.¹²⁵ The numbers of adverse feelings increases with number of hours committed to caregiving per week.^{125, 135} Beyond the effects on individuals, there are broad impacts of caregiving on the labour market, governments and the economy.¹³⁶ Employee turnover and missed paid work due to informal caregivers' obligations was estimated to cost Canadian employers \$1.28 billion in lost productivity in 2007.¹³⁷ In the same year, the cost of replacement for unpaid caregivers was estimated to be \$24 billion.¹³⁸ To address this issue, the Government of Canada announced the intent to develop and launch a Canadian Employers for Caregivers Plan to engage with employers on cost-effective workplace solutions that will help maximize caregivers' labour market participation. The Plan will include the creation of an employer panel that would identify promising workplace practices that support caregivers.¹¹⁵

In the short term, a range of policies could support family and friend caregivers caring for older Canadians—flexible labour practices, income security, home/continuing care as well as health promotion and caregiver education and training.¹²⁸ Creating flexible workplaces may enable caregivers to continue working while also reducing the negative consequences of job interruption, reduced income and lower retirement pensions. In the longer term, reduced availability of caregivers may increase reliance on the formal system.^{128, 131} As a result, broad-based home care, greater community involvement and private enterprise (for individual paid care) may need to be utilized more. Such practices involve increased expenditures for individuals as well as use of privately offered care.¹²⁸ However, privately offered care is not accessible and affordable to all who may require it.¹³¹ Broad and comprehensive social approaches to deliver care may be necessary to improving wages and benefits, training standards, availability in remote areas, and improving recruitment and retention of these essential workers.¹³¹

Participating in community and work

Demographic change has raised concern for a possible inequitable burden of labour and community participation across population groups.²² From the early 1920s to the mid-1960s, about 60% of Canadians were working age, but then, the baby boom population increased this proportion to nearly 70%.¹⁴ In the future, this proportion is expected to decline rapidly and the number of working-age Canadians will fall from about 5 for every senior in 2012 to about 2.7 for every senior by 2030.¹⁴ Views on retirement are evolving as people now tend to reach the age of retirement healthier and more active than in previous generations.²⁹ Some older people may want to be employed for the sake of a second or subsequent career, whereas for others, employment may also be a necessity to make ends meet.^{22, 139} As more seniors work longer for financial reasons, social engagement and activity, the average age for retirement is increasing.^{139, 140} Canada no longer has a mandatory age of retirement.¹¹³

Seniors' participation in the labour force has more than doubled since 2000, from 6.0% in 2000 to 13.0% in 2013.¹⁴¹ In particular, for those aged 65 to 69 years, the participation rate more than doubled between 2000 and 2012 from 11.4% to 25.5%.¹⁴¹ Seniors' participation in the labour force attenuates some of the impacts of a decreasing labour pool, leverages investments made in seniors' knowledge and skills, and provides opportunities for older Canadians to remain engaged and socially connected.^{22, 31, 142}

Not all seniors are working into old age. Older workers report health problems as the most common reasons for premature exclusion from the workforce.¹⁴³ Of the 35% of workers who left work before their expected age of retirement, about 24% reported having three chronic conditions.¹⁴³ Older workers suggest that having opportunities to change work patterns (work part-time or have flexible hours), change careers or work in more accessible and age-friendly environments would extend their participation in the workforce.^{142, 144} An UN report noted that employers who effectively supported older workers did so by offering flexible hours and promoting personal-development programs to keep workers active by participating in physical and mental activities.¹⁴⁵ They also provided flexible work schedules to accommodate the needs of workers who are also caregivers to older individuals and increased part-time work opportunities among seniors.¹⁴⁴ Making such changes to the workplace benefits all of society and can be enabled by collaborations across workplaces and jurisdictions.^{142, 144}

Extended periods of retirement are often spent in good health and provide opportunities to be involved with family and/or community. While seniors provide the highest average number of volunteer hours, volunteering and community involvement tends to decline with age.¹⁴⁶

Seniors programs depend on volunteers and much informal care is given by seniors.¹⁰⁴ All sectors can contribute to increasing Canada's volunteer sector by encouraging future volunteers. People who volunteer when they are young are more likely to continue these contributions later in life.^{104, 146, 147} In the future, public health may depend on the work of volunteers and can promote evidence that points to protective factors for health associated with volunteering and being involved in community.^{147, 148}

Continuing research and understanding population change

Looking ahead to how Canada will adapt to a changing demographic involves projecting and forecasting based on current and known realities. The health issues impacting today's seniors are known but it is less clear what role these health issues will play in the future or how factors that influence the health of today's younger Canadians are interconnected and will evolve over time and as individuals age.^{22, 29, 30} Canada has identified the need for research on aging and evidence to support the enhancement of programs, services, policies and care. The Canadian Longitudinal Study on Aging (CLSA) was established to contribute to meeting these needs (see the textbox "The Canadian Longitudinal Study on Aging").¹⁴⁹

The Canadian Longitudinal Study on Aging

The CLSA is a long-term national study developed to better understand aging.¹⁴⁹ CLSA investigators are following about 50,000 men and women aged between 45 and 85 years for 20 years or longer to gather information on various factors that influence their health (including biological, medical, psychological, social, lifestyle and economic factors).^{149, 150}

Collecting long-term data will supply researchers, public health professionals, healthcare providers and policy makers with valuable information on how Canadians age. This information will contribute to disease prevention practices and improvement in health service delivery; a better understanding of the impact of socioeconomic factors that influence aging over the lifecourse; and the body of information needed to guide and improve age-related health policies and programs.^{149, 150}

The CLSA is a strategic initiative of the Canadian Institutes of Health Research (CIHR), and support for this study comes from CIHR, the Canadian Foundation for Innovation and the Public Health Agency of Canada as well as partners with Veterans Affairs Canada and the provinces of British Columbia, Alberta, Manitoba, Ontario, Quebec, Nova Scotia, Prince Edward Island and Newfoundland and Labrador.^{149, 151} As well, universities and academic/research institutions are leading and partnering with governments and supporter organizations to deliver the CLSA.^{149, 151}

In addition to looking at aging populations more research is needed to consider how to address health issues of all populations and age groups over time to ensure the health of the population across the lifecycle.

Continuing efforts

While Canada has made great strides in implementing public health initiatives to maintain and improve the health of Canadians as they age, considerable challenges

remain. The continued prevalence of unhealthy lifestyles and of chronic diseases challenges healthy aging now and is likely to continue to do so. Public health can invest in research, prevention and promotion programs and policies for seniors as well as younger Canadians to help reduce the burden of disease and increase the capacity for healthy aging over the next generation and beyond.

PUBLIC HEALTH CAN:

- tackle chronic disease early by promoting healthy practices and preventing the onset of disease;
- act on the growing burden of dementia by increasing research, raising awareness and improving opportunities for those living with disease;
- develop and sustain supportive environments for all ages to reduce and prevent injuries and falls;
- work across sectors to meet the basic needs of seniors and take into account diversity of the older populations in the future; and
- value aging and its role in society and build intergenerational relations by developing policies, programs and practices designed to support all ages.

HIGHLIGHTS

- The impacts of changing climate are already evident in Canada and projected to continue.
- Climate change can exacerbate many existing health concerns and present new risks to the health of Canadians.
- Adaptive capacity in Canada is generally high but is unevenly distributed between and within regions and populations.
- Public health action is needed to reduce vulnerability and risks.
- Some adaptation is taking place in Canada, both in response to and in anticipation of the impacts of climate change.

PUBLIC HEALTH IN A CHANGING CLIMATE

The global climate is changing and Canada, like many other countries, is vulnerable.^{152–154} Changes in climate are expected to increase risks to health in many ways, including through more extreme weather events and the associated impacts on community infrastructure, decreased air quality and diseases transmitted by insects, food and water.^{152–155} Although efforts are underway to protect the health of Canadians, continued action will be needed as climate changes.^{153, 154, 156}

This section includes:

- a brief overview of how the climate is changing;
- a discussion on how changes in climate are influencing the health of Canadians; and
- a consideration of broad public health measures that can be taken to prepare for and adapt to climate change.



A changing climate

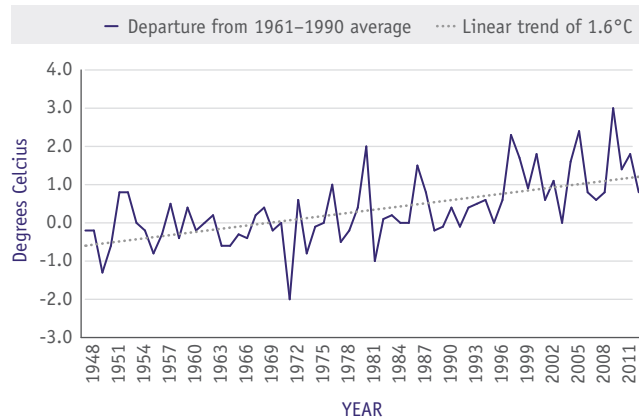
The global climate has changed considerably over the past century, and notably so over the last 30 years.^{157–159} This is evidenced by changes in average climate conditions and in climate variability as well as extreme climate events across the globe.^{154, 157, 159}

Many of the changes observed globally include warming of the oceans and surface temperatures, melting ice and snow in seas and lakes, rising sea levels and coastal erosion.^{157, 159, 160} In turn, research indicates that these environmental changes are altering precipitation patterns and increasing the potential for more severe and frequent extreme weather conditions (i.e. periods of excessive warmth or cold, wetness or dryness) resulting in hazardous events such as heat waves, ice storms, droughts, floods, hurricanes, wildfires, landslides and avalanches.^{154, 157, 159}

In simplest terms, the difference between weather and climate is a measure of time. **WEATHER** refers to the atmospheric conditions—the sunshine, cloud cover, winds, rain, snow and excessive heat—of a specific place over a short period of time. **CLIMATE** refers to the average atmospheric conditions that occur over long periods of time. In other words, a changing climate refers to changes in long-term averages of daily weather (e.g. precipitation, temperature, humidity, sunshine, wind velocity and other measures of weather).^{152, 155}

The story does not end here: climate models project continued changes in climate conditions across the globe.^{159, 161}

FIGURE 3. Annual national temperature departures and long-term trend, Canada, 1948 to 2013¹⁶²



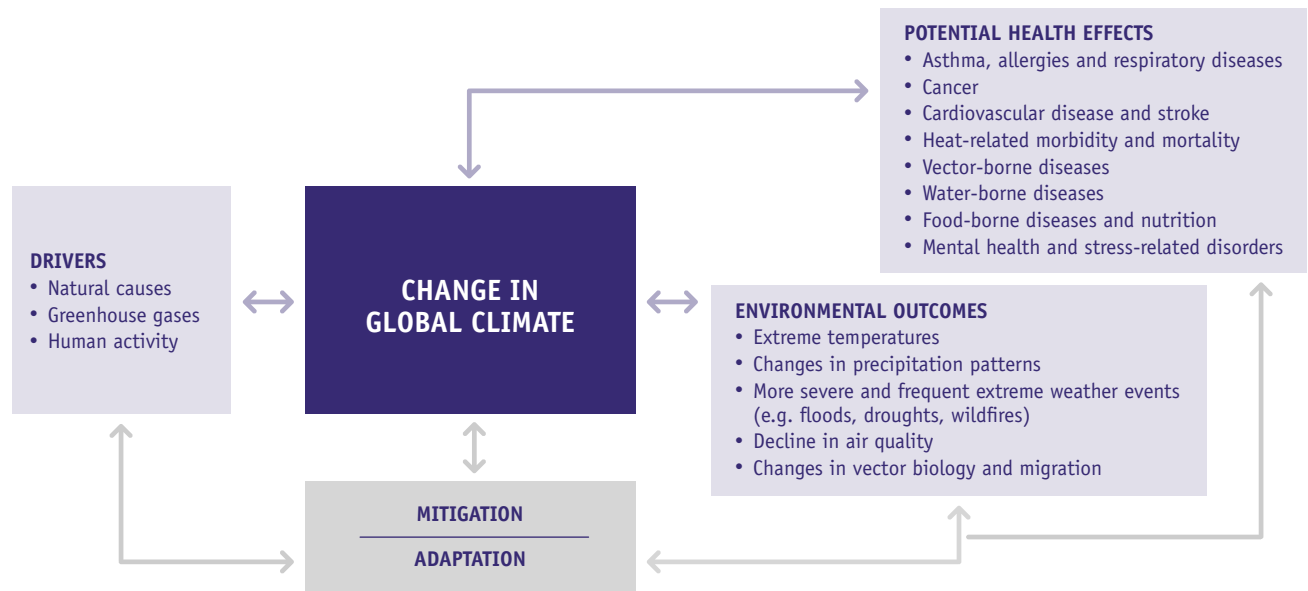
Canada is no exception to these changes.¹⁵³⁻¹⁵⁵ The annual average temperatures across Canada have increased by 1.6 degrees Celsius over the past 66 years (see Figure 3).¹⁶² The impacts of environmental change are particularly visible in Canada's North: winters are

shorter and summers are warmer resulting in changes to ice conditions affecting hunting and fishing, the distribution and migratory behaviour of some wildlife species are being altered and more frequent forest fires.^{153-155, 160, 163-167}

Climate risks to health: now and in the future

Changes in climate can potentially have widespread direct and indirect effects on people's physical, social and mental health and well-being.^{152, 154, 155, 168-170} In particular, climate change can influence extreme heat-related morbidity and mortality; health conditions such as asthma and allergies, respiratory diseases, cancer and cardiovascular diseases and stroke associated with decreased air quality; infectious diseases related to changes in vector biology and migration and water and food contamination; and mental health and stress-related disorders (see Figure 4).^{154, 155, 168} Extreme weather events can also impact critical community infrastructure, in turn, adversely affecting overall health and well-being.^{152, 154, 155, 168} The burden of these health issues is anticipated to increase as the changes in climate advance in the absence of further adaptations.^{154, 155, 168}

FIGURE 4. Pathways by which changes in climate can increase risks to health^{155, 168}



Adapted from Portier, C.J. et al. (2010).

Any climatic effect on health can be more severe when sensitivities and vulnerabilities are present. The very young and the very old as well as those with underlying health conditions may experience greater climate-related health risks than the general population.^{154, 155} Broader determinants of health such as age, socioeconomic conditions, housing and community infrastructure, geographic location and access to support and social services can contribute to increased sensitivities and vulnerabilities.^{124, 155, 171} Ensuring that basic needs are met will be important for people and communities to adapt to changes in the environment.

The following brief overview describes some of the potential health effects of increased temperatures, changes in precipitation and extreme weather events. These sections are not comprehensive assessments of the risks from climate change on health. Rather, they are meant to encourage broad discussions about some of the health issues that may potentially warrant further public health consideration.

Heat-related morbidity and mortality

Projected increases in the frequency and severity of extreme weather events such as heat waves, ice storms, floods, wildfires, landslides, avalanches and hurricanes may increase the risk of weather-related illnesses, injuries, disability and death.^{152, 154, 155} The impact on health will vary based on the severity of the extreme weather event and the level of preparedness of communities and individuals. Given the unpredictability of such events, emergency management and response efforts and critical infrastructures play a role in the degree that these events can affect health.^{152, 154, 155, 172}

Extreme heat events are posing a growing public health risk in Canada.^{152, 155, 173–176} Over-exposure to extreme heat can place excessive stress on the body. Such stress can lead to skin rashes, heat cramps, loss of consciousness and heat exhaustion. It can also cause heat stroke that may result in severe and long-lasting health consequences and death. Heat can also exacerbate pre-existing chronic respiratory, cerebral and cardiovascular conditions and affect mental health and well-being.^{155, 168, 174, 176–180} Canadian and international research indicates that daily mortality rates can increase when temperatures rise above 25 degrees Celsius.^{174, 181, 182}

A range of factors can influence vulnerability to heat-related health risks.^{152, 154} Age, housing and access to cool spaces and air conditioning, social isolation, neighbourhood characteristics, and the use of certain medications can increase risks associated with extreme heat.^{174, 180, 183} Extreme heat is of greater concern to seniors, infants and children, and those with underlying health issues.^{154, 155, 174, 180}

As the number of Canadians living in urban centres increases, heat-related health risks may increase even more.¹⁷⁴ The urban built environment has the potential to exacerbate the effects of heat.¹⁷⁴ For example, high concentrations of non-reflective surfaces such as buildings, roadways and parking lots can generate, absorb and slowly release heat resulting in urban centres being several degrees warmer than surrounding areas. Expanding parks and green spaces and increasing the density of trees in and around cities can help to reduce this effect.^{174, 184}

Health conditions influenced by poor air quality

Air pollution episodes in Canada are projected to get longer and more severe with climate change.¹⁸⁵ Certain aspects of air quality—in particular ground-level ozone concentrations and airborne fine particulate matter (PM_{2.5})—can impact health.^{185–187} In addition, pollen (due to altered growing seasons), mould (from flooding), dust (because of droughts) and smoke (from wildfires and wood smoke) resulting from changes in climate can also impact health.^{155, 168, 188–190} Air pollution can exacerbate health concerns if also combined with extreme heat.¹⁹¹

Broadly, exposure to poor outdoor air quality has been associated with a number of adverse health concerns including allergies, respiratory (e.g. asthma, lung damage) and cardiovascular diseases (cardiac dysrhythmias) and cancer.^{192–198} Negative health effects can increase as air quality decreases. Studies have shown that it can exacerbate pre-existing health conditions and contribute to increased rates of emergency room visits, hospital admissions and premature death.^{185–187, 192, 193, 196, 199} Reaction to air pollution differs with each person. Those most sensitive to health risks associated with poor air quality include children, pregnant women, seniors, people living with respiratory and cardiovascular diseases, and those living in highly populated areas that are more likely to experience episodes of elevated poor air quality.^{154, 185–187, 196}

Vector-borne diseases

Recent studies on vector-borne diseases show that climate trends can influence disease transmission by shifting the geographic range and seasonality of vectors, increasing reproduction rates and shortening the incubation period of pathogens.^{154, 155, 200–202} Changing climate conditions may also heighten the risk of exposure to vector-borne diseases as habitats expand and become better able to support the vectors.^{200–203} As a result, Canada may experience the emergence of diseases that are currently rare (see the textbox “Lyme disease: an emerging infectious disease in Canada”).^{203–210}

Lyme disease: an emerging infectious disease in Canada

Climate change has contributed to the emergence of Lyme disease in northeastern United States and in most southern areas of Canada including parts of British Columbia, Manitoba, Ontario, Quebec, New Brunswick and Nova Scotia, and can potentially affect the spread of the disease into new geographic regions.^{207–209, 211} Lyme disease can cause skin rash, arthritis, nervous system disorders and in extreme cases, debilitation and death.²¹² It is caused by a bacterium transmitted by infected ticks (most commonly black-legged, or deer tick, *Ixodes scapularis*). Warmer temperatures can accelerate tick life cycles, create more favourable conditions for survival and for finding hosts, and increase the risk that new tick populations will become established in new parts of Canada.^{205, 206, 208–210, 213}

West Nile virus (WNV), a mosquito-borne illness, is another good example of the relationship between climate and disease migration. First documented in Canadian birds in 2001, WNV has since spread rapidly and is now found in most of the country.^{155, 214, 215} The first human case of WNV was reported in 2002. Since then, more than 5,454 cases of human WNV disease have been reported to the Public Health Agency of Canada with cases concentrated in a number of urban and semi-urban areas of southern Quebec and southern Ontario, rural and semi-urban areas of British Columbia and in rural populations in the Prairies.^{154, 155, 204, 215, 216} Changes in climate can shorten the life cycle of the mosquito, accelerate its rate of reproduction, expand its geographic range and lengthen the overall transmission season.^{213, 216–218} While most of

those infected have no symptoms or mild flu-like symptoms from which they fully recover, WNV can cause severe illness, including meningitis and encephalitis and its long-term effects are not fully understood.^{219, 220}

Food- and water-borne diseases

The potential effects of climate trends on food- and water-borne illnesses, nutrition and food security, while mostly indirect, can nonetheless, significantly impact health.^{154, 155, 168, 221, 222} Food-borne illnesses tend to peak during warmer summer months, illustrating a strong seasonal pattern. This can, in part, be attributed to changes in food consumption and preparation practices that can increase risk of food spoilage and food-borne diseases. However, some of this seasonal increase can be associated with increased temperature. Warmer weather can allow bacteria to grow more readily in food and can favour flies and other pests that affect food safety. The occurrence of *Salmonella*, *Campylobacter* and *E. coli* infections in Canada has been linked to increased temperature. Research in Australia and the United Kingdom has found similar findings.^{154, 155, 222–229}

Food security can also be influenced by changes in climate.^{154, 221, 230} Extreme weather events such as flooding, drought and wildfires can affect food systems by impacting crop production, food availability, markets and related costs. Changes in rainfall can lead to drought or flooding, or warmer or cooler temperatures can affect the length of the growing season.^{154, 221, 231–233} Being food insecure can lead to poor nutrition and thus an increased risk of unhealthy weight and having chronic health conditions and mental illness.²³⁴ This is of particular concern for remote and northern communities in Canada.^{153–155, 164, 235–239} Changes in climate can affect the distribution and availability (through fishing and hunting) of some of the traditional food sources that contribute to the diet of most northern Canadians. Unpredictable ice and weather conditions can restrict access to some foods. Changes in distribution and availability also affect aspects of Aboriginal peoples’ cultural and social identity.^{153–155, 165–167, 240–243} The availability of safe drinking water and the risk of water-borne infections is a particular concern in remote and northern communities.^{154, 155, 167, 244}

Extreme weather and climate conditions have also been linked to a number of reported water-borne disease outbreaks in Canada.^{155, 245–247} Frequent and intense rainfall can increase the risk of water contamination. Extreme rainfall can also threaten fisheries through contamination

with metals, chemicals and other toxicants that are released into the environment.^{154, 155, 168} Most commonly, storm water run-off flushes contaminants into waterways and shallow groundwater sources.^{155, 245, 248} If combined with poor water management systems or aging or compromised water utility infrastructures (e.g. treatment facilities, distribution systems), the risk of exposure to water-borne diseases may increase.^{154, 155, 245, 248} The public health implications of drinking-water contamination in Walkerton, Ontario, in 2000 is a good illustration. Heavy rainfall, combined with ineffective drinking-water management systems and operating practices, resulted in more than 2,300 cases of illness and 7 deaths after drinking water became contaminated with *E. coli* O157:H7 and *Campylobacter jejuni*.²⁴⁹

Conversely, drought-caused decreases in water levels can concentrate contaminants in water.^{155, 168, 188, 250, 251} Similarly, higher temperatures can affect the growth and survival of bacteria, overwhelming water treatment plants, particularly older water systems.^{152, 154, 155} Droughts can also increase demand and pressure on water supplies.^{154, 155} For good health, Canadians require access to safe, secure drinking water supplies.

Mental health and stress-related disorders

Changes in climate and the subsequent disruption to the social, economic and environmental determinants of health can influence an individual's mental health and well-being. Extreme weather events can lead to geographic displacement of populations, damage or loss of property and injury and/or death of loved ones.^{152-155, 252-257} These circumstances can, in turn, lead to acute traumatic stress and chronic mental illness, such as anxiety and depression, post-traumatic stress disorder, sleep difficulties, social avoidance, irritability and drug or alcohol abuse.^{155, 168, 252, 256-259} People already vulnerable to poor mental health, mental illness and stress-related disorders may be at an increased risk of exacerbated effects.^{154, 155}

Mental health in rural and remote northern communities and the influence of changes in climate is of particular concern.^{169, 255, 260-262} The Inuit Mental Health Adaptation to Climate Change (IMHACC) project, a community-based initiative that examined the relationship between climate change and mental health and well-being in five communities in Nunatsiavut, Labrador, found that disruption in land-based activities due to changes in weather, snowfall and ice stability, and wildlife and

vegetation patterns are affecting the way of life, cultural identity and social connectedness of Inuit communities.²⁶³ These societal changes are negatively influencing Inuit people's mental health.²⁶⁰⁻²⁶⁴

The severity of mental health impacts following extreme weather events can depend on the level of coping and the availability of support services during and after the event.^{155, 168, 255} Rural and remote northern communities tend to have limited resources and insufficient support services.¹⁵⁵

Other indirect exposures and health effects

Significant indirect impacts on health as a result of climate change can occur through the effects on physical infrastructures (e.g. roads, storm water and flood control systems, houses and buildings) within communities.^{154, 155, 265} Changes in climate, particularly severe and frequent extreme weather events, can undermine or compromise systems and infrastructures and thus increase risks to health and safety.^{152, 154, 155, 168} Infrastructure in northern communities is also particularly vulnerable to changes in temperature and precipitation patterns.^{164, 266} Existing chronic health conditions can also be potentially exacerbated when critical infrastructure has been weakened or overloaded.^{155, 168}

Moving forward: addressing climate change health risks and vulnerabilities

As changes in climate have become more evident, so has the need for public health to anticipate, manage and respond to the effects these changes pose.^{155, 156} However, addressing these health impacts is challenging. The issues are broad and complex.¹⁵⁴⁻¹⁵⁶ Public health must strive to prevent and adapt to current as well as anticipated and unforeseen threats and identify the most vulnerable populations.¹⁵⁴

Responses to climate change can draw upon existing, core, long-standing public health functions such as research, education and awareness, surveillance and monitoring, and emergency planning. Protecting Canadians from climate change will, to a great extent, not entail the development of new programs. Rather, it will require modifying and strengthening existing public health policies and practices to make them more effective and to target particularly vulnerable populations.^{152, 155} Responding to the public health challenges posed by changes in climate also requires a multijurisdictional,

multidisciplinary and integrated response. Strengthening existing relationships and fostering new partnerships among all levels of government, academia, non-governmental organizations, communities and individuals should be the focus.^{154, 155, 267}

The broad strategies discussed below—by no means a comprehensive list—illustrate the range of different possible adaptation strategies.

