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The Burden of Chronic Diseases in Ontario

Key Estimates to Support Efforts in Prevention

July 2019

Ontario

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FOREWORD

This report provides data and evidence to support health system planning and policy and program development for chronic disease prevention in Ontario. It presents estimates of deaths, hospitalizations, new cases and people living with chronic disease diagnoses in Ontario. It also presents estimates of the prevalence of modifiable chronic disease risk factors in Ontario for adults and youth.

In 2015, chronic diseases caused about three-quarters of deaths in Ontario. The majority of these deaths were due to four major chronic diseases: cancers, cardiovascular diseases, chronic lower respiratory diseases and diabetes, which are the focus of this report. These chronic diseases not only reduce the quality and length of people's lives, they are also expensive to treat. Their direct healthcare costs are estimated to be $10.5 billion a year in Ontario (2010 estimate in 2018 dollars).

Tobacco smoking, alcohol consumption, physical inactivity and unhealthy eating are modifiable risk factors that are common to the four major chronic diseases, and are responsible for a substantial proportion of chronic disease diagnoses and deaths in Ontario. The prevalence of risk factors is high in Ontario, especially for populations that face health inequities, such as those with low socioeconomic status and poor mental health. Indigenous peoples in Ontario also have disproportionately high rates of chronic disease risk factors, as well as chronic disease prevalence and mortality. The total direct healthcare costs and indirect costs (e.g., lost productivity due to disability and premature mortality) for these risk factors are estimated in this report to be $7.0 billion a year for tobacco smoking, $4.5 billion for alcohol consumption, $2.6 billion for physical inactivity and $5.6 billion for unhealthy eating, including $1.8 billion for inadequate vegetable and fruit consumption. Addressing these risk factors is therefore critical to reducing the health and economic burden of chronic diseases, minimizing hospital overcrowding and ending hallway medicine in Ontario.

This report supports CCO's Chronic Disease Prevention Strategy and Public Health Ontario's Strategic Plan, 2014–2019. For more data and evidence on chronic diseases and risk factors, please visit the CCO and Public Health Ontario websites.

CCO and Public Health Ontario welcome the opportunity to continue working with our partners to improve data, reduce chronic disease risk factors and address health inequities and Indigenous health in Ontario.

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HIGHLIGHTS

This report is jointly produced by CCO and Public Health Ontario. It provides evidence that reducing chronic diseases is a leading health priority in Ontario. The data reported highlight the considerable burden of disease that could be reduced if more people in Ontario did not smoke, limited their alcohol consumption, were physically active and ate healthier.

The burden of chronic diseases

In 2015, chronic diseases caused about three-quarters of deaths in Ontario. Cancers, cardiovascular diseases, chronic lower respiratory diseases and diabetes were the most common causes of chronic disease deaths in Ontario and were responsible for 63.7 percent of deaths in 2015. There were more than half a million new cases of these four diseases in 2015. Their estimated annual direct healthcare costs are $10.5 billion (2010 estimate in 2018 dollars). In 2015, of the four leading causes of chronic disease deaths in Ontario:

- Cancers caused the most deaths; 28,195 people died of cancer.
- Cardiovascular diseases accounted for the highest number of new cases of chronic disease. They were also responsible for the largest number of hospitalizations in 2016.
- There were 60,530 people newly diagnosed with chronic obstructive pulmonary disease, which is a major chronic lower respiratory disease, and tobacco smoking is its leading cause.
- About 1.3 million people were living with diabetes, making it the second most prevalent chronic disease, after cardiovascular diseases. Diabetes also increases the risk of dying from cardiovascular and other diseases.

People in Ontario with the lowest socioeconomic status had disproportionately high rates of hospitalization in 2016 and deaths in 2015 due to a chronic disease.

Chronic disease risk factors

Chronic disease risk factors are common in Ontario adults and youth. In 2015/2016 in Ontario:

- 17.9 percent of adults and 6.5 percent of youth reported smoking tobacco daily or occasionally;
- 20.5 percent of adults reported exceeding Canada's Low-Risk Alcohol Drinking Guidelines and 30.2 percent of youth reported having at least one drink in the past year;

- 42.4 percent of adults were physically inactive, reporting physical activity levels that did not meet national guidelines, and 72.8 percent of youth reported less time spent being physically active than recommended for their age group;
- 71.8 percent of adults and 76.6 percent of youth reported inadequate vegetable and fruit consumption, eating vegetables and fruit fewer than five times a day;
- 50.9 percent of adults and 65.9 percent of youth reported having two or more chronic disease risk factors, and only 12.7 percent of Ontario adults and 7.3 percent of youth reported having none of these risk factors (using different risk factor definitions for adults and youth); and
- Ontario adults with the lowest socioeconomic status were more likely to be current smokers, physically inactive and consume vegetables and fruit fewer than five times a day than those with the highest socioeconomic status.

Chronic disease risk factors have been observed to be more common in people with poor mental health. In Ontario in 2015/2016, compared to those with good, very good or excellent mental health:

- Rates of daily or occasional tobacco smoking, physical inactivity and inadequate vegetable and fruit consumption were higher in adults reporting poor or fair self-perceived mental health; and
- Rates of daily or occasional tobacco smoking, underage drinking and inadequate vegetable and fruit consumption were higher in youth reporting poor or fair self-perceived mental health.

ECONOMIC BURDEN

The total annual economic burden of chronic disease risk factors is estimated to be $7.0 billion for tobacco smoking, $4.5 billion for alcohol consumption, $2.6 billion for physical inactivity and $5.6 billion for unhealthy eating, including $1.8 billion for inadequate vegetable and fruit consumption.

Chronic diseases in Indigenous peoples in Ontario

Chronic diseases have a disproportionately high impact on Indigenous peoples in Ontario. A number of chronic diseases, chronic disease deaths and risk factors are more common in Indigenous populations than in the non-Indigenous population, and the incidence of cancer is increasing more rapidly in First Nations populations than in the non-Indigenous population.

INTRODUCTION

Background

Chronic diseases commonly have a long duration and progress slowly. They have an impact on quality of life and require ongoing medical care.[1] Many chronic diseases are preventable, yet they are the leading cause of death in Ontario.

Cancers, cardiovascular diseases, chronic lower respiratory diseases and diabetes are the most common causes of chronic disease deaths in Ontario. Based on estimates from the Public Health Agency of Canada, their estimated annual direct healthcare costs are $10.5 billion a year in Ontario.* Comparatively, Ontario spent $192 million on chronic disease prevention in 2016/2017.[4]

Tobacco smoking, exceeding recommended limits for alcohol consumption, physical inactivity and unhealthy eating are the main modifiable risk factors for chronic diseases and their prevalence is considerable in Ontario. By reducing the prevalence of these risk factors, there is potential to reduce the burden of chronic diseases. People in Ontario could stay healthy and productive for longer, reducing healthcare and broader societal costs.[5,6]

About this report

PURPOSE

This report was jointly produced by CCO and Public Health Ontario. It brings together data from a number of sources to provide evidence that reducing chronic diseases is a leading health priority in Ontario. It highlights the considerable burden of disease that could be reduced if a higher proportion of people in Ontario did not smoke, limited their alcohol consumption, were physically active and ate healthier. Ultimately, this report aims to improve the health of people in Ontario by supporting system planning, and policy and program development throughout the province.

This report presents key estimates of the burden of cancers, cardiovascular diseases, chronic lower respiratory diseases and diabetes, as well as the prevalence of tobacco smoking, exceeding recommended limits for alcohol consumption, physical inactivity and unhealthy eating for adults and youth in Ontario. A short section on the prevalence of people in Ontario who have two or more chronic disease risk factors is also included

* Amount based on estimates from the Economic Burden of Illness in Canada custom report generator.[2] The custom report generated for Ontario includes drug, hospital care and physician care costs for 2010, adjusted for 2018 dollars,[3] for malignant neoplasms, diabetes mellitus, diseases of the circulatory system, chronic obstructive pulmonary disease, bronchiectasis and asthma.

because risk factors can act synergistically.[7,8] This means that when risk factors are combined, the increase in risk becomes greater than the effects of the individual risk factors added together.

Disease burden in this report is measured through mortality, hospitalization, incidence and prevalence for the four major chronic diseases, as well as the prevalence, attributable mortality and economic costs of the four major risk factors. Although other measures of chronic disease burden, such as the number of years lived in poor health and informal caregiving costs, are important, they are not described in this report. In addition, this report focuses on reducing the number of people in Ontario diagnosed with a chronic disease. However, reducing the prevalence of risk factors in people who have already been diagnosed with a chronic disease is also important for improving life expectancy and overall health.

Brief sections addressing health inequities, which are barriers to reducing the burden of chronic diseases, are included in this report. Two short sections examine the relationships between socioeconomic status and chronic disease outcomes, and between self-perceived mental health and the prevalence of chronic disease risk factors. The report also features an overview of chronic diseases in Indigenous peoples in Ontario, who have disproportionately high rates of chronic diseases, mortality and risk factors.[*]

ABOUT CCO AND CANCER CARE ONTARIO

An agency of the Ministry of Health and Long-Term Care, CCO is the Ontario government's principal advisor on cancer and chronic kidney disease care, as well as access to care for key health services. CCO houses Cancer Care Ontario and the Ontario Renal Network, which use CCO's infrastructure, assets and models to improve the province's health systems for cancer and chronic kidney disease. For more information, visit CCO's website.

