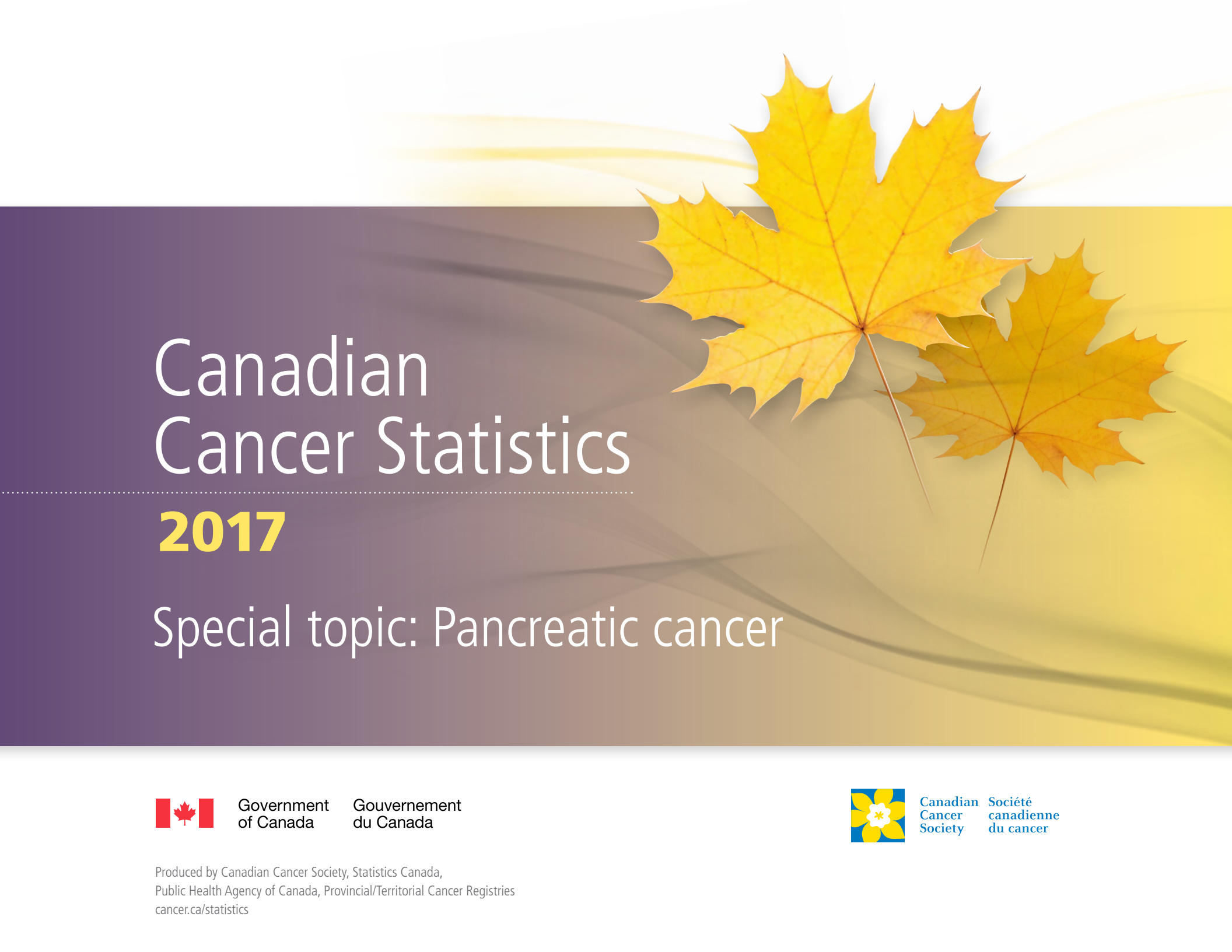

Canadian Cancer Statistics

2017

Special topic: Pancreatic cancer

Government of Canada / Gouvernement du Canada

Canadian Cancer Society / Société canadienne du cancer

Produced by Canadian Cancer Society, Statistics Canada,
Public Health Agency of Canada, Provincial/Territorial Cancer Registries
cancer.ca/statistics

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This publication is available in English and French on the Canadian Cancer Society's website at cancer.ca/statistics. Visit the website for the most up-to-date version of this publication and additional resources, such as individual figures from the publication and an archive of previous editions.

The development of this publication over the years has benefited considerably from the comments and suggestions of readers. The Advisory Committee appreciates and welcomes such comments. To offer ideas on how the publication can be improved or to be notified about next year's publication, complete the evaluation form or email stats@cancer.ca.

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Table of Contents

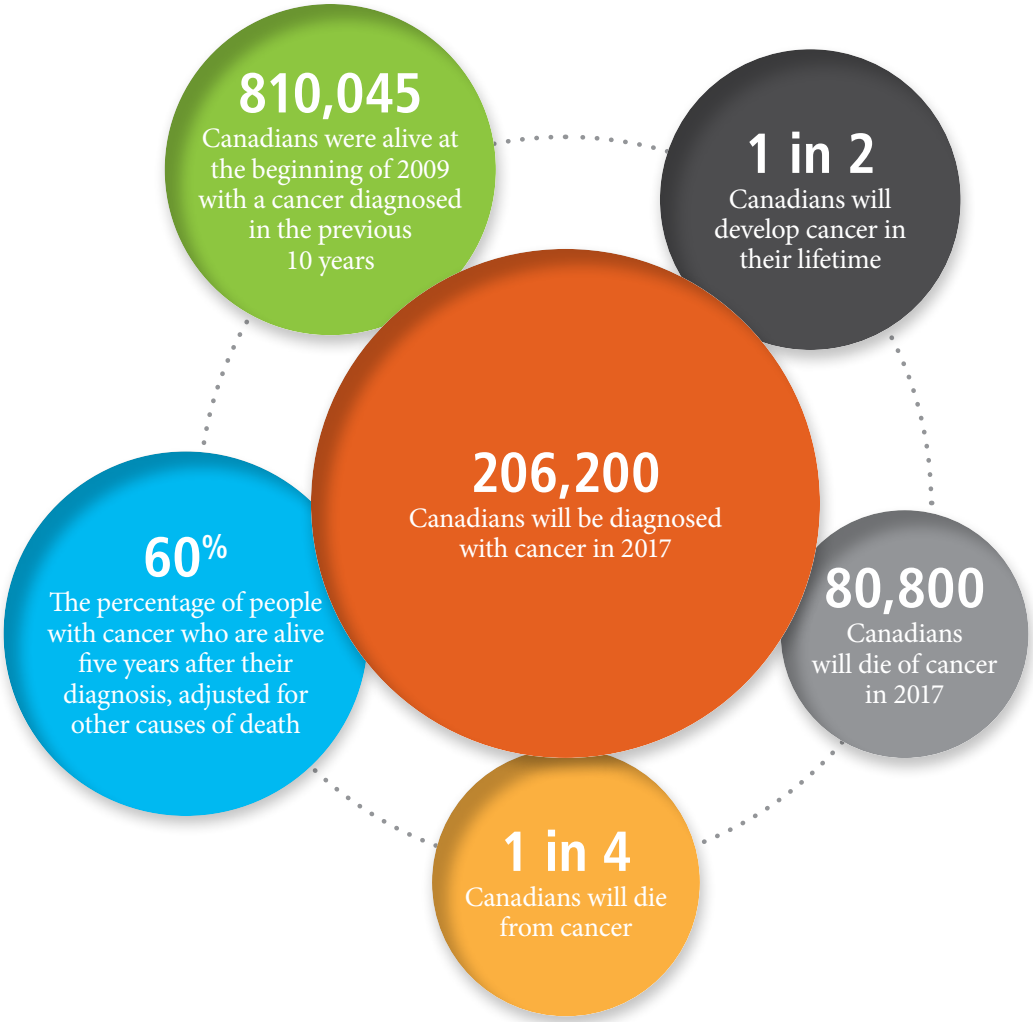
Executive summary

Canadian Cancer Statistics is an annual publication that provides estimates of the burden of cancer in Canada for the current year.

About 1 in 2 Canadians will develop cancer in their lifetime, and about 1 in 4 Canadians will die of cancer. In 2017, it is projected that 206,200 Canadians will develop cancer, and 80,800 will die of the disease. Lung and bronchus (lung), breast, colorectal and prostate cancer account for half of all new cancer cases diagnosed. Lung cancer is the leading cause of cancer death, causing more cancer deaths among Canadians than the other three major cancer types combined. Despite this large impact, there has been a substantial drop in the lung cancer mortality rate in males over the past 30 years, which has contributed to a decline in the mortality rate in males for all cancers combined. The mortality rate for all cancers combined in females has also gone down, due in part to declines in the mortality rates for breast and colorectal cancers.

Cancer can affect males and females of all ages. Almost 90% of Canadians who develop cancer are over the age of 50, but its impact at a younger age can be particularly devastating. In 2012, cancer was the leading cause of disease-related death in children under the age of 15 years.[1]

Overall, the five-year net survival for people diagnosed with cancer is about 60%, but it varies widely by the type of cancer. Some cancers have very high five-year net survival, including thyroid cancer (98%) and testicular cancer (96%). Other cancers have consistently low five-year net survival, such as cancer of the esophagus (14%) and pancreas (8%). Differences in net survival among cancer types are due to several



factors, including stage and aggressiveness of the cancer at diagnosis, and the availability of effective early detection, diagnostic and treatment services.