Mitigation and adaptation

Strategies for mitigating and adapting to changes in climate can help protect the environment and minimize or avoid certain adverse health effects now and for future generations.^{152–156} Mitigation refers primarily to actions taken to slow, stabilize or reverse the effects of climate change by reducing greenhouse gases.²⁶⁸ Adaptation refers to the actions taken to anticipate, prepare and lessen those effects of climate change that cannot be prevented through mitigation. While mitigation efforts will primarily occur in other sectors, public health has a definite role to play in informing Canadians about research on health-related impacts and implementing effective adaptation measures to reduce risks to health.^{152–156}

Building capacity as an adaptation to climate change

The capacity of individuals and communities to cope and adapt to current and anticipated changes in climate can significantly influence the degree to which these changes will impact their health.^{155, 156} Adaptive capacity in Canada is generally high but can be unevenly distributed.^{154, 155} A number of factors affect how people and communities understand, experience and respond to climate change, in some cases increasing risks and susceptibility to health impacts.^{154, 155, 269} Broader determinants of health, such as age, income, housing conditions, and community factors such as population density, level of economic development, income level and distribution, local environmental conditions and the quality and availability of health services all influence vulnerability to changes in climate.^{152, 153, 155, 270–272}

Factors that influence (both positively and negatively) community resilience to climate change need to be considered.²⁶⁹ Community-based research initiatives can support innovation and inform strategic planning and capacity building efforts and be an important source of

knowledge.^{273, 274} The EnRiCH project (Enhancing Resilience and Capacity for Health), led by the University of Ottawa, is an example of a recent project that examined community resilience and developed, tested and evaluated community mobilization interventions to enhance resilience in at-risk communities.^{275, 276} An important factor that can enable communities to be resilient in the face of extreme weather events and deteriorating community infrastructure is strong neighbourhood connectivity and cohesion.^{269, 274} Similarly, Australia developed a strategic framework that identified social cohesion as valuable in guiding local climate change planning and action.^{170, 277}

Vulnerability to climate-related health risks can be reduced through prevention and adaptation.^{154, 269} Encouraging public participation at all levels (e.g. local, regional and national) helps communities prepare for and respond to the health risks of climate change.²⁷⁸ Health Canada's Climate Change and Health Adaptation Program for Northern First Nations and Inuit Communities supports the development of community projects across Canada's North that focus on climate-influenced health issues.^{169, 243, 279} The program is unique in recognizing that the adaptive capacity of communities varies and that they experience different challenges. It encourages communities to become more engaged by integrating local knowledge with science-based knowledge to develop promising local adaptation strategies that address vulnerabilities.^{243, 279–281} From 2008 to 2011, the program funded 36 community-based projects and developed a variety of communication materials (e.g. on drinking water, food security and safety, and land, water and ice safety) to support decision making on health-related issues.^{243, 279–281} Through these measures, communities have also increased their knowledge and understanding of the health effects of climate change. This knowledge enables communities to find ways to address vulnerabilities at a community level, mitigate risks, adapt to the challenges and protect health.^{279–281}

More research into how populations and communities are vulnerable to changes in climate is needed to inform decision making.^{155, 270, 271, 282} Vulnerability assessments can foster a better understanding of risks posed by climate change and inform the development and implementation of effective adaptation measures.^{269, 278, 282, 283} Assessments need to be ongoing to address current and future risks and barriers to adaptation.^{282, 283}

Continuing investment in research

Health research is both valuable and important. More research into climate change can foster a greater understanding of how these changes influence the health of Canadians.¹⁵⁴ For example, the Public Health Agency of Canada's Preventative Public Health Systems and Adaptation to a Changing Climate Program (2011–2016) was initiated to conduct research and enhance surveillance methods, engage public health stakeholders and inform decision making on climate change adaptation.²⁸⁴ Such research can help to answer specific questions or address existing knowledge gaps and shed more light on potential climate-related health risks. As well, contributing more knowledge to climate change discussions can help develop more appropriately targeted and evidence-based public health adaptation initiatives. Research can help identify more effective strategies and tools to protect those Canadians who are more vulnerable to exposures and risks. Research is also needed to enhance response capacity to handle the challenges that climate change is expected to place on public health in the future.^{152, 154, 155, 284}

Increasing education and awareness

Public communication and education initiatives play an important role in establishing healthy behaviours and choices.^{154, 155, 285} A more informed public, aware of the steps that can be taken to reduce risks and protect health, can also bring about changes in the environmental conditions that affect their health.^{154, 155, 285} For example, a health promotion approach to reducing sources of air pollution would encourage and support the use of more environmentally friendly means of transportation (e.g. walking, biking and using public transit), while promoting a more active and healthy lifestyle.²⁸⁶

Ways to educate and raise awareness about climate-related health risks include broad public messaging on environmental health issues and targeted campaigns that focus on a specific sector (or target audience) and a particular health issue. Approaches that raise awareness of potential health risks and also provide specific advice on how Canadians can best protect themselves are also beneficial.^{285, 287} Such approaches, which encourage people to play an active role in their own health and safety by being prepared could include public health messaging on health, safety tips, health marketing materials and educational toolkits for public health professionals' use.^{288, 289} It can also be useful to consider different

communication strategies and outlets, such as new technologies and social media, in order to disseminate messaging more effectively.^{154, 285}

Health promotional materials have been created to inform Canadians about reducing their exposure to the WNV.^{290–292} Efforts have also targeted those at an increased risk of exposure such as active seniors and those who spend more time outdoors.²⁹² The province of Alberta utilized a series of marketing strategies including informational radio interviews called *Let's Go Outdoors*, insertions in newspapers and magazines targeted to high risk areas and a general public awareness campaign *Fight the Bite*.²⁹² As part of the WNV public education campaign, First Nations and Inuit Health regional staff provided consultations to First Nations residents and community and healthcare workers to educate about WNV and the steps to take against it.²⁹³ Other provinces/territories and regions across the country have used similar strategies.¹⁵⁵

The Public Health Agency of Canada has developed a comprehensive action plan to educate and raise awareness of both the general public and healthcare professionals on Lyme disease to mitigate the risks to Canadians posed by the disease. The *Action Plan on Lyme Disease* will feature a series of communication activities including advertising campaigns, outreach materials, media engagement such as interviews, conference presentations and webinars, and social media activities.²¹¹

Developing approaches to communication that are effective at getting people to adopt health-promoting behaviours is a central challenge.^{154, 285, 294, 295} Research indicates that, despite public health messaging, people may not be acting on the information and making choices or changes to reduce health risks.^{154, 294–296} For example, heat-health communication campaigns aim to increase knowledge of the potential risks to health from extreme heat and to influence individuals to adopt protective behaviours.²⁸⁷ A review found that people had poor perception of heat-health risks and were confused by existing heat-health messages, and that messaging did not target the appropriate audiences.^{294, 296} Effective public outreach initiatives need to be delivered during periods of high risk (e.g. before and during the warmer months and during extreme heat events) and through a variety of communication outlets such as media (mass/broadcast and targeted), interpersonal networks and community events (see the textbox "Air Quality Health Index").¹⁷⁴

Air Quality Health Index

The Air Quality Health Index (AQHI) is a health risk scale that describes conditions hourly and provides twice daily Environment Canada forecasts on the mixture of pollutants in the air.^{297–299} Included are messages on how to reduce the short term associated risks as well as health advice targeted to specific vulnerable groups—children, seniors and people with cardiovascular and respiratory disease—as well as the general population. The goal of the index is to support Canadians in making informed decisions that can reduce associated risks to health from exposure to poor air quality.^{155, 297, 298, 300}

People can disassociate air quality health risks from their own situation, either by underestimating their own exposure or assuming the risks apply to other people who are more vulnerable.^{155, 294} Most Canadians know that air quality advisories are provided in their area. However, this information initially had a limited impact in attracting attention and prompting actions to reduce personal exposure, even during poor air quality events.^{155, 297, 300} In response, a number of social marketing initiatives were undertaken to make the AQHI as effective as possible at reaching sensitive populations. Media partnerships, particularly with The Weather Network, were also formed to increase the reach of AQHI through television, print, radio, automated telephone and the Internet.^{155, 297, 298, 300} Partnerships were also developed with other government agencies and non-governmental organizations who work directly with sensitive populations.³⁰⁰

An early evaluation of the AQHI showed an increased awareness of risks and use of information and products among at-risk groups. A later evaluation, in 2010, noted further opportunities to broaden the use of information and products.^{297, 300, 301} Outreach efforts with non-governmental health organizations have led to broad support by the Canadian health community with positive signs with respect to public awareness.³⁰²

To increase the effectiveness of communication campaigns, collaboration is needed to deliver consistent, audience-appropriate and easily understood messages. Communication materials should target vulnerable populations and their caregivers and proactive action strategies should consider differences in perceptions, knowledge and abilities. The effectiveness of public communication and education initiatives can be improved by engaging the community to identify risks, develop and share best practices, and tailor activities and products to the needs of specific regions, communities and populations.^{174, 287, 294, 295}

There is also a need to improve awareness and knowledge of the risks to health caused by climate change. Adaptation measures among public health and emergency management professionals and the general public can help in developing effective communication materials whose aim is to reduce health risks associated with climate change. Developed through Health Canada's Heat Resiliency Initiative, the report *Communicating the Health Risks of Extreme Heat Events: Toolkit for Public Health and Emergency Management Officials* identifies communication strategies, based on leading research and practice, to influence behaviours through health promotion campaigns.²⁸⁷

Building and sustaining healthy environments

Improving the potential of communities to promote health in the face of climate change will be an ongoing challenge. More is needed to make Canada's infrastructure more resilient, particularly in relation to extreme weather events.^{154, 155, 303} The state and age of roads, sanitation facilities, wastewater treatment systems, flood control structures and building standards and codes are integral to the protection of health.^{154, 155, 303} Recent impacts of extreme weather events like the 2013 Southern Alberta floods demonstrated the need to develop new infrastructure designs that can better withstand more intense weather events.^{304, 305} Initiatives to help support rebuilding aging infrastructure, such as the 2014 New Building Canada Plan are also important.³⁰⁶ As current infrastructure is upgraded and replaced, it is important to consider new and updated design values, revised codes and building standards, and new approaches to incorporating climate change considerations into planning designs.^{154, 155, 307}

In addition, it is important to consider the opportunities and limitations of various aspects of infrastructure in urban and rural areas in Canada in terms of their capacity to adapt to climate change.^{153–155} About 82% of Canadians live in urban areas and this population is growing.^{15, 308} While urban areas tend to be wealthier and have more access to services (e.g. healthcare, social services and education), they also tend to depend more on critical infrastructures (e.g. energy, transportation and water) and experience more severe heat stress and poorer air quality.^{153, 309} The impact of extreme weather can also be exacerbated in highly populated areas. Also, with increased urbanization and population pressures, Canadians are moving into more marginal land, such as coastlines and floodplains. New construction and urban plans and designs should take into account protection from weather-related natural hazards, as these settlement patterns could increase health risks.^{154, 155, 310–314}

Likewise, smaller, remote and rural communities can experience challenges, particularly due to limited support services, resources and infrastructure, resulting in residents being less protected.^{153, 315} Infrastructure in northern communities is particularly vulnerable to changing ice conditions and can present additional challenges to the design, development and management of infrastructure in the North.^{154, 167, 266, 272} Access to tools that enable these communities to adapt infrastructure to these changing conditions is necessary.^{266, 272, 316} The Northern Infrastructure Standardization Initiative, led by the Standards Council of Canada (SCC) with support from Aboriginal Affairs and Northern Development Canada, is one measure taken to address this issue.³¹⁷ The initiative supports adapting northern infrastructure to a changing climate by changing critical codes and standards to address the effects of climate change on new infrastructure as well as maintaining and repairing existing infrastructure. The SCC aims to identify gaps and needs in existing codes and standards to support infrastructure and ensure it reflects the unique circumstances of this region in light of changes in climate.^{266, 316}

As mentioned, strategic and smart land-use planning is essential.^{155, 318} The design of cities and roadways, and the location of places of work and home and other aspects of land use all affect the health of Canadians.^{154, 309, 319} For example, planning can influence how much Canadians need to use motor vehicles to get around, which also influences transportation's role as one of the major sources of air pollution.^{309, 320} Neighbourhood designs that include

high-quality pedestrian environments and a mix of land uses (e.g. planting trees, increasing green spaces, patterns of subdivisions, housing and buildings, etc.) can improve health by promoting active forms of transportation, reducing air pollution and associated respiratory ailments and lowering the risk of motor vehicle-related accidents.^{309, 318–324}

While these measures are not direct public health functions, there is still a role for public health to play. Public health officials can inform and educate the public about health risks, advocate for changes that promote and improve health and work together with land-use and building planners, community and regional officials to encourage the adoption of health-promoting changes in urban planning and community infrastructure.³¹⁸



Surveillance and monitoring

Research data and analysis gathered from public health surveillance systems and tools can support a number of public health functions.³²⁵ In the case of infectious diseases, it can help to identify changes in disease trends, including patterns associated with changes in climate (see the textbox “The Rothamsted trap”).^{213, 326} It can also be used as a reporting function to identify vulnerable or affected individuals and communities in

order to implement response and disease control measures to reduce further exposure to health risks.³²⁵ During the WNV season, the Public Health Agency of Canada, together with other national, provincial and territorial public health authorities, produces a weekly WNV MONITOR report and map. This report summarizes the activity of the virus across Canada. Information in these reports can be used by provincial and municipal health authorities to ensure Canadians know how to reduce their exposure to risk.^{327, 328} As well, research gathered through surveillance initiatives can provide a clearer picture of health concerns to facilitate informed decision making and appropriate public health action. This ensures efforts are targeted and resources appropriately allocated where they are most needed.³²⁵ Research data informs and supports the development of policies and strategic plans such as the Public Health Agency of Canada's *Action Plan on Lyme disease*.²¹¹ All of these measures are important in preventing and controlling infectious diseases.³²⁹

The Rothamsted trap

In collaboration with Brock University and the Public Health Agency of Canada, Niagara Region Public Health constructed a Rothamsted trap to capture insects that may serve as carriers of infectious diseases.^{213, 326, 330} The trap, measuring 40-feet high, acts like a vacuum, collecting around 300 insects per day from May to October.³³¹ The trap was modelled after the work of Rothamsted Research, an agricultural research centre in the United Kingdom that first developed the traps.³³¹ Although in service in Europe for a number of years, this Rothamsted trap is the first to be used in Canada.^{213, 326, 330} As part of the Pilot Infectious Disease Impact and Response System program, this is an initiative in vector identification and disease surveillance. It can help researchers detect new/exotic disease vectors before human disease cases are reported. It can also support current vector-borne disease strategies and public health responses.^{213, 326, 330}

Early warning systems have been developed as a precautionary measure to detect a number of climate-related health risks including air quality concerns (see the textbox "Air Quality Health Index"), wildfires, extreme heat and ultraviolet radiation.^{155, 191, 287, 332}

These forecasting tools can help in mobilizing public health action by issuing public advisories and alerts to mitigate health risks before impending dangerous health conditions occur. These systems also support broader surveillance and information sharing initiatives.^{155, 175, 191, 287, 332-335}

Several communities in Canada, as well as in Australia, Europe and the United States, have developed heat-health action plans and warning systems such as Heat Alert and Response Systems (HARS).^{174, 333-337} HARS are developed to reduce heat-related morbidity and mortality during extreme heat by alerting the public, including vulnerable populations, about the risks and providing individuals with information and other resources to help them protect themselves during an extreme heat event.^{174, 338} Since 2008, Health Canada has worked with federal, provincial and municipal partners to implement a Heat Resiliency Initiative which supports the development of HARS. This initiative also aims to strengthen the capacity of communities, healthcare professionals and individuals to manage heat-related health risks.³³⁹ Evaluations of the few existing HARS demonstrates that these systems can help to protect people from illness and death associated with extreme heat events particularly when based on knowledge of community- and region-specific weather conditions that result in increased heat-related health concerns.^{174, 334, 338} Future efforts may consider public risk perceptions in relation to changing behaviours to protect health; choosing alternative communication strategies that increase awareness and change behaviours; conducting vulnerability assessments to identify and target interventions; monitoring HARS activities and evaluating them at the end of the heat season; and implementing long-term preventative actions that reduce heat exposure and negative health outcomes.^{154, 174, 338, 340}

Emergency planning

The potential for more frequent and severe extreme weather events necessitates effective emergency management measures. Indeed, planning for the unexpected is a key challenge posed by climate change.^{155, 341} Climate-related emergencies can escalate quickly in scope and severity,

cross provincial and regional boundaries, take on international dimensions and significantly impact health.^{154, 155} Extreme weather events can overwhelm the capacity of communities and local governments to respond—particularly if they are unprepared. It is important to consider how extreme weather events can compromise critical infrastructure and emergency services, limit access to support services and resources and challenge efforts by emergency management personnel to manage exposure and reduce impact.^{269, 341}

Comprehensive risk management measures that (pre-impact) reduce, prevent, prepare for and mitigate emergencies, and help in the (post-impact) response and recovery can reduce health risks and protect health, lessen the impact on critical public services and preserve infrastructure and the environment.^{269, 341-344} Proactive planning can also bring to light gaps or areas of deficiencies and limited resources, and identify more

vulnerable population groups, to redirect or enhance efforts and resources where needed.¹⁵⁵ As well, the use of risk assessments and evaluations can help to reduce vulnerability and mitigate potential impacts. All of these community emergency management measures can help to increase community resilience.^{269, 341}

Continuing efforts

Canadians remain vulnerable to the effects of climate change and its impacts on the health. Public health has considerable experience in reducing risks to health from environmental change; this experience can be drawn upon to meet the challenges posed by climate change. Long standing, core public health functions can provide a strong basis for protecting Canadians from climate-related health risks. Efforts made now can significantly reduce vulnerability to the health impacts of future changes in climate.

PUBLIC HEALTH CAN:

- continue research to better understand how changes in climate affect health particularly that of vulnerable Canadians;
- increase awareness among public health professionals and the general public about the health risks of a changing climate;
- be proactive and consider short- and long-term climate changes;
- find ways to adapt to reduce the impacts on health;
- optimize ongoing assessments and share best practices and lessons learned to develop more effective public health adaptation programs; and
- support multijurisdictional, multidisciplinary collaborative approaches to tackle the challenges of climate change in Canada.

HIGHLIGHTS

- Technology can be used in numerous ways to improve, promote and monitor health.
- Within the field of public health, technology can be a tool for researchers, public health professionals, communities and individual Canadians.
- The ubiquitous nature of computers and their related technologies can play a key role in implementing and delivering health promotion and prevention programs.
- Social media is an emerging and rapidly changing technology that lends itself to key areas of public health, particularly those that involve the sharing of information, such as improving health literacy and surveillance.

DIGITAL TECHNOLOGY AS A TOOL FOR PUBLIC HEALTH

As technology has evolved, so has its use and application to public health. The telephone has gone from being a tool to transmit electrocardiograph data early in the 20th century to a way for patients to receive health information and advice from health professionals remotely, via telehealth systems.^{345, 346} Canadians have become accustomed to the technology that routinely surrounds them when they access health services or programs, from computerized health information systems and electronic medical records to diagnostic tools and treatment equipment. Personal computers and mobile



device apps are used to connect with health-related information and tools. Behind the scenes, scientific researchers make use of technology to develop new methods and tools for public health and also to create new technology itself.

Technology can provide public health professionals, communities and individuals with a wide range of tools to address issues of public health more efficiently and quickly in a more connected way. As technology continues to advance, its role in public health will also change. The vast range of available technologies will continue to be used in educating, informing, training and communicating with both the public and public health professionals; in surveillance and data collection for detecting infectious disease outbreaks; in monitoring of chronic disease and injuries; in monitoring and evaluating programs; in making transparent and evidence-based decisions; to improve the speed and accuracy of diagnoses; and in providing new and more effective treatments. New and innovative uses of technology for public health will also emerge as the field continues to grow and evolve.

This section presents just some of the ways in which certain digital technologies can be and are being used to address several key functions of public health.

Health promotion and protection

Health promotion is a core function of public health. Public health practitioners and professionals work with communities, agencies and individuals to develop and implement programs and interventions aimed at positively influencing health behaviours.³⁴⁷

EHealth interventions

Once a program or intervention is developed it must then be delivered. Technology can help by providing the means through which such programs and interventions are offered. In particular, eHealth interventions allow public health to benefit from current technologies.³⁴⁸

EHEALTH is defined as “health services and information delivered or enhanced through the Internet and related technologies.”³⁴⁹

A literature review assessed the ways that particular types of eHealth interventions, are being used to encourage the adoption of health promoting/protecting behaviours.³⁴⁸

EHealth interventions can take numerous forms and address a vast range of issues.³⁴⁸ To provide a manageable and focused assessment, the review excluded eHealth interventions involving telehealth, telemedicine, television or radio, use of electronic health records, gaming or videogames, and personal wearable devices, and interventions were narrowed to include traditional public health functions.³⁴⁸ The literature identified studies in the United States, the Netherlands, the United Kingdom, Australia and Canada that used websites and web portals; email and text messaging; goal setting; assessment and monitoring/tracking; risk assessments; online training, counselling/motivational interviewing; tailored feedback and peer and expert advice; and social network sites, live chats and discussion boards as intervention tools.³⁴⁸ The public health issues addressed through the interventions included diet, nutrition, healthy weights, increasing physical activity, smoking cessation, sexual health promotion, immunization uptake, substance use reduction and general and/or multiple lifestyle issues.³⁴⁸ The intervention approaches were classified into three categories: web-based; mHealth (mobile technologies, such as cell phones, tablets etc.); and computer-based (stand-alone computers without Internet, such as a computer kiosks or CD-ROMs).³⁴⁸

The studies included in the review mostly targeted adults from the general population as well as adolescents, college/university students and adults in workplace settings.³⁴⁸ A large number of the studies targeted youth in relation to improving healthy eating and physical activity.³⁴⁸ Young adults were also most often involved in studies related to sexual health such as increasing screening for sexually transmitted infections (STIs) and adopting healthier sexual behaviours.³⁴⁸ Employee interventions targeted multiple lifestyle behaviours, mostly related to healthy eating and increasing physical activity.³⁴⁸ Only a few studies analyzed interventions with seniors; one examined seniors’ use of mobile phones and another focused on a web intervention, with both aiming to increase older adults’ level of physical activity.³⁴⁸ In light of the aging demographic in Canada, the increased use of the Internet among those over 55 years of age, the lack of interventions for this population and the promise shown in the above studies, this is a potential area for growth.³⁴⁸

Canadian studies focused mostly on web-based or online (enhanced and/or interactive websites or web portals) programs and on one texting intervention.³⁴⁸ The studies addressed a variety of health topics: uptake of vitamin C, reduction in alcohol use, reduction in smokeless tobacco use, increase in physical activity, general health-seeking behaviours, reduction in drug use and increased access to information on sexual risk behaviours and testing for STIs (see the textbox “Using technology to increase testing for sexually transmitted infections”). Interestingly, over half of these studies targeted adolescents and young adults.³⁴⁸



Using technology to increase testing for sexually transmitted infections

In 2011, Ottawa Public Health launched the *Get Tested. Why Not?* campaign targeting 15 to 29 year olds. The campaign focuses on increasing STI testing for chlamydia and gonorrhoea, as well as increasing access to health information. The campaign uses a bilingual, youth-friendly website to provide information and answers to questions about STIs. Website visitors are able to assess their risk for STIs and their appropriateness for testing. They can then download a testing requisition form directly from the website and use it to have a biological (urine) sample submitted to any local participating laboratory. Although visitors are advised to follow-up with their regular doctor or at a sexual health centre immediately should they have any symptoms, this approach eliminates the need to visit a primary care provider before being tested.³⁵⁰ After the first year of the campaign, surveyed participants indicated gaining more knowledge, such as information about services for STI testing and risks of contracting STIs, and felt that they would change their behaviours, such as asking partners to get tested and to use condoms.³⁵⁰ In 2013, Ottawa Public Health launched a new sister site to *Get Tested. Why Not?* called *Sex It Smart*. The intent is to support safer sex practices by not only encouraging testing to prevent the spread of STIs but also increasing access to free condoms. Individuals/agencies can go online and order free condoms that will be mailed directly to their home or prepared for agency pick-up.⁶⁰⁷

Overall, study results indicated that eHealth interventions are feasible in controlled settings and that individuals are generally open to using technology to monitor and improve health behaviours, attitudes and beliefs.³⁴⁸ In some cases, certain features of the technology, for example, brief, relevant and positive text messages, were better at enhancing engagement.³⁵¹

The effectiveness of interventions varied based on the health topic. Alcohol use reduction/prevention studies and sexual health studies showed mostly positive and significant outcomes, whereas smoking cessation and multiple risk factor studies showed both positive



and negative outcomes, depending on the type of intervention.³⁴⁸ The eHealth intervention studies associated with the most positive and significant outcomes were those that mixed components (e.g. website plus face-to-face support), tailored components to individual needs (personalized feedback or advice) and integrated behaviour change theory, irrespective of health topic.³⁴⁸ In addition, many studies showed effects over the short term (less than 6 months), but longer-term results were lacking.³⁴⁸ In assessing the level of effectiveness of such interventions, reported study limitations such as self-reported outcome measures, limited ability to generalize of results due to small sample sizes, high attrition rates and loss to follow up must be kept in mind.³⁴⁸

As with other uses of technology as a public health tool, accessibility should be taken into account to ensure equitable program and service delivery. For example, in all but one of the mHealth intervention studies, participants had to have a cell phone, and in some cases, a data plan.^{348, 352} Using text messaging can potentially marginalize populations with low literacy levels or without access to a mobile phone.³⁴⁸ Interventions need to match the target population and be integrated into the pool of public health interventions.³⁴⁸ EHealth strategies need to deliver health information through culturally and socioeconomically acceptable formats; increase skills in delivering accessible health information; and engage online social network members who assume leadership roles as well as trusted people (e.g. elders).^{348, 353} To address health equity concerns, factors that need to be considered include lack of physical access to technology; lack of meaningful access (information needs to be designed to reach and appeal to diverse populations); language abilities and eHealth literacy skills; age; disability; and cultural relevance of tools.^{348, 354} It is critically important to engage end users in co-designing interventions to ensure relevance, uptake and sustained use of eHealth interventions.³⁴⁸

There is definitely room for careful application of eHealth interventions in public health in Canada, with attention needed to address challenges to health equity. There is also a need to support further research of eHealth applications in the Canadian context.³⁴⁸ New interventions, including some that have already been implemented, continue to be developed (see the textbox “ImmunizeCA”).