ABOUT PUBLIC HEALTH ONTARIO

Public Health Ontario (PHO) is a Crown corporation whose mandate is to provide scientific and technical advice and support to clients working in government, public health, healthcare and related sectors. PHO enables informed decisions and actions that protect and promote health and contribute to reducing health inequities. For more information visit Public Health Ontario's website.

[*] For detailed information on chronic diseases in Indigenous peoples in Ontario, please see Cancer Care Ontario's *Path to Prevention: Recommendations for Reducing Chronic Disease in First Nations, Inuit and Métis* report.

DATA SOURCES AND ESTIMATES

This report brings together key estimates on chronic diseases in Ontario from a variety of sources, as described in Table 1. Abbreviations that are used to cite data sources in this report are also provided. Detailed descriptions of the methods used in producing these estimates are provided in a separate technical appendix document and all the data for these estimates are presented in the supplementary tables of this report.

Estimates presented in this report are for Ontario as a whole. Some estimates are also available for sub-Ontario geographies, such as by public health unit and Local Health Integration Network through PHO's online tool Snapshots and by Local Health Integration Network through Cancer Care Ontario's Ontario Cancer Profiles. With authorization to access the necessary data, estimates may be generated for additional geographies by consulting the methods in the accompanying technical appendix.

Table 1: Data sources and estimates

Data source	Estimate	Notes	Cited as
Vital Statistics – Death, IntelliHEALTH ONTARIO, Ontario Ministry of Health and Long-Term Care	**Deaths**	• Most recent year of data available at time of analysis was 2015. • Align with Association of Public Health Epidemiologists in Ontario (APHEO) Core Indicators.	IntelliHEALTH
Canadian Chronic Disease Surveillance System (CCDSS), supported by the Public Health Agency of Canada	**Incidence and prevalence** of cardiovascular diseases, chronic lower respiratory diseases, diabetes	• Most recent year of data available at time of writing was 2015. • Age groupings and case definitions were as defined by the CCDSS.	CCDSS
Ontario Cancer Registry, Cancer Care Ontario	**Incidence** of cancer	• Most recent year of data at time of analysis was 2015.	Cancer Care Ontario
Discharge Abstract Database – Inpatient Discharges, IntelliHEALTH ONTARIO, Ontario Ministry of Health and Long-Term Care	**Hospitalizations**	• Most recent year of population estimates available at time of analysis (to facilitate rate estimates) was 2016. • Align with APHEO Core Indicators.	IntelliHEALTH

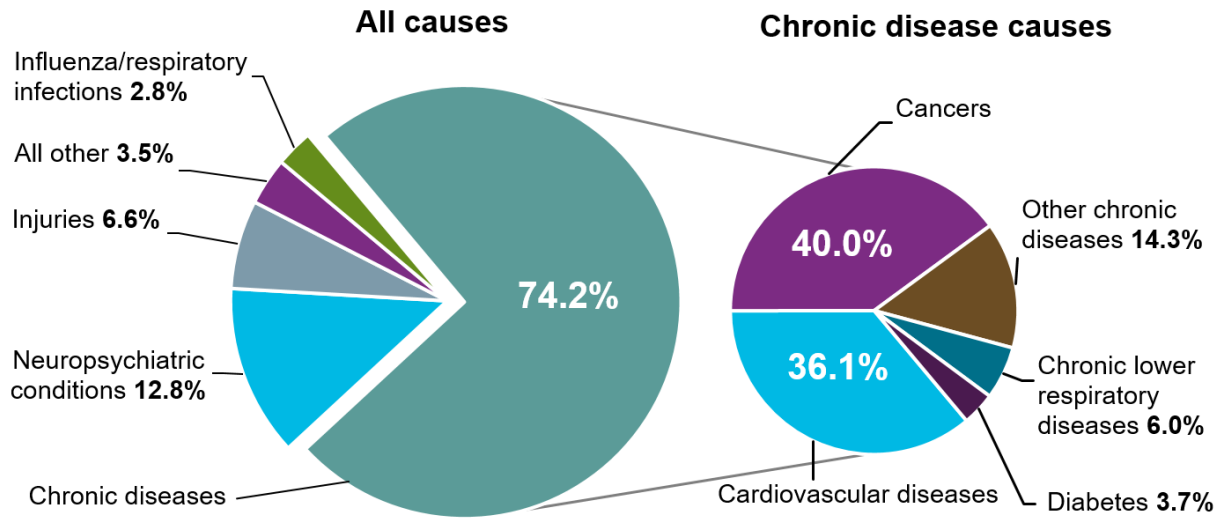
Data source	Estimate	Notes	Cited as
Canadian Community Health Survey (CCHS), Statistics Canada	**Prevalence of risk factors and chronic diseases (self-reported)**	• Most recent cycle of data available at time of analyses were from the 2015/2016 cycle. • Estimates were produced from CCHS share file from Statistics Canada. • CCHS was redesigned in 2015, prohibiting direct comparisons with earlier CCHS cycles. Therefore, the CCHS trends in this report compare 2003 to 2013/2014. • Align with APHEO Core Indicators, where possible.	Statistics Canada
Ontario Marginalization Index (ON-Marg)	**Socioeconomic status**	• Assigned to cases (IntelliHEALTH) and people (IntelliHEALTH and Statistics Canada) based on place of residence, using material deprivation quintiles from 2016 ON-Marg. • ON-Marg is considered an acceptable proxy for individual-level socioeconomic status.[9]	ON-Marg
Literature published from 2013 to 2018	**Economic burden**	• Estimates produced from a systematic search of literature published from 2013 to 2018. • All estimates are in 2018 Canadian dollars.	As listed in the References section

THE BURDEN OF CHRONIC DISEASES

Overview

In 2015, chronic diseases caused about three-quarters of deaths in Ontario (IntelliHEALTH) (Figure 1). Cancers, cardiovascular diseases, chronic lower respiratory diseases and diabetes were the most common causes of chronic disease deaths in Ontario and were responsible for 63.7 percent of all deaths in 2015 (85.8 percent of chronic disease deaths). There were 566,556 new cases of these four major chronic diseases in Ontario in 2015 (CCDSS).

Figure 1: Causes of death, all causes and chronic disease causes, Ontario, 2015



Source: Death (Vital Statistics – Death), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, Extracted March 5, 2019.
Prepared by: Public Health Ontario, Health Promotion, Chronic Disease, and Injury Prevention; Cancer Care Ontario, Prevention and Cancer Control (Population Health and Prevention).
Notes: Cause of death based on primary cause, Ontario residents only. Data are presented in Supplementary Table S1. Download supplementary tables at ccohealth.ca/cdburden.

Cancers, cardiovascular diseases, chronic lower respiratory diseases and diabetes are described in this section using the most recent data available for Ontario. The descriptions include:

- The number of deaths in 2015;
- The incidence of disease, including the number of new cases diagnosed in 2015 and the age-standardized incidence rate (cases per 100,000) in 2015 compared with 2000;
- The prevalence, or number, of people in Ontario living with a diagnosis in 2015;
- The number of hospitalizations in 2016; and
- Estimates of the proportion of new cases that may be preventable.

A discussion of the link between socioeconomic status and chronic disease outcomes is included at the end of this section. Definitions for low and high socioeconomic status are found in the technical appendix.

Cancer

In 2015, 28,195 people died of cancer in Ontario (IntelliHEALTH) and an estimated 83,326 new cases of cancer were diagnosed in people of all ages* (Cancer Care Ontario). The most commonly diagnosed cancers in males were prostate, lung and colorectal, and the most deaths were caused by lung, colorectal and prostate cancers. In females, the leading cancers were breast, lung and colorectal, and the most deaths were caused by lung, breast and colorectal cancers (Cancer Care Ontario).

In 2015, the age-standardized incidence of cancer was 571 cases per 100,000 people, compared to 538 cases per 100,000 people in 2000 (Cancer Care Ontario).

In 2013, 585,016 people living in Ontario had received a cancer diagnosis in the past 30 years, and 370,713 had received a cancer diagnosis in the past 10 years.[10]

In 2016, there were 57,768 hospitalizations for all cancer types (IntelliHEALTH).

Large-scale population studies suggest that about four in 10 cases of cancer can be prevented by eliminating modifiable risk factors.[11-13] Tobacco smoking is responsible for the largest proportion of preventable cancers.[11-13] Alcohol consumption, physical inactivity and unhealthy eating are also major causes of preventable cancers.[11-13]

* Estimate includes all new cases of invasive neoplasia except for basal cell and squamous cell skin cancers.

Cardiovascular diseases

Cardiovascular diseases caused 26,012 deaths in Ontario in 2015 (IntelliHEALTH). Table 2 provides the number of new cases diagnosed and the prevalence, or number of people living with a diagnosis, for ischemic heart disease (heart disease due to narrowed arteries), acute myocardial infarction (heart attack), stroke and hypertension in people in Ontario, ages 20 and older, in 2015. Table 2 also shows new diagnoses and prevalence of heart failure in those ages 40 and older. The prevalence of cardiovascular diseases includes all people in Ontario living with a diagnosis in 2015, including those who were newly diagnosed that year.