This year's publication features an in-depth analysis of the burden of pancreatic cancer in Canada (*Chapter 6: Special topic: Pancreatic cancer*), highlighting the urgent need to address the challenges presented by this cancer. In 2017, 5,500 Canadians are expected to be diagnosed with pancreatic cancer and 4,800 are expected to die of this disease. This makes pancreatic cancer the 12th most commonly diagnosed cancer in Canada, but it is the fourth leading cause of cancer-related death. The high mortality relative to incidence reflects pancreatic cancer's poor prognosis. Only about 50% of people with pancreatic cancer survive beyond 3.9 months, and its five-year survival is the lowest of the 23 cancers reported in this publication.

Because of the limited improvements in pancreatic cancer prevention, detection and treatment, especially relative to the other major cancers, pancreatic cancer is expected to become the third leading cause of cancer-related death in Canada in the coming years. Recent advances have made tangible but modest improvements in treatment that extend life, but only by a few months. To improve outcomes for those diagnosed with pancreatic cancer in a meaningful way, there needs to be a better understanding of the disease to determine how to detect it earlier and develop therapeutic strategies that can be tested in clinical trials. Continuing to monitor the burden of pancreatic cancer will help us understand its etiology and assess if progress is being made.

As of January 2009, an estimated 810,045 Canadians had been diagnosed with cancer in the previous 10 years and were still alive. This means that about 2.4% of the Canadian population was living with, or beyond, a cancer diagnosis in the decade leading up to 2009. More recently, the 2013/14 Canadian Community Health Survey (CCHS) estimated that 5.1% of Canadians reported ever having cancer in their lifetime.[2] The information from CCHS will differ from the data used for this publication in that the CCHS data covers a longer time period, is self-reported (and therefore subject to recall bias) and likely captures some benign or precancerous conditions that were excluded from the registry definition (e.g., non-melanoma skin cancer and *in situ* breast cancer).

Measures of the cancer burden in Canada are vital for developing and evaluating health policy, and they help decision-makers assess the type and allocation of health resources needed to inform cancer and health research priorities. The data are also essential for informing and evaluating primary and secondary cancer prevention activities and assessing the impact of early detection and cancer treatment on the cancer trajectory. Finally, these statistics can be useful for prioritizing services to help Canadians and their families who have been affected by cancer and who may need support after their treatment has ended. We hope that our readers think critically about what these numbers mean and how they can be used to reduce cancer incidence, improve survival and develop better overall care for those dealing with cancer in Canada.

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About this publication

Canadian Cancer Statistics is an annual series that began in 1987. This edition was developed by cancer surveillance experts on the Canadian Cancer Statistics Advisory Committee, who were brought together by the Canadian Cancer Society, the Public Health Agency of Canada and Statistics Canada. In addition to these organizations, members of this committee are from the provincial and territorial cancer registries, the Canadian Council of Cancer Registries, the Canadian Partnership Against Cancer and the United States Centers for Disease Control and Prevention.

Purpose and intended audience

The aim of this annual publication is to provide detailed information on incidence, mortality, survival and other measures of cancer burden for the most common types of cancer in Canada. Data are presented by sex, age group and geographic region. Trends over time are also examined. The publication is designed to help health professionals, policy-makers and researchers make decisions and identify priority areas. The media, educators and members of the public with an interest in cancer may also find this publication valuable.

Format

This publication is organized as follows:

- The *Introduction* provides an overview of cancer in Canada by describing the health and economic challenges posed by the disease, the potential role prevention can play in addressing the cancer burden and the value of surveillance in cancer control efforts in Canada.
- *Chapter 1* describes the incidence of cancer in Canada by age, sex, geography and over time. In previous editions, this information was discussed over two chapters.
- *Chapter 2* examines the mortality associated with cancer in Canada by age, sex, geography and over time. In previous editions, this information was discussed over two chapters.
- *Chapter 3* focuses on cancer survival in Canada by age, sex, geography and over time. This information is a repetition of *Chapter 5* in the 2016 edition.
- *Chapter 4* describes the prevalence of cancer in Canada by examining the number of people diagnosed with cancer who are still alive and the number of tumours diagnosed among individuals living with or beyond cancer. This information is a repetition of *Chapter 6* in previous editions.
- *Chapter 5* synthesizes the information in *Chapters 1* to *4* and provides additional contextual information.

How these statistics can be used

Cancer cases (incidence): Useful for determining the type and amount of healthcare resources needed for cancer control and support activities.

Age-standardized incidence rates (ASIR): Facilitate comparisons across populations and over time; can reflect changes in risk factors and show where progress is being made (or not) in cancer prevention.

Cancer deaths (mortality): Useful for determining the healthcare and support services needed, particularly for people with cancer who are at the end of life.

Age-standardized mortality rates (ASMR): Facilitate comparisons across populations and over time; can reflect changes in incidence rates, show where progress is being made in early detection, diagnosis and treatment and indicate where more progress is needed.

Annual percent change (APC): Useful for examining trends over time.

Average annual percent change (AAPC): Useful for comparing the average change in age-standardized incidence rates across cancers for a common time period.

Net survival: Useful for monitoring the effects of early detection, diagnosis and treatment on cancer outcomes.

Cancer prevalence: Useful for determining the healthcare and support services needed for people with cancer, cancer survivors and their families.

- *Chapter 6* features an in-depth look at pancreatic cancer in Canada. It includes statistics on the burden of pancreatic cancer in Canada not reported elsewhere in the publication, as well as information on pancreatic cancer risk factors, diagnosis, treatment and emerging research. The special topics are selected annually based on criteria that include data availability, recent trends and suggestions from readers through evaluation forms.
- *Appendix I* provides links to online tools that contain actual (not projected) data available on Statistics Canada's website, as well as a brief description of how to use the tools.
- *Appendix II* describes the data sources and methods used to produce the statistics in this publication.
- *Appendix III* includes a record of previous special topics (which are available in past editions) and lists of the abbreviations, tables and figures in this publication.
- The last section of this publication (*For further information)* includes contact information for the organizations leading the development of the publication and for the provincial and territorial cancer registries.
- The *Introduction* and *Chapters 1* to *4* conclude with a list of other relevant resources, including links to online databases for additional analyses.

Analysis and production

The Surveillance and Epidemiology Division of the Centre for Chronic Disease Prevention (CCDP) at the Public Health Agency of Canada and the Health Statistics Division of Statistics Canada conducted the analyses that are presented in this publication. Provincial and territorial cancer registries were consulted in the preparation of the cancer incidence and mortality projections for their jurisdictions. These consultations can reveal differences between national and provincial projections that arise from case-reporting differences between registries or more recent changes in provincial or territorial rates. In some instances, a correction factor may be applied to projections based on provincial feedback (see *Appendix II: Data sources and methods* for more details). No new data were available to produce more up-to-date estimates of survival (*Chapter 3*) and prevalence (*Chapter 4*) for this edition, but the most recent versions of these chapters were included to ensure the completeness of this publication. The Canadian Cancer Statistics Advisory Committee advises on the methodology and interpretation of results and authors the accompanying text. The Canadian Cancer Society coordinates the production of this publication and supports its development and dissemination with charitable funds.

A note on data

The main sources of data for this publication are the Canadian Cancer Registry (CCR; primary source of recent cancer incidence data), National Cancer Incidence Reporting System (NCIRS; source for cancer incidence data prior to 1992), Canadian Vital Statistics Death database (CVS: D; source of cancer mortality data) and population life tables, population estimates and forecasts on population growth.

- Provincial and territorial cancer registries collect clinical and demographic data on newly diagnosed cancer cases for people residing in their province or territory. These data are reported annually to Statistics Canada and added to the CCR.
- Provincial and territorial registrars of vital statistics collect demographic and cause-of-death information for people who die in their province or territory. These data are reported annually to Statistics Canada and added to the CVS: D.
- Cancer cases included in the analysis include only invasive primary cancers. The exception is *in situ* carcinoma of the bladder, which is considered invasive for surveillance reporting because of its high rate of progression and recurrence.[1]
- Non-melanoma skin cancers (neoplasms, not otherwise specified [NOS], epithelial neoplasms NOS, basal and squamous) are not included since most provincial and territorial cancer registries (PTCRs) do not collect incidence data on this type of cancer. These cancers are difficult to register because they may be diagnosed, treated or both in a variety of settings that do not report to the PTCRs, including dermatologist offices.
- This publication examines over 20 cancer types, which together represent the vast majority of cancers that occur in Canada.

Actual data and projected statistics

This publication strives to provide the most up-to-date statistics. However, because time is required for reporting, collating, verifying, analyzing and publishing surveillance data, the most recent information available is several years behind the publication year. Actual cancer incidence data used for this publication are for the period 1988 to 2013 (except for Quebec, for which data were available to 2010). Data for 1992 to 2013 were obtained from the CCR and data prior to 1992 were from the NCIRS. Actual cancer mortality data are for the period 1988 to 2012 for all provinces and territories and were obtained from the CVS: D. Short-term statistical projections provide estimates of expected cancer incidence and mortality for recent years where data are not yet available (see *Appendix II: Data sources and methods*). Incidence is projected for each year from 2014 to 2017 for all provinces and territories (except for Quebec, where incidence was projected for 2011 to 2017). Mortality is projected for each year from 2013 to 2017 for all provinces and territories.

The CCR is a dynamic database that is updated as new data become available. Projected estimates are derived using statistical models; therefore, they should be viewed with caution. Moreover, models can produce estimates that vary considerably from year to year. For this reason, using the estimates to track year-to-year changes (such as comparing numbers in this edition to those from prior editions) can be misleading and should be avoided.