ImmunizeCA

Immunization is one of the great success stories of public health.³⁵⁵ The reduction in the number of cases of vaccine-preventable diseases in Canada has been key in contributing to improved overall health and increased life expectancy.³⁵⁵ All Canadian provinces and territories have a recommended immunization schedule for their residents and a system for recording those immunizations.³⁵⁶ However, it can be difficult for individuals to keep track of, and manage, their own immunizations or those of their children, which may lead to missed or incomplete immunizations. In March 2014, the new ImmunizeCA mobile application (app) was released to help Canadians track and manage their immunizations and records more easily.³⁵⁷

ImmunizeCA is a bilingual app developed with funding from the Public Health Agency of Canada through collaboration between the Canadian Public Health Association, Immunize Canada and the Ottawa Hospital Research Institute.³⁵⁷ The app provides access to personal immunization records, schedules and information specific to Canadian children, adults and travellers.^{357, 358} It is customizable to the user’s age, gender and home province or territory allowing the information to be tailored to their particular situation.³⁵⁹ In addition to storing personal records it allows quick, easy access to reliable, expert information about immunization schedules, vaccine-preventable diseases and vaccines.³⁵⁸ It also allows people to manage appointments and provides alerts for disease outbreaks in the area.³⁵⁸

The new ImmunizeCA app is available for Android, iPhone and BlackBerry systems and can be downloaded for free from Google Play, iTunes and BlackBerry World.³⁵⁸

Looking at the way in which technology is being used to encourage health-promoting and protecting behaviours, it is clear that the potential exists to improve use of social networks.³⁴⁸ Some individual health behaviours and resulting chronic conditions, such as smoking and obesity, have been shown to be “contagious” to some degree, that is, they tend to “spread” within social networks.^{360–362} If an individual has social connections to others who smoke or are obese, they are more likely to smoke or be obese themselves.^{360–362} Knowing this, social media in particular could be used to identify public health programs and interventions and target individuals, rather than an entire network, with the intention that individual change will spread to others.³⁶⁰

Education and awareness

Improving health literacy

Public health uses education and awareness programs to influence health behaviours and increase knowledge so that Canadians are better able to manage and understand their own health and that of others.² However, to play a role in managing one’s own health requires a certain degree of health literacy, that is, the ability to access, understand and apply the relevant health information.²⁶⁷ The Canadian Council on Learning found that 60% of all Canadians over the age of 15 do not have the necessary level of health literacy to obtain, understand and act on health information or make appropriate health decisions.^{363, 364}

Public health can use technology in various ways to improve Canadians’ knowledge and awareness of their health. One way is to use technology as a tool to improve health literacy. A main component of health literacy is the capacity to obtain the basic health information needed to make appropriate health decisions.³⁶⁵ Although information on its own is likely insufficient to bring about a change in behaviour, it is still a necessary component. Social media has the potential to help Canadians get that information.³⁶⁶

HEALTH LITERACY is “the ability to access, understand, evaluate and communicate information as a way to promote, maintain and improve health in a variety of settings across the life-course.”²⁶⁷

The Internet is an extremely common source of health information in North America.^{366, 368} A 2012 survey found that three-quarters of adults in the United States searched for health information online in the previous year.³⁶⁹ In Canada, 70% of home Internet users searched for medical or health information online in 2009, up from 59% only two years earlier.³⁶⁸ With more than 200 million monthly active users worldwide on Twitter and more than one billion on Facebook, social media is positioned to connect millions of Canadians with important public health information.^{370, 371}

Although social media is popularly believed to be the domain of younger people, research in the United States found that almost two-thirds of Internet users aged 50 to 64 years and almost one-half of those aged 65 years and older were using social networking sites such as Facebook and Twitter in 2013.³⁷² Consequently, it only makes sense that health organizations reach out to this ready-made audience.³⁶⁶

Aside from its built-in user base, social media has a number of features or aspects that make it an effective means of sharing health information. For example, minimal effort is necessary to share information in real time.³⁷³ Organizations can take advantage of the existing infrastructure, which may make using it inexpensive.³⁷³ The multidirectional nature of the communications allows for quicker and more extensive distribution of the information than traditional methods.³⁷³

Simply having access to the information, however, is just one aspect of health literacy; the user must also be able to understand and evaluate the information to make appropriate health decisions.²⁶⁷ The information and approach must therefore be adjusted to users' levels of reading and comprehension.³⁶⁶ In addition, knowing how family, social context, culture and education play a role is key.^{374, 375} These influences can affect how individuals receive health information, perceive health problems, express their symptoms and their views on what, and by whom, treatment should be provided.^{375, 376}

SOCIAL MEDIA refers to interactive “websites and applications that enable users to create and share content or to participate in social networking.”³⁶⁷

Exclusive reliance on text in health messages can be a barrier to health literacy.³⁷⁷ Online health information providers should also consider alternative and complementary media formats—photographs, illustrations, animation, video, live seminars and interactive games—and learning environments that allow Canadians with literacy or language issues to more easily understand the information (see the textbox “T2X: Getting the message to teens”).^{374, 377}

T2X: Getting the message to teens

Funded by the National Institutes of Health in the United States, Teen 2 Xtreme (T2X) is a website (www.t2x.me) developed for teens to use social networking to improve health literacy.^{378–380}

The website is intended for teens only and includes content written both by teens and professionals.^{378, 380} Visitors can learn more about relevant health and life issues such as nutrition, sexual health, smoking, stress and violence and others.^{378, 380} The site uses numerous interactive resources including blogs, video sharing, text messaging, games and chats to get the information out.^{378, 379}

Teens can chat 24/7 and in real time with health experts, participate in online health-oriented social networking and access educational campaigns that allow them to text keywords to a designated number and receive a response on their mobile devices with customized content on the T2X website.³⁷⁸ Current educational campaigns include Talking to Your Doctor, ReThink Your Drink (which discourages consumption of soft drinks), Pertussis, Meningitis, Stop Bullying and Smoking Prevention.³⁸¹ Members participating in a particular campaign complete a pre- and post-test of their knowledge of the topic and their change in intention about a related health behaviour. Results so far are positive.³⁸¹ For example, among teens participating in the ReThink Your Drink campaign, post-tests showed a 21% improvement in knowledge, 26% change in attitude and 19% change in intention for positive behavioural change.³⁸¹

The strength of social media is the ease with which users can exchange information, rather than merely passively receive one-way statements.³⁸² Dynamic back-and-forth interchanges can take place with peers or with healthcare professionals. People find it helpful to discuss symptoms, treatments and concerns with their peers with similar health issues or similar questions.^{377, 383} Social media allows Canadians to do so from the comfort and privacy of their own homes. This allows them to ask questions they might be too embarrassed to ask their doctors.³⁷⁷ Communicating with people with whom they perceive they share a problem can help patients open up.³⁷⁷ In addition, it may be easier to understand information shared by peers than the jargon used by some healthcare professionals.³⁷⁷ People can connect with each other where otherwise they may never have due to barriers in geography, distance or the rarity of their condition.³⁸³ This access to a broader range of information can increase their knowledge and help them make better, more informed decisions about their health.^{377, 383} Even between peers the information exchange can go beyond text to include photos or video. For example, a fertility specialist in the United States asked one of his patients to produce a video showing her self-administering her daily in vitro fertilization (IVF) injections. The video was then posted on YouTube for other patients to watch to help them overcome their fears and gain confidence in their own abilities.³⁷⁷

The aspects of social media that make it well suited as a positive tool for health literacy are also its main drawbacks. The speed and range of messages that pass through social media, along with its largely un-moderated format, create potential risks.^{374, 377} The risk of spreading inaccurate, biased or incomplete information or misinformation is considerable given that basically anyone is allowed to post anything they want.^{366, 374, 377} The source of the information may be missing, thus preventing assessment of the credibility of the information.³⁷⁴ The information may be correct, but written in such a way that it could be misunderstood and have negative health consequences.^{366, 374} The viral nature of social media then allows this information or misinformation to spread very quickly, especially during times of public anxiety or fear.^{366, 374}

Health organizations may also consider privacy issues and the value of employee time as reasons against adopting social media as a tool for public communication.³⁸⁴ They must also be careful not to cross the fine line between providing general information and giving specific medical advice in a public venue.³⁸⁴

Some of the risks associated with social media can be lessened, however, by building trustworthy websites and by monitoring and moderating content. Official websites such as those of the Public Health Agency of Canada, the United States Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) can be promoted to Canadians as trustworthy and credible. The content of social media websites should be monitored to prevent spam, malicious content or privacy violations without eliminating the individual user's ability to freely post content.³⁷⁴

Social media tools are only of use if people are able to access and use them, which not all Canadians can.^{377, 385, 386} Barriers to access include cost, location, low literacy levels, disability and factors that relate to people's capacity to use these technologies appropriately and effectively.^{377, 386} These are the barriers faced most often by some of the most vulnerable Canadians who are also some of those most in need of improved health literacy. They include older Canadians, people living in low-income households and those living in remote and northern communities, which may include First Nations, Inuit and Métis people.³⁸⁷

Moving past the barriers requires improving access to technology and, when necessary, tailoring the information and messages to those with limited health literacy. In terms of access, one solution is to make the technology publicly available in schools, libraries and health clinics or doctors' offices.³⁷⁷ In fact, most schools and libraries already offer public computer use; some may also have staff on hand who can assist or instruct users.³⁷⁷ Placing accessible computers in clinics or other places used for health-related reasons would allow people to access information that may be pre-screened or recommended by knowledgeable staff.³⁷⁷ For those with low general literacy or physical limitations that may make traditional browsing difficult, touchscreens with visual cues and icons could help eliminate those barriers.³⁷⁷



Surveillance

Surveillance—the collection, analysis and reporting of data in order to track and forecast health events and determinants—is central to any public health system.³²⁵ Through surveillance public health officials can identify and respond to public health threats, create practical, evidence-based policies and programs, and meet Canada’s international public health obligations.³²⁵

Global health surveillance

Just as the Internet and social media can provide individuals with important information, they can also be a source of invaluable data for public health professionals

“PUBLIC HEALTH SURVEILLANCE is the ongoing, systematic collection, analysis, and interpretation of health data, essential to the planning, implementation and evaluation of public health practice, closely integrated with the dissemination of these data to those who need to know and linked to prevention and control.”³⁸⁸

and official organizations around the world. Global health surveillance has changed, and it continues to adapt in light of the worldwide influence of the Internet.³⁸⁹ Information can flow freely and rapidly, allowing for the quicker detection of outbreaks and speedy dissemination of information between officials and to the public.³⁸⁹ In addition, the sources of information available online provide a different perspective to that offered by traditional health reporting.³⁸⁹

The Internet and social media’s value as surveillance tools lies in the fact that changes in information and communication patterns on the Internet can act as an early-warning system for epidemics and outbreaks or other changes in population health.^{389–391} Conversely, public health officials can use data about the information being shared by the public to target public health campaigns, educate, correct misinformation and alleviate fears.^{390, 392} This is what WHO did during the days following the Japanese tsunami in 2011.³⁹³ Social media was used as a communication tool to allow WHO to manage critical health information being shared with the public after the incident (see the textbox “Fukushima radiation threat: Informing the public through social media”).³⁹³

Fukushima radiation threat: Informing the public through social media

During the Japanese tsunami and Fukushima radiation emergency of 2011, WHO used social media to manage the global health crisis. Because some people were afraid of possible radiation poisoning from the damaged Fukushima nuclear reactor following the tsunami, they began drinking wound cleaner in the hope that the iodine in it would protect them. Others took iodine pills. WHO became aware of this through social media three days after the tsunami. The organization turned to Facebook and Twitter to warn the public that drinking the wound cleaner could be harmful and that they should see a medical professional rather than self-medicating with the iodine pills.

Three days later, WHO observed via social media that misinformation about iodine was leading people in China to hoard iodized salt and some people to consume seaweed or seaweed supplements for their iodine. Once again, WHO turned to social media to address the behaviour, tweeting that neither seaweed nor salt contain enough iodine to help against radiation poisoning and that, in fact, consuming too much iodized salt could cause poisoning. Just two days later, the success of WHO’s social media communications was evident when it was reported that Chinese consumers were trying to return their salt to retailers.

Social media facilitated the speed and ease with which WHO was able to respond to this particular global health crisis and continues to be used by WHO to educate, build awareness and clarify rumours.³⁹³

In addition to informal web and social media posts of members of the public, public health surveillance can make use of online secondary data such as news reports, expert newsletters and aggregate information that has already been synthesized, analyzed and/or reported.^{390, 394} A number of Internet surveillance systems that use a more selective approach and choose high quality, expert-curated secondary data sources are in use. These include the Global Public Health Intelligence Network (GPHIN), developed in Canada in 1997, and HealthMap, developed in the United States in 2006.^{389, 390, 394} These systems use an automated process to monitor and analyze online sources, facilitating early detection of global public health threats (see the textbox “Global Public Health Intelligence Network”).^{389, 390, 394–396}

Global Public Health Intelligence Network

The concept of Internet-based surveillance is not new. One of the earliest systems to be developed was the Global Public Health Intelligence Network (GPHIN), which was launched in 1997 as part of WHO’s Global Outbreak and Alert Response Network (GOARN).³⁸⁹ GPHIN is an electronic public health early-warning system developed by the Public Health Agency of Canada to help identify globally significant disease outbreaks and other health threats from around the world by taking advantage of the existing globalized virtual communications.^{389, 390, 395} GPHIN’s aim is to disseminate timely alerts to help control outbreaks, the spread of infectious disease, contamination of food and water, bioterrorism, natural disasters and exposure to chemical agents and nuclear materials.³⁹⁶

This global surveillance initiative is an Internet-based surveillance system that monitors open source information, such as news wires, discussion groups and websites, in nine languages and retrieves relevant reports.^{395, 397} These reports are reviewed by a team of multidisciplinary analysts who apply their interpretive and analytical skills to identify and flag to GPHIN members those public health events that may have serious public health implications.³⁹⁷ GPHIN’s state-of-the-art reporting techniques proved crucial in the early stages of the 2003 SARS outbreak.³⁸⁹

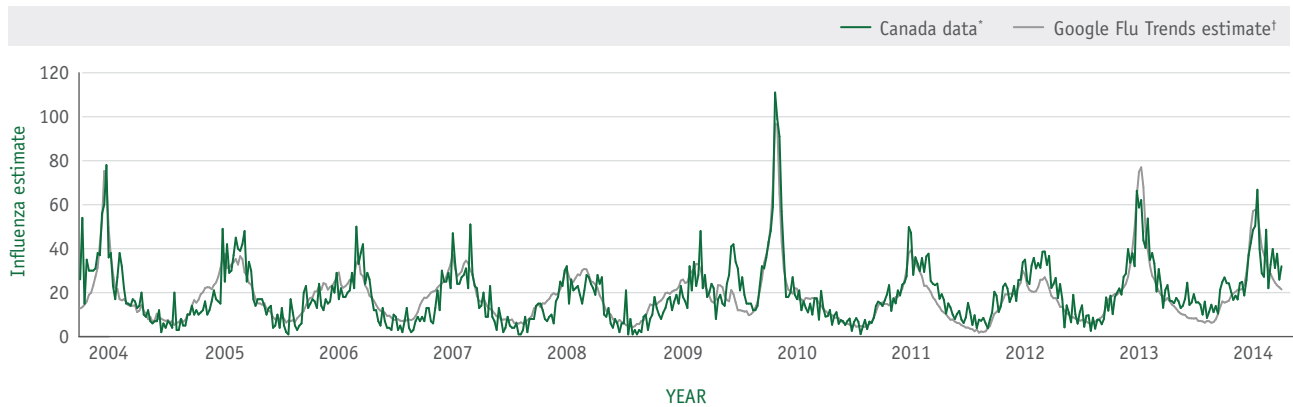
Syndromic surveillance

Syndromic surveillance, just as its name suggests, aims to track symptoms associated with a defined syndrome, such as influenza-like illness or acute respiratory illness, rather than depending on laboratory-confirmed disease data.^{398–400} Traditionally, this surveillance is carried out through reports from official sources such as emergency departments or primary care providers.^{398, 401} Nowadays, however, members of the general public can also contribute directly to these data through social media.^{399, 402} While people discuss their symptoms, illnesses and state of health with others in open forums, they are providing additional information for these surveillance systems.^{399, 400}

One area that has benefitted from the use of social media-based syndromic surveillance is influenza monitoring. Although diagnostic tests can be used to identify individual cases of influenza, the prevalence of influenza in the population at any given time can only be estimated.⁴⁰² Those estimates often rely on syndromic surveillance to capture symptoms related to influenza-like illness (ILI). However, not all people experiencing symptoms will visit an emergency department or physician, so traditional methods do not capture these data.⁴⁰¹ In addition, traditional systems rely on a limited number of sentinel sites for reporting and delays are frequent.⁴⁰¹ Capturing user-generated ILI-related information on the Internet may provide a more complete real-time picture of influenza trends and cases.^{401–403}

Google has taken that concept and created Google Flu Trends (GFT).^{403, 404} The idea behind GFT is that people with ILI perform search queries on their symptoms to find information that helps them self-diagnose. GFT tracks the search queries looking for keywords and phrases related to ILI. In fact, the estimates of influenza activity from the system have been shown to be highly correlated with data reported by official public health organizations around the world (see Figure 5).^{403, 404}

FIGURE 5. Canadian flu activity and Google Flu Trends, the week of September 28, 2003, through the week of March 30, 2014⁴⁰⁵⁻⁴⁰⁸



* Influenza-like illness per 1,000 patient visits.

† Estimates based on Google search data.

As good as these web-based systems are, however, they are not as accurate as traditional systems and can lead to incorrect estimates.⁴⁰⁹ In 2009, GFT greatly underestimated the prevalence of ILI at the beginning of the H1N1 pandemic in the United States.⁴¹⁰ Despite altering its algorithm after Pandemic H1N1, GFT severely overestimated peak flu levels for early in 2013 in the United States.⁴⁰⁹ Yet even with their limitations, systems such as GFT can still provide useful information. However, they are not meant as a replacement for traditional surveillance and reporting systems, but rather, they should be seen as complimentary to them. In fact, research has shown that a combination of data from both GFT and the CDC in the United States produced better estimates than either system on its own.⁴⁰⁹



As people’s Internet browsing behaviours only record proxy measures of influenza, they cannot measure other influenza-related data such as healthcare usage or the clinical spectrum of cases.⁴⁰¹ This type of data can be collected, however, by having individuals use an Internet-based questionnaire to record their specific symptoms and healthcare usage over time.⁴⁰¹ These Internet-based cohort systems have been implemented in several European countries, namely Belgium and the Netherlands (under the name “Der Grote Griepmeting”—the Great Influenza Survey), Portugal (“Gripenet”) and Italy (“Influweb”).⁴⁰¹ These systems have been shown to provide results in line with those from traditional surveillance methods and may be able to detect increased influenza activity more rapidly.⁴⁰¹ Such systems can work alongside traditional systems to provide complementary additional information.⁴⁰¹

Infectious disease outbreaks and trends are not the only things that can be captured through the mining of Internet and social media activity. People’s online searches, discussions and postings can also provide information useful in identifying issues surrounding chronic diseases, including mental illness.^{411, 412} For example, social media mining can show pockets of poor mental health or mental illness in communities, thereby allowing the relevant health service to develop early intervention strategies.⁴¹² Researchers in Taiwan found suicide to be correlated with lottery sales as an indirect indicator of feelings of hopelessness at the social level.⁴¹³ A South Korean study tested the hypothesis that social

media data such as weblog contents are more promising sources to gauge the public mood than activity such as lottery sales. The study found a significant association between social media data and the national suicide rate and resulted in a predictive model that could potentially be used to develop new models for use in forecasting and prevention of suicide.⁴¹⁴

Continuing efforts

This section has only touched on a very small piece of the picture in terms of the countless possibilities for the relationship between public health and technology. For instance, the idea of technology as a public health issue itself, such as the dangers of texting and driving, the

impact of social media on mental health or the change in youth interaction via social media as it relates to bullying, also needs to be addressed as technology continues to permeate more and more of Canadians' everyday lives. In addition, this report has not explored the very important ethical, legal and privacy concerns surrounding the use of social media as a source of data. These are legitimate concerns that must be brought to the forefront of any planning and discussions around this topic.

There are endless ways in which public health and technology do, can and will come together. Although the role of technology in public health in the future is as yet unknown, Canadians can take a cue from today and try to plan for and guide the relationship.

PUBLIC HEALTH CAN:

- support continued research into new technologies or the use of existing technologies as tools for public health;
- evaluate the efficacy of tools to ensure that technologies are not adopted under the assumption that all are beneficial or worthwhile;
- consider any barriers that may exist for the user or the recipient, such as language, culture, literacy level, geographic location, etc., to avoid potentially increasing any health inequalities when implementing technology-based tools; and
- ensure implementation of technologies in programs and policies is flexible, open, and responsive to new developments given the rapid rate at which technologies change.

MOVING FORWARD

The *who*, *where* and *what* of factors influencing public health touch on a broad range of topics, but all conclude with key priority areas that will drive public health into the future. The common underlying theme through the three independent sections of this report is one of *change*. Populations, environments and technologies are in flux, and public health, and other sectors, must plan and be adequately prepared for these increasingly rapid changes. Change can bring benefits, for example, technological advancements and universal design of built environments that contribute to public health. But change will also bring challenges such as caring for a growing elderly population. Public health has a role to play in building upon the benefits and addressing the challenges. However, given that we don't know exactly what the future holds, we need to be flexible and ready to respond quickly to any possible challenge that may arise. Each section in this report concludes that public health functions—protecting and preventing against disease and promoting health—are relevant not only now, but also in the future. Nor are they exclusive to what we conventionally think of as public health.



Planning for the future

People, organizations and sectors continually plan for the future. Every day, Canadians invest in education for their children, buy houses and save for retirement. People also make individual choices towards staying healthy by eating well and exercising. In addition, governments plan for appropriate infrastructure to support a vibrant sustainable economy, an educated healthy workforce, and a better future for its citizens among other mid- and long-term priorities. Many decisions are made to minimize adverse outcomes and increase benefits based on our view of future scenarios. While no one can see into the future, people can build upon resources that are available to them at the time.

Planning for public health also involves investing and making choices with the goal of securing a healthier future for the greatest number of people and reduced health inequalities in that future. To do this, public health professionals will need to build upon current strategies as well as incorporate new approaches, address new challenges and adapt to new tools. This involves considering what happens if risk factors or conditions of ill health worsen or change over time and assessing how changes to populations, environments and technologies will impact health. The health of the population now and in the future remains the primary priority of public health.

The three sections of this report outline the efforts that need to be continued moving forward and highlight certain priorities for public health in the future.

Focus on traditional public health approaches and practices

While approaches and technologies are branching into exciting new areas and capturing interest, public health will still rely on basic fundamental principles and strategies to prevent disease and injury and protect and promote health and well-being. Differences in health outcomes between populations require that public health programs and practices must continue to consider the broader determinants of health in planning. As well, the three sections of this report confirmed that lifecourse matters. Healthy aging, for example, is a lifelong process that involves many practices, decisions and adaptations to change throughout the preceding years.