Table 2: New cases, prevalence and age-standardized incidence rate (ASIR) of cardiovascular diseases per 100,000 people, Ontario

Cardiovascular disease	Age group (years)	New cases 2015	Prevalence 2015 (% population)	ASIR 2000	ASIR 2015
Ischemic heart disease	20+	58,300	1,016,820 (8.9%)	1,289	589
Acute myocardial infarction	20+	21,950	240,060 (2.1%)	317	186
Stroke	20+	34,870	347,560 (3.0%)	402	304
Heart failure	40+	37,690	272,470 (3.6%)	830	503
Hypertension	20+	126,610	2,984,740 (25.9%)	3,222	1,899

Source: Canadian Chronic Disease Surveillance System 2017 (Public Health Agency of Canada). Available at: infobase.phac-aspc.gc.ca/ccdss-scsmc/data-tool/.

Prepared by: Public Health Ontario, Health Promotion, Chronic Disease, and Injury Prevention; Cancer Care Ontario, Prevention and Cancer Control (Population Health and Prevention).

Notes: Prevalence counts all people in Ontario living with a diagnosis in 2015, including new cases. Disease definitions: Ischemic heart disease refers to impaired heart function due to arterial plaque, reducing the supply of oxygenated blood to the heart.[14] Acute myocardial infarction or a heart attack occurs when a blood clot forms around plaque in the arteries, suddenly blocking the supply of blood to the heart.[15] Stroke occurs when the supply of oxygenated blood to the brain is interrupted.[14] Heart failure occurs when damage to the heart makes it unable to pump enough blood and oxygen to the rest of the body.[16] Hypertension is high blood pressure that can damage arteries leading to acute myocardial infarction, stroke, heart failure and other diseases, if uncontrolled overtime.[14] Data are presented in Supplementary Table S3. Download supplementary tables at ccohealth.ca/cdburden.

The age-standardized incidence rates for each of these cardiovascular diseases were lower in 2015 than in 2000 (Table 2).

In 2016, there were 138,688 hospitalizations for cardiovascular diseases (IntelliHEALTH).

Hypertension is included in Table 2 because although it is not a cardiovascular disease, it is considered a major cardiovascular disease risk factor and is treated even if there is no definitive cardiovascular disease diagnosis. In Ontario, hypertension is associated with $273 million in annual direct healthcare costs,* and in 2015, it was the main cause of 555 deaths.[17]

The percentage estimates of cardiovascular diseases that could be prevented by reducing risk factors such as smoking tobacco, alcohol consumption, unhealthy eating and physical inactivity vary across a number of studies.[18-21] For example, a large international study suggests that 90 percent of first myocardial infarctions in men and 94 percent in women may be preventable.[21] A large American study found that modifiable risk factors accounted for approximately 65 to 90 percent of cardiovascular disease incidence, with higher estimates for African American participants compared to white participants.[19]

Chronic lower respiratory diseases

Chronic lower respiratory diseases caused 4,297 deaths in 2015 (IntelliHEALTH). Chronic obstructive pulmonary disease (COPD) and asthma are two major chronic lower respiratory diseases.[22,23] COPD refers to a group of lung diseases, including emphysema and chronic bronchitis.[24] Deaths caused by COPD may be underestimated by about 50 percent because COPD can lead to death due to pneumonia and cardiovascular diseases.[25]

In 2015, 60,530 people in Ontario ages 35 and older were newly diagnosed with COPD and 883,440 were living with a COPD diagnosis (CCDSS). A total of 61,580 people in Ontario ages 1 and older were newly diagnosed with asthma and about 1.9 million were living with an asthma diagnosis (CCDSS).

The age-standardized incidence rates for COPD were 1,104 cases per 100,000 in 2000 and 783 cases per 100,000 in 2015 (CCDSS). For asthma, the age-standardized incidence rates were 1,001 cases per 100,000 in 2000 and 499 cases per 100,000 in 2015 (CCDSS).

* Amount based on estimates from the Economic Burden of Illness in Canada custom report generator.[2] The custom report generated for Ontario includes drug, hospital care and physician care costs for 2010, adjusted for 2018 dollars.[3]

In 2016, there were 26,337 hospitalizations for COPD and 4,752 hospitalizations for asthma (IntelliHEALTH).

Smoking is the leading cause of COPD and worsens existing asthma in adults;[26] second-hand smoke also has some effect in the development of asthma in children.[27]

Diabetes

Diabetes occurs when the body cannot produce enough insulin or cannot properly use insulin, which is needed to convert sugar into energy.[28] In 2015, 2,698 people died of diabetes in Ontario (IntelliHEALTH). Similar to COPD, deaths from diabetes are underestimated because this disease also increases the risk of dying from other conditions, including cardiovascular diseases and colorectal cancer.[29,30]

In 2015, 81,700 people in Ontario ages 1 and older were newly diagnosed with diabetes and 1.3 million were living with a diagnosis of the disease (CCDSS).

The age-standardized incidence of diabetes increased from 660 cases per 100,000 in 2000 to 853 cases per 100,000 in 2006, followed by a decrease to 640 cases per 100,000 in 2015 (CCDSS).

In 2016, there were 14,509 hospitalizations for diabetes in Ontario (IntelliHEALTH).

Four large-scale trials suggest that 50 to 60 percent of type 2 diabetes may be preventable by eliminating modifiable risk factors such as physical inactivity, low vegetable and fruit consumption, and tobacco smoking.[31-34] About 90 percent of Canadians with diabetes have type 2 diabetes.[35]

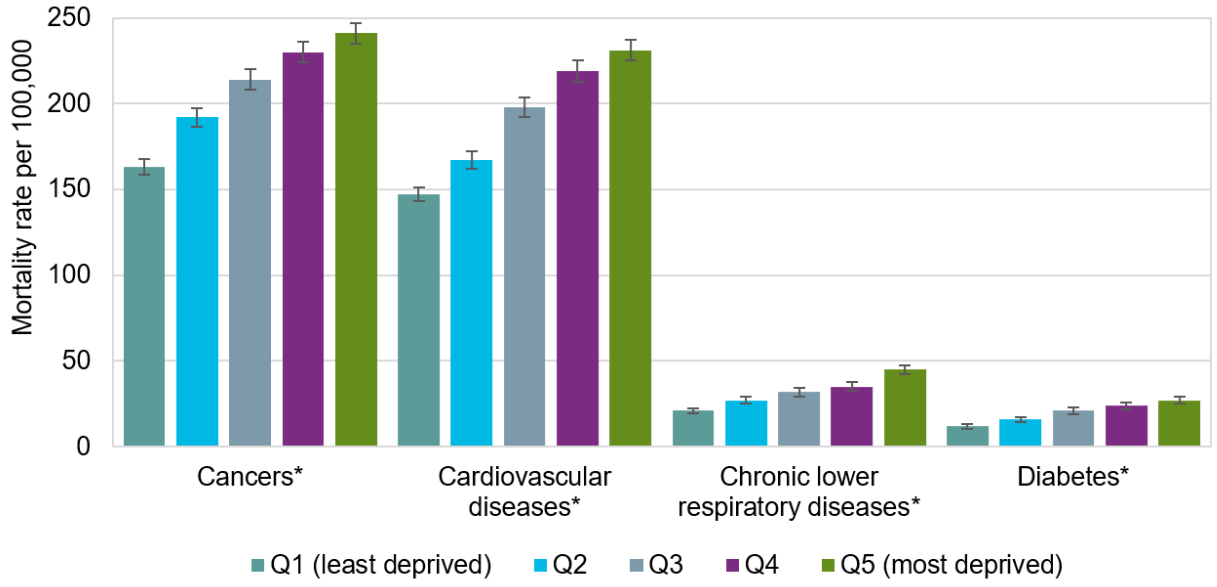
In brief: Socioeconomic status and chronic disease outcomes

A number of factors, such as income, education and housing status, form the basis of someone's socioeconomic status and shape the foundation for good health.[36] In 2015/2016, people in Ontario ages 12 and older with the lowest socioeconomic status were more likely to report having cardiovascular diseases, chronic lower respiratory diseases and diabetes than those with the highest socioeconomic status (ON-Marg, Statistics Canada) (Supplementary Tables S5–S7). Self-reported cancer prevalence was evenly distributed across socioeconomic status groups (Supplementary Table S4).

However, people in Ontario who had the lowest socioeconomic status were significantly more likely to die of cancers, cardiovascular diseases, chronic lower respiratory diseases and diabetes in 2015 (ON-Marg, IntelliHEALTH) (Figure 2). Because reported cancer prevalence is similar across groups, the difference in cancer mortality could be due to earlier stage of diagnoses and better survival in people with higher socioeconomic status.[37]

Those with the lowest socioeconomic status also had more hospitalizations due to cancers, cardiovascular diseases, lower respiratory diseases and diabetes in 2016 compared to those with higher socioeconomic status (ON-Marg, IntelliHEALTH) (Supplementary Tables S9–S12).