For information on how to access the most recent data available, see *Appendix I*, refer to the additional sources of information listed at the end of each chapter, contact the respective cancer registries (see a list of Canadian Provincial and Territorial Cancer Registries) or contact Statistics Canada's Research Data Centres network.

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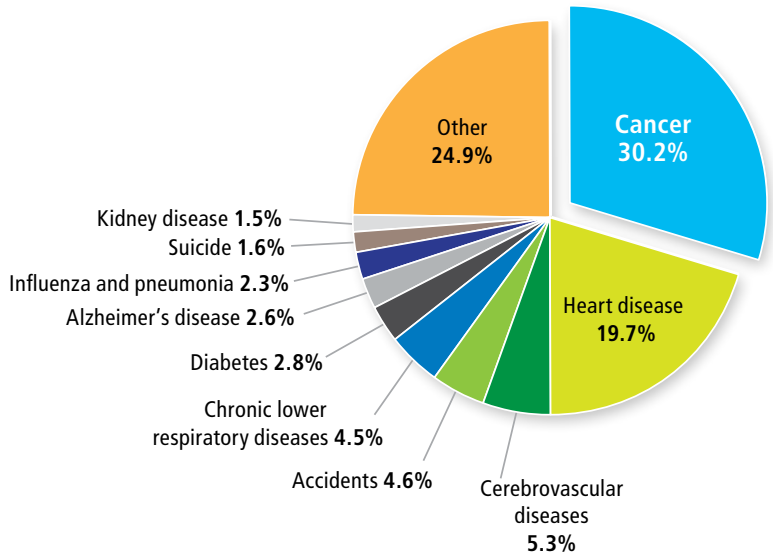
Introduction

Cancer in Canada

Almost half of all Canadians will develop cancer in their lifetime, and one-quarter of Canadians are expected to die of the disease. Cancer is the leading cause of death in Canada (Figure A), responsible for 30% of all deaths, followed by cardiovascular diseases (heart disease and cerebrovascular diseases), accidents and chronic lower respiratory diseases.[1]

Cancer is also the leading cause of premature mortality, as measured by potential years of life lost (PYLL). PYLL is a summary measure of premature mortality that accounts for deaths occurring at younger ages. As such, it tends to be more influenced by deaths from diseases and injuries affecting children and young adults, for whom the potential years of life are greater. During the period between 2010 and 2012, the PYLL for all cancers combined was almost 1,500,000. This is more than any of the other leading causes of premature death in Canada (Figure B).

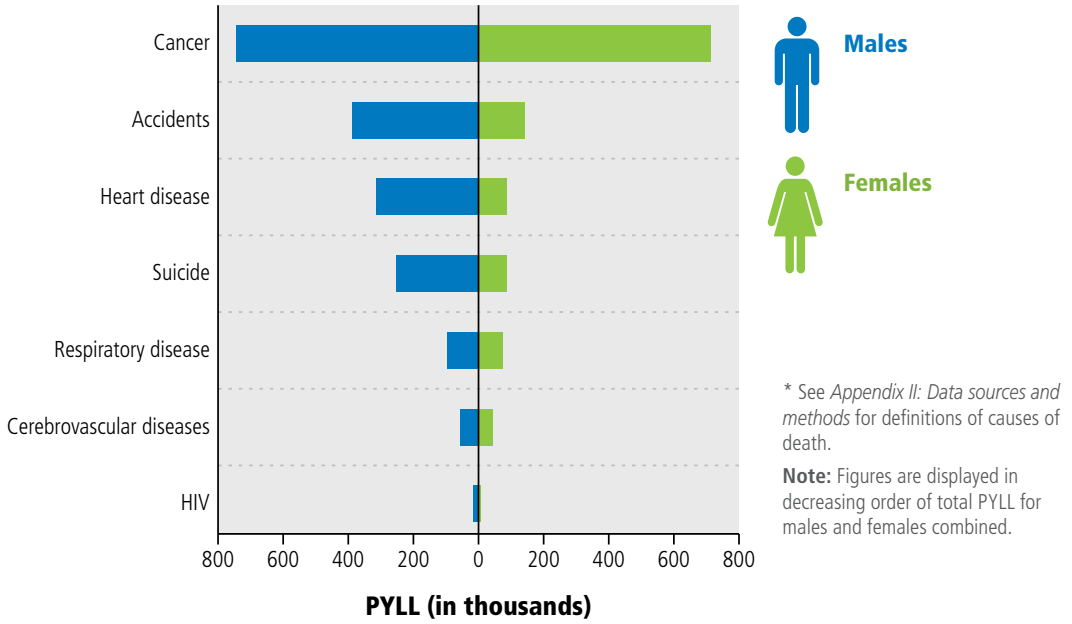
FIGURE A Proportion of deaths due to cancer and other causes, Canada, 2012



Note: The total of all deaths in 2012 in Canada was 246,596.
Data source: Canadian Vital Statistics Death database at Statistics Canada.[1]

Although many individuals who survive a cancer diagnosis continue to live productive and rewarding lives, the cancer experience presents many physical, emotional and spiritual challenges that can persist long after the disease is treated. In addition to being personally costly, cancer has major economic ramifications on the Canadian society at large. It is difficult to obtain reliable measures of the true cost of cancer, and different approaches can produce a wide range of estimates. The Public Health Agency of Canada estimated that in 2008 cancer was the seventh most costly illness or injury in Canada, accounting for $4.4 billion in economic costs. This includes $3.8 billion in direct healthcare costs (including hospital, drug and physician costs) and $586 million in indirect costs from lost productivity due to illness or premature death. Cancer was the costliest illness in terms of lost productivity due to death.[2] Given the increasing number of cancer cases diagnosed each year and inflation, this cost is likely much higher today.

FIGURE B Selected causes of death* and their associated potential years of life lost (PYLL), Canada, 2010–2012



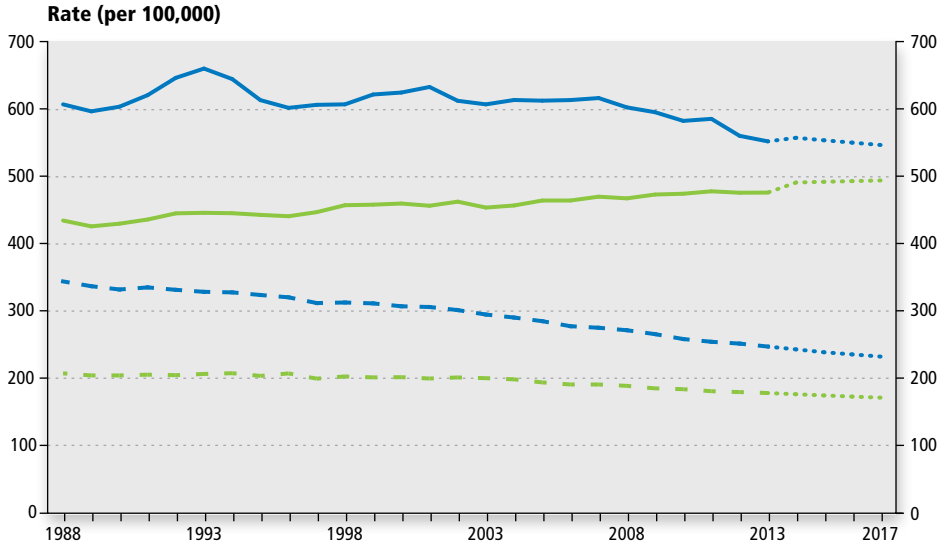
* See *Appendix II: Data sources and methods* for definitions of causes of death.

Note: Figures are displayed in decreasing order of total PYLL for males and females combined.

Analysis by: Statistics Canada, Mortality and potential years of life lost, by selected causes of death and sex, three-year average, Canada, provinces, territories, health regions and peer groups, CANSIM 102-4313
Data source: Canadian Vital Statistics Death database at Statistics Canada

Despite ongoing challenges, much progress has been made in the fight against cancer. Today, more is known about what causes cancer, how it develops and how best to prevent and treat it. More is also known about how we can maintain and improve the quality of life of people living with cancer, cancer survivors and their families and caregivers. Progress can be seen in trends in incidence rates over time and even more so in trends in mortality rates (Figure C). For example, incidence rates in males have been declining since the early 1990s, and mortality rates for all cancers combined have been decreasing for both sexes over the past 30 years.