Invest in health research

This report has identified several areas where research will be important to public health in the future. Having better information allows for better identification of long-term trends and areas where public health investment and efforts should focus. Further investigation is needed into how to use and capture the health information available through new technologies and social media. More research is required on specific health concerns (e.g. neurological conditions including dementia) that continue to burden Canadians. And finally, research on the effectiveness of programs and interventions and possible improvements is required. Robust evaluations can contribute to overall knowledge and provide important information on whether programs are reaching their targeted goals and populations and are applicable in other regions or situations.

Continue and improve public health surveillance

Continued and improved surveillance will be a necessary component of public health in the future. Investments in surveillance can result in improvements in early disease detection and prevention as well as in identification of associated behaviours and risk factors. Effective surveillance can also project and forecast outcomes, trigger early warnings and communicate strategies for domestic and global public health events, as well as identify issues that require further study. Using surveillance systems to facilitate early warnings and public health advisories (e.g. Air Quality Health Index) may be an effective practice to reduce the health impacts of natural and climatic change.

Continue education and awareness programs

Education programs and practices must adapt to changes in health as well as populations, environments and technologies and public health messages must achieve a balance between positive and negative messages. Programs must be evaluated to measure the clarity of the message, whether the program reaches its target audiences and if behaviours changed. For example, heat advisories are showing promise at changing behaviours (e.g. limiting physical activity on extreme heat days) to reduce health risks.

Address vulnerability and foster resilience

Differences in health outcomes, access to technologies and services, vulnerable populations and environments are common issues across the three sections of this report. These differences can result in gaps in health status among populations. Vulnerability can also influence the ability to adapt to change, ultimately widening the gaps between those with and without opportunities for good health.

Develop opportunities for remote communities

Remote communities were noted as having harsher environments, unequal access to resources and other factors that adversely influence health outcomes. While technology can be used to deliver some aspects of public health programs in remote communities, it is not complete and limited access, lack of trained human resources (and reduced capacity to train) as well as cultural and regional relevance impede use of technology.

Collaborate to create supportive and sustainable environments

Establishing partnerships and working collaboratively to support community efforts to create sustainable conditions can enable and promote good health. Successful programs and initiatives, such as age-friendly communities, rely on the participation of seniors and other community members at all stages of program development and implementation.

Build community capacity

Investments in disadvantaged communities and people will make a difference in creating public health for all and achieving health equity. The underlying issues are as diverse as individuals, and need to be understood and addressed accordingly. Despite a focus on the role global systems will play in public health in the future, communities are the critical players in the development and implementation of comprehensive and effective public health strategies. Every effort must be made to build on the knowledge, experience and investments already in place in Canadian communities.

Take intersectoral action

Encouraging collaboration with non-health related sectors to create and promote healthy public policies is key since health issues involve many factors that fall outside the mandate of public health and the healthcare sector. To effectively prevent adverse health outcomes and improve health opportunities in the future, all levels of government, non-governmental organizations, the private sector, communities and individuals must work together towards integrated and coherent policies and actions. In addition, many changes and health issues are linked to global systems such as a changing climate. Future public health efforts will rely on international collaborations, partnerships, knowledge sharing and international laws and policies. Opportunities continue to exist for Canada to play a leadership role and work across sectors to tackle multiple determinants of health and develop broad cross-sectoral strategies.

A way forward

Preparing for the future means adapting to, and planning for, change. Public health in the future will involve building on the strengths of current public health approaches, adapting practices to meet changes and working with partners across sectors and various levels of government. Progress will involve capitalizing on these areas:

- furthering investment in public health programs and services to enhance health, reduce risks and to support the development of strong evidence, being accountable to this evidence, and increasing capacity for further research and surveillance;
- focusing attention on education and awareness and maximizing the benefits of technologies to communicate messages and breakdown misinformation;
- building supportive and sustainable environments that incorporate natural and social factors;
- fostering strong public health leadership in Canadian communities and internationally; and
- promoting policies across all sectors and levels of government that help create and support healthy populations.



Looking to the future

Our collective health is influenced by the type of society we choose to create. When we look forward, we need to ask not what will drive public health, but how we can work together and leverage ever-changing factors to achieve health for all. Understanding the issues and connections will better prepare us for the unknown, build resilience and give us the resources required to meet future needs.

Healthy aging is important to all Canadians. Our seniors continue to benefit society through their active participation in the workforce, in the voluntary sector and as active members of our communities and families. It is troubling that young populations, our future seniors, are showing signs of ill health and, in some cases, at a greater level than their predecessors. These trends indicate that public health still has much work to do in preventing disease and promoting good health and well-being across the lifecycle.

There are numerous known health impacts of changing physical and social environments. We must adapt and find ways to build resilience and support among those who have not shared the same benefits. We must build communities in tune with the physical environment. We must create urban communities that are universally accessible and adaptive. As well, we must work with our community and global partners to make the necessary changes as public health risks respect no borders.

Technology has changed how we interact and communicate. Much can be learned about health and perceptions of health through, for example, what people are posting online. Technology allows us to expand our understanding of public health issues, to increase surveillance and monitoring as well as create an understanding of susceptibility. While technological change is exciting, we still need to be cautious and respect ethical and privacy concerns. We must ensure that the new technologies are truly benefitting those we are targeting and that we are not creating new inequalities.

Public health in the future will be the realization of the efforts we make today. We can all work together to:

- establish healthy practices from childhood to old age;
- participate in society and volunteer to benefit ourselves and others;
- sustain our physical environment, protect natural spaces and enhance built environments;
- participate in the global community;
- challenge stigma and raise awareness about health; and
- recognize that inequality harms us all and work to improve opportunity for everyone.

If the future is all about change, we can be the change that sets the future.

Dr. Gregory Taylor

APPENDIX A: THE HEALTH AND WELL-BEING OF CANADIANS

Many factors can impact and influence the health of a population. Being able to identify who we are using characteristics such as age and sex, and factors that may influence overall health, such as education, income and personal behaviours, can help to explain some health outcomes.

Who we are

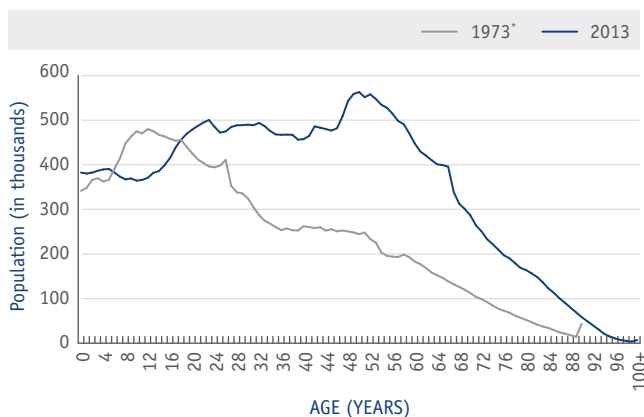
Population

Canada's population has increased by 56% over the past 40 years and exceeded 35 million people in 2013.¹⁵ As estimated by the 2011 National Household Survey, 1.4 million people in Canada identified as Aboriginal (61% First Nations, 32% Métis and 4% Inuit), while 6.8 million identified as being foreign born.^{9, 415} The majority of Canadians (61%) lived in large urban population centres in 2011.^{15, 308}

Life expectancy

The life expectancy of Canadians has increased dramatically, by approximately 19 years for males and 22 years for females, over the past three-quarter century.^{17, 18}

FIGURE A.1 Population by age, Canada, 1973* and 2013¹⁵



* Population totals at 90 years in 1973.



FIGURE A.2 Population distribution by origin, Canada, 2011^{9, 15, 415}

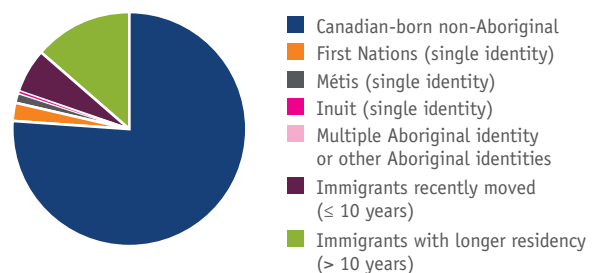


FIGURE A.3 Population distribution by population density, Canada, 2011^{15, 308}

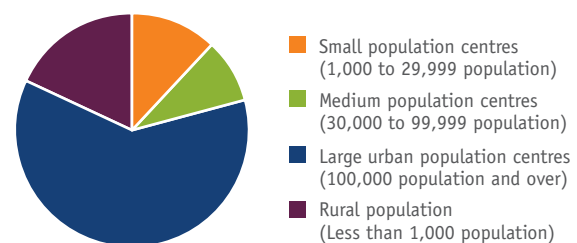


FIGURE A.4 Life expectancy at birth by sex, Canada, 1931 and 2009/2011^{17, 18}

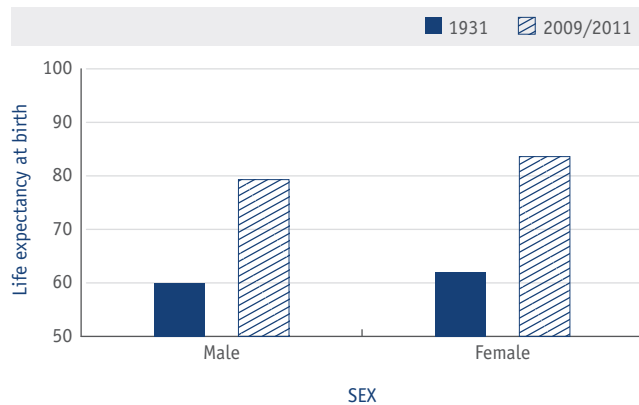
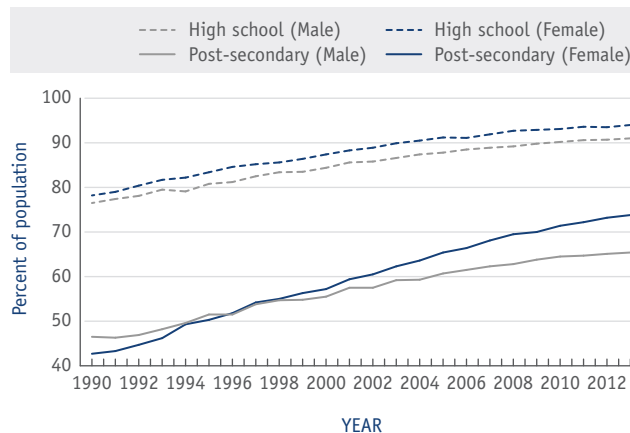


FIGURE A.5 Population* completing high school or post-secondary school by sex, Canada excluding territories, 1990 to 2013⁴¹⁶



Factors influencing health

Education, employment and income

Education

Better education generally leads to better overall health.^{124, 418, 419} The number of Canadians who have completed high school has steadily increased over the past 20 years.⁴¹⁶ The number of people, particularly females, who have completed a post-secondary education has also increased.⁴¹⁶

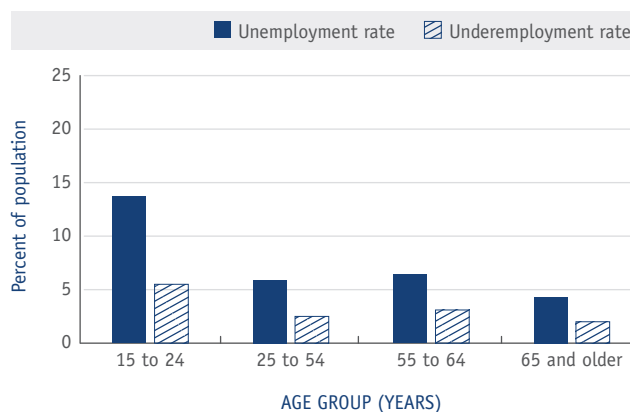
Employment

Unemployment has been associated with poorer health outcomes.^{124, 171} Unemployed workers are twice as likely as their employed counterparts to experience psychological problems such as depression, anxiety, low self-perceived health and poor self-esteem.^{419, 420}

Like unemployment, underemployment—people working part-time because they cannot find full-time employment, discouraged employment seekers and those waiting to hear about possible employment—is unequally distributed across the population.⁴²¹ Younger workers, females and visible minorities report higher rates of underemployment.⁴²¹

* Population aged 25 to 44 years.

FIGURE A.6 Unemployment and underemployment rate by age group, Canada excluding territories, 2013⁴¹⁷

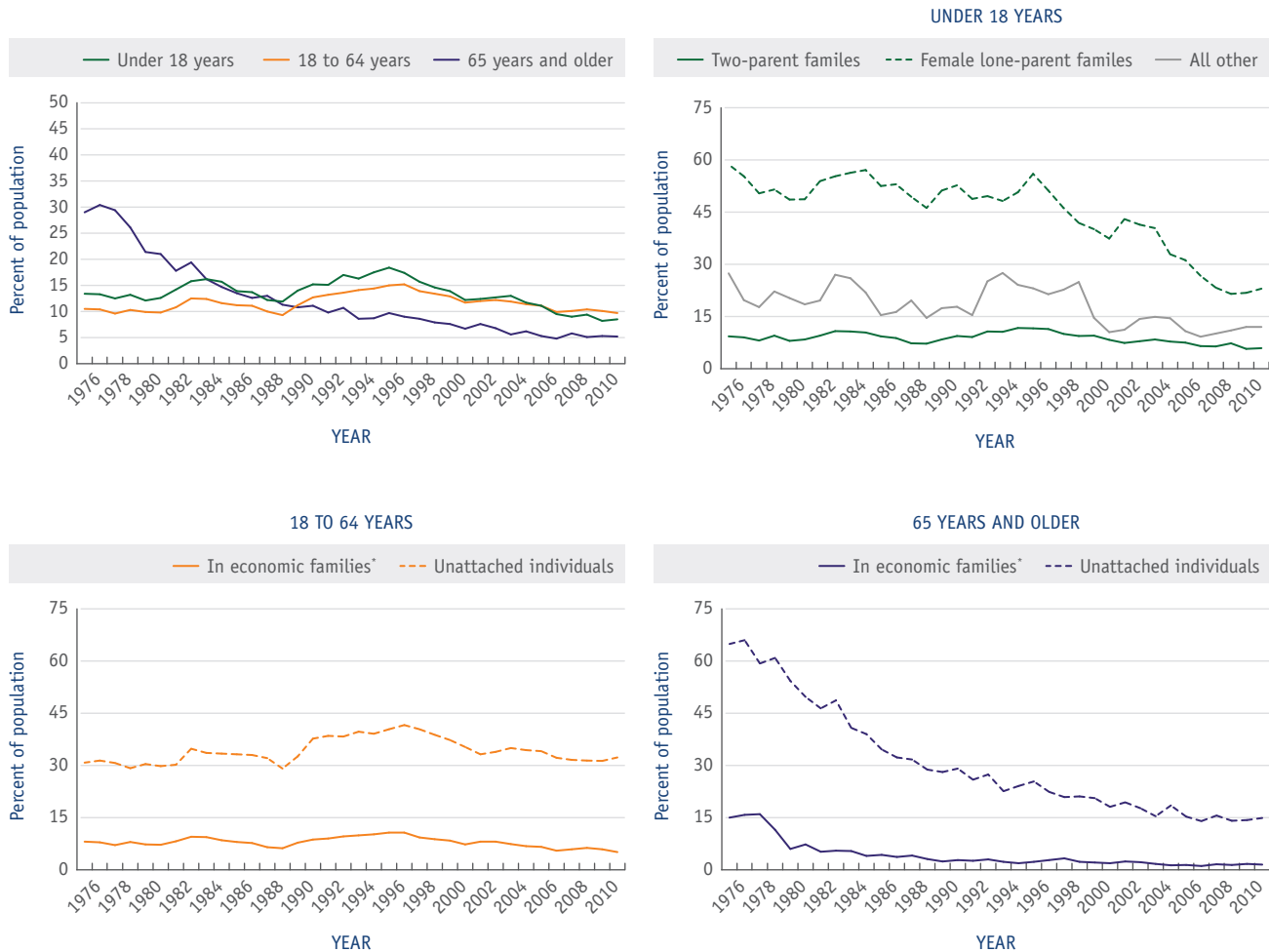


Household income

Overall, the percentage of people living in after-tax low-income households has decreased.¹⁰⁹ Research has linked living on low income to lower life expectancy, increased rates of suicide and other burdens of disease such as diabetes and cardiovascular disease.^{124, 419, 422-424}

A household is said to be in low income when they are likely to spend 20% or more of their total post-tax income on necessities (food, clothing and footwear, and shelter), compared to an average family of the same size in the same broad community size.⁴²⁵

FIGURE A.7 Canadians living in low income after tax by age group and select household type, Canada excluding territories, 1978 to 2011^{109, 426}



* Economic family refers to a group of two or more people who live in the same dwelling and are related to each other by blood, marriage, common-law or adoption. A couple may be of opposite or same sex. Foster children are included.

Environment, housing and community

Ozone concentrations and fine particulate matter

Poor outdoor air quality, including smog, can exacerbate respiratory and cardiovascular diseases, increasing emergency room visits, hospital admissions and premature deaths.^{185, 186, 427} The two main components of smog are ozone concentrations and fine particulate matter.¹⁸⁵

FIGURE A.8 Annual average ozone concentrations, Canada and select regions, 2000 to 2011⁴²⁸⁻⁴³³

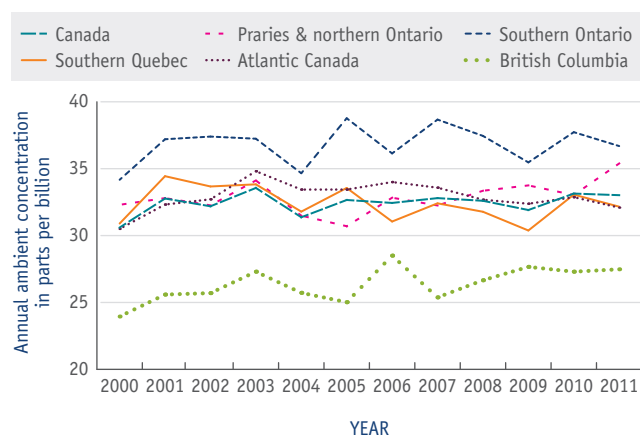
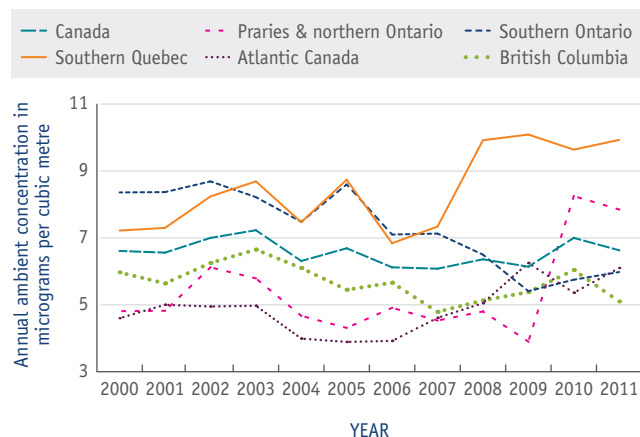


FIGURE A.9 Annual average fine particulate matter concentrations, Canada and select regions, 2000 to 2011⁴³⁴⁻⁴³⁹



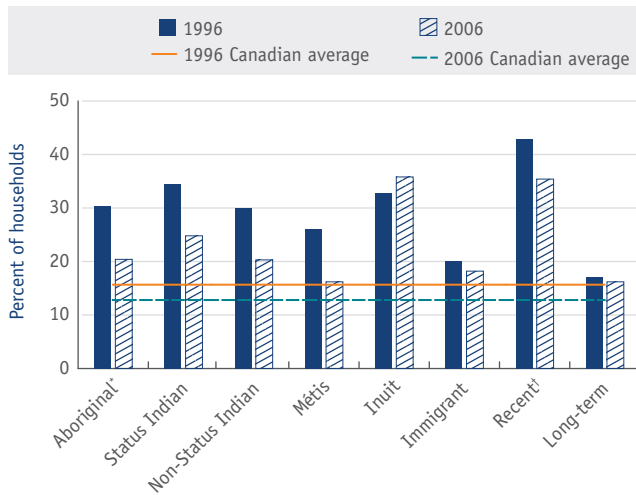
Housing conditions

Housing, a critical component of a person's environment, was identified as a basic requirement for health in the 1986 Ottawa Charter for Health Promotion.^{124, 440} Living in poor housing conditions (e.g. indoor air pollution caused by moulds, off-gassing from modern materials) has been linked to respiratory conditions, lead poisoning, injuries from falls and decreased mental health.^{419, 441} Physical design of housing can also affect health. Accessibility features, for example ramps and grab bars, can improve quality of life for those with disabilities or frailties.⁴⁴²⁻⁴⁵² Those who cannot access affordable housing may experience increased levels for stress and feel more vulnerable and insecure.⁴¹⁹

A household is considered to be in core housing need if it does not meet one or more of the adequacy, suitability or affordability standards and it would have to spend 30% or more of its before-tax income to pay the median rent (including utility costs) of alternative local market housing that meets all three standards.⁴⁵⁶ Nationally, the percentage of households in core housing need has decreased from 15.6% to 12.7% between 1996 and 2006.⁴⁵⁶



FIGURE A.10 Households in core housing need by origin, Canada, 1996 and 2006^{453–455}



* An Aboriginal household is defined as: a non-family household in which at least 50% of household members self-identified as Aboriginal; or a family household that meets at least one of two criteria: at least one spouse, common-law partner, or lone parent self-identified as an Aboriginal; or at least 50% of household members self-identified as Aboriginal. Data excludes farm, band, and reserve households (for which shelter costs are not collected by the Census); households with incomes of zero or less; and households whose shelter costs equal or exceed their incomes.

† Recent immigrant households represent those households whose primary maintainer immigrated to Canada in the 5 years prior to the Census. For 2006, the primary maintainer arrived between 2001 and 2005. For 1996, the primary maintainer arrived between 1991 and 1995.

Community belonging

Family, friends and a feeling of belonging to a community gives people the sense of being a part of something larger than themselves.⁴⁵⁷ The extent to which people participate in their community and feel that they belong can positively influence their long-term physical and mental health.⁴⁵⁸

Violent crime

One measure of safety in a community is the crime rate. While many Canadians believe that crime rates in their neighbourhoods have either stayed constant (62%) or increased (26%), in reality they have actually been decreasing.^{459–461}

FIGURE A.11 Population reporting somewhat or very strong sense of community belonging by age group and area of residency, Canada, 2012^{38, 48}

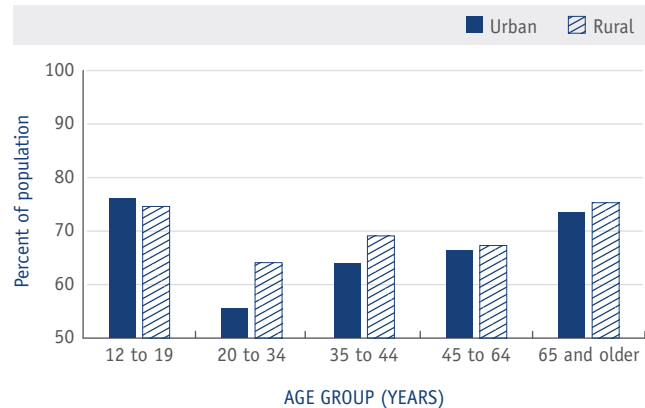
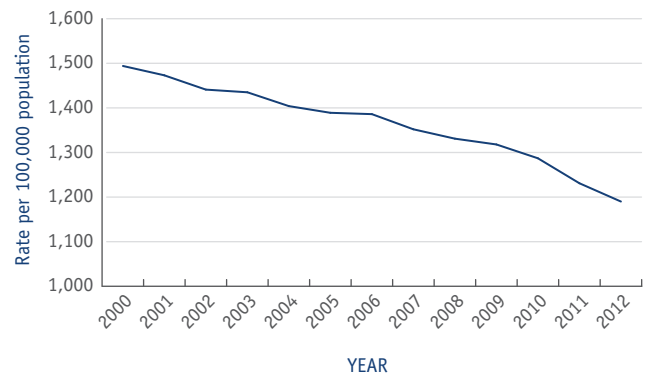


FIGURE A.12 Police-reported violent crime rate, Canada, 2000 to 2012^{460, 461}

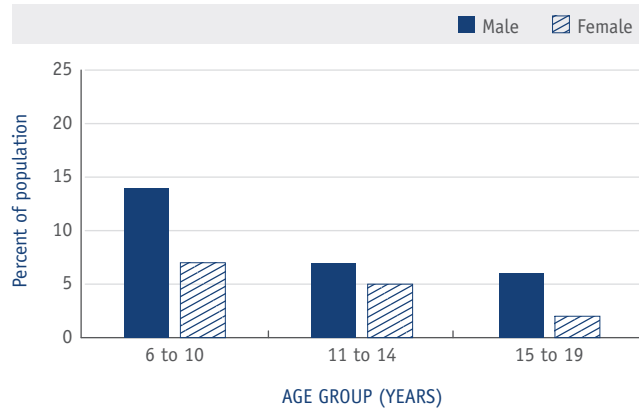


Health behaviours

Physical activity

Studies report that physical inactivity can increase the risk for poor health outcomes such as coronary heart disease, stroke, hypertension, colon cancer, breast cancer, type 2 diabetes, depression, arthritis and osteoporosis.⁴⁶² In order to maximize the health benefits associated with being physically active, World Health Organization (WHO) and Canadian guidelines suggest that adults should accumulate at least 150 minutes of moderate-to-vigorous physical activity per week; while 60 minutes of moderate-to-vigorous physical activity every day is recommended for children and youth aged between 5 and 17 years.^{463, 464}

FIGURE A.13 Children and youth attaining suggested levels of physical activity by age group and sex, Canada, March 2007 to February 2009⁴¹



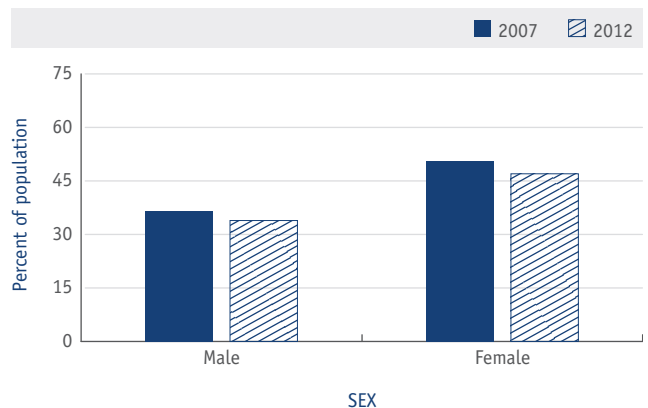
Fruit and vegetable consumption

Eating habits also play a key role in achieving and maintaining health.^{465, 466} Eating fresh fruits and vegetables daily can help in preventing a variety of diseases including type 2 diabetes, heart disease, osteoporosis and certain types of cancer.^{465, 467}

FIGURE A.14 Adults attaining suggested levels of physical activity by age group and sex, Canada, March 2007 to February 2009⁴²



FIGURE A.15 Population* reporting fruit and vegetable consumption, 5 or more times per day, by sex, Canada, 2007 and 2012⁴⁶⁸



* Population aged 12 years and older.