Figure 2:
Mortality (rate per 100,000 people) with selected chronic diseases as the main cause, by material deprivation quintile, Ontario, 2015



Sources: Matheson, FI; Ontario Agency for Health Protection and Promotion (Public Health Ontario). 2016 Ontario marginalization index. Toronto: Providence St. Joseph's and St. Michael's Healthcare; 2018. Joint publication with Public Health Ontario. Death (Vital Statistics – Death), Ontario Ministry of Health and Long-Term Care, IntelliHEALTH ONTARIO, Extracted February 2019.

Prepared by: Public Health Ontario, Health Promotion, Chronic Disease and Injury Prevention; Cancer Care Ontario, Prevention and Cancer Control (Population Health and Prevention).

Notes: Mortality rate per 100,000 people in the general population. I—I represents 95% confidence intervals. * Significant inequality in mortality, determined by Slope Index of Inequality (SII) and Relative Index of Inequality (RII). Material deprivation is a measure of marginalization and is assessed here at the dissemination area (DA) level, using ON-Marg 2016. Data are presented in Supplementary Table S8. Download supplementary tables at ccohealth.ca/cdburden.

CHRONIC DISEASE RISK FACTORS

Overview

Tobacco smoking, alcohol consumption that exceeds recommended limits, physical inactivity and unhealthy eating are common in Ontario. In 2015/2016, only 12.7 percent of Ontario adults and 7.3 percent of youth reported having none of these risk factors (Statistics Canada).

This section provides:

- Estimates of the percentage of deaths that are due to each risk factor in Ontario;
- Risk factor prevalence rates for Ontario adults and youth in 2015/2016;
- Differences in risk factor prevalence by socioeconomic status (area-level as a proxy for individual-level socioeconomic status);
- Changes in risk factor prevalence in 2013/2014 compared to 2003 (comparisons with 2015/2016 are not appropriate due to a redesign of the Canadian Community Health Survey);
- Estimates of the economic burden of each of the four risk factors based on a systematic search of the literature published from 2013 to 2018 (all costs are provided in 2018 Canadian dollars); and
- The prevalence of adults and youth in Ontario who have multiple risk factors.

The economic burden estimates include direct healthcare costs (e.g., hospital care, ambulatory care, physician services and prescription drugs) and indirect costs (e.g., lost productivity due to disability and premature mortality). Studies from high-income countries that used different risk factor definitions and examined different types of direct healthcare and indirect costs were included. More details on these studies and the methodology used to generate the estimates can be found in a separate technical appendix.

A discussion on self-perceived mental health and chronic disease risk factor prevalence is provided at the end of this section.

Tobacco smoking

Tobacco smoking remains a major cause of chronic diseases in Ontario. Tobacco smoking causes cardiovascular diseases, chronic lower respiratory diseases, lung cancer and almost 20 other types of cancer.[26] Based on estimates for 2007, about 23.7 percent of deaths in Ontario were due to tobacco smoking.[38] Although, using tobacco in other forms and exposure to second-hand smoke also increase the risk of chronic diseases, they are not examined in this report.

In 2015/2016, 1.9 million adults in Ontario (17.9 percent) ages 20 and older were current tobacco smokers, reporting daily or occasional tobacco cigarette smoking (Statistics Canada) (see Figure 3 for the prevalence of risk factors in adults). The prevalence of current smokers decreased from 2003 to 2013/2014 by 4.5 percentage points (19.2 percent relative change).[39] Lower smoking rates in adults will likely contribute to fewer deaths from smoking in future years, but the current prevalence of smoking remains high.

Ontario adults with the lowest socioeconomic status had the highest smoking rates in 2015/2016, at 25.3 percent (ON-Marg, Statistics Canada) (Supplementary Table S17). Adults with the highest socioeconomic status reported the lowest smoking rate (13.5 percent) in 2015/2016.

In youth ages 12 to 19, 6.5 percent were current smokers, reporting daily or occasional tobacco cigarette smoking (Statistics Canada) (see Figure 4 for the prevalence of risk factors in youth).

A review of cost estimates for Canada finds an average per capita direct healthcare cost from tobacco smoking of $192 and an average indirect per capita cost of $295.[40-43] When these averages were applied to the Ontario population, the direct healthcare cost of smoking per year was an estimated $2.7 billion and the indirect cost was $4.2 billion, totalling almost $7.0 billion.

Internationally, studies in high-income countries have estimated per capita direct healthcare costs from tobacco that range from $5 to $588, depending

on the methodology used.[26,44-47] Indirect per capita cost estimates range from $76 to $930.[26,45,48]

E-CIGARETTES

E-cigarettes expose users to fewer toxic substances than tobacco smoking and may therefore be less harmful, but their long-term toxicity is uncertain.[49] In addition, evidence for the effectiveness of e-cigarettes as a smoking cessation aid is limited, and e-cigarette use among youth and young adults likely increases the risk of ever smoking.[49] Some evidence also suggests e-cigarette use may increase the frequency and intensity of subsequent smoking in youth and young adults.[49] In 2017, 21.6 percent of Ontario students in Grades 7 to 12 reported ever having used e-cigarettes,[50] and in 2016/2017, 9.9 percent of Ontario students in Grades 10 to 12 reported use in the past 30 days.[51] These rates of e-cigarette use may affect future tobacco smoking in Ontario. For more information on e-cigarettes, please see Public Health Ontario's report, *Current Evidence on E-Cigarettes: A Summary of Potential Impacts*.

Alcohol consumption

Alcohol consumption causes oral, pharyngeal, laryngeal, esophageal, colorectal, liver and breast cancers.[52,53] No safe limit of alcohol consumption has been identified to prevent the development of these cancers and the overall risk of cancer increases at higher levels of consumption.[52,53] Heavy alcohol consumption is an established cause of cardiovascular diseases and diabetes.[54] An estimated 12.8 percent of deaths in 2007 in Ontario were due to heavy alcohol consumption (10 or more drinks per week for men, six or more drinks a week for women).[38]

In 2015/2016, 2.1 million adults in Ontario (20.5 percent) ages 19 and older exceeded the recommended limits of Canada's Low-Risk Alcohol Drinking Guidelines* (Statistics Canada) (see Figure 3 for the prevalence of risk factors in adults). The prevalence of adults exceeding Canada's Low-Risk Alcohol Drinking Guidelines decreased from 2003 to 2013/2014 by 2.6 percentage points (11.2 percent relative change).[56]

Exceeding recommended limits for alcohol consumption was highest among adults in Ontario with the highest socioeconomic status in 2015/2016 (ON-Marg, Statistics Canada) (Supplementary Table S18). However, among Ontario adults ages 25 and older who reported at least one heavy drinking episode in the past month (four or more drinks for women and five or more drinks for men), adults living in lower income neighbourhoods were more likely to report heavy drinking episodes at least once a week and consuming a greater number of drinks per episode.[57] In addition, research suggests that among people who drink, those with lower socioeconomic status experience greater harms from alcohol, including increased risk of chronic diseases, hospitalizations and death.[58]

Underage drinking increases the risk of heavy alcohol consumption in adulthood.[59] In 2015/2016, 30.2 percent of youth ages 12 to 18 reported consuming at least one drink in the past year (Statistics Canada) (see Figure 4 for the prevalence of risk factors in youth). Underage drinking was highest in youth with higher socioeconomic status in Ontario (ON-Marg, Statistics Canada) (Supplementary Table S23).

These estimates of alcohol consumption are based on self-reporting. Objectively measured rates are likely higher because alcohol consumption has been shown to be under-reported.[60]

A review of cost estimates for Canada found an average per capita direct healthcare cost from all alcohol consumption (rather than only heavy alcohol consumption) of $111 and an average indirect per capita cost of $188.[40,41,43] When these averages were applied to the Ontario population, alcohol consumption resulted in an estimated $1.6 billion in direct healthcare costs a year and $2.9 billion in indirect costs, totalling $4.5 billion.

Internationally, two studies estimated direct healthcare and indirect costs for all alcohol consumption.[61,62] The per capita estimates were $115 and $186 for direct healthcare costs and $82 and $2,761 for indirect costs.[61,62]

* Canada's Low-Risk Alcohol Drinking Guidelines recommend no more than two drinks a day or 10 drinks a week for women, no more than three drinks a day or 15 drinks a week for men, and at least two non-drinking days per week.[55]

Physical inactivity

Physical inactivity is a well-established risk factor for chronic diseases. Rates of death due to all causes, ischemic heart disease, stroke, type 2 diabetes, colorectal cancer and cardiorespiratory impairment increase at higher levels of physical inactivity.[63,64] Some evidence shows that the risk of breast and endometrial cancers likely increases with physical inactivity.[65] An estimated 23.0 percent of deaths in Ontario in 2007 were due to physical inactivity.[38]

In 2015/2016, 4.6 million adults in Ontario (42.4 percent) ages 18 and older reported not meeting recommended physical activity levels based on the Canadian Physical Activity Guidelines[*] (Statistics Canada) (see Figure 3 for the prevalence of risk factors in adults).