FIGURE C Age-standardized incidence and mortality rates for all cancers combined, by sex, Canada, 1988–2017



Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry, National Cancer Incidence Reporting System and Canadian Vital Statistics Death databases at Statistics Canada

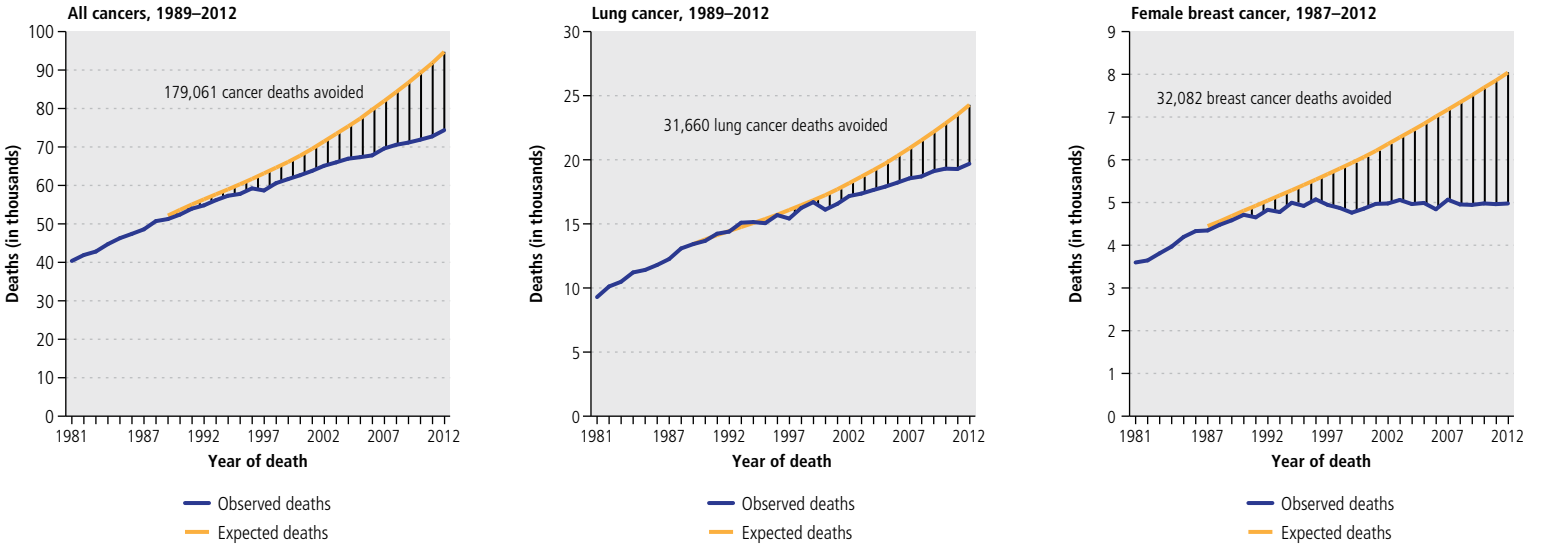
Note: Rates are age-standardized to the 2011 Canadian population. Projected rates are based on long-term historic data and may not always reflect recent changes in trends. Incidence excludes non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). Actual incidence data were available to 2013 for all provinces and territories except Quebec, for which data were available to 2010 and projected thereafter. Actual mortality data were available to 2012. For further details, see *Appendix II: Data sources and methods*. Dotted lines represent projected rates.

Since the peak in the cancer mortality rate in Canada in 1988, it is estimated that over 179,000 deaths have been avoided as a result of cancer prevention and control efforts (Figure D). Many of the deaths avoided were related to cancers of the breast and lung and bronchus (lung). It is estimated that over 31,000 lung cancer deaths have been avoided, largely reflecting a reduction in smoking among Canadians. Over 32,000 breast cancer deaths have also been avoided, in part reflecting the role of breast cancer screening in women and advances in breast cancer treatment (see *Chapter 2* for further details).

Canada has one of the highest-quality national population-based cancer registry systems in the world.[3] The information gained from the national cancer registry is valuable for monitoring cancer patterns and serves as a source of data for cancer control planning, healthcare resource allocation and research.

Surveillance data are also essential for informing and evaluating both primary prevention efforts (e.g., efforts to reduce risk factors and promote protective factors) and secondary prevention efforts (e.g., screening and early detection). To this end, this annual publication provides the most current summary of key cancer surveillance indicators, which can be used as a measure of the impact of cancer control efforts in Canada.

FIGURE D Number of cancer deaths avoided* since the cancer mortality rate peaked in Canada for all cancers combined, lung and female breast cancers



*For overall and lung cancer deaths, the orange line represents the number of deaths that would have occurred if the death rate had remained the same as in 1988. For breast cancer deaths, the orange line represents the number of deaths that would have occurred if the death rate had remained the same as in 1986.

Note: Mortality rates were available to 2012 for all provinces and territories. For further details, see *Appendix II: Data sources and methods*.

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

Comparable cancer indicators for different countries can be found through various international resources, including the GLOBOCAN database,[4] the Cancer Incidence in Five Continents publication,[5] Cancer Incidence in North America,[6] the International Cancer Benchmarking Partnership[7] and the CONCORD studies on cancer survival.[8] These studies indicate that Canada compares favourably to other high-income countries on several measures, including survival and mortality rates.

The World Health Organization suggests that prevention offers the most cost-effective, long-term strategy for controlling cancer and other non-communicable diseases.[9] Reducing the risk of cancer can be achieved through individual actions and policies that protect the public. The most notable cancer risk factors include:

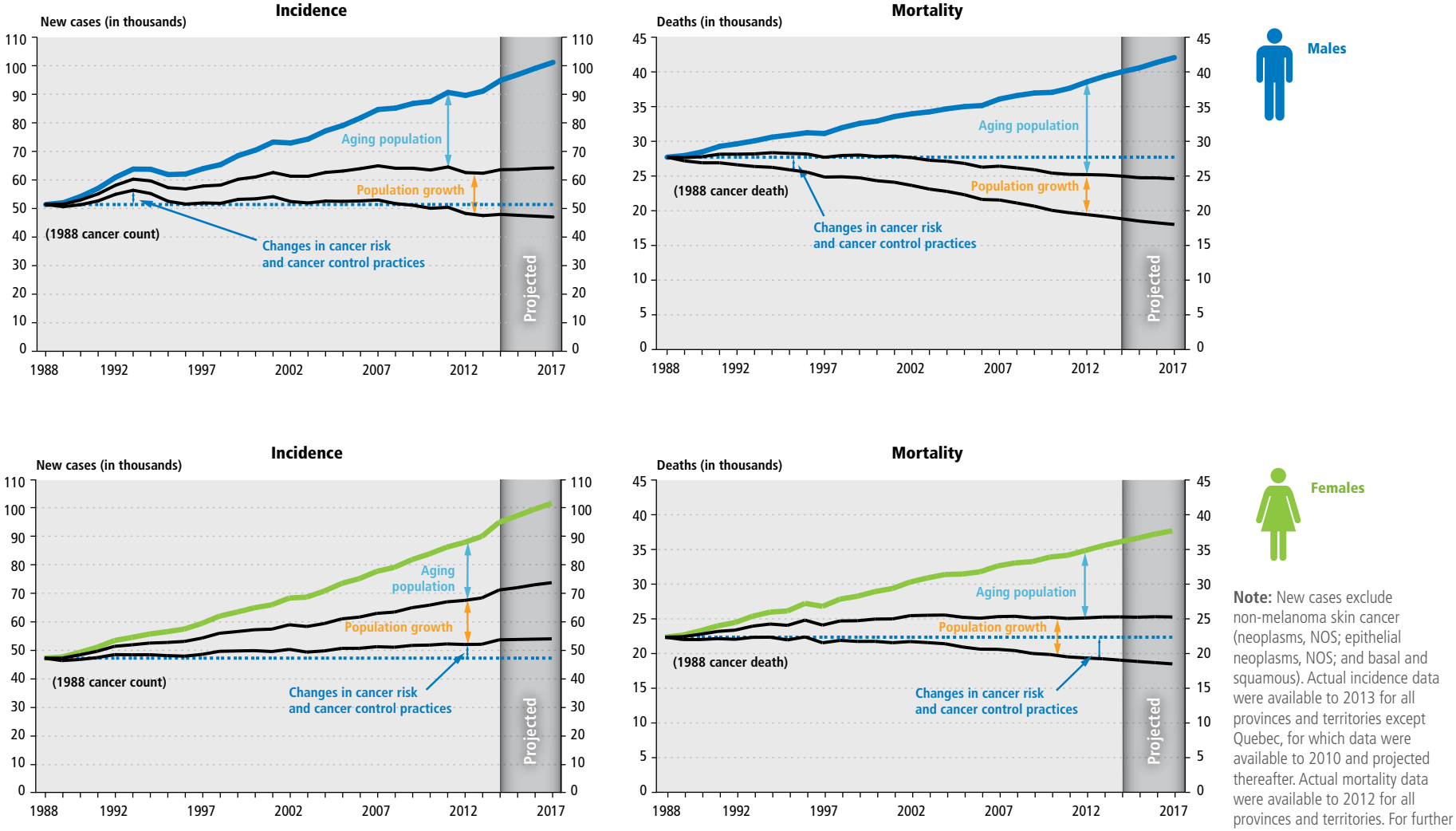
- Smoking: Tobacco is responsible for nearly one-fifth of cancer deaths worldwide, making it the single greatest avoidable risk factor for cancer.[9]
- Unhealthy lifestyle: Eating well, being active and having a healthy body weight can prevent about one-third of cancers diagnosed (among 12 major cancers) worldwide, according to the American Institute for Cancer Research and the World Cancer Research Fund. Eating well includes having a diet high in vegetables, fruit and fibre, and low in red and processed meat. Being active includes doing daily activities that increase the heart rate and reducing the amount of time spent sitting.[10, 11]
- Alcohol: Alcohol is a risk factor for many different types of cancer, and the risk of cancer increases with the amount of alcohol consumed.[9]
- Sunlight and tanning beds: Limiting time in midday sun, wearing protective clothing, seeking shade and using sunscreen can help reduce the risk of skin cancer while still allowing people to receive the health benefits of sun exposure.[10] Indoor tanning does not provide a safe alternative to the sun and should be avoided.[12]
- Cancer-related infections: Vaccines can protect against some infections associated with cancer, such as the human papillomavirus (HPV)[13] and hepatitis B.[14] Lifestyle can also play an important role in preventing infection.
- Environmental and occupational carcinogens: The International Agency for Research on Cancer has classified almost 200 agents as known or probable carcinogens, including radon, asbestos, air pollution, arsenic and many industrial chemicals. Knowing if you are exposed to these agents (e.g., testing for radon) and taking action to reduce exposure (e.g., radon mitigation at home, protective equipment at work) can lower the risk of cancer.[15]

Getting screened for cancer and being treated for precancerous conditions (as is done with cervical and colorectal cancer screening), as well as understanding and adapting based on genetic risk, can also reduce the number of people diagnosed with cancer.