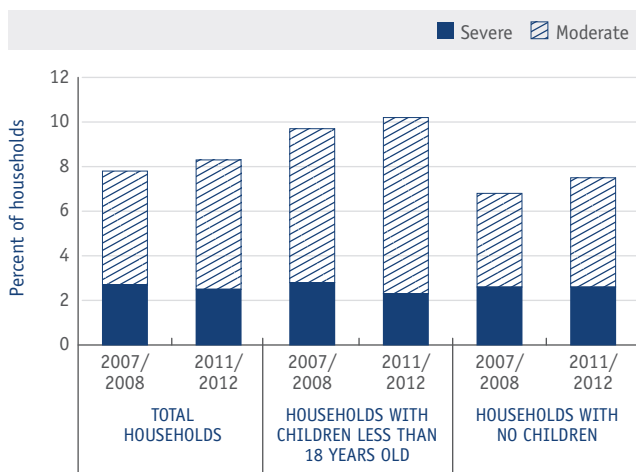
FIGURE A.16 Recommended number of Canada's Food Guide servings per day⁴⁶⁷

AGE IN YEARS	CHILDREN			TEENS		ADULTS			
	2-3	4-8	9-13	14-18	14-18	19-50		51+	
Sex	Girls and Boys			Females	Males	Females	Males	Females	Males
Vegetables and fruit	4	5	6	7	8	7-8	8-10	7	7
Grain products	3	4	6	6	7	6-7	8	6	7
Milk and alternatives	2	2	3-4	3-4	3-4	2	2	3	3
Meat and alternatives	1	1	1-2	2	3	2	3	2	3

Food security

The number of households in Canada reporting moderate to severe levels of food insecurity has been increasing.⁴⁶⁹ Being able to eat healthily requires being food secure—having “... physical and economic access to sufficient, safe and nutritious food to meet ... dietary needs and food preferences for an active and healthy life” at all times.⁴⁷⁰ Food insecurity among Aboriginal households in Canada can be 3 to 6 times higher than among non-Aboriginal households (depending on the study and Aboriginal sub-population), with populations living in northern and isolated communities being especially at risk.^{234–236, 471, 472}

FIGURE A.17 Household food insecurity by household type, Canada, 2007/2008 and 2011/2012⁴⁶⁹



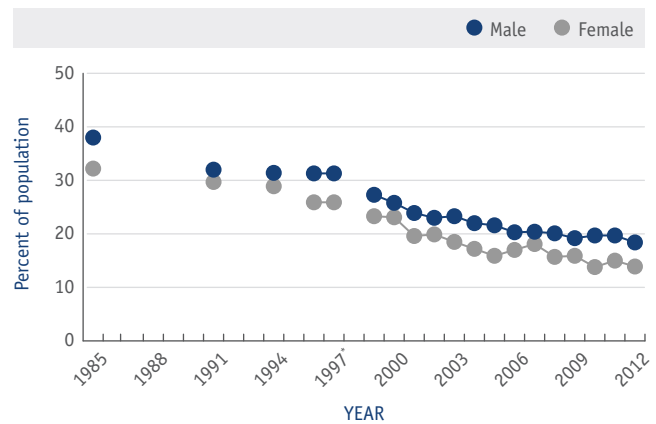
SEVERE FOOD INSECURITY: Indication of reduced food intake and disrupted eating patterns.

MODERATE FOOD INSECURITY: Indication of compromise in quality and/or quantity of food consumed.

Tobacco use

Smoking and exposure to second-hand smoke have been linked to an increased risk of a number of diseases and conditions that affect cardiovascular and respiratory systems.^{475, 476} Tobacco smoke also includes known cancer-causing substances.⁴⁷⁶ Despite decreases in the prevalence of smoking among all Canadians over the past three decades, Aboriginal people’s rates of non-traditional tobacco use continue to be high (31% of Métis, 58% of Inuit, and 57% of First Nations people on reserve).^{473, 474, 477–479}

FIGURE A.18 Current smokers[†] by sex, Canada excluding territories, 1985 to 2012^{473, 474}



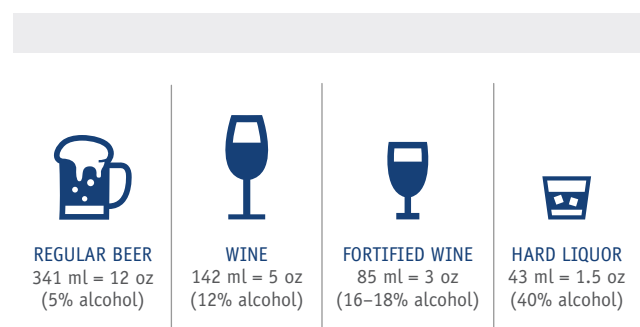
* Data for 1996/1997 from same survey year.

† Population aged 15 years and older.

Alcohol use

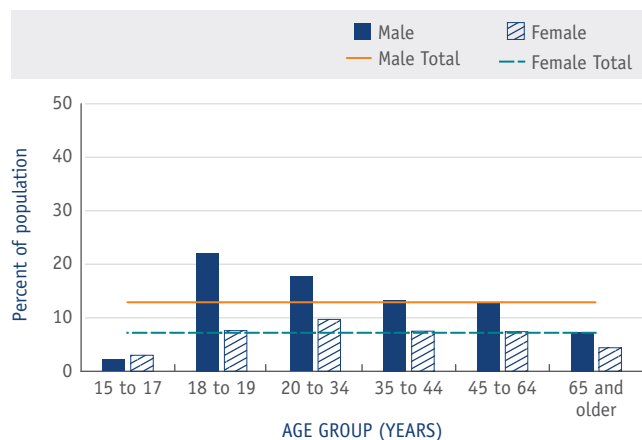
Alcohol intoxication can harm physical and mental health, affect personal relationships, people’s ability to work and study and in extreme cases can cause death.^{480, 481} For females, consuming 3 drinks or more on a single occasion exceeds the low-risk guidelines for acute effects, while consuming more than 10 drinks a week with more than 2 drinks most days exceeds the low-risk guidelines for chronic effects.⁴⁸² For males, consuming 4 drinks or more on a single occasion exceeds the low-risk guidelines for acute effects, while consuming more than 15 drinks a week with more than 3 drinks most days exceeds the low-risk guidelines for chronic effects.⁴⁸²

FIGURE A.19 What is a standard drink?⁴⁸⁰



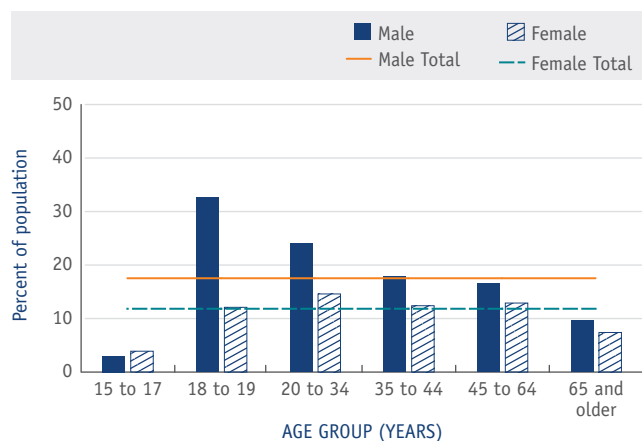
NOTE: Some beers have more alcohol content than one standard drink.

FIGURE A.20 Exceeding low-risk drinking guidelines* for acute effects by age group and sex, Canada excluding territories, 2012⁴⁸³



* Alcohol consumption in the past 7 days.

FIGURE A.21 Exceeding low-risk drinking guidelines* for chronic effects by age group and sex, Canada excluding territories, 2012⁴⁸³



* Alcohol consumption in the past 7 days.

Illicit drug use

The use of illicit drugs (i.e. abuse, misuse or dependence) can affect performance at school and at work and, in extreme cases, cause death.⁴⁸⁵⁻⁴⁸⁸ Illicit drug use has been linked to various health and social problems including panic attacks, hallucinations, psychosis, paranoia and risky or violent behaviour.⁴⁸⁵⁻⁴⁸⁸ In Canada, the most commonly used illicit drug is cannabis.⁴⁸² Pharmaceutical drugs prescribed for therapeutic purposes, including

FIGURE A.22 Cannabis use in the past 12 months by age group, Canada excluding territories, 2012^{483, 484}

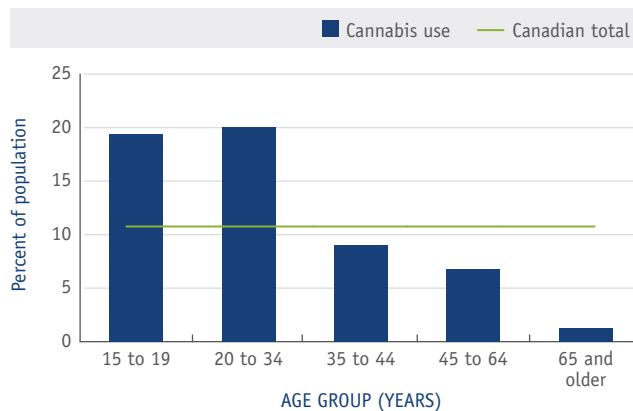
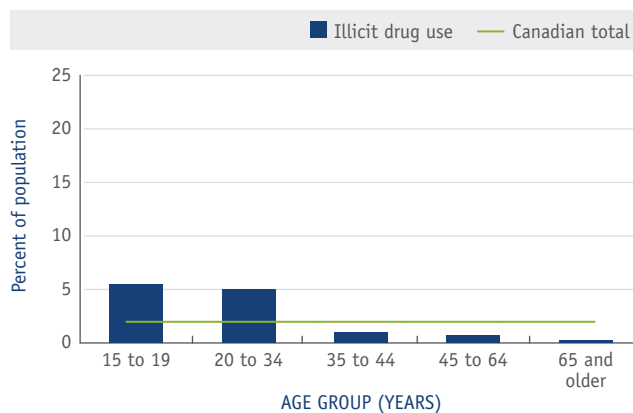


FIGURE A.23 Illicit drug* use in the past 12 months excluding cannabis by age group, Canada excluding territories, 2012^{483, 484}



* Includes cocaine, speed, ecstasy, heroin and hallucinogens including salvia.

opioid pain relievers, stimulants, tranquillizers and sedatives, may also be abused due to their psychoactive properties.⁴⁸² In 2012, of those who used psychoactive pharmaceutical drugs, 6.3% reported abusing them.⁴⁸²

Contact with medical doctor

Access to healthcare is fundamental to health.^{489, 490} In 2012, the majority (85%) of Canadians reported having a regular medical doctor.⁴⁶⁸ Of those who reported not having a regular medical doctor, nearly one-half (46%) indicated they had not tried to contact one.^{38, 48} Barriers such as language, sociocultural differences, physical inaccessibility and transportation can also limit access.^{419, 491-493}

Contact with dental professional

Good oral health is a key component to a healthy life. Poor oral health can result in a range of negative health outcomes including gum disease, lung infections, diabetes and heart disease.^{494, 495} Despite the importance of oral health, many Canadians do not visit a dental health professional every year.^{38, 48} Overall, the promotion of good oral health habits such as making healthy food choices, brushing teeth twice daily with fluoridated toothpaste, regular flossing and visits to a dental care provider can all help to prevent decay and maintain a healthy mouth for a lifetime.⁴⁹⁶

FIGURE A.24 Having a regular medical doctor and contact with a medical doctor by age group, Canada, 2012⁴⁶⁸

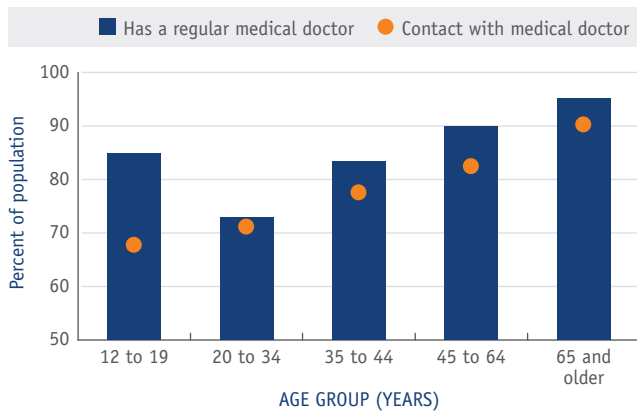
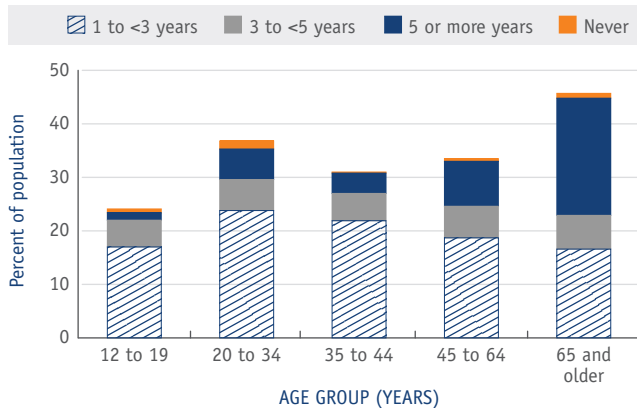


FIGURE A.25 Last time visited dentist by select age groups, Canada, 2012^{38, 48}



Health status

Perceived health and health-adjusted life expectancy

Overall, the majority of Canadians feel that their health is either very good or excellent.⁴⁶⁸ Between 2003 and 2012, very good or excellent self-perceived health increased through most age groups.⁴⁶⁸ While life expectancy and perceived health have increased, not all years are spent in good health.^{468, 497, 498}

FIGURE A.26 Very good or excellent self-perceived health by age group, Canada, 2003 and 2012⁴⁶⁸

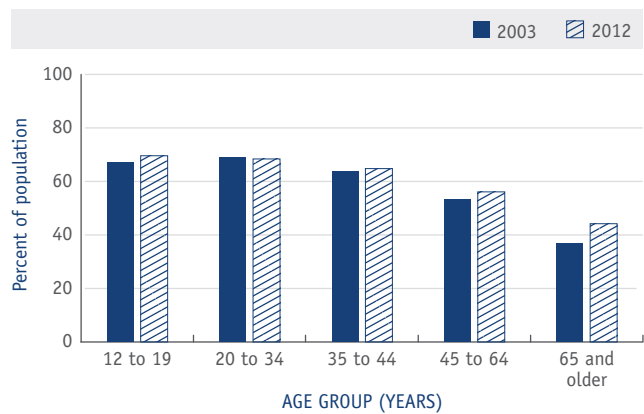
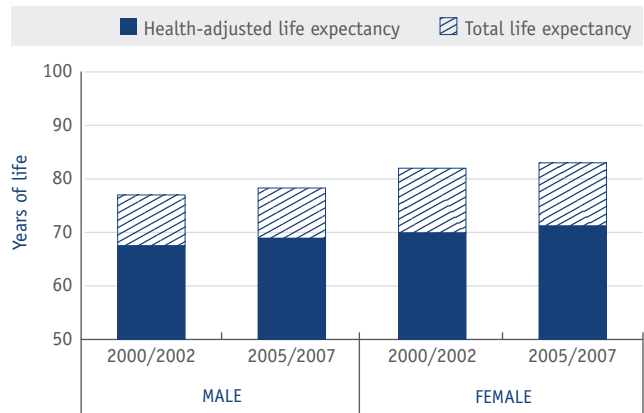


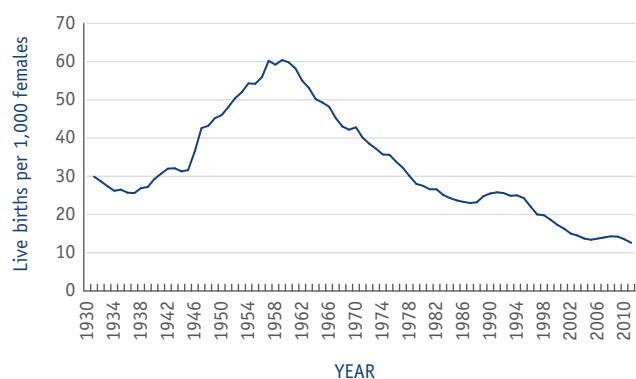
FIGURE A.27 Life expectancy and health-adjusted life expectancy at birth by sex, Canada excluding territories, 2000/2002 and 2005/2007⁴⁹⁷



Teen birth rate

Rates of teen births have been declining since the late 1950s.^{499–501} The decline in teen births can be attributed to several factors including an increase in the availability and use of contraceptives, legalized abortion, changing social values and an increased awareness of risks associated with unprotected sex.^{502–504}

FIGURE A.28 Teen* birth rate, Canada, 1930 to 2011^{499–501}



* Females aged 15 to 19 years.

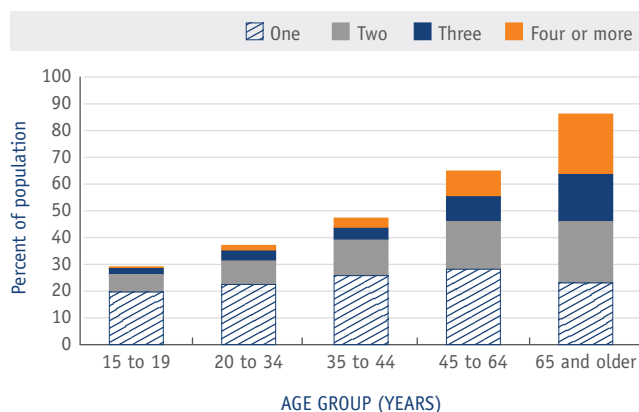
Chronic conditions

Although chronic health conditions are most often experienced by—and associated with—older members of the population, in 2012 more than one-half (55%) of Canadians aged 12 years and older reported living with at least one chronic health condition.^{38, 48}

Cancer incidence

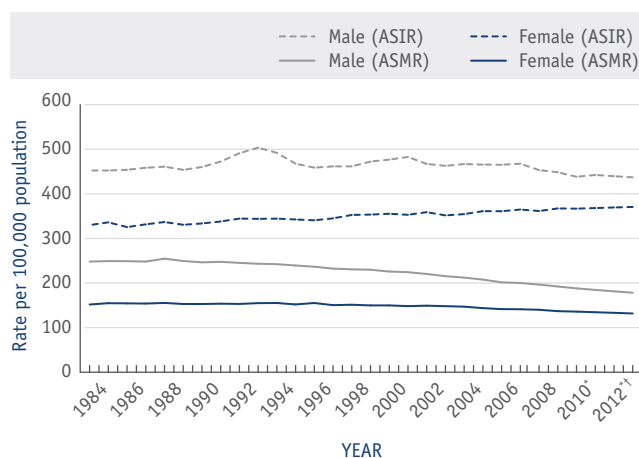
An estimated 187,600 new cases of cancer were expected to be diagnosed in 2013.⁵⁰⁵ Cancers of the lung, breast, colon/rectum and prostate were expected to account for more than one-half (52%) of all cancers diagnosed in the same year.⁵⁰⁵ Although mortality rates for both males and females declined, the age-standardized incidence rate for all cancers increased between 1984 and 2013 for females, but remain fairly stable for males.⁵⁰⁵

FIGURE A.29 Canadians reporting one or more chronic health condition* by age group, Canada, 2012^{38, 48}



* Conditions include asthma, arthritis, back problems, high blood pressure, migraines, chronic bronchitis, diabetes, heart disease, cancer, ulcers, effects from stroke, urinary incontinence, bowel disorders, Alzheimer's disease, mood disorders and anxiety disorders.

FIGURE A.30 Age-standardized incidence rates (ASIR)[†] and age-standardized mortality rates (ASMR)* for all cancers by sex, Canada, 1984 to 2013⁵⁰⁵



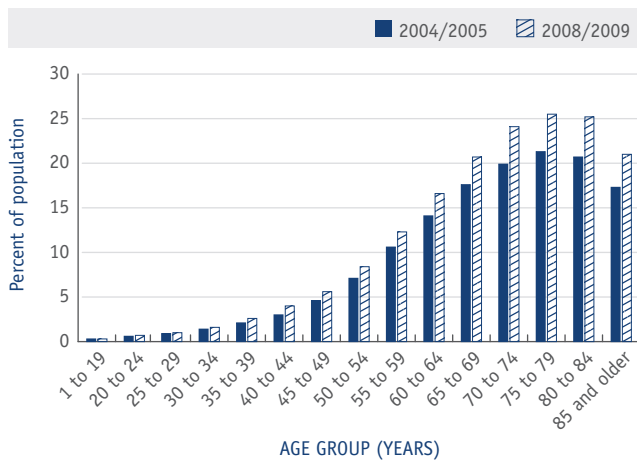
* ASMR for 2010 through 2013 are estimated based on all provinces and territories. Actual data were available to 2009. These estimates are based on long-term trends and may not reflect recent changes in trends.

† ASIR for 2011 through 2013 are estimated based on all provinces and territories. Actual data were available to 2010 except for Quebec (2007). These estimates are based on long-term trends and may not reflect recent changes in trends.

Diabetes prevalence

According to the 2008/2009 Canadian Chronic Disease Surveillance System, close to 2.4 million Canadians aged one year and older were living with diagnosed diabetes.³⁹ Although both type 1 and type 2 diabetes have been linked to genetic anomalies, type 2 diabetes is also associated with being overweight or obese.^{39, 507} People living with diabetes have an increased risk of developing cardiovascular problems, kidney disease, blindness and diabetic foot ulcers.⁵⁰⁸

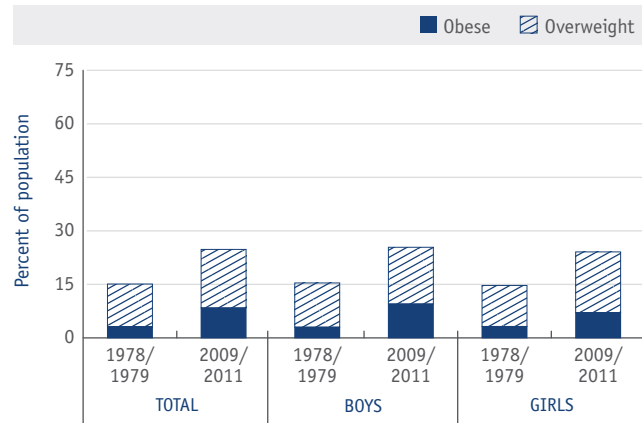
FIGURE A.31 Diagnosed diabetes by age group, Canada, 2004/2005 and 2008/2009^{39, 506}



Obesity

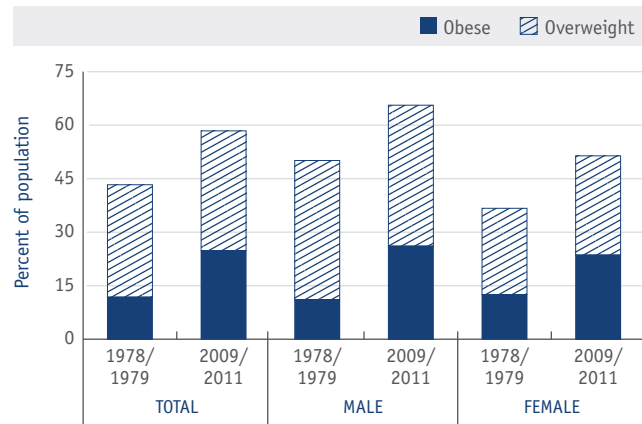
Obesity is a complex issue that involves a range of biological, behavioural and societal factors.^{33, 509} Physical activity, sedentary behaviours, screen time, diet and socioeconomic status can all contribute to increased body weight.⁵⁰⁹ Links have been made between obesity and chronic health conditions (type 2 diabetes, asthma, gallbladder disease, osteoarthritis, chronic back pain), cancers and cardiovascular diseases.⁵⁰⁹⁻⁵¹¹ Body mass index (BMI) is a common measure based on height and weight that is used to determine healthy and unhealthy weights. While BMI is considered an adequate measure for portions of the population, standard BMI categories may not accurately reflect the rate of overweight and obesity in all populations including Inuit and seniors.⁵¹²⁻⁵¹⁴

FIGURE A.32 Measured rates of childhood and adolescent* overweight and obesity by sex, Canada excluding territories, 1978/1979 and 2009/2011^{40, 515}



* Children and youth aged 5 to 17 years.