In Ontario, physical inactivity is higher in adults with the lowest socioeconomic status than in those with the highest socioeconomic status (44.1 percent versus 37.3 percent) (ON-Marg, Statistics Canada) (Supplementary Table S19).

In Ontario youth ages 12 to 17, 72.8 percent did not meet recommended levels of physical activity based on the Canadian 24-Hour Movement Guidelines for Children and Youth (ages 5 to 17)[†] (Statistics Canada) (see Figure 4 for the prevalence of risk factors in youth). These guidelines recommend higher levels of physical activity for youth than for adults.[66]

[*] The Canadian Physical Activity Guidelines recommend that adults ages 18 and older should accumulate at least 150 minutes of moderate- to vigorous-intensity aerobic physical activity per week for 10 minutes or more at a time.[66]

[†] The Canadian 24-Hour Movement Guidelines for Children and Youth (ages 5 to 17) recommend that youth ages 12 to 17 accumulate at least 60 minutes of moderate- to vigorous-intensity physical activity daily. This should include vigorous-intensity activities at least three days per week. The guidelines also recommend activities to strengthen muscle and bone at least three days per week.[66] Only daily moderate-to vigorous-intensity physical activity and not types of activities are included in the physical inactivity rate reported.

In 2013/2014, the self-reported physical inactivity rates (measured only for leisure time and based on energy expenditure values) for adults and youth in Ontario improved and were lower than in 2003.[67]

These estimates are based on self-reporting. Objectively measured rates of physical inactivity are likely higher because self-reported physical activity has been shown to be over-reported.[68]

Expenditures linked to physical inactivity were identified in nine studies,[40,41,69-75] including three that provided estimates for Canada.[40,41,69] In the studies for Canada, the average estimated per capita direct healthcare cost was $69 and the average estimated per capita indirect cost was $115.[40,41,69] No recent studies for Ontario were identified. When these average estimates for Canada were applied to the Ontario population, the direct healthcare cost spent by the province on physical inactivity was $0.98 billion a year and the indirect cost was $1.65 billion, totalling $2.6 billion.

Internationally, studies for high-income countries have estimated direct per capita healthcare costs linked to physical inactivity that range from $5 to $120.[69-75] Indirect per capita cost estimates range from $6 to $285.[69-75]

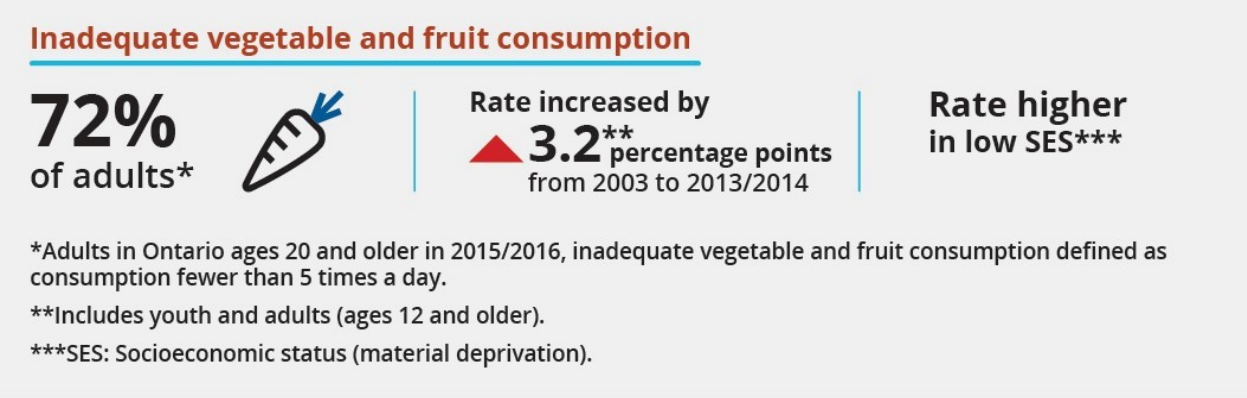
SEDENTARY BEHAVIOUR AND SCREEN TIME

Research identifies sedentary behaviour as a risk factor for chronic diseases that is separate from physical inactivity.[76] Sedentary behaviour involves engaging in specific activities while sitting or lying down that expend low levels of metabolic energy, such as watching television, using a computer and other time spent using a screen.[76]

In 2015/2016, the average recreational screen time for adults ages 18 and older in Ontario was 22.2 hours per week or 3.2 hours per day (Statistics Canada) (Supplementary Table S15). The Canadian 24-Hour Movement Guidelines for Children and Youth (ages 5 to 17) recommend a maximum of two hours per day of recreational screen time for youth ages 12 to 17,[77] but in 2015/2016, 65.0 percent of youth ages 12 to 17 exceeded this maximum (Statistics Canada) (Supplementary Table S16).

Recreational screen time was higher among people with lower socioeconomic status. Adults with the lowest socioeconomic status reported the highest recreational screen time, at an average of 24.1 hours per week, and adults with the highest socioeconomic status reported the lowest recreational screen time, at 21.2 hours per week (ON-Marg, Statistics Canada) (Supplementary Table S20).

Unhealthy eating



Daily frequency of vegetable and fruit consumption is a mark of overall diet quality,[78] and it has an independent and inverse association with the risk of cardiovascular diseases.[79,80] Vegetable and fruit consumption, excluding potatoes and other starchy vegetables, may also protect from the development of some aerodigestive* cancers.[81] There is limited evidence that vegetable and fruit consumption may have a protective effect against chronic obstructive pulmonary disease and asthma.[82,83] Vegetable and fruit consumption fewer than five times a day caused an estimated 20.0 percent of deaths in Ontario in 2007.[38]

In Ontario in 2015/2016, 7.1 million adults ages 20 and older (71.8 percent) reported inadequate vegetable and fruit consumption, or consumption of vegetables and fruit (excluding potatoes) fewer than five times a day (Statistics Canada) (see Figure 3 for the prevalence of risk factors in adults).

Inadequate vegetable and fruit consumption is slightly higher in adults with lower socioeconomic status (ON-Marg, Statistics Canada) (Supplementary Table S21).

In youth ages 12 to 19, 76.6 percent reported inadequate vegetable and fruit consumption in 2015/2016 (Statistics Canada) (see Figure 4 for the prevalence of risk factors in youth).

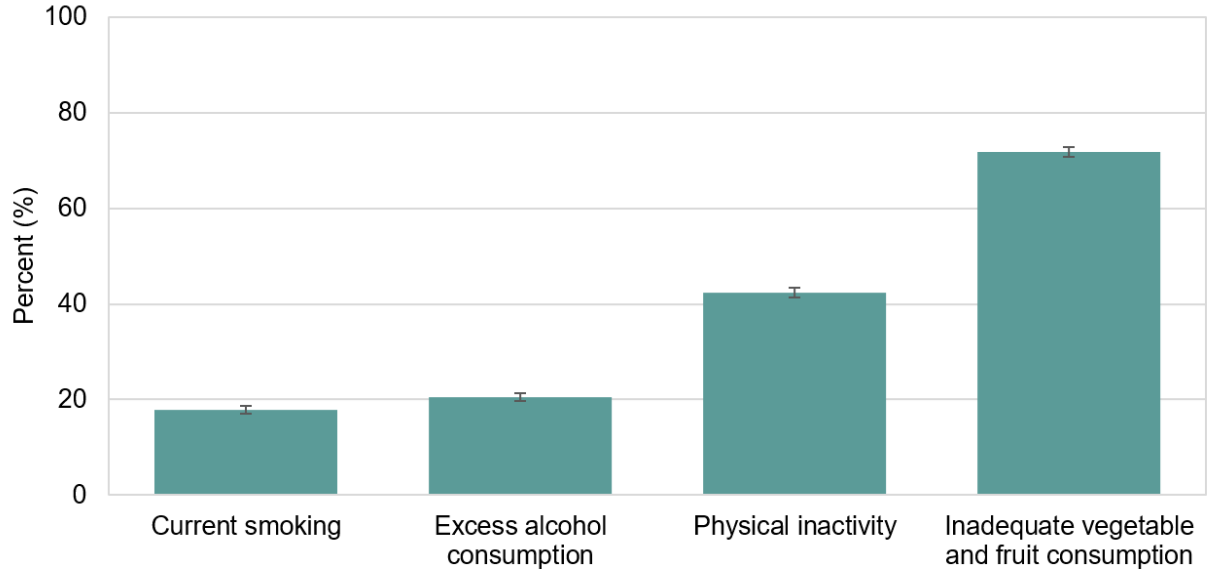
From 2003 to 2013/2014, the prevalence of adults and youth in Ontario who reported inadequate vegetable and fruit consumption increased by 3.2 percentage points (5.5 percent relative change).[84]

No international studies and three Canadian studies were identified that linked expenditures to inadequate vegetable and fruit consumption.[40,41,85] Per capita estimates averaged $41 in direct healthcare costs and $82 in indirect costs across

* The World Cancer Research Fund uses the term “aerodigestive cancers” to include head and neck cancers and esophageal cancer.[81]