Age-standardized incidence rates have been decreasing in males and increasing slightly in females. However, the total number of cancer cases are going up for both sexes. Increases in the number of new cancer cases and deaths over the past 30 years can largely be attributed to the aging and growing population. Figure E shows the trends in new cases and deaths attributed to the aging population, population growth and changes in cancer risk factors and cancer control practices. The lowest solid line represents the total number of new cancer cases or cancer deaths that would have occurred each year if the population size and age structure remained the same as they were in 1988. Changes in cancer risk and cancer control practices have a small impact on the overall number of cancer cases compared with the impact of the aging and growing population. However, changes in cancer risk and cancer control practices have contributed to a reduction in the number of Canadians who die of cancer. The middle line represents the number of cases or deaths that would have occurred each year if the annual rates were applied to a population that grew larger but maintained the same age distribution as 1988. The uppermost line represents the number of new cases or deaths that actually occurred once the impact of population growth and aging were taken into account.

As the Canadian population continues to grow and age, the average annual number of Canadians aged 65 and older is expected to more than double, from 4.2 million in 2003 to 2007 to 9.4 million in 2028 to 2032.[16] The average annual number of cancer cases in 2028 to 2032 is projected to be 79% higher than it was in 2003 to 2007.[17, 18] As a result, the Canadian healthcare system is expected to face increasing demand for cancer services, including diagnostics, treatment, palliative care and survivor supports and services.

FIGURE E Trends in new cases and deaths (in thousands) for all cancers and ages, attributed to changes in cancer risk and cancer control practices, population growth and aging population, by sex, Canada, 1988–2017



Note: New cases exclude non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). Actual incidence data were available to 2013 for all provinces and territories except Quebec, for which data were available to 2010 and projected thereafter. Actual mortality data were available to 2012 for all provinces and territories. For further details, see *Appendix II: Data sources and methods*. The range of scales differs between the graphs.

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry, National Cancer Incidence Reporting System and Canadian Vital Statistics Death databases at Statistics Canada

What is new or noteworthy this year?

This publication has been produced annually since 1987, and each year efforts are made to ensure the information provided is based on the most up-to-date data and most appropriate methodology available. The following are among the most noteworthy updates this year:

- Incidence projections to 2017 were based on actual data up to the year 2013 (except for Quebec, for which actual incidence data were to 2010 and were projected thereafter).
- Mortality projections for 2017 were based on actual data up to the year 2012.
- Incidence and mortality rates were age-standardized to the 2011 Canadian population, as was first done in the 2016 edition. In previous editions (1995 to 2015) rates were age-standardized to the 1991 population.
- Information on cancer incidence has been combined into one chapter (*Chapter 1*) as was information on cancer mortality (*Chapter 2*). In previous editions, there were two chapters for incidence and two for mortality.
- A new section has been added this year that synthesizes and contextualizes key statistics on incidence, mortality and survival. This new section is in *Chapter 5*.
- Since the most up-to-date data available can be found through Statistics Canada's online resource, CANSIM, this year the data tables in *Appendix I* are replaced with links to CANSIM and a brief tutorial on how to use the online tables. Previously, *Appendix I* provided actual incidence and mortality statistics for the most recent year used in the projections analyses.
- This edition includes a special focus on pancreatic cancer, highlighting incidence, mortality and survival statistics for this disease (*Chapter 6*).
- A number of statistical methods have been updated, including the methods used to estimate the probability of developing or dying from cancer, project incidence and mortality, and calculate annual percent changes (APC). This year also marks the first time this publication reports average annual percent change (AAPC). For more information on these methods, see *Appendix II: Data sources and methods*. Additional information about estimates of the lifetime probability of developing cancer is provided below.

Methodological update: Lifetime probability of developing cancer

The methodology used to estimate the probability of developing cancer has been improved this year. Estimates of cancer risk are now based on the first diagnosis of a type of cancer and are corrected for prevalent cases in the population. The correction for prevalent cases results in higher probabilities of developing cancer in older age groups, especially for cancers with a high incidence rate and long survival. As a result, the estimates reported in Table 1.1 and Figure 1.1 of this publication are different from the corresponding estimates reported for 2010 in *Canadian Cancer Statistics 2016*. For example, the lifetime probability of developing cancer reported in this publication is 1 in 2 for males and 1 in 2.2 for females, where it is previously estimated to be 1 in 2.2 for males and 1 in 2.4 for females. It is important to note that such differences are primarily attributable to improvements in methodology rather than changes in risk.

Other resources

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CHAPTER 1
Incidence: How many people get cancer in Canada by sex, age and geography?

Highlights

- An estimated 206,200 new cases of cancer are expected to be diagnosed in Canada in 2017, with roughly an equal number among males and females. Half of these (103,200 cases) will include lung, breast, colorectal and prostate cancers.
- It is expected that 1 in 2 Canadians will develop cancer in their lifetime. Males have a 49% lifetime probability (or a 1 in 2 chance) of developing cancer. Females have a 45% lifetime probability (or a 1 in 2.2 chance) of developing cancer.
- In general, incidence rates increase with age. In 2017, it is estimated that 89% of all cancers will be diagnosed in Canadians 50 years of age and over, while 45% will occur in Canadians 70 years of age and older.
- Among people between the ages of 20 and 59 years, females have higher incidence rates of cancer than males. This difference is most likely due to high incidence rates of breast and thyroid cancer in females between those ages. Cancer incidence rates are higher in males for all other age groups.
- In recent years, the incidence rate of cancer has increased in females and decreased in males. The largest annual percent increase was for thyroid cancer for both males and females, and the largest decrease was for prostate cancer in males and laryngeal cancer in females.
- The increase in incidence rates for some cancers may be related to increasing risk factors. For other cancers, this increase in incidence may relate to increased detection (e.g., thyroid cancer). Decreases in incidence may correspond, in part, to declines in major risk factors, such as smoking (e.g., for lung and laryngeal cancers), as well as changes in screening practices (e.g., prostate cancer).
- Increases in the number of new cancer cases have implications for the need for screening, diagnostic, treatment and support services, including palliative care.

Introduction

Each hour of the day in 2017 in Canada, 24 people are expected to be diagnosed with cancer. The number of new cases of cancer each year (incidence) is an important measure of the cancer burden on the Canadian population and healthcare system. Trends in incidence rates and population projections can be used to predict the future burden of cancer. This information is essential for ensuring that adequate screening, diagnostic, treatment and support services, including palliative care, are available, as well as for directing future cancer prevention, control and research programs.

Cancer strikes males and females, young and old, and those in different regions across Canada on a decidedly uneven basis. This chapter examines incidence by sex, age and geographic region to see who is affected by cancer in Canada.

Probability of developing cancer

The probability of developing a specific type of cancer depends on many factors, including age, sex, risk factors (e.g., smoking, obesity) and life expectancy. This probability reflects the average experience of people in Canada and does not take into account individual behaviours and risk factors; therefore, it should not be interpreted as an individual's risk.

The biggest risk factor for cancer is age, and the Canadian population is aging.[1] Like many other developed countries, Canada now has a greater proportion of seniors (people who are over 65 years of age) than at any time in the past, and seniors represent the fastest-growing age group in Canada. As a result, it is expected that a growing number of people will be diagnosed with diseases related to aging, including cancer.

Methodological improvement

As of this edition, the methodology used to estimate the probability of developing cancer has been improved. Estimates of cancer risk are now based on the first diagnosis of a type of cancer and are corrected for prevalent cases in the population. The correction for prevalent cases results in higher probabilities of developing cancer in older age groups, especially for cancers with a high incidence rate and long survival. As a result, the estimates reported in Table 1.1 and Figure 1.1 of this publication are different from the corresponding estimates in *Canadian Cancer Statistics 2016*, which were also reported for 2010. It is important to note that such differences are primarily attributable to improvements in the methodology and not to changes in risk. See *Appendix II: Data source and methods for additional information*.

In Canada, 1 in 2 males and 1 in 2.2 females (approximately 1 in 2 Canadians) are expected to develop cancer in their lifetime (Figure 1.1). These numbers reflect the likelihood at birth that Canadians will develop cancer at some point during their lives.

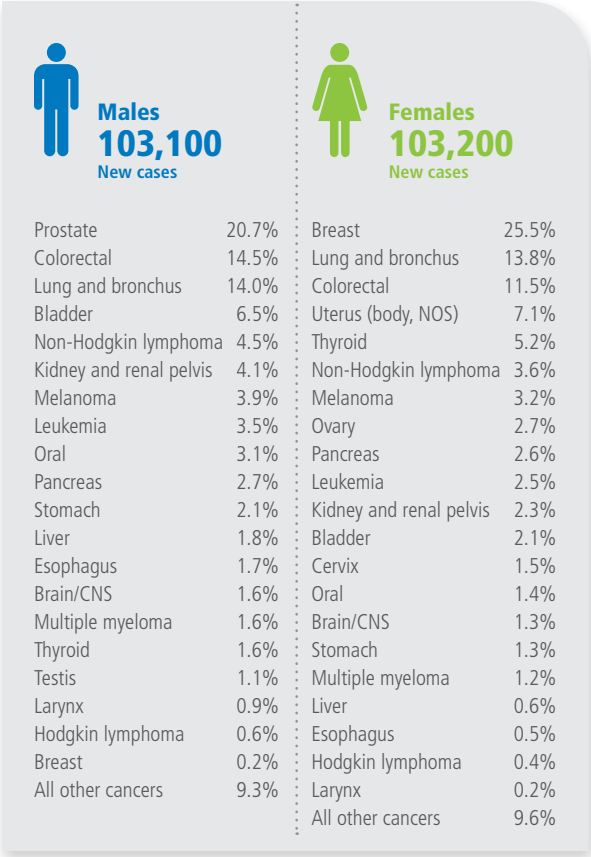
The probability of developing cancer varies by cancer type for males and females.