FIGURE A.33 Measured rates of adult* overweight and obesity by sex, Canada excluding territories, 1978/1979 and 2009/2011^{40, 515}

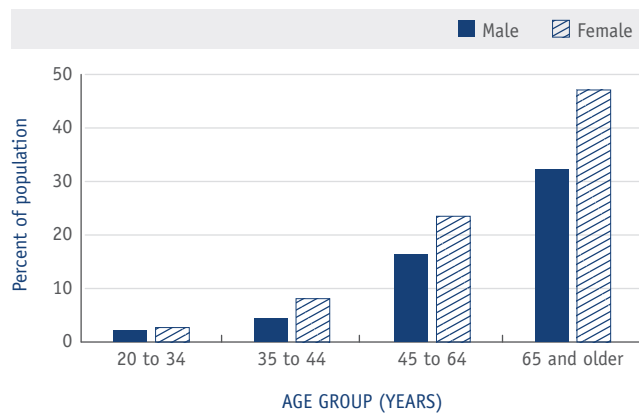


* Adults aged 18 to 64 years.

Arthritis

The term “arthritis” describes more than 100 conditions that affect joints, the tissue surrounding joints and other connective tissue.^{516, 517} Osteoarthritis and rheumatoid arthritis are two of the most common types.^{516, 518, 519} In 2012, 15% (4.4 million) of Canadians aged 15 years and older reported that they had been diagnosed with arthritis.⁴⁶⁸ Disability associated with all forms of arthritis results from problems in body function or structure (reduced mobility of joints, pain and body stiffness), limitations or restrictions in carrying out activities of daily living including self-care (showing, toileting and dressing) or mobility (transferring from beds to chairs and walking around the house) and problems a person may experience in their involvement in life situations (working or participating in social activities).^{516, 520, 521}

FIGURE A.34 Arthritis by age group and sex, Canada, 2012⁴⁶⁸



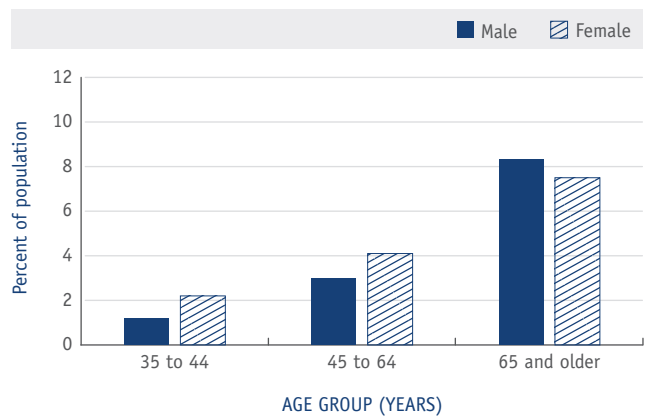
Respiratory conditions

Chronic respiratory diseases include asthma, chronic obstructive pulmonary disease (COPD), cystic fibrosis, sleep apnea and occupational lung disease.^{522, 523} Two important respiratory diseases are asthma and COPD. Asthma is characterized by coughing, shortness of breath, chest tightness and wheezing.^{523, 524} Early onset of asthma has been linked to low birth-weight and exposure to tobacco smoke including second-hand smoke and parental smoking, whereas later onset has been linked to obesity and increased exposure to allergens and environmental factors such as pollution.^{476, 523–525} COPD is an umbrella term for a number of chronic lung diseases characterized by shortness of breath, cough and sputum production.^{523, 526}

FIGURE A.35 Asthma by age group and sex, Canada, 2012⁴⁶⁸



FIGURE A.36 Chronic obstructive pulmonary disease (COPD) by age group and sex, Canada, 2012⁴⁶⁸

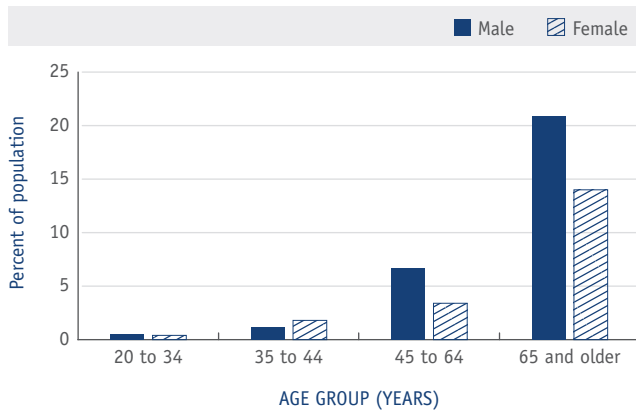


In 2012, 8% of the population aged 12 years and older reported having asthma and 4% of the population aged 35 years and older reported having COPD.⁴⁶⁸

Heart disease

Heart disease is a broad term for a group of conditions affecting the structure and functions of the heart.^{527, 528} The conditions include ischemic heart disease, heart failure, rheumatic heart disease and congenital heart disease.⁵²⁸ In 2012, 5% of Canadians aged 12 years and older reported having heart disease.^{38, 48} Reported rates of heart disease increase with age, with seniors aged 65 to 79 years and 80 years and older reporting the highest rates of heart disease (15% and 24%, respectively).^{38, 48}

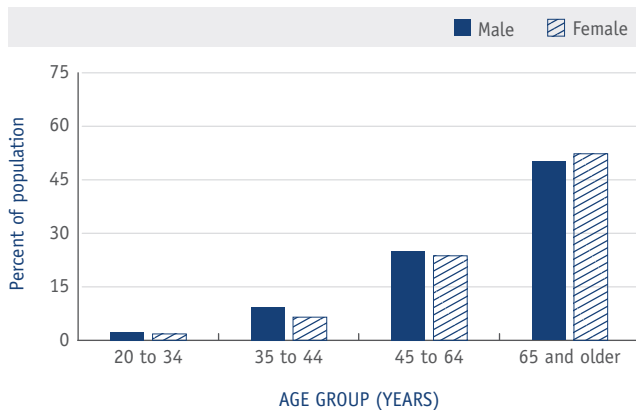
FIGURE A.37 Heart disease by age group and sex, Canada, 2012^{38, 48}



High blood pressure

High blood pressure, also known as hypertension, increases the risk of stroke, heart attack or failure, dementia, kidney disease, eye problems and erectile dysfunction.⁵²⁹ In 2012, 18% (5.4 million) of Canadians aged 12 years and older reported having high blood pressure.^{38, 48}

FIGURE A.38 High blood pressure by age group and sex, Canada, 2012^{38, 48}



Infectious diseases

Despite progress in preventing and controlling infectious diseases, they continue to be a major health issue and public health concern.^{2, 329} While most infections are minor and go unreported, some can be serious; many cases are preventable.^{329, 530}

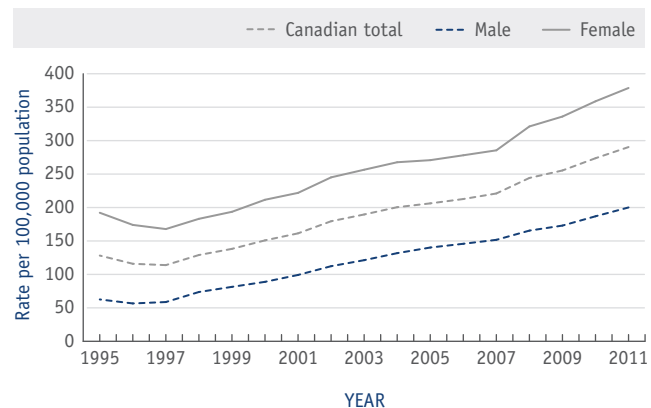
Sexually transmitted infections

Rates of sexually transmitted infections (STIs) officially reported to the Canadian Notifiable Disease Surveillance System (CNDSS) have increased in the overall Canadian population over the past 15 years.⁵³¹ Untreated STIs, whether symptomatic or not, can have long-lasting effects making early detection and treatment important. STIs have been linked to pelvic inflammatory disease, infertility, ectopic pregnancies and low birth-weight babies as well as various types of cancers including cervical, anal and penile and increased risk of acquiring human immunodeficiency virus (HIV).⁵³¹⁻⁵³⁹ These trends must be interpreted with caution, since both laboratory testing methods and clinical screening practices have changed over time.⁵³¹

CHLAMYDIA

Chlamydia, an infection caused by the bacterium *Chlamydia trachomatis*, is the most commonly reported bacterial STI in Canada.⁵³¹ Chlamydial infections are frequently asymptomatic.⁵³⁵ In the absence of screening, a lack of symptoms can increase the risk of unknowingly spreading the disease as well as the risk of longer-term health implications for infected individuals. Nationally reported chlamydia rates have increased each year since 1997, resulting in a relative increase of 62% between 2002 and 2011.⁵³¹ The infection disproportionately affects younger people, particularly females, although it is common in both sexes.⁵³¹

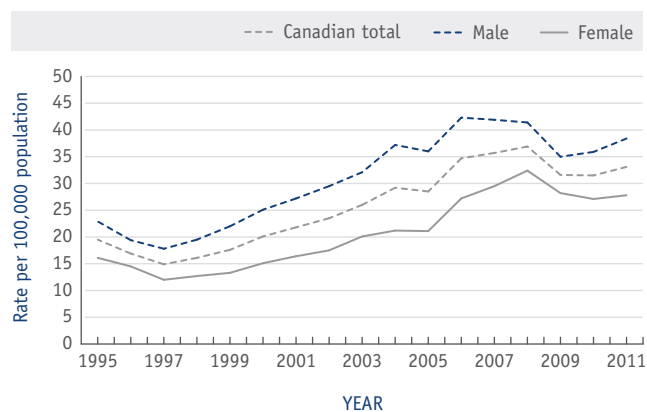
FIGURE A.39 Reported rates of chlamydia by sex, Canada, 1995 to 2011^{531, 540}



GONORRHEA

Gonorrhea, an infection caused by the bacterium *Neisseria gonorrhoeae*, is the second most commonly reported bacterial STI in Canada.⁵³¹ Over the last 30 years, multiple strains of gonorrhea have become less susceptible to certain first-line antibiotics such as penicillin, tetracycline and, more recently, quinolones and third-generation oral and injectable cephalosporins.^{531, 541-544} Reported rates of gonorrhea have steadily increased over time, with an overall increase of 41% from 2002 to 2011.⁵³¹

FIGURE A.40 Reported rates of gonorrhea by sex, Canada, 1995 to 2011^{531, 540}

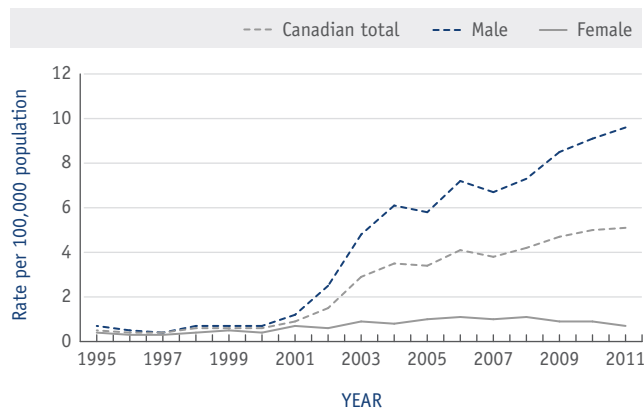


SYPHILIS

Syphilis is an infection caused by the bacterium *Treponema pallidum*.⁵³¹ From 1993 to 2000, reported rates of infectious syphilis were relatively stable, but the rates began to sharply increase in 2001.⁵³¹ Between 2002 and 2011, reported syphilis rates increased 232%.⁵³¹ The dramatic increase in cases of syphilis has been most notable among men who have sex with men.^{531, 539, 545} Syphilis infection can increase susceptibility to HIV infection.^{531, 537-539} Co-infection of syphilis among people living with HIV and AIDS is increasing.^{531, 537-539}



FIGURE A.41 Reported rates of infectious syphilis by sex, Canada, 1995 to 2011^{531, 540}

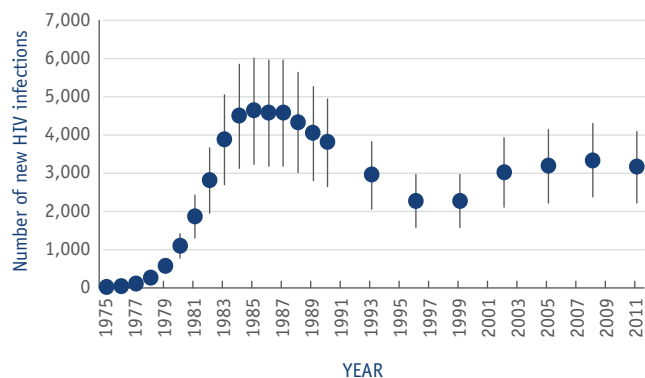


HIV

HIV attacks the immune system and can develop into a chronic progressive illness that can make an individual vulnerable to other infections and to chronic diseases.⁵⁴⁷ HIV is transmitted from one person to another through exposure to infected blood or body fluids during unprotected sexual intercourse or by sharing or using contaminated needles.⁵⁴⁷ An HIV-positive mother can also transmit the virus to her infant during pregnancy, delivery or breastfeeding if she is not taking antiretroviral medication.^{547, 548} Having an STI such as chlamydia or syphilis can increase the risk of HIV transmission and becoming infected with HIV.^{531, 537-539} Approximately 3,175 new HIV infections occurred in 2011, similar to the estimated number of new infections in preceding years.⁵⁴⁶ However, as many as 25% of Canadians infected with HIV, or 17,980 people, may be unaware of their infection and thus may be unknowingly infecting others.⁵⁴⁶

In Canada, HIV infection is not evenly distributed but rather is concentrated in certain at-risk populations, such as men who have sex with men (47% of all new infections) and people who inject drugs (17%).⁵⁴⁶ The rate of new HIV infection among people originating from HIV-endemic countries is about 9 times higher than that in the Canadian-born population whereas Aboriginal people experience an HIV infection rate 3.5 times higher than the non-Aboriginal population.⁵⁴⁶ The number of Canadians living with HIV is increasing because new infections continue to occur but fewer people are dying prematurely as a result of the disease due to the availability of effective antiretroviral treatments.⁵⁴⁶

FIGURE A.42 *Estimated number of new HIV infections* for selected years, Canada*⁵⁴⁶



* Bars indicate range of uncertainty.

Tuberculosis

Tuberculosis (TB) is an infectious bacterium that is spread from person to person primarily through the air.^{549–551} TB bacteria of the lungs or airways enter the air when a person with active TB disease exhales by coughing, sneezing or even just talking.^{549, 551} The bacteria can remain air-borne for several hours and then be inhaled by other people who may, in turn, become infected.^{549, 551} Over time, an infected person may develop active TB disease.^{549, 552} Known risk factors for developing either latent TB infection or active TB disease include having a weakened immune system or underlying illness such as HIV or diabetes; coming into close contact with people with known or suspected TB (e.g. sharing living space or living in communities with high rates of TB disease); having a personal history of active TB; having received inappropriate or inadequate treatment for TB disease in the past; living in a low-income household, in crowded and inadequately ventilated housing or being homeless; being malnourished; having a history of smoking or substance abuse; being a resident in an institutional setting such as a long-term care or correctional facility; and working with people at risk of developing TB.^{552, 553} Despite the overall low incidence of TB disease in Canada, the burden of TB is higher in Canadian Aboriginal populations and in foreign-born Canadians compared to other Canadians.^{554–559}



FIGURE A.43 *Reported new active and re-treatment tuberculosis cases by origin, Canada, 2002 to 2012*^{555–559}

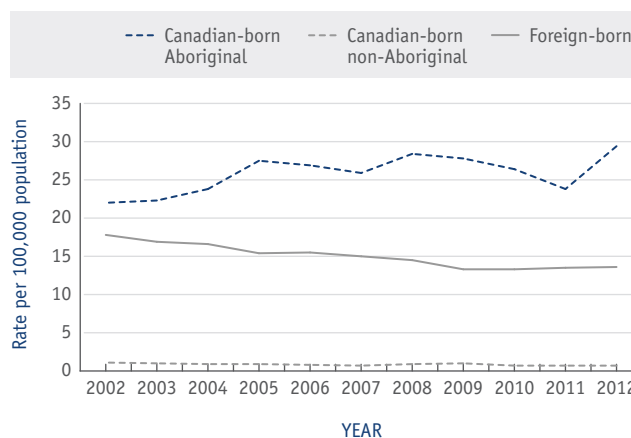
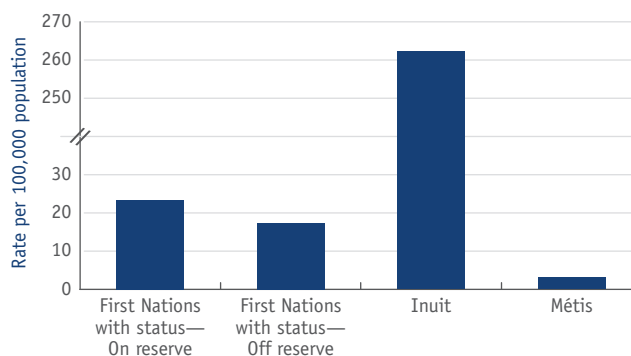


FIGURE A.44 *Reported new active and re-treatment tuberculosis cases by Aboriginal status, Canada, 2012*⁵⁵⁵



Mental health and mental illness

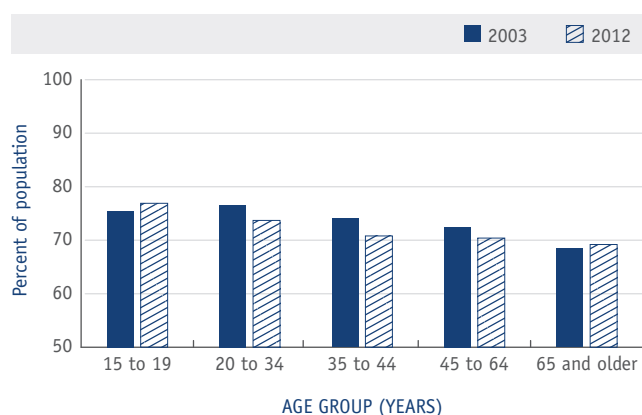
Mental health is an important aspect of the overall health and well-being of all Canadians.⁷⁴ It can affect people of all ages, cultures, education and income levels, however, those with a family history of mental illness, substance abuse issues, certain chronic health conditions or who have experienced stressful life events are more at risk.^{560, 561} A considerable body of research supports the concept that mental health and mental illness are not on opposite ends of a single continuum.⁵⁶⁰ Rather mental health and mental illness exist on two separate but related continua, therefore, mental health is more than the absence of mental illness.⁵⁶²



Perceived mental health

It is difficult to determine the state of the population's mental health and rates of mental illness because data are limited. Nevertheless, the data available through surveys, studies and databases help to illustrate the mental health of Canadians. According to the 2012 Canadian Community Health Survey, the majority of Canadians 15 years and older reported their mental health as very good or excellent (72%).^{38, 48}

FIGURE A.45 Very good or excellent self-perceived mental health by age group, Canada, 2003 and 2012^{38, 48, 563, 564}



Mood disorders and major depression

Mood disorders—such as depression, bipolar disorder, mania or dysthymia—are the most commonly self-reported mental health conditions.^{38, 48} Mood disorders can create feelings of distress or impairment in social, work and school settings as well as other areas of everyday life.⁵⁶⁰ Major depressive disorder, one type of mood disorder, is typically a recurrent illness with relapses where the more severe and long-lasting the initial symptoms are the less likely a person is to fully recover.^{560, 565}

FIGURE A.46 Mood disorders and major depressive episodes by age group and sex, Canada, 2012⁴⁴

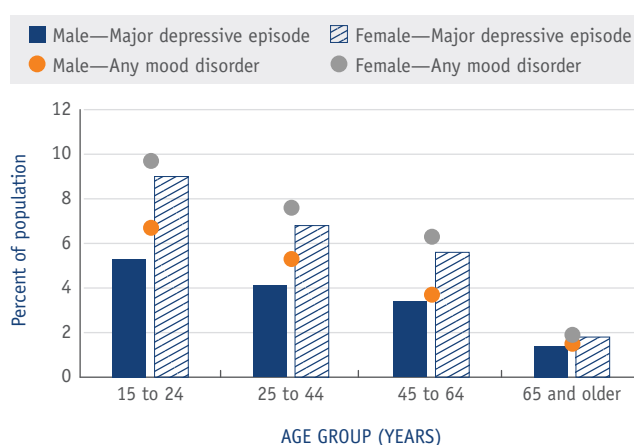
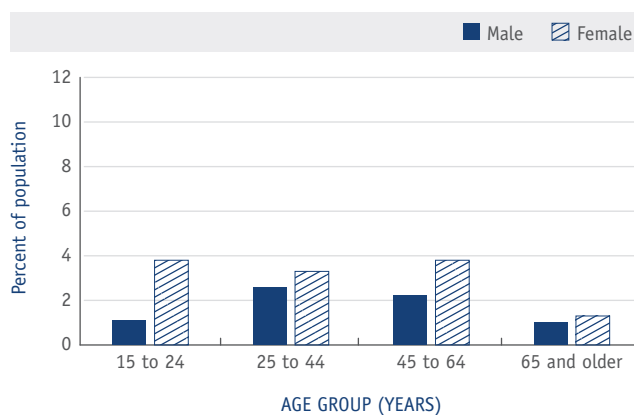


FIGURE A.47 Generalized anxiety disorder by age group and sex, Canada, 2012⁴⁴



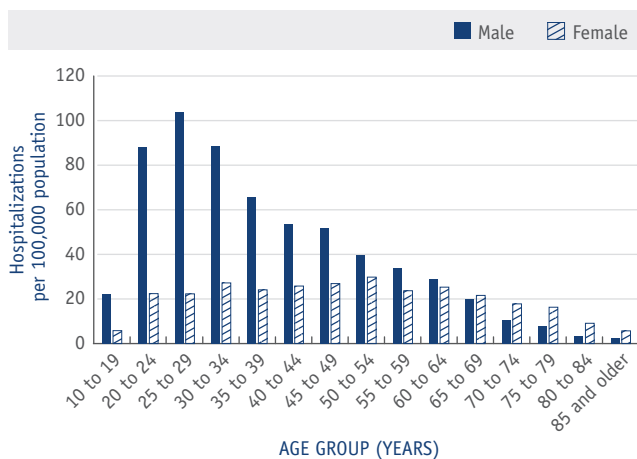
Anxiety

Most people have experienced moments of anxiousness at some point in their lives, but for those living with an anxiety disorder, these feelings are amplified and can interfere with relationships, school and work performance and social and recreational activities.⁵⁶⁰ People living with an anxiety disorder may avoid situations that intensify their anxiety or develop compulsive rituals that lessen the anxiety.⁵⁶⁰ Symptoms of anxiety disorders often manifest earlier in life.⁵⁶⁰

Schizophrenia

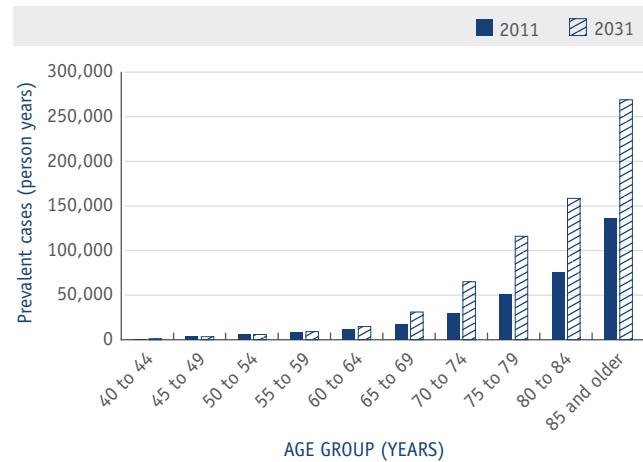
Schizophrenia has a profound effect on person's ability to function effectively in all aspects of life—self-care, family relationships, income, school, employment, housing, community and social life.^{560, 566} Early in the disease process, people with schizophrenia may lose their ability to relax, concentrate or sleep and may withdraw from friends and not even recognize that they are ill.^{560, 566} With effective early treatment to control symptoms, people can prevent further symptoms and increasing symptom severity and can optimize their chance of leading full, productive lives.^{560, 566} While rates of schizophrenia are roughly equal in males and females, males tend to develop the illness earlier in life whereas females develop it later.^{560, 566}

FIGURE A.48 Hospitalizations for schizophrenia* in acute care hospitals, by age group and sex, Canada, 2010^{15, 567}



* Using most responsible diagnosis.