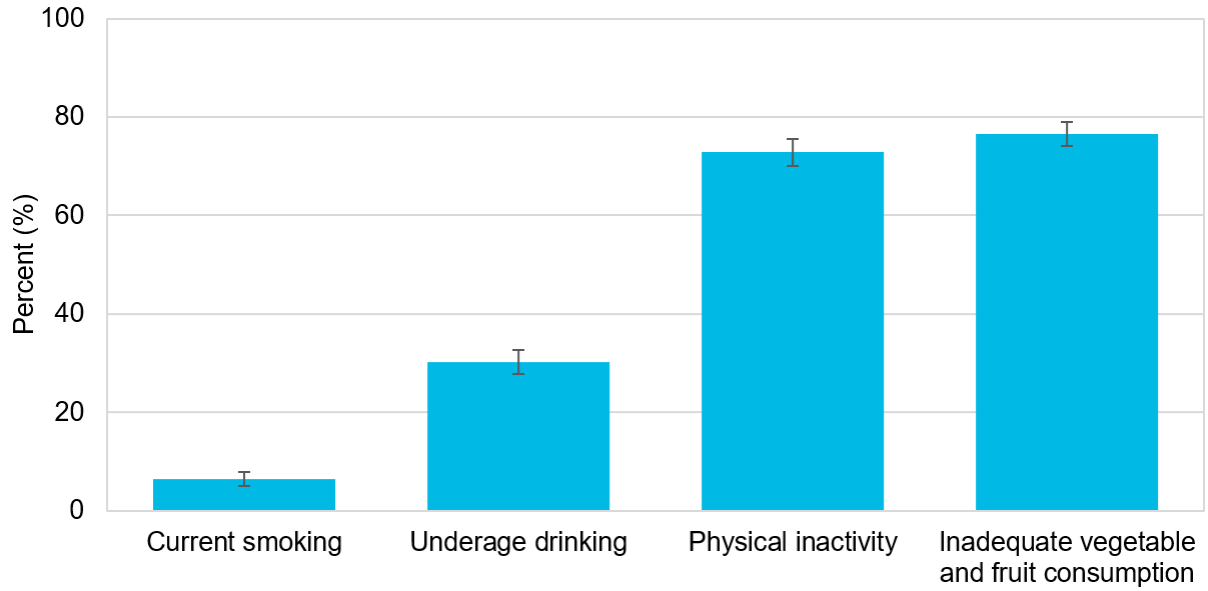
the three studies. When these estimates were applied to the Ontario population, direct healthcare cost spent by the province on inadequate vegetable and fruit consumption was $584 million a year and the indirect cost was $1.2 billion, totalling $1.8 billion. Additionally, two Canadian studies examining expenditures linked to poor diet quality were identified.[86,87] In these two studies, per capita estimates averaged $137 in direct healthcare costs and $257 in indirect costs.[86,87] When these estimates were applied to the Ontario population, the direct healthcare cost spent by the province on poor diet quality was $1.9 billion a year and the indirect cost was $3.7 billion, for a total of $5.6 billion.

Figure 3: Percent of adults reporting selected chronic disease risk factors, Ontario, 2015/2016



Source: Canadian Community Health Survey, 2015/2016, Statistics Canada.
Prepared by: Public Health Ontario, Health Promotion, Chronic Disease and Injury Prevention; Cancer Care Ontario, Prevention and Cancer Control (Population Health and Prevention).
Notes: I—I represents 95% confidence intervals. Current smoking (ages 20 and older) = respondents who are daily or occasional smokers. Excess alcohol consumption (ages 19 and older) = respondents who exceed Canada's Low-Risk Alcohol Drinking Guidelines, which recommend no more than 2 drinks a day or 10 drinks a week for women and no more than 3 drinks a day or 15 drinks a week for men, and at least 2 non-drinking days per week. Physical inactivity (ages 18 and older) = respondents whose levels of physical activity do not meet the Canadian Physical Activity Guidelines, which recommend that adults ages 18 and older should accumulate at least 150 minutes of moderate- to vigorous-intensity aerobic physical activity per week in bouts of 10 minutes or more. Inadequate vegetable and fruit consumption (ages 20 and older) = respondents who reported eating vegetables (excluding potatoes) and fruit fewer than 5 times per day. Data are presented in Supplementary Table S13. Download supplementary tables at ccohealth.ca/cdburden.

Figure 4:
Percent of youth reporting selected chronic disease risk factors, Ontario, 2015/2016



Source: Canadian Community Health Survey, 2015/2016, Statistics Canada.
Prepared by: Public Health Ontario, Health Promotion, Chronic Disease and Injury Prevention; Cancer Care Ontario, Prevention and Cancer Control (Population Health and Prevention).
Notes: I—I represents 95% confidence intervals. Current smoking (ages 12 to 19) = respondents who are daily or occasional smokers. Underage drinking (ages 12 to 18) = at least 1 drink in the past 12 months. Physical inactivity (ages 12 to 17) = respondents whose levels of physical activity do not meet the Canadian 24-Hour Movement Guidelines for Children and Youth (ages 5 to 17), which recommend that youth ages 12 to 17 accumulate at least 60 minutes of moderate- to vigorous-intensity physical activity daily. Inadequate vegetable and fruit consumption (ages 12 to 19) = respondents who reported eating vegetables (excluding potatoes) and fruit fewer than 5 times per day. Data are presented in Supplementary Table S14. Download supplementary tables at ccohealth.ca/cdburden.

HEALTHY BODY WEIGHTS

Healthy eating combined with physical activity are important for maintaining a healthy body weight. Complex factors such as the cost and availability of healthy foods, competing life concerns, available options for physical activity, personal biological constitution and mental health status are also determinants of healthy body weights.[88]

Overweight and obesity, commonly measured by body mass index (BMI) and waist circumference are independent risk factors for several cancers, ischemic heart disease and diabetes.[89,90]

In 2015/2016, 61.5 percent of adults in Ontario ages 18 and older had a BMI of 25 or higher, which is classified as overweight or obese.[91] The percentage of Ontario adults ages 18 and older who were overweight or obese was higher in 2013/2014 than in 2003.[84]

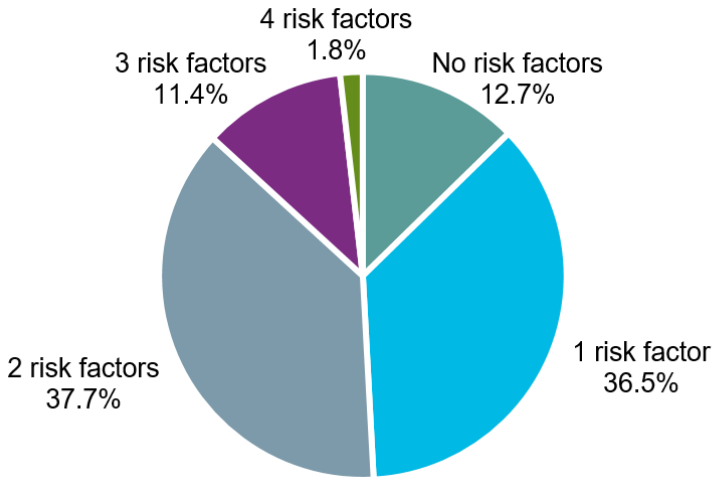
Multiple risk factors

Having two or more risk factors for chronic diseases can create a synergistic effect.[7,8] This means that when risk factors are combined, the increase in risk becomes greater than the effects of the individual risk factors added together. Smoking tobacco and alcohol consumption have a synergistic effect in increasing the risk of some cancers.[52,92,93] In addition, a recent study from New Zealand found that people who increased their physical activity and improved their diet were 17.5 times more likely to lose weight than those who made no changes. People increasing only physical activity were five times more likely to lose weight and people changing only diet were seven times more likely to lose weight than those who made no changes.[94]

In 2015/2016, 50.9 percent of adults in Ontario ages 18 and older reported having two or more of the four major risk factors for chronic diseases (Statistics Canada) (Figure 5).

Having two or more risk factors is slightly more common in adults in Ontario with the lowest socioeconomic status (53.3 percent) than in those with the highest socioeconomic status (46.7 percent) (ON-Marg, Statistics Canada) (Supplementary Table S29).

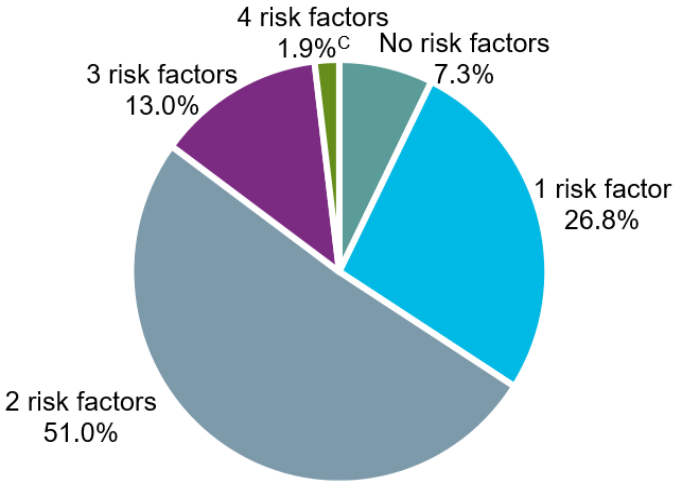
Figure 5:
Percent of adults (ages 18+) reporting 0–4 risk factors, Ontario, 2015/2016



Source: Canadian Community Health Survey, 2015/2016, Statistics Canada.
Prepared by: Public Health Ontario, Health Promotion, Chronic Disease and Injury Prevention; Cancer Care Ontario, Prevention and Cancer Control (Population Health and Prevention).
Notes: Risk factors: current smoking, excess alcohol consumption, physical inactivity, inadequate vegetable and fruit consumption. Data are presented in Supplementary Table S27. Download supplementary tables at ccohealth.ca/cdburden.