- As shown in Table 1.1, Canadian males are more likely to develop prostate cancer than any other cancer, with 1 in 7 males expected to be diagnosed with prostate cancer in their lifetime. After prostate cancer, lung and bronchus (lung) cancer has the next highest lifetime risk (1 in 11 males), followed by colorectal cancer (1 in 13 males).
- Canadian females are more likely to develop breast cancer than any other cancer, with 1 in 8 females expected to develop breast cancer in their lifetime. One in 14 females is expected to be diagnosed with lung cancer during their lifetime, and 1 in 16 is expected to be diagnosed with colorectal cancer.

FIGURE 1.1 Lifetime probability of developing cancer, Canada, 2010

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry and Vital Statistics Death databases at Statistics Canada

FIGURE 1.2 Percent distribution of projected new cancer cases, by sex, Canada, 2017



Males		Females	
Prostate	20.7%	Breast	25.5%
Colorectal	14.5%	Lung and bronchus	13.8%
Lung and bronchus	14.0%	Colorectal	11.5%
Bladder	6.5%	Uterus (body, NOS)	7.1%
Non-Hodgkin lymphoma	4.5%	Thyroid	5.2%
Kidney and renal pelvis	4.1%	Non-Hodgkin lymphoma	3.6%
Melanoma	3.9%	Melanoma	3.2%
Leukemia	3.5%	Ovary	2.7%
Oral	3.1%	Pancreas	2.6%
Pancreas	2.7%	Leukemia	2.5%
Stomach	2.1%	Kidney and renal pelvis	2.3%
Liver	1.8%	Bladder	2.1%
Esophagus	1.7%	Cervix	1.5%
Brain/CNS	1.6%	Oral	1.4%
Multiple myeloma	1.6%	Brain/CNS	1.3%
Thyroid	1.6%	Stomach	1.3%
Testis	1.1%	Multiple myeloma	1.2%
Larynx	0.9%	Liver	0.6%
Hodgkin lymphoma	0.6%	Esophagus	0.5%
Breast	0.2%	Hodgkin lymphoma	0.4%
All other cancers	9.3%	Larynx	0.2%
		All other cancers	9.6%

CNS=central nervous system, NOS=not otherwise specified

Note: The complete definition of the specific cancers listed here can be found in Table A2.

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry and National Cancer Incidence Reporting System databases at Statistics Canada

New cases of cancer in 2017

An estimated 206,200 new cases of cancer are expected to be diagnosed in 2017 (Table 1.2).

- Four cancers (prostate, breast, lung and colorectal) combined are expected to account for half of all cancers diagnosed in Canada in 2017.
- As shown in Figure 1.2, prostate and female breast are the leading cancers. About 21,300 new cases of prostate cancer are expected, which is 21% of all new male cases. About 26,300 new cases of breast cancer are expected, which is 26% of all new female cases.
- In males, colorectal cancer and lung cancer are the next most common cancers, each accounting for approximately 14% of all new cases. In females, lung cancer is the second most common cancer, representing 14% of all new cases, followed by colorectal cancer, representing approximately 12% of all new cases.

Probability

The chance of developing cancer measured over a defined period of time. The probability of developing cancer is expressed as a percentage or as a chance (e.g., 20% or 1 in 5 people over a lifetime).

Incidence

The number of new cancer cases diagnosed in a given period of time, often a year.

Age-standardized incidence rate (ASIR)

The number of new cases of cancer per 100,000 people, standardized to the age structure of the 2011 Canadian population. In this publication, ASIR is also referred to as "incidence rate."

Annual percent change (APC)

The estimated change in the age-standardized incidence rate per year over a defined period of time in which there is no significant change in trend (i.e. no changepoint). It is reported as a percentage.

Average annual percent change (AAPC)

The weighted average of the APCs in effect during a period of time, where the weights equal the proportion of time accounted for by each APC in the interval. AAPC summarizes the change in age-standardized rates over a specified interval. It is reported as a percentage.

Changepoint

The year corresponding to a significant change in trend of age-standardized rates. The changepoint year is determined by an algorithm and may not correspond identically to patterns in the data in Tables 1.3 and 1.4.

Statistical significance

Refers to a result that is unlikely due to chance given a predetermined threshold (e.g., fewer than 1 out of 20 times, which is expressed as $p<0.05$).

Confidence limits (CL)

Upper and lower values of a range that provide an indication of the precision of an estimate. Confidence limits are usually 95%, which means that, assuming no other sources of bias, one can be 95% confident the limits contain the true value for the estimate of interest.

Incidence over time

Between 1988 and 2017, the number of new cancer cases rose steadily (Figure 1.3). However, age-standardized incidence rates (ASIR) have decreased for males and increased for females.

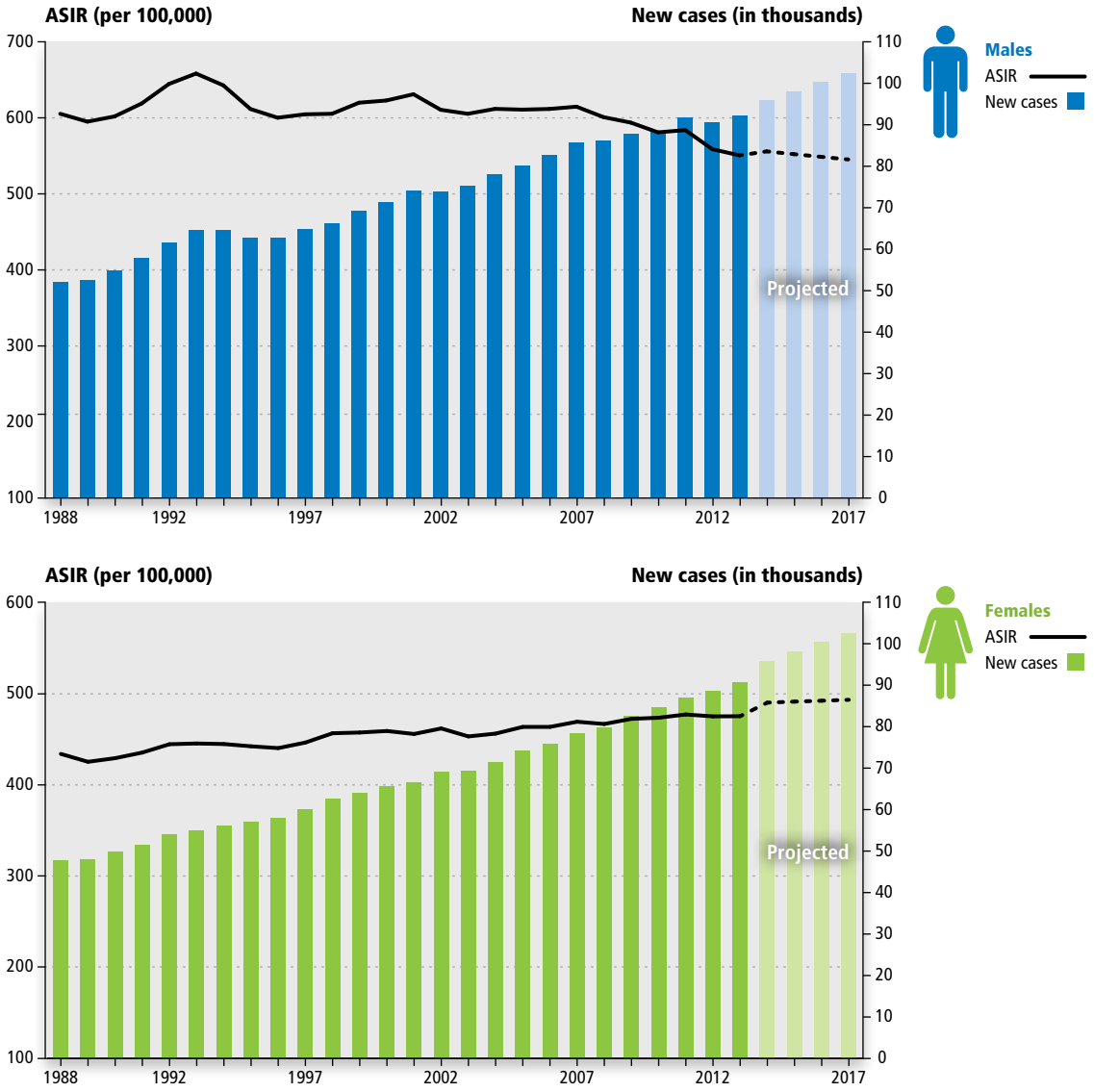
- In males, brief peaks in the number of new cancer cases in the early 1990s and early 2000s reflect the underlying trend in incidence rates of prostate cancer, the leading cancer in males.
- Among females, the continued slight increase in the overall age-standardized cancer incidence rate primarily reflects the steady rise in incidence rates for melanoma, thyroid and uterine cancer (body of the uterus and uterus not otherwise specified [NOS]).