FIGURE A.49 Projected prevalence of Alzheimer's disease or other dementia by age group, Canada, 2011 and 2031⁸¹



Alzheimer's disease

Alzheimer's disease and other dementias are progressive degenerative neurological conditions that are more common among seniors.^{76, 80} Alzheimer's disease progresses from mild to severe.⁵⁶⁸ Mild forms of Alzheimer's can cause problems such as getting lost, having difficulty handling money or paying bills, taking longer to complete routine tasks, repeating sentences, poor judgment and small changes in mood or personality.⁵⁶⁸ Moderate Alzheimer's disease causes damage to parts of the brain that control language, reasoning, sensory perception and conscious thought resulting in increased memory loss and confusion.⁵⁶⁸ Those with severe Alzheimer's disease experience significant shrinkage of brain tissue that results in an inability to communicate, as well as complete dependence on others for care.⁵⁶⁸ In 2011, an estimated 340,200 of Canadians ages over 40 years were living with a diagnosis of Alzheimer's disease or other dementias and this number will probably more than double within 20 years.⁷⁶

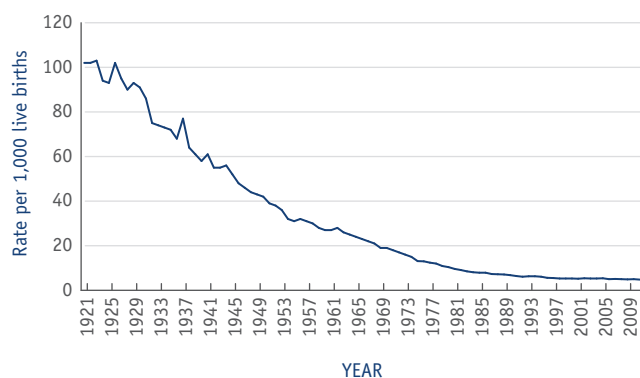
Causes of death

Infant mortality

During the last century, infant mortality has dropped from a rate of more than 100 deaths per 1,000 live births in the early 1920s to 4.8 per 1,000 live births in 2011.^{569, 570, 572} The significant decline in infant death rates has been attributed to improved sanitation, nutrition, standard of living, level of education and family planning.^{504, 573} The

main causes of death in infancy are related to congenital malformations (e.g. Down syndrome and malformations of the heart), as well as disorders due to premature birth or low birth-weight.^{574, 575}

FIGURE A.50 Infant mortality rate, Canada, 1921 to 2011^{569–571}



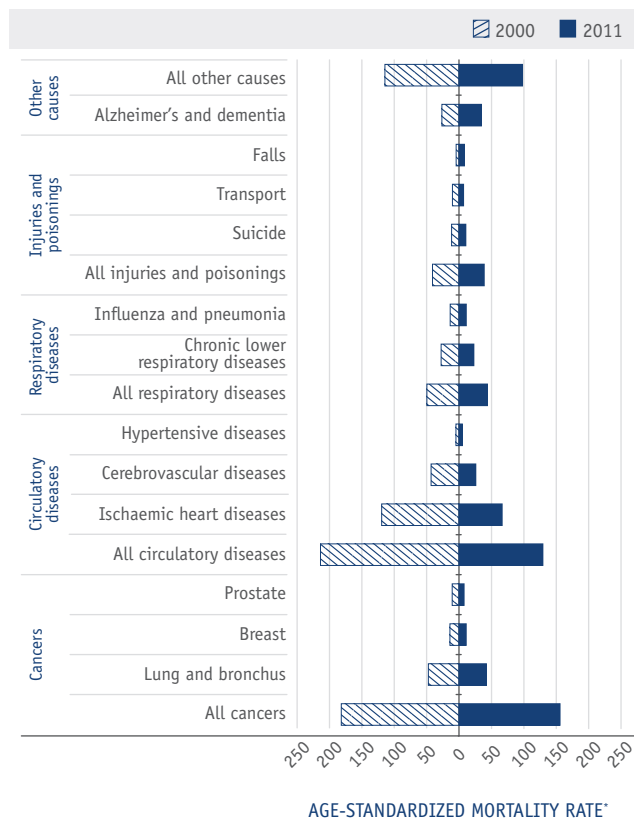
Leading causes of mortality

In 2011, cancers were the leading overall cause of death in Canada (31%), followed by circulatory diseases (27%) and respiratory diseases (9%).^{574–593} Since population distributions are not identical, age-standardized mortality rates (ASMR) provide a better indication of mortality risk within a population. Between 2000 and 2011, the ASMR have decreased among cancers, circulatory diseases, respiratory diseases and injuries and poisonings.^{15, 577, 584, 585, 592} During the same period, deaths from Alzheimer’s and other dementias increased.^{15, 580}

Potential years of life lost

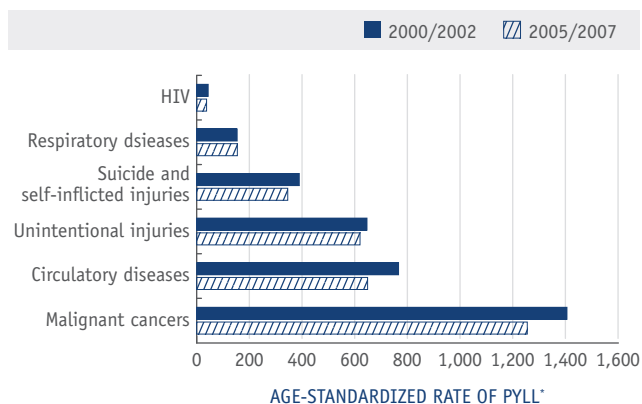
While knowing the number of deaths due to a particular disease or condition is important for understanding the health of the Canadian population, so too is knowing the age at which those deaths occur. Measuring the number of potential years of life lost (PYLL) to premature death provides a better sense of the impact a given disease or condition has on the health of the population. For example, if a Canadian dies of cancer aged 45 years, he or she has potentially lost 30 years of life (conservatively assuming a life expectancy of 75 years at birth, as is commonly done in these calculations).⁵⁹⁴ In 2009, most years of lost life were due to premature deaths associated with cancers, circulatory diseases and unintentional injuries.⁵⁹⁵

FIGURE A.51 Change in age-standardized mortality rate by select causes of death, Canada, 2000 and 2011^{15, 577, 580, 581, 584, 585, 592}



* per 100,000 population.

FIGURE A.52 Age-standardized rate of potential years of life lost (PYLL) by select causes, Canada, 2000/2002 and 2005/2007⁵⁹⁴



* per 100,000 population.

Summary

Although the health of Canadians is considered to be very good by international standards, a closer inspection of differing rates of death, disease and disability among various groups shows that some of us experience worse health and a lower quality of life than others. Many factors influence these outcomes, including the aging

of the population, increasing survival rates for potentially fatal conditions and changes in behaviours related to eating, physical activity and the use of substances such as drugs, tobacco and alcohol. These are not the only factors at play; evidence shows that income, education, employment and working conditions can also affect individual health behaviours and outcomes.

TABLE A.1 *Who we are*

Who we are (million people)		Year
Population (as of July 1, 2013)	35.2	2013
Aboriginal peoples	1.40	2011
First Nations (single identity)	0.85	2011
Inuit (single identity)	0.06	2011
Métis (single identity)	0.45	2011
Multiple Aboriginal identity	0.01	2011
Other Aboriginal identities	0.03	2011
Immigrant	6.78	2011
By birthplace		
Africa	0.49	2011
Asia	3.04	2011
Caribbean and Bermuda	0.35	2011
Central America	0.15	2011
Europe	2.13	2011
Oceania and other [*]	0.07	2011
South America	0.29	2011
United States	0.26	2011
By years since immigration		
Recent (\leq 10 years)	2.15	2011
Long-term ($>$ 10 years)	4.62	2011
Population centre residents	28.1	2011
Life expectancy at birth (years of expected life, females)	83.6	2009/2011
Life expectancy at birth (years of expected life, males)	79.3	2009/2011

^{*} "Other" includes countries such as Saint Pierre and Miquelon, Bonaire, Saint Eustatius and Saba; Falkland Islands (Malvinas); Greenland; Saint Barthélemy; Saint Martin (French part); and South Georgia and the South Sandwich Islands, the category "Other country," as well as immigrants born in Canada.

NOTE: Definitions and data sources can be found in Appendix B.

SOURCE: Statistics Canada.

TABLE A.2 *Factors influencing health*

Factors influencing our health		95% CI	Year
Education, employment and income			
High school graduates (%) [*]	84.4	—	2013
Some post-secondary education (%) [*]	64.6	—	2013
Post-secondary graduates (%) [*]	59.6	—	2013
Unemployment rate (%) [†]	7.1	—	2013
Persons living in low income, after tax (% of the population, based on 1992 low income cutoff)	8.8	—	2011
Environment, housing and community			
Ozone concentrations (parts per billion)	33.0	—	2011
Fine particulate matter concentrations (micrograms per cubic metre)	6.6	—	2011
Core housing need (% of households in need)	12.7	—	2006
Urban core housing need (% of urban households in need)	13.2	—	2010
Sense of community belonging, somewhat or very strong (%) ^{‡,§}	66.1	(65.3–66.8)	2012
Violent crime incidents (per 100,000 population per year)	1,190.1	—	2012
Health behaviours			
Physical activity during leisure-time, moderately active or active (%) ^{‡,§}	53.9	(53.1–54.6)	2012
Fruit and vegetable consumption, 5+ times per day (%) ^{‡,§}	40.6	(39.8–41.3)	2012
Households reporting moderate to severe food insecurity (%) ^{‡,§}	8.3	(8.0–8.7)	2011/2012
Current smoker (%) [†]	16.1	(15.0–17.3)	2012
Exceeds low-risk drinking guidelines for acute effects (%) ^{†,‡}	9.9	(8.8–11.0)	2012
Exceeds low-risk drinking guidelines for chronic effects (%) ^{†,‡}	14.4	(13.1–15.7)	2012
Illicit drug use in the past year (%) ^{†,‡}	10.6	(9.4–11.8)	2012
Contact with medical doctor (%) ^{‡,§}	78.7	(78.1–79.4)	2012
Contact with dental professional (%) ^{‡,§}	65.5	(64.6–66.4)	2012

^{*} Population aged 25+ years.

[†] Population aged 15+ years.

[‡] Self-reported data.

[§] Population aged 12+ years.

NOTE: Definitions and data sources can be found in Appendix B.

SOURCES: Statistics Canada, Environment Canada, Canada Mortgage and Housing Corporation and Health Canada.

TABLE A.3 Health status

Our health status		95% CI	Year
Health-adjusted life expectancy and perceived health			
Perceived health, very good or excellent (%) ^{*†}	59.9	(59.2–60.6)	2012
Health-adjusted life expectancy at birth (years of expected health life, females)	71.2	(71.0–71.4)	2005/2007
Health-adjusted life expectancy at birth (years of expected health life, males)	68.9	(68.7–69.0)	2005/2007
Teen birth rate (live births per 1,000 female population aged 15 to 19 years per year)	12.6	—	2011
Chronic conditions			
Cancer incidence (new cases age-standardized per 100,000 population per year)	398.6	—	2013
Diabetes prevalence (%) [‡]	6.8	(6.83–6.85)	2008/2009
Obesity (%) [§]	26.2	(25.3–27.1)	2009/2011
Arthritis (%) [*]	15.4	(15.0–15.9)	2012
Asthma (%) ^{*†}	8.1	(7.7–8.5)	2012
Chronic obstructive pulmonary disease (%) ^{*¶}	4.2	(3.9–4.5)	2012
Heart diseases (%) ^{*†}	4.9	(4.5–5.3)	2012
High blood pressure (%) ^{*†}	18.4	(17.6–19.2)	2012
Infectious diseases			
Chlamydia (new cases per 100,000 population annually)	290.4	—	2011
Gonorrhea (new cases per 100,000 population annually)	33.1	—	2011
Infectious syphilis (new cases per 100,000 population annually)	5.1	—	2011
New HIV diagnoses (number of new positive HIV tests)	2,062	—	2012
Tuberculosis (new active and re-treatment cases per 100,000 population annually)	4.8	—	2011
Mental health and mental illness			
Perceived mental health, very good or excellent (%) ^{*†}	71.7	(71.0–72.4)	2012
Major depressive episode (% , previous 12 months) [*]	4.7	(4.3–5.1)	2012
Alcohol use or dependence (% , previous 12 months) [*]	3.2	(2.8–3.5)	2012
Anxiety disorders, generalized (% , previous 12 months) [*]	2.6	(2.3–2.8)	2012
Schizophrenia or psychosis (ever diagnosed) [*]	1.3	(1.1–1.5)	2012
Alzheimer's disease and other dementias (per 1,000 population) ^{*#}	3.6	—	2011
Causes of death			
Infant mortality rate (deaths under one year per 1,000 live births)	4.8	—	2011
Leading causes of mortality (deaths per 100,000 population per year)			
Cancers	211.0	—	2011
Circulatory diseases	192.7	—	2011
Respiratory diseases	64.3	—	2011
Causes of premature mortality, aged 0 to 74 years (potential years of life lost per 100,000 population per year)			
Cancers	1,504.0	—	2009
Circulatory diseases	755.4	—	2009
Unintentional injuries	546.3	—	2009
Suicide and self-inflicted injuries	322.2	—	2009
Respiratory diseases	208.0	—	2009
HIV	28.3	—	2009

* Self-reported data.

† Population aged 12+ years.

‡ Population aged 1+ years.

§ Population aged 18+ years.

¶ Population aged 35+ years.

|| Population aged 15+ years.

Population aged 40+ years.

NOTE: Definitions and data sources can be found in Appendix B.

SOURCES: Statistics Canada, Canadian Cancer Society, Public Health Agency of Canada and Alzheimer Society of Canada.

APPENDIX B: DEFINITIONS AND DATA SOURCES FOR INDICATORS

— A —

Aboriginal peoples (2011)⁵⁹⁶

The collective name for the original peoples of North America and their descendants. The *Constitution Act* (1982) recognizes three groups of Aboriginal peoples—Indians, Inuit and Métis.

Data source

Statistics Canada. (2013). *Aboriginal Peoples in Canada: First Nations People, Métis and Inuit*. (Ottawa: Statistics Canada).

First Nations (single identity) (2011)^{9, 596}

A term commonly used in the 1970s to replace “Indian.” Although the term First Nation is now widely used, no legal definition of it exists. Among its uses, the term “First Nations peoples” refers to the Indian peoples in Canada, both Status and Non-Status. Single identity refers to those people who reported identifying solely as First Nations.

Data source

Statistics Canada. (2013). *Aboriginal Peoples in Canada: First Nations People, Métis and Inuit*. (Ottawa: Statistics Canada).

Inuit (single identity) (2011)^{9, 596}

The Aboriginal people of Arctic Canada who live primarily in Nunavut, the Northwest Territories and northern parts of Labrador and Quebec. Single identity refers to those people who reported identifying solely as Inuit.

Data source

Statistics Canada. (2013). *Aboriginal Peoples in Canada: First Nations People, Métis and Inuit*. (Ottawa: Statistics Canada).

Métis (single identity) (2011)^{9, 596}

People with mixed First Nations and European ancestry who identify themselves as distinct from Indian people, Inuit or non-Aboriginal people. Single identity refers to those people who reported identifying solely as Métis.

Data source

Statistics Canada. (2013). *Aboriginal Peoples in Canada: First Nations People, Métis and Inuit*. (Ottawa: Statistics Canada).

Multiple Aboriginal identity (2011)⁵⁹⁷

People who identify themselves with more than one Aboriginal group.

Data source

Statistics Canada. (2013). *Aboriginal Peoples in Canada: First Nations People, Métis and Inuit*. (Ottawa: Statistics Canada).

Other Aboriginal identities (2011)⁹

Aboriginal identities not included elsewhere.

Data source

Statistics Canada. (2013). *Aboriginal Peoples in Canada: First Nations People, Métis and Inuit*. (Ottawa: Statistics Canada).

Alcohol use or dependence (2012)⁴⁴

Population aged 15 years and over classified as meeting criteria for alcohol abuse or dependence in the 12 months before the interview.

Alcohol dependence is characterized by a recurrent pattern of use where at least three of the following occur in the same 12-month period: increased tolerance, withdrawal, increased consumption, unsuccessful attempts to quit, a lot of time lost recovering or using, reduced activities, and continued drinking despite persistent physical or psychological problems caused or intensified by alcohol.

Alcohol abuse is characterized by a recurrent pattern of use where at least one of the following occurs: failure to fulfill major roles at work, school or home; use in physically hazardous situations; recurrent alcohol-related problems or continued use despite social or interpersonal problems caused or intensified by alcohol. By definition, people who meet the criteria for alcohol dependence are excluded from meeting the criteria for alcohol abuse.

Data source

Statistics Canada. (2013–09–17). *Table 105–1101—Mental Health Profile, Canadian Community Health Survey—Mental Health (CCHS), by age group and sex, Canada and provinces, occasional (number), CANSIM (database)* [Data File].

Alzheimer's disease and other dementias (2011)⁸¹

Alzheimer's disease is a degenerative disease of the brain with characteristic pathological features and is the most common form of dementia. Dementia is a syndrome characterized by loss of memory, the ability to think, as well as changes in mood, behaviour and ability to communicate. Other common types of dementia include vascular dementia, front temporal dementia, or Lewy body dementia, each with distinct clinical and pathological features. In this report, the term 'other dementias' includes these forms as well as instances of dementia not classified by type.

Data source

Public Health Agency of Canada. (2014). *Mapping Connections: An Understanding of Neurological Conditions in Canada*. (Ottawa: Public Health Agency of Canada).

Anxiety disorder, generalized (2012)⁴⁴

Population aged 15 years and over classified as meeting criteria for generalized anxiety disorder in the 12 months before the interview. Generalized anxiety disorder is characterized by a pattern of frequent, persistent worry and excessive anxiety about several events or activities during a period of at least 6 months. Symptoms of generalized anxiety disorder include restlessness or feeling keyed up or on edge, being easily fatigued, difficulty concentrating, irritability, muscle tension, shakiness, sleep disturbance (difficulty falling asleep or staying asleep or restless, unsatisfying sleep), excessive sweating, palpitations, shortness of breath and various gastrointestinal symptoms.

Data source

Statistics Canada. (2013-09-17). *Table 105-1101—Mental Health Profile, Canadian Community Health Survey—Mental Health (CCHS), by age group and sex, Canada and provinces, occasional (number), CANSIM (database)* [Data File].

Arthritis (2012)⁴⁶⁸

Population aged 15 years and over who reported that they have been diagnosed by a health professional as having arthritis. Arthritis includes rheumatoid arthritis and osteoarthritis, but excludes fibromyalgia.

Data source

Statistics Canada. (2013-06-17). *Table 105-0501—Health indicator profile, annual estimates, by age group and sex, Canada, provinces, territories, health regions (2012 boundaries) and peer groups, occasional, CANSIM (database)* [Data File].

Asthma (2012)⁴⁶⁸

Population aged 12 years and over who reported that they have been diagnosed by a health professional as having asthma.

Data source

Statistics Canada. (2013-06-17). *Table 105-0501—Health indicator profile, annual estimates, by age group and sex, Canada, provinces, territories, health regions (2012 boundaries) and peer groups, occasional, CANSIM (database)* [Data File].

— C —

Cancer incidence (2013)⁵⁰⁵

Estimated number of new cancer cases diagnosed in a given population during a specific period of time (usually one year) and calculated as the rate per 100,000 population.

Data source

Canadian Cancer Society's Advisory Committee on Cancer Statistics. (2013). *Canadian Cancer Statistics 2013*. (Toronto: Canadian Cancer Society).

Cancers (2011)⁵⁷⁷

Deaths associated with malignant cancers (ICD-10 C00-C97) expressed as a rate per 100,000 population, over a specific time-period.

Data source

Statistics Canada. (2014-01-27). *Table 102-0522—Deaths, by cause, Chapter II: Neoplasms (C00 to D48), age group and sex, Canada, annual (number), CANSIM (database)* [Data File]; and Statistics Canada. (2013-11-22). *Table 051-0001—Estimates of population, by age group and sex for July 1, Canada, provinces and territories, annual (persons unless otherwise noted), CANSIM (database)* [Data File].

Chlamydia (2011)⁵³¹

Estimated rate of chlamydia (*Chlamydia trachomatis*) per 100,000 population was reported to the Public Health Agency of Canada by the provinces and territories.

Data source

Public Health Agency of Canada. (2014). *Report on Sexually Transmitted Infections in Canada: 2011*. (Ottawa: Public Health Agency of Canada).

Chronic obstructive pulmonary disease (2012)⁴⁶⁸

Population aged 35 years and over who reported that they have been diagnosed by a health professional as having chronic obstructive pulmonary disease, chronic bronchitis or emphysema.

Data source

Statistics Canada. (2013–06–17). *Table 105–0501—Health indicator profile, annual estimates, by age group and sex, Canada, provinces, territories, health regions (2012 boundaries) and peer groups, occasional, CANSIM (database)* [Data File].

Circulatory diseases (2011)⁵⁸⁴

Deaths associated with circulatory diseases (ICD–10 I00–I99) expressed as a rate per 100,000 population, over a specific time-period.

Data sources

Statistics Canada. (2014–01–27). *Table 102–0529—Deaths, by cause, Chapter IX: Diseases of the circulatory system (I00 to I99), age group and sex, Canada, annual (number), CANSIM (database)* [Data File]; and Statistics Canada. (2013–11–22). *Table 051–0001—Estimates of population, by age group and sex for July 1, Canada, provinces and territories, annual (persons unless otherwise noted), CANSIM (database)* [Data File].

Contact with dental professional (2012)⁴⁸

Population aged 12 years and over who reported that they have consulted with a dental professional (dentist, dental hygienist or orthodontist) in the past 12 months.

Data source

Statistics Canada. *Canadian Community Health Survey, 2012: Annual* [Share Microdata File]. Ottawa, Ontario: Statistics Canada. All computations on these microdata were prepared by the Public Health Agency of Canada and the responsibility for the use and interpretation of these data is entirely that of the author(s).

Contact with medical doctor (2012)⁴⁶⁸

Population aged 12 years and over who reported that they have consulted with a medical doctor in the past 12 months. Medical doctor includes family or general practitioners as well as specialists such as surgeons, allergists, orthopaedists, gynaecologists or psychiatrists. For population aged 12 to 17, includes pediatricians.

Data source

Statistics Canada. (2013–06–17). *Table 105–0501—Health indicator profile, annual estimates, by age group and sex, Canada, provinces, territories, health regions (2012 boundaries) and peer groups, occasional, CANSIM (database)* [Data File].

Core housing need (2006)⁴⁵⁶

A household is in core housing need if it does not meet one or more of the adequacy, suitability or affordability standards and it would have to spend 30% or more of its before-tax income to pay the median rent (including utility costs) of alternative local market housing that meets all three standards:

- Adequate housing does not require any major repairs, according to residents. Major repairs include defective plumbing or electrical wiring or structural repairs to walls, floors or ceilings.
- Suitable housing has enough bedrooms for the size and make-up of resident households according to National Occupancy Standard (NOS) requirements. Enough bedrooms based on NOS requirements means one bedroom for each cohabiting adult couple; unattached household member aged 18 years and over; same-sex pair of children aged under 18 years; and additional boy or girl in the family, unless there are two opposite sex children under 5 years of age, in which case they are expected to share a bedroom. A household of one individual can occupy a bachelor unit (i.e. a unit with no bedroom).
- Affordable housing costs less than 30% of before-tax household income. For renters, shelter costs include rent and any payments for electricity, fuel, water and other municipal services. For owners, shelter costs include mortgage payments (principal and interest), property taxes, and any condominium fees, along with payments for electricity, fuel, water and other municipal services.

Data source

Canada Mortgage and Housing Corporation. (2009). *2006 Census Housing Series: Issue 3—The Adequacy, Suitability, and Affordability of Canadian Housing, 1991–2006*. (Canada: Canada Mortgage and Housing Corporation).

Urban core housing need (2010)⁵⁹⁸

Core housing need in urban households, where urban households are defined as those in census metropolitan areas (CMAs) and census agglomerations (CAs).

Data source

Canada Mortgage and Housing Corporation. (2013). *Canadian Housing Observer 2013*. (Canada: Canada Mortgage and Housing Corporation).

Current smoker (2012)³⁷

Population aged 15 years and over who have identified themselves as either daily smokers or non-daily smokers (also known as occasional smokers).

Data source

Health Canada. (2013–10–01). *Table 1. Smoking status and average number of cigarettes smoked per day, by age group and sex, age 15+ years, Canada 2011* [Data File].

— D —

Diabetes prevalence (2008/2009)³⁹

The proportion of people who are affected by diabetes at a given point in time.