In youth ages 12 to 17, 65.9 percent reported having two or more of the four major risk factors that are defined for their age group (Statistics Canada) (Figure 6). This rate cannot be compared to the rate for adults because the risk factors are defined differently for youth and adults.

Figure 6: Percent of youth (ages 12–17) reporting 0–4 risk factors, Ontario, 2015/2016



Source: Canadian Community Health Survey, 2015/2016, Statistics Canada.
Prepared by: Public Health Ontario, Health Promotion, Chronic Disease and Injury Prevention; Cancer Care Ontario, Prevention and Cancer Control (Population Health and Prevention).
Notes: C = interpret estimate with caution due to high sampling variability. Risk factors: current smoking, underage drinking, physical inactivity, inadequate vegetable and fruit consumption. Data are presented in Supplementary Table S28. Download supplementary tables at ccohealth.ca/cdburden.

In brief: Mental health and chronic disease risk factors

Mental health issues, including substance use disorders, have emerged as widely recognized influences and priorities for improving chronic disease outcomes.[95] Many studies in a number of countries show that people with poor mental health or an addiction are more likely to have chronic disease risk factors.[96-98] For example, depression may be associated with the development of increased sedentary behaviours and physical inactivity,[97] and nicotine addiction is the main determinant of tobacco smoking.[26,49] In addition, in 2015/2016, people in Ontario who reported mental health issues or illicit substance use had two to six times the rate of nicotine addiction (tobacco smoking or use of alternative tobacco products, which include e-cigarettes) than people without these issues (Statistics Canada; data not shown). Poor mental health can therefore lead to poorer physical health and increased mortality due to an increased prevalence of chronic disease risk factors.[98]

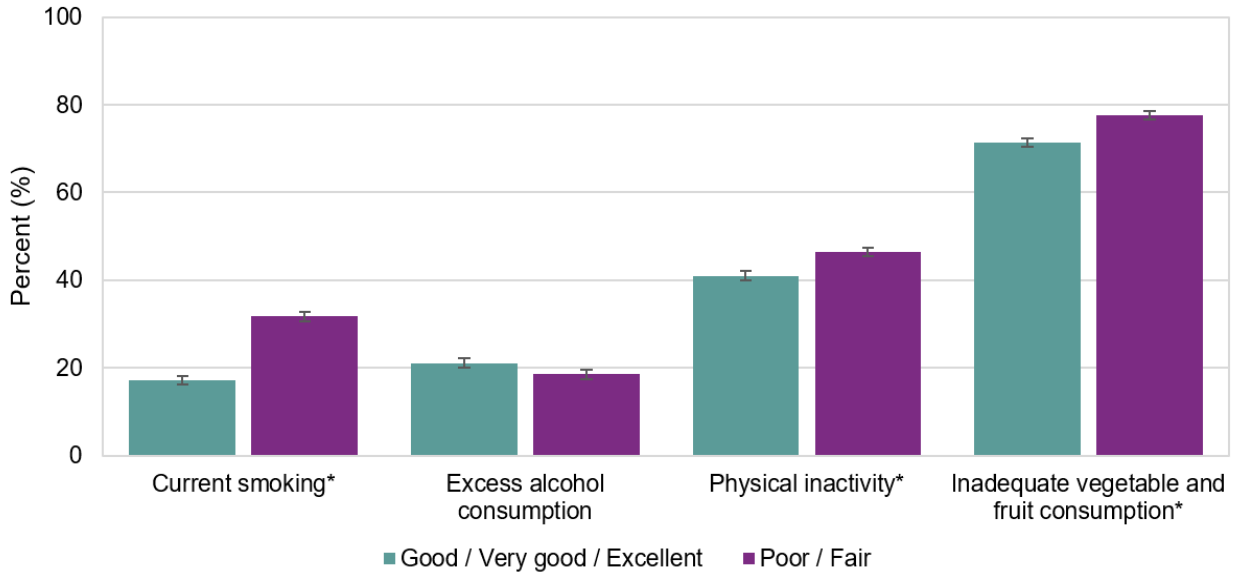
This section analyzes the connection between chronic disease risk factors and self-perceived mental health in Ontario adults and youth to identify whether these risk factors are more common in those with poorer mental health. Although the direct relationship between poor mental health and chronic disease outcomes is not examined in this report, it is also an important consideration.

In 2015/2016, rates of current smoking, physical inactivity and inadequate vegetable and fruit consumption were higher in Ontario adults reporting poor or fair self-perceived mental health than in adults reporting good, very good or excellent self-perceived mental health (Statistics Canada) (Figure 7).

Recreational screen time was also higher in Ontario adults with poor or fair mental health (29.8 hours per week) than in adults with good, very good or excellent mental health (21.5 hours per week) (ON-Marg, Statistics Canada) (Supplementary Table S33).

Adults with poor or fair self-perceived mental health in Ontario are also more likely to have multiple risk factors (two or more) than adults with good, very good or excellent self-perceived mental health (Statistics Canada) (Supplementary Table S34).

Figure 7:
Percent of adults reporting selected chronic disease risk factors, by self-perceived mental health, Ontario, 2015/2016

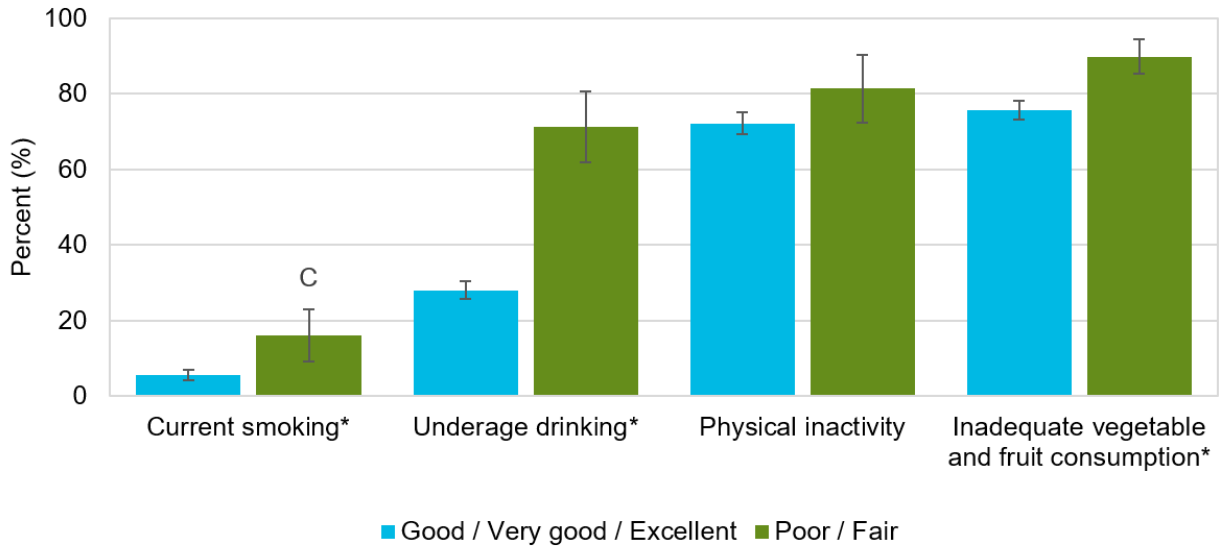


Source: Canadian Community Health Survey, 2015/2016, Statistics Canada.
Prepared by: Public Health Ontario, Health Promotion, Chronic Disease and Injury Prevention; Cancer Care Ontario, Prevention and Cancer Control (Population Health and Prevention).
Notes: I—I represents 95% confidence intervals. Current smoking (ages 20 and older) = people who are daily or occasional smokers. Excess alcohol consumption (ages 19 and older) = exceeding Canada's Low-Risk Alcohol Drinking Guidelines, which recommend no more than 10 drinks a week for women, with no more than 2 drinks a day most days and no more than 15 drinks a week for men, with no more than 3 drinks a day most days. Physical inactivity (ages 18 and older) = respondents whose levels of physical activity do not meet the Canadian Physical Activity Guidelines, which recommend that adults ages 18 and older should accumulate at least 150 minutes of moderate- to vigorous-intensity aerobic physical activity per week in bouts of 10 minutes or more. Inadequate vegetable and fruit consumption (ages 20 and older) = respondents who reported eating vegetables (excluding potatoes) and fruit fewer than 5 times per day. * Significant difference by self-perceived mental health determined by Rao-Scott Chi-Square Test. Data are presented in Supplementary Table S31. Download supplementary tables at ccohealth.ca/cdburden.