Trends for selected cancers

Tables 1.3 and 1.4 show the ASIR for selected cancers in males and females over a 30-year period.

Table 1.5 shows the most recent changepoint year and subsequent annual percent change (APC) for 1992 to 2013. In the absence of a changepoint, the APC is for the complete time period. The APCs reported are based on the results of a regression model (see *Appendix II*: *Data sources and methods*).

FIGURE 1.3 New cases and age-standardized incidence rates (ASIR) for all cancers, Canada, 1988–2017



Note: "All cancers" excludes non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). Rates are age-standardized to the 2011 Canadian population. Projected rates are based on long-term historic data and may not always reflect recent changes in trends. Actual incidence data were available to 2013 for all provinces and territories except Quebec, for which data were available to 2010 and projected thereafter. For further details, see *Appendix II: Data sources and methods*.

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry and National Cancer Incidence Reporting System databases at Statistics Canada

View data

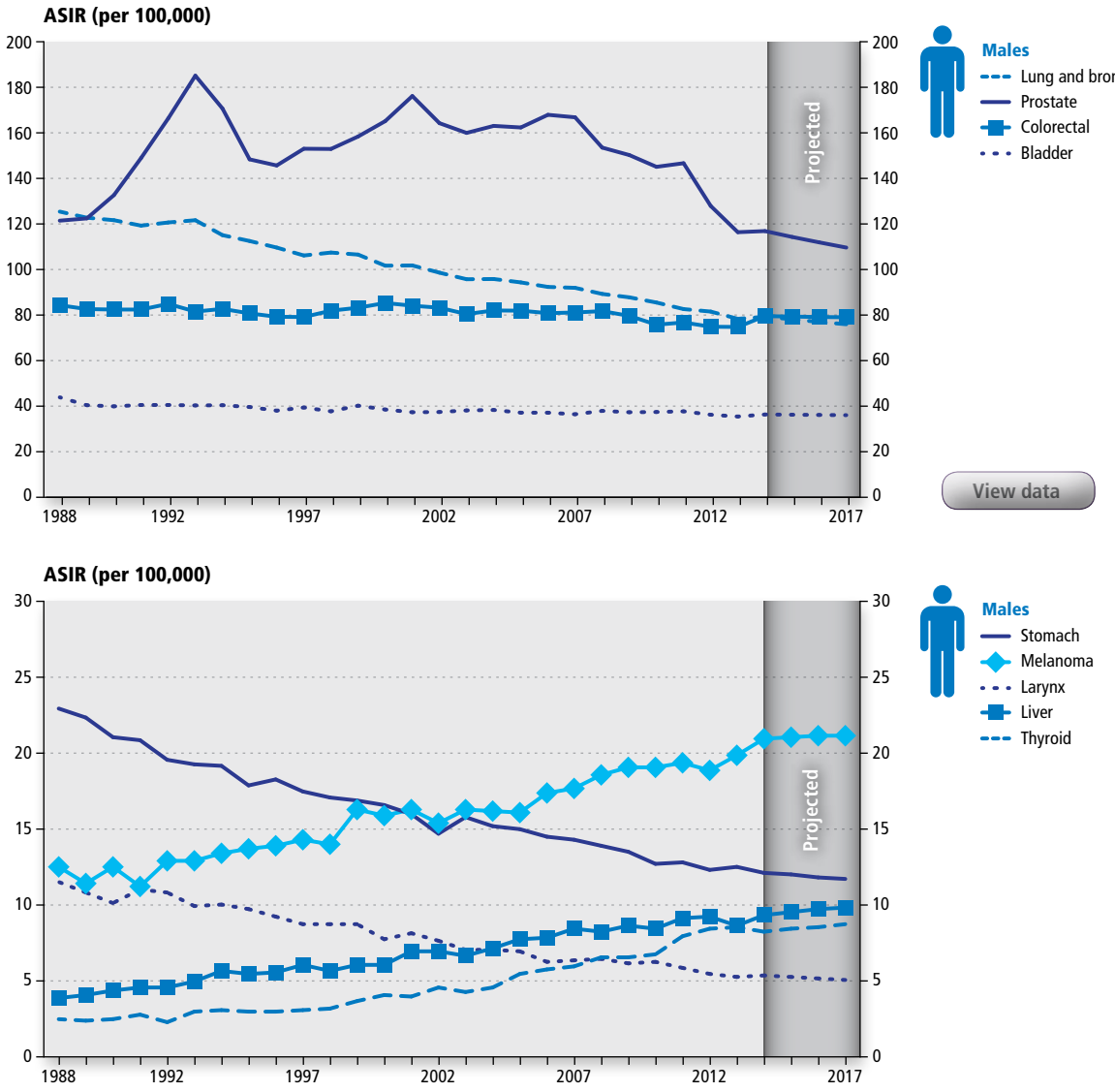
Figures 1.4 and 1.5 show the five most common cancers for both sexes combined (lung, colorectal, prostate, female breast and bladder) and cancers with a statistically significant APC of at least 2% per year (uterus and cervix in females, stomach in males, and melanoma, liver, larynx and thyroid in both sexes).

Additional discussion of these cancers is provided below.

Bladder cancer

Bladder cancer is the fourth most commonly diagnosed cancer in males and the 12th most commonly diagnosed cancer in females, accounting for over 4% of all cancers in both sexes combined. Between 1992 and 2013, there was a statistically significant decrease in the rate of bladder cancer in males (0.5% per year) and females (0.2% per year). In recent decades, the incidence of bladder cancer has decreased in most Western countries but increased in some eastern European and developing countries.[2] These patterns may in part reflect reductions in smoking,[2, 3] which is estimated to account for between 34% and 50% of all bladder cancers.[4, 5]

FIGURE 1.4 Age-standardized incidence rates (ASIR) for selected* cancers, males, Canada, 1988–2017



* Five most frequent cancers (both sexes combined) and cancers with a statistically significant change in incidence rate of at least 2% per year (see Table 1.5).

Note: Rates are age-standardized to the 2011 Canadian population. See Table 1.3 for data points. Projected rates are based on long-term historic data and may not always reflect recent changes in trends. Actual incidence data were available to 2013 for all provinces and territories except Quebec, for which data were available to 2010 and projected thereafter. For further details, see *Appendix II: Data sources and methods*. The range of scales differs widely between the figures. The complete definition of the specific cancers included here can be found in Table A2.

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry and National Cancer Incidence Reporting System databases at Statistics Canada

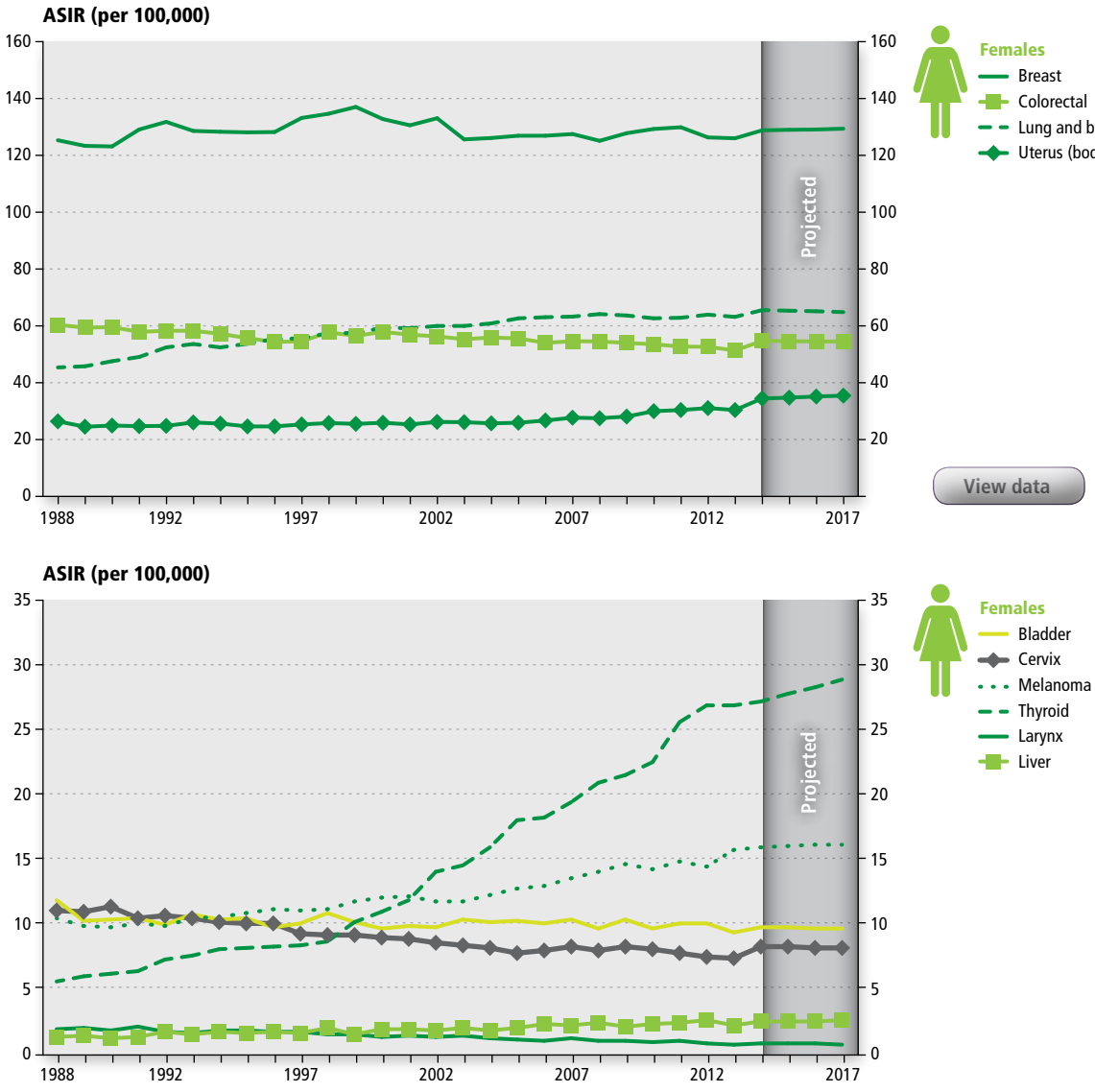
Occupational exposure to certain chemicals is the second most important risk factor for bladder cancer. Exposure to aromatic amines (especially betanaphthylamine, benzidine, 4-aminobiphenyl and 4-o-toluidine), polyaromatic hydrocarbons (PAHs) and diesel engine exhaust is also found to increase the risk for bladder cancer.[6]

Cervical cancer

In 2017, 1,550 cases of cervical cancer are expected to be diagnosed in Canada, making it the 13th most commonly diagnosed cancer in Canadian women. Incidence rates vary across the country, from a low of 6.5 per 100,000 in Quebec to a high of 10.7 per 100,000 in Newfoundland and Labrador.

Over the past 30 years, there has been a 26% decline in ASIR, from 11.2 per 100,000 in 1988 to 8.3 per 100,000 in 2017. Since 2009, the annual percent decrease in incidence rates has been 3.0%.

FIGURE 1.5 Age-standardized incidence rates (ASIR) for selected* cancers, females, Canada, 1988–2017



* Five most frequent cancers (both sexes combined) and cancers with a statistically significant change in incidence rate of at least 2% per year (see Table 1.5).

Note: Rates are age-standardized to the 2011 Canadian population. See Table 1.4 for data points. Projected rates are based on long-term historic data and may not always reflect recent changes in trends. Actual incidence data were available to 2013 for all provinces and territories except Quebec, for which data were available to 2010 and projected thereafter. For further details, see *Appendix II: Data sources and methods*. The range of scales differs widely between the figures. The complete definition of the specific cancers included here can be found in Table A2.

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry and National Cancer Incidence Reporting System databases at Statistics Canada

The decrease in the incidence of cervical cancer is largely a result of routine screening with Papanicolaou (Pap) tests, which can find precancerous lesions before they turn into invasive cervical cancer. The Canadian Task Force on Preventive Health Care (CTFPHC) recommends screening every three years for asymptomatic, sexually active women between the ages of 25 to 69 years. The CTFPHC recommends that routine screening may cease for women aged 70 years of age and older who have had three successive negative Pap tests in the previous 10 years.

Human papillomavirus (HPV) infections are the most common sexually transmitted infections. While virtually all women who develop cervical cancer have had an HPV infection, having an HPV infection does not mean that a woman will develop cervical cancer. Vaccines to protect against the most common types of HPV that cause cervical cancer are recommended for females nine years of age and older in Canada.[7]

For more discussion about the burden of cervical cancer, see *Canadian Cancer Statistics 2016*.[8]

Colorectal cancer

Colorectal cancer is the second most common cancer, accounting for 13% of all cancers. Starting from the mid-1980s, overall incidence rates for colorectal cancer declined for both sexes until the mid-1990s, though this decline was more prominent for females.[9] Incidence rates then rose, only to decrease again, beginning in 2000 for females and 2008 for males (Table 1.5). This is most likely due to increased use of colorectal cancer screening, which can identify treatable precancerous polyps and reduce cancer incidence. The decline in colorectal cancer incidence rates appears confined to older adults as rates are increasing among adults younger than 50 years of age in Canada and in the United States.[10-13]

Colorectal cancer is linked to several modifiable risk factors, including obesity, physical inactivity, consumption of red and processed meat and smoking.[14, 15] Diabetes may also increase the risk for colorectal cancer.[16]

The CTFPHC recommends screening adults aged 50–74 years who are not at high risk with a fecal occult blood test (FOBT) every two years or flexible sigmoidoscopy every 10 years.[17] As of 2017, all 10 provinces had implemented or are in the process of implementing organized colorectal cancer screening programs.[18, 19] Participation rates vary within and between the existing organized programs, and none meet the target of 60%.[18]

For more discussion about the burden of colorectal cancer, see *Canadian Cancer Statistics 2011*.[20]

Female breast cancer

Breast cancer is the third most common cancer in Canada, accounting for 13% of all cancers and 25% of cancers among females. The breast cancer incidence rate rose in the 1990s. This increase is due in part to increased opportunistic mammography screening that was done before organized provincial screening programs were implemented from 1988 onward. Since 1988, incidence rates have fluctuated. The reasons for these fluctuations are unclear but are likely attributable to continued participation in mammography screening and to long-term changes in hormonal factors, such as early age at menarche, breastfeeding, late age at menopause, oral contraceptive use and late age at full-term pregnancy.[21] Diabetes may also increase the risk of breast cancer.[16] The sharp decrease in incidence that occurred around 2002 may reflect the reduced use of hormone replacement therapy (HRT) among post-menopausal women at that time.[22, 23] From 2004 through 2013, the breast cancer incidence rate mostly stabilized. This is consistent with data from the United States.[24]

Laryngeal cancer

Incidence rates of laryngeal cancer decreased significantly from 1992 to 2013 for both males (3.2% per year) and females (3.4% per year). As cancer of the larynx is most strongly associated with smoking[25] and alcohol[26], the decreasing trends in smoking[27, 28] may have contributed to the declines in incidence rates.

Liver cancer

The incidence rate of liver cancer increased significantly between 1992 and 2013, by 3.1% per year in males and 2.1 % per year in females. These increases may be at least partially explained by rising immigration from regions of the world where risk factors for liver cancer, such as hepatitis B and C infection and exposure to aflatoxin, are more common.[29]

For more discussion about the burden of liver cancer, see *Canadian Cancer Statistics 2013*.[30]

Lung and bronchus (lung)

Lung cancer is the most common cancer, accounting for 14% of all cancers. In males, the incidence rate of lung cancer began to level off in the mid-1980s[31] and has been declining since then (1.9% per year since 1992). Among females, rates were stable between 2006 and 2013. The incidence rate of lung cancer remains higher among males (77 per 100,000) than females (65 per 100,000), although rates among younger adults appear to be converging.[32]

The differences in lung cancer incidence rates among males and females reflect past differences in tobacco use. According to the 2013 Canadian Tobacco, Alcohol and Drugs Survey, the prevalence of smoking for Canadians aged 15 years and over is 15% in both sexes combined.[27] In males, a drop in the prevalence of daily smokers began in the mid-1960s in Canada, preceding the drop in lung cancer incidence by about 20 years. In females, the drop in smoking was not until mid-1980s, suggesting that lung cancer incidence rates in women may also begin to decrease in the coming years.

Melanoma

Incidence rates of melanoma have increased in both males and females over the past several decades. Between 1992 and 2013 incidence rates increased by 2.1% per year in males and 2.0% per year in females.

Exposure to ultraviolet (UV) radiation through exposure to sunlight, tanning beds and sun lamps appears to be a major risk factor for melanoma.[33] Other risk factors include having a fair complexion, the number and type of moles, personal and family history of skin cancer, a weakened immune system and a history of severe blistering sunburn.

For more discussion about the burden of melanoma, see *Canadian Cancer Statistics 2014*.[34]

Prostate cancer

Prostate cancer is the fourth most common cancer, accounting for 10% of all cancers and 21% of cancers among males. Since 2007, the age-standardized prostate cancer incidence rate has been declining by about 5.3% per year. Incidence rates peaked in 1993 and again in 2001. Each of these peaks was followed by a decline. These peaks are compatible with two waves of intensified screening activity using the prostate-specific antigen (PSA) test. While the PSA test is not currently recommended in Canada as a population-based screening test,[17] its use as a screening test is widespread.[35, 36]

Prostate cancer incidence rates have also been decreasing lately in the United States, but at a faster pace than in Canada. From 2011 to 2012, the rate in the United States decreased by 19.1%[37] compared with 12.3% in Canada.[38] In the United States, the decline in the 2012 rate coincides with a significant drop in self-reported PSA screening rates, possibly related to revised guidelines released by the United States Preventive Services Task Force.[39, 40]

Stomach cancer

Incidence rates for stomach cancer continue to decline in both males (2.2% per year between 1992 and 2013) and females (1.3% per year between 2001 and 2013). Incidence rates in males are currently about half of what they were in 1988. This decline may be due to long-term improvements in diet[41] and decreases in smoking and heavy alcohol use.[42] The declining incidence rates of stomach cancer may also be related to the more recent recognition and treatment of infection with the bacterium *Helicobacter pylori*, an important risk factor for stomach cancer.[43]

Thyroid cancer

Thyroid cancer has undergone the most rapidly increasing incidence rate among all major cancers, not only in Canada but worldwide.[44] In Canada, rates of thyroid cancer increased 6.2% per year between 1992 and 2013 in males and 5.9% per year between 2004 and 2013 in females.

A recent study, led by researchers from the International Agency for Research on Cancer (IARC), shows that a large proportion of thyroid cancers in developed countries are likely only diagnosed