Data source

Public Health Agency of Canada. (2011). *Diabetes in Canada: Facts and figures from a public health perspective*. (Ottawa: Public Health Agency of Canada).

— E —

Exceeds low-risk drinking guidelines for acute effects (2012)⁵⁹⁹

Population aged 15 years and over who consume more than 3 drinks (for women) or 4 drinks (for men) on any single occasion.

Data source

Health Canada. (2013). *Canadian Alcohol and Drug Use Monitoring Survey (CADUMS). Detailed tables for 2012*.

Exceeds low-risk drinking guidelines for chronic effects (2012)⁵⁹⁹

Population aged 15 years and over who consume more than 10 drinks a week for women, with more than 2 drinks a day most days and 15 drinks a week for men, with more than 3 drinks a day most days.

Data source

Health Canada. (2013). *Canadian Alcohol and Drug Use Monitoring Survey (CADUMS). Detailed tables for 2012*.

— F —

Fine particulate matter concentrations (2011)⁴³⁴

The national annual average fine particulate matter (PM_{2.5}) indicator is based on the annual average concentrations recorded at 56 monitoring stations across Canada.

Data source

Environment Canada. (2013–11–01). *Fine particulate matter concentrations, Canada, 2000 to 2011* [Data File].

First Nations (2011)

See *Aboriginal people(s)*.

Fruit and vegetable consumption, 5+ times per day (2012)⁴⁶⁸

Indicates the usual number of times (frequency) per day a person, aged 12 years and over, reported eating fruits and vegetables. Measure does not take into account the amount consumed.

Data source

Statistics Canada. (2013–06–17). *Table 105–0501—Health indicator profile, annual estimates, by age group and sex, Canada, provinces, territories, health regions (2012 boundaries) and peer groups, occasional, CANSIM (database)* [Data File].

— G —

Gonorrhoea (2011)⁵³¹

Estimated rate of gonorrhoea (*Neisseria gonorrhoeae*) per 100,000 population was reported to the Public Health Agency of Canada by the provinces and territories.

Data source

Public Health Agency of Canada. (2014). *Report on Sexually Transmitted Infections in Canada: 2011*. (Ottawa: Public Health Agency of Canada).

— H —

Health-adjusted life expectancy (2005/2007)⁴⁹⁷

Health-adjusted life expectancy is the number of years in full health that an individual can expect to live given the current morbidity and mortality conditions. Health-adjusted life expectancy uses the Health Utility Index (HUI) to weigh years lived in good health higher than years lived in poor health. Thus, health-adjusted life expectancy is not only a measure of quantity of life but also a measure of quality of life.

Data source

Statistics Canada. (2012–05–23). *Table 102–0122—Health-adjusted life expectancy, at birth and at age 65, by sex and income, Canada and provinces occasional (years), CANSIM (database)* [Data File].

Heart disease (2012)⁴⁸

Population aged 12 years and over who reported that they have been diagnosed by a health professional as having heart disease.

Data source

Statistics Canada. *Canadian Community Health Survey, 2012: Annual* [Share Microdata File]. Ottawa, Ontario: Statistics Canada. All computations on these microdata were prepared by the Public Health Agency of Canada and the responsibility for the use and interpretation of these data is entirely that of the author(s).

High blood pressure (2012)⁴⁸

Population aged 12 years and over who reported that they have been diagnosed by a health professional as having high blood pressure or having used blood pressure medication in the past month.

Data source

Statistics Canada. *Canadian Community Health Survey, 2012: Annual* [Share Microdata File]. Ottawa, Ontario: Statistics Canada. All computations on these microdata were prepared by the Public Health Agency of Canada and the responsibility for the use and interpretation of these data is entirely that of the author(s).

High school graduates (2013)⁴¹⁶

Population aged 25 years and over who have received a high school diploma or, in Quebec, completed Secondary V or, in Newfoundland and Labrador, completed fourth year of secondary.

Data source

Statistics Canada. (2014–01–10). *Table 282–0004—Labour force survey estimates (LFS), by educational attainment, sex and age group, annual, CANSIM (database)* [Data File].

Households reporting moderate to severe food insecurity (2011/2012)⁴⁶⁹

This variable is based on a set of 18 questions and indicates whether households both with and without children were able to afford the food they needed in the previous 12 months. The levels of food security are defined as: 1- Food secure: No, or one, indication of difficulty with income-related food access; 2- Moderately food insecure: Indication of compromise in quality and/or quantity of food consumed; 3- Severely food insecure: Indication of reduced food intake and disrupted eating patterns.

Data source

Statistics Canada. (2013–12–11). *Table 105–0546—Household food insecurity measures, by presence of children in the household, Canada, provinces and territories occasional (number), CANSIM (database)* [Data File].

Illicit drug use in the past year (2012)⁴⁸⁴

Population aged 15 years and over who reported using an illicit drug (cannabis, cocaine/crack, speed, ecstasy, hallucinogens, heroin or salvia) in the 12 months before the interview.

Data source

Health Canada. (2013). *Canadian Alcohol and Drug Use Monitoring Survey (CADUMS). Detailed tables for 2012.*

Immigrant (2011)⁶⁰⁰

A person who is, or has ever been, a landed immigrant/permanent resident. This person has been granted the right to live in Canada permanently by immigration authorities. While “immigrant” usually applies to persons born outside Canada, it may also apply to a small number of persons born inside Canada to parents who are foreign-born.

Data source

Statistics Canada. (2014–03–04). *Citizenship, Place of Birth, Immigrant Status and Period of Immigration, Age Groups and Sex for the Population in Private Households of Canada, Provinces, Territories, Census Metropolitan Areas and Census Agglomerations, 2011 National Household Survey* [Data File].

By birth place (2011)⁶⁰¹

Birth place refers to the name of the province, territory or country in which the person was born. It may refer to a province or territory if the person was born in Canada. It refers to a country if the person was born outside Canada. The geographic location is specified according to boundaries current at the time the data are collected, not the boundaries at the time of birth.

Data source

Statistics Canada. (2014–03–04). *Citizenship, Place of Birth, Immigrant Status and Period of Immigration, Age Groups and Sex for the Population in Private Households of Canada, Provinces, Territories, Census Metropolitan Areas and Census Agglomerations, 2011 National Household Survey* [Data File].

By years since immigration (2011)⁶⁰⁰

Years since immigration refers to the period in which the immigrant first obtained his or her landed immigrant/permanent resident status.

Data source

Statistics Canada. (2014–03–04). *Citizenship, Place of Birth, Immigrant Status and Period of Immigration, Age Groups and Sex for the Population in Private Households of Canada, Provinces, Territories, Census Metropolitan Areas and Census Agglomerations, 2011 National Household Survey* [Data File].

Infant mortality rate (2011)⁵⁷²

The number of infant deaths occurring within the first year of life, during a given calendar year, per 1,000 live births in the same calendar year.

Data source

Statistics Canada. (2013-09-24). *Table 102-0504—Deaths and mortality rates, by age group and sex, Canada, provinces and territories, annual, CANSIM (database)* [Data File].

Infectious syphilis (2011)⁵³¹

Estimated rate of infectious syphilis (including primary, secondary and early latent stages) per 100,000 population was reported to the Public Health Agency of Canada by the provinces and territories.

Data source

Public Health Agency of Canada. (2014). *Report on Sexually Transmitted Infections in Canada: 2011*. (Ottawa: Public Health Agency of Canada).

Inuit (2011)

See *Aboriginal people(s)*.

— L —

Life expectancy at birth (2009/2011)⁶⁰²

The number of years a person would be expected to live, starting at birth, if the age- and sex-specific mortality rates for a given observation period (such as a calendar year) were held constant over his/her life span.

Data source

Statistics Canada. (2013). Deaths, 2010 and 2011. *The Daily*, September 25, 2013.

— M —

Major depressive episode (2012)⁴⁴

Population aged 15 years and over classified as meeting criteria major depressive episode in the 12 months before the interview. Major depressive episode requires at least one episode of 2 weeks or more with persistent depressed mood and loss of interest or pleasure in normal activities, accompanied by problems such as decreased energy, changes in sleep and appetite, impaired concentration and feelings of guilt, hopelessness, or suicidal thoughts.

Data source

Statistics Canada. (2013-09-17). *Table 105-1101—Mental Health Profile, Canadian Community Health Survey—Mental Health (CCHS), by age group and sex, Canada and provinces, occasional (number), CANSIM (database)* [Data File].

Métis (2011)

See *Aboriginal people(s)*.

— N —

New HIV diagnoses (2012)⁶⁰³

The number of newly diagnosed cases of human immunodeficiency virus (HIV) in the population reported to the Public Health Agency of Canada during a specified time.

Data source

Public Health Agency of Canada. (2013-11-29). *At a Glance—HIV and AIDS in Canada: Surveillance Report to December 31st, 2012*.

— O —

Obesity (2009/2011)⁶⁰⁴

Body Mass Index (BMI) is a method of classifying body weight according to health risk. It is calculated for the population aged 18 years and over, excluding pregnant females and persons less than 3 feet (0.914 metres) tall or greater than 6 feet 11 inches (2.108 metres). BMI is calculated as follows: weight in kilograms divided by height in metres squared. According to World Health Organization and Health Canada guidelines, health risk levels are associated with each of the following BMI categories (see Table B.1).

Data source

Statistics Canada. *Canadian Health Measures Survey, 2009–2011: Cycle 2* [Share Microdata File]. Ottawa, Ontario: Statistics Canada. All computations on these microdata were prepared by the Public Health Agency of Canada and the responsibility for the use and interpretation of these data is entirely that of the author(s).

TABLE B.1 BMI and health risk⁶⁰⁴

Weight	BMI (kg/m ²)	Health risk
Underweight	Under 18.5	Increased
Normal weight	18.5–24.9	Least
Overweight	25.0–29.9	Increased
Obese class I	30.0–34.9	High
Obese class II	35.0–39.9	Very high
Obese class III	40 or greater	Extremely high

Ozone concentrations (2011)⁴²⁸

The national annual average ozone (O₃) indicator is based on the annual average of the daily maximum 8-hour average concentrations recorded at 127 monitoring stations across Canada.

Data source

Environment Canada. (2013–11–01). *Ozone concentrations, Canada, 1997 to 2011* [Data File].

— P —

Perceived health, very good or excellent (2012)⁴⁶⁸

Population aged 12 years and over who reported perceiving their own health status as being either excellent or very good. Perceived health refers to the perception of a person's health in general, either by the person himself or herself, or in the case of a proxy response, by the person responding. Health means not only the absence of disease or injury but also physical, mental and social well-being.

Data source

Statistics Canada. (2013–06–17). *Table 105–0501—Health indicator profile, annual estimates, by age group and sex, Canada, provinces, territories, health regions (2012 boundaries) and peer groups, occasional, CANSIM (database)* [Data File].

Perceived mental health, very good or excellent (2012)⁴⁶⁸

Population aged 12 years and over who reported perceiving their own mental health status as being either excellent or very good. Perceived mental health refers to the perception of a person's mental health in general. Perceived mental health provides a general indication of the population suffering from some form of mental disease, mental or emotional problems, or distress, not necessarily reflected in perceived health.

Data source

Statistics Canada. (2013–06–17). *Table 105–0501—Health indicator profile, annual estimates, by age group and sex, Canada, provinces, territories, health regions (2012 boundaries) and peer groups, occasional, CANSIM (database)* [Data File].

Persons living in low income, after tax (2011)⁴²⁵

Canadian families who are likely to spend 20 percentage points more of their total post-tax income on necessities (food, clothing and footwear, and shelter) compared to an average family of the same size, in the same broad community size. Low income is based on the consumption patterns for 1992, revised in 2005, and adjusted for family size, community sizes and inflation based on the national Consumer Price Index. After-tax income is total income, which includes government transfers, less income tax (see Table B.2).

Data source

Statistics Canada. (2013–06–27). *Table 202–0802—Persons in low income families, annual, CANSIM (database)*. [Data File].

TABLE B.2 Low income cut-offs after tax, Canada, 2011⁴²⁵

Size of family unit	Rural Areas (\$)	Community Size			
		Census Agglomeration		Census Metropolitan Area	
		Population less than 30,000 (\$)	Population less than 30,000 (\$)	Population 100,000 and 499,999 (\$)	Population 500,000 and over (\$)
1 person	12,629	14,454	16,124	16,328	19,307
2 persons	15,371	17,592	19,625	19,872	23,498
3 persons	19,141	21,905	24,437	24,745	29,260
4 persons	23,879	27,329	30,487	30,871	36,504
5 persons	27,192	31,120	34,717	35,154	41,567
6 persons	30,156	34,513	38,502	38,986	46,099
7 or more persons	33,121	37,906	42,286	42,819	50,631

Physical activity during leisure-time, moderately active or active (2012)⁴⁶⁸

Population aged 12 years and over who reported a level of physical activity, based on their responses to questions about the nature, frequency and duration of their participation in leisure-time physical activity. Respondents are classified as active, moderately active or inactive based on an index of average daily physical activity over the past three months. For each leisure-time physical activity the respondent engages in, average daily energy expenditure is calculated by multiplying the number of times the activity was performed by the average duration of the activity by the energy cost (kilocalories per kilogram of body weight per hour) of the activity. The index is calculated as the sum of the average daily energy expenditures of all activities. Respondents are classified as follows: 3.0 kcal/kg/day or more = physically active; 1.5 to 2.9 kcal/kg/day = moderately active; less than 1.5 kcal/kg/day = inactive.

Data source

Statistics Canada. (2013-06-17). *Table 105-0501—Health indicator profile, annual estimates, by age group and sex, Canada, provinces, territories, health regions (2012 boundaries) and peer groups, occasional, CANSIM (database)* [Data File].

Population (2013)¹⁵

Estimates are based on the 2011 Census counts adjusted for census net undercoverage including adjustment for incompletely enumerated Indian reserves and the components of demographic growth that occurred since that census.

Data source

Statistics Canada. (2013-11-22). *Table 051-0001—Estimates of population, by age group and sex for July 1, Canada, provinces and territories, annual (persons unless otherwise noted), CANSIM (database)* [Data File].

Population centre residents (2011)⁶⁰⁵

A population centre has a minimum population concentration of 1,000 persons and a population density of at least 400 persons per square kilometre, based on the current census population count. All areas outside population centres are classified as rural areas. Population centres include all the population living in the cores, secondary cores and fringes of census metropolitan areas (CMAs) and census agglomerations (CAs), as well as the population living in population centres outside CMAs and CAs.

Data source

Statistics Canada. (2014-01-13). *Population and dwelling counts, for population centres, 2011 and 2006 censuses (table). Population and Dwelling Count Highlight Tables. 2011 Census* [Data File].

Post-secondary graduates (2013)⁴¹⁶

Population aged 25 years and over who have completed a certificate (including a trade certificate) or diploma from an educational institution beyond the secondary level. This includes certificates from vocational schools, apprenticeship training, community college, Collège d'Enseignement Général et Professionnel (CEGEP), and school of nursing. Also included are certificates below a bachelor's degree obtained at a university.

Data source

Statistics Canada. (2014-01-10). *Table 282-0004—Labour force survey estimates (LFS), by educational attainment, sex and age group, annual (persons unless otherwise noted), CANSIM (database)* [Data File].

Potential years of life lost⁵⁹⁴

Potential years of life lost is the population average of the number of years of life lost, across all persons dying prematurely from any cause—before the age of 75 years, over a specific period of time. A person who dies at age 25 years, for example, has lost 50 years of life.

Premature mortality due to cancers (2009)^{594, 595}

Potential years of life lost for all malignant neoplasms (ICD-10 C00-C97) is the population average of the number of years of life lost, across all persons dying prematurely from any cancer before age 75 years, over a specific period of time.

Data source

Statistics Canada. *Canadian Vital Statistics, Death Database, 2009*. All computations on these data were prepared by the Public Health Agency of Canada and the responsibility for the use and interpretation of these data is entirely that of the author(s).

Premature mortality due to circulatory diseases (2009)^{594, 595}

Potential years of life lost for all circulatory disease (ICD-10 I00-I99) is the population average of the number of years of life lost, across all persons dying prematurely from any circulatory disease before age 75 years, over a specific period of time.

Data source

Statistics Canada. *Canadian Vital Statistics, Death Database, 2009*. All computations on these data were prepared by the Public Health Agency of Canada and the responsibility for the use and interpretation of these data is entirely that of the author(s).

Premature mortality due to HIV (2009)^{594, 595}

Potential years of life lost for human immunodeficiency virus (HIV) infection (ICD-10 B20-B24) is the population average of the number of years of life lost, across all persons dying prematurely from HIV before age 75 years, over a specific period of time.

Data source

Statistics Canada. *Canadian Vital Statistics, Death Database, 2009*. All computations on these data were prepared by the Public Health Agency of Canada and the responsibility for the use and interpretation of these data is entirely that of the author(s).

Premature mortality due to respiratory diseases (2009)^{594, 595}

Potential years of life lost for all respiratory disease (ICD-10 J00-J99) is the population average of the number of years of life lost, across all persons dying prematurely from any respiratory disease before age 75 years, over a specific period of time.

Data source

Statistics Canada. *Canadian Vital Statistics, Death Database, 2009*. All computations on these data were prepared by the Public Health Agency of Canada and the responsibility for the use and interpretation of these data is entirely that of the author(s).

Premature mortality due to suicide and self-inflicted injuries (2009)^{594, 595}

Potential years of life lost for suicides (ICD-10 X60-X71, X75-X84, Y87.0) is the population average of the number of years of life lost, across all persons dying prematurely from any self-inflicted injury before age 75 years, over a specific period of time.

Data source

Statistics Canada. *Canadian Vital Statistics, Death Database, 2009*. All computations on these data were prepared by the Public Health Agency of Canada and the responsibility for the use and interpretation of these data is entirely that of the author(s).

Premature mortality due to unintentional injuries (2009)^{594, 595}

Potential years of life lost for unintentional injuries (ICD-10 V01-X59, Y85-Y86) is the population average of the number of years of life lost, across all persons dying prematurely from any unintentional injury before age 75 years, over a specific period of time.

Data source

Statistics Canada. *Canadian Vital Statistics, Death Database, 2009*. All computations on these data were prepared by the Public Health Agency of Canada and the responsibility for the use and interpretation of these data is entirely that of the author(s).

— R —

Respiratory diseases (2011)⁵⁸⁵

Deaths associated with respiratory diseases (ICD-10 J00-J99) expressed as a rate per 100,000 population, over a specific time-period.

Data sources

Statistics Canada. (2014-01-27). *Table 102-0530—Deaths, by cause, Chapter X: Diseases of the respiratory system (J00 to J99), age group and sex, Canada, annual (number), CANSIM (database) [Data File]*; and Statistics Canada. (2013-11-22). *Table 051-0001—Estimates of population, by age group and sex for July 1, Canada, provinces and territories, annual (persons unless otherwise noted), CANSIM (database) [Data File]*.

— S —

Schizophrenia or psychosis (2012)⁴⁴

Population aged 15 years and over who reported that they have ever been diagnosed by a health professional with schizophrenia or psychosis.

Data source

Statistics Canada. (2013-09-17). *Table 105-1101—Mental Health Profile, Canadian Community Health Survey—Mental Health (CCHS), by age group and sex, Canada and provinces, occasional (number), CANSIM (database)* [Data File].

Sense of community belonging, somewhat or very strong (2012)⁴⁶⁸

Population aged 12 years and over who reported their sense of belonging to their local community as being very strong or somewhat strong.

Data source

Statistics Canada. (2013-06-17). *Table 105-0501—Health indicator profile, annual estimates, by age group and sex, Canada, provinces, territories, health regions (2012 boundaries) and peer groups, occasional, CANSIM (database)* [Data File].

Some post-secondary education (2013)⁴¹⁶

Population aged 25 years and over who worked toward, but did not complete, a degree, certificate (including a trade certificate) or diploma from an educational institution, including a university, beyond the secondary level. This includes vocational schools, apprenticeship training, community college, Collège d'Enseignement Général et Professionnel (CEGEP), and school of nursing.

Data source

Statistics Canada. (2014-01-10). *Table 282-0004—Labour force survey estimates (LFS), by educational attainment, sex and age group, annual, CANSIM (database)* [Data File].

— T —

Teen birth rate (2011)⁵⁰¹

Number of live births per 1,000 female population aged 15 to 19 years.

Data source

Statistics Canada. (2013-03-18). *Table 102-4505—Crude birth rate, age-specific and total fertility rates (live births), Canada, provinces and territories, annual (rate), CANSIM (database)* [Data File].

Tuberculosis (2011)⁵⁵⁵

Number of cases of new active and re-treatment tuberculosis cases per 100,000 population.

Data source

Public Health Agency of Canada. (2014). *Tuberculosis in Canada, 2012*. (Ottawa: Public Health Agency of Canada).

— U —

Unemployment rate (2013)⁴¹⁶

The unemployment rate is the number of unemployed persons (those who, during the reference week, were without work, had actively looked for work in the past four weeks, and were available for work as well as persons on layoff or who had a new job to start in four weeks or less) expressed as a percentage of the labour force.

Data source

Statistics Canada. (2014-01-10). *Table 282-0004—Labour force survey estimates (LFS), by educational attainment, sex and age group, annual, CANSIM (database)* [Data File].

Urban core housing need (2010)

See *Core housing need*.

— V —

Violent crime incidents (2012)⁶⁰⁶

Offences that deal with the application, or threat of application, of force to a person. These include homicide, attempted murder, various forms of sexual and non-sexual assault, robbery and abduction.

Data source

Statistics Canada. (2013-07-25). *Table 252-0051—Incident-based crime statistics, by detailed violations, annual (number unless otherwise noted), CANSIM (database)* [Data File].

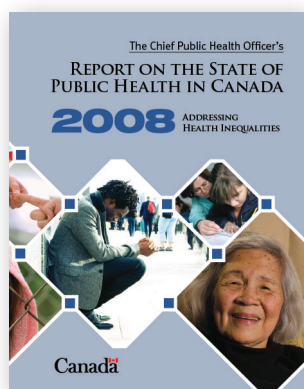
APPENDIX C: THE CHIEF PUBLIC HEALTH OFFICER'S REPORTS ON THE STATE OF PUBLIC HEALTH IN CANADA

The *Public Health Agency of Canada Act* requires the Chief Public Health Officer to submit an annual report on the state of public health in Canada to the Minister of Health within six months of the end of each fiscal year. The Minister lays the report before each House of Parliament on any of the first 15 days on which the House is sitting after receipt of the report.¹

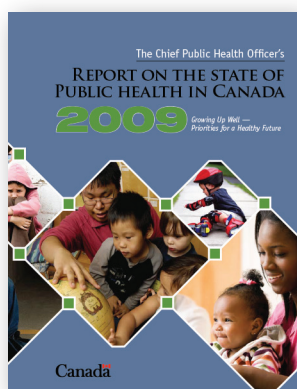
The Act specifies that the CPHO:

- may prepare and publish reports on any issue related to public health;
- may, in any report, refer to public health problems and their causes, as well as any measures that may, in his or her opinion, be effective in preventing or resolving those problems; and
- must, to the extent possible, set out the source of the data and information used in the preparation of the report and methodology employed to arrive at the report's findings, conclusions or recommendations.¹

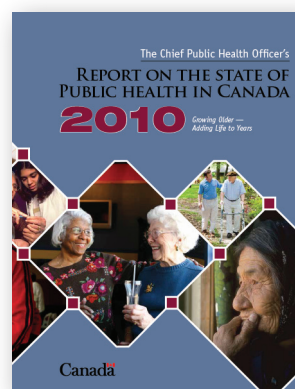
Previous reports from the Chief Public Health Officer of Canada are shown below.



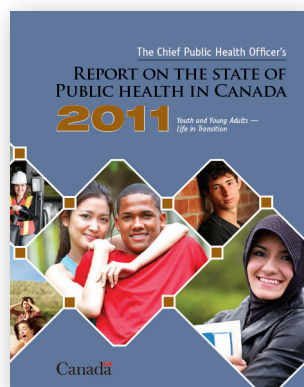
ADDRESSING HEALTH INEQUALITIES



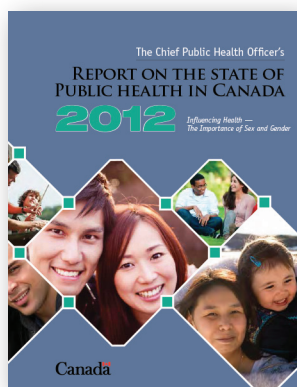
GROWING UP WELL—
PRIORITIES FOR A HEALTHY FUTURE



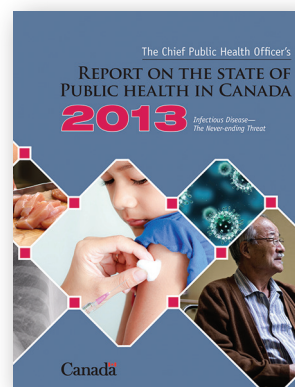
GROWING OLDER—
ADDING LIFE TO YEARS



YOUTH AND YOUNG ADULTS—
LIFE IN TRANSITION



INFLUENCING HEALTH—
THE IMPORTANCE OF SEX AND GENDER



INFECTIOUS DISEASE—
THE NEVER-ENDING THREAT

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