Rates of current smoking, underage drinking and inadequate vegetable and fruit consumption were higher in youth reporting poor or fair self-perceived mental health than in youth reporting good, very good or excellent mental health (Statistics Canada) (Figure 8). The largest difference was seen with underage drinking: 71.3 percent of youth with poor or fair self-perceived mental health reported having at least one drink in the past 12 months, whereas only 28 percent of youth with good, very good or excellent mental health reported having at least one drink (Statistics Canada) (Figure 8).

Youth with poor or fair self-perceived mental health are also more likely to have multiple risk factors (two or more) than youth with good, very good or excellent self-perceived mental health (Statistics Canada) (Supplementary Table S36).

Figure 8:
Percent of youth reporting selected chronic disease risk factors, by self-perceived mental health, Ontario, 2015/2016



Source: Canadian Community Health Survey, 2015/2016, Statistics Canada.
Prepared by: Public Health Ontario, Health Promotion, Chronic Disease and Injury Prevention; Cancer Care Ontario, Prevention and Cancer Control (Population Health and Prevention).
Notes: C = interpret estimate with caution due to high sampling variability. I—I represents 95% confidence intervals. Current smoking (ages 12 to 19) = people who are daily or occasional smokers. Underage drinking (ages 12 to 18) = at least 1 drink in the past 12 months. Physical inactivity (ages 12 to 17) = respondents whose levels of physical activity do not meet the Canadian Physical Activity Guidelines, which recommend that youth ages 12 to 17 accumulate at least 60 minutes of moderate- to vigorous-intensity physical activity daily. Inadequate vegetable and fruit consumption (ages 12 to 19) = respondents who reported eating vegetables (excluding potatoes) and fruit fewer than 5 times per day. * Significant difference by self-perceived mental health determined by Rao-Scott Chi-Square Test. Data are presented in Supplementary Table S32. Download supplementary tables at ccohealth.ca/cdburden.

CHRONIC DISEASES IN INDIGENOUS PEOPLES IN ONTARIO

Chronic diseases have a disproportionately high impact on Indigenous peoples in Ontario. The data in Table 3 show the percentage of First Nations living on- and off-reserve, Métis and non-Indigenous people in Ontario who reported having specific chronic diseases from 2007 to 2010.

Table 3:
Percent of respondents reporting selected chronic diseases, by First Nations on- and off-reserve, Métis and non-Indigenous (non-Aboriginal) identity, Ontario, 2007–2010

Chronic disease	First Nations on-reserve (RHS, 2008–2010, ages 18+)	First Nations off-reserve (CCHS, 2007–2010, ages 12+)	Métis (CCHS, 2007–2010, ages 12+)	Non-Aboriginal (CCHS, 2007–2010, ages 12+)
Cardiovascular disease	--	19.4%	18.1%	14.8%
Diabetes	21.6%	8.7%	4.9%	4.3%
Asthma	11.4%	15.6%	12.1%	8.6%
Chronic obstructive pulmonary disease	--	4.3%	3.2%	1.6%
Cancer	2.5%	1.5%	0.6%	1.2%

Sources: Chiefs of Ontario. First Nations Regional Health Survey (RHS) Phase 2 (2008/10) Ontario Region Final Report. Toronto: First Nations Information Governance Centre; 2012. Canadian Community Health Survey, 2007–2010, Statistics Canada in: Cancer Care Ontario. Path to Prevention – Recommendations for Reducing Chronic Disease in First Nations, Inuit and Métis. Toronto: Queen's Printer for Ontario; 2016.

Prepared by: Cancer Care Ontario, Prevention and Cancer Control (Indigenous Cancer Control Unit).

Notes: For First Nations off-reserve, Métis and non-Aboriginal: Cardiovascular disease = percentage of respondents ages 12 and older who reported having high blood pressure, heart disease or have suffered from the effects of a stroke. Diabetes = percentage of respondents ages 12 and older who reported having diabetes. Asthma = percentage of respondents ages 12 and older who reported having asthma. Chronic obstructive pulmonary disease (COPD) = percentage of respondents ages 35 and older who reported having chronic bronchitis, emphysema or COPD. Cancer = percentage of respondents ages 12 and older who reported having cancer. For First Nations on-reserve = percentage, for each of diabetes, asthma and cancer, of respondents ages 18 and older reporting the health condition in response to "Have you been told by a health care professional that you have any of the following health conditions?" Data are presented in Supplementary Table S37. Download supplementary tables at ccohealth.ca/cdburden.

A higher percentage of First Nations living off-reserve and Métis populations reported having cardiovascular diseases, diabetes, asthma and chronic obstructive pulmonary disease (COPD) than non-Indigenous people in Ontario.[99] The reported prevalence of diabetes is especially high in the on-reserve First Nations population in Ontario. The Regional Health Survey found a rate of reported diabetes diagnoses of 21.6 percent among adults ages 18 and older.[100]

Rates of reported cancer in First Nations living on- and off-reserve are similar to the non-Indigenous population. However, incidence rates are increasing more rapidly in First Nations populations.[101] For some cancers, such as lung, colorectal and kidney, the incidence rates are much higher in First Nations people than in other people in Ontario.[101]

A 2010 survey of Inuit adults living in Ottawa, ages 18 and older found rates of reported diagnoses of 4.7 percent for heart disease, 25 percent for hypertension, 2.6 percent for diabetes, 6.8 percent for cancer and 6.7 percent for bronchitis, emphysema or COPD.[102] For approximate comparison, the 2009 rates for the general adult population, ages 18 and older in Ottawa were 3.7 percent for heart disease, 16 percent for hypertension, 6.1 percent for diabetes and 1.9 percent for bronchitis, emphysema or COPD.[102] General population estimates for heart disease, diabetes and bronchitis, emphysema or COPD had high sampling variability and must be interpreted with caution.[102]

Chronic disease mortality rates in Indigenous populations are much higher than the rates in the non-Indigenous population in Ontario. Mortality rates for diabetes are as much as five times higher in Registered First Nations women than in non-Indigenous women and three-and-half times higher in Registered First Nations men than in non-Indigenous men.[99]

Prevalence rates for chronic disease risk factors are also higher in Indigenous populations than in the non-Indigenous population. For example, current smoking in particular is substantially higher in First Nations, Inuit and Métis adults and youth than in non-Indigenous adults and youth.[99]

Detailed risk factor data on Indigenous populations in Ontario can be found in reports published by CCO and partner organizations.[103-105] CCO's *Path to Prevention: Recommendations for Reducing Chronic Disease in First Nations, Inuit and Métis* report also makes recommendations on policies and programs that can reduce chronic disease risk factors and address the social determinants of Indigenous health.[99]

CONCLUSION

Cancers, cardiovascular diseases, chronic lower respiratory diseases and diabetes cause about two-thirds of all deaths in Ontario. This report, produced jointly by CCO and Public Health Ontario, estimates the burden of these four chronic diseases through their mortality, incidence, prevalence and hospitalizations. It shows that the overall burden is considerable and that there is a disproportionately high burden of these diseases in Indigenous populations and people with lower socioeconomic status in Ontario. Chronic diseases not only reduce the quality and length of people's lives, they are also expensive to treat. The direct healthcare costs linked to the four major chronic diseases are estimated to be $10.5 billion a year in Ontario.*

Tobacco smoking, alcohol consumption, unhealthy eating and physical inactivity are risk factors that are common to the major chronic diseases. This report shows that addressing these risk factors – which also have a higher prevalence in populations with health inequities – is critical to reducing the health and economic burden of chronic diseases in Ontario. The burden of chronic diseases that could be reduced is described in this report by estimating the proportion of chronic diseases that are preventable, the prevalence of chronic disease risk factors, the percentage of deaths linked to each risk factor, and the costs of the risk factors on Ontario's healthcare system and on society as a whole. For example, the total annual direct healthcare costs and indirect costs (e.g., lost productivity due to disability and premature mortality) for these risk factors are estimated at $7.0 billion for smoking, $4.5 billion for alcohol consumption, $2.6 billion for physical inactivity and $5.6 billion for unhealthy eating, including $1.8 billion for inadequate vegetable and fruit consumption.

This report provides governments and other partners with the data and evidence needed to develop and support comprehensive strategies for reducing chronic disease risk factors in Ontario. CCO's Prevention System Quality Index reports also provide more information on evidence and opportunities related to system-level policies and programs that reduce chronic disease risk factors. CCO and Public Health Ontario continue to collaborate with partners on chronic disease prevention, including through CCO's chronic disease prevention strategy, which was launched in 2015 and is being renewed until 2023. More information about CCO's and Public Health Ontario's work in chronic disease prevention can be found on their websites.

* Amount based on estimates from the Economic Burden of Illness in Canada custom report generator.[2] The custom report generated for Ontario includes drug, hospital care and physician care costs for 2010, adjusted for 2018 dollars,[3] for malignant neoplasms, diabetes mellitus, diseases of the circulatory system, chronic obstructive pulmonary disease, bronchiolectasis and asthma.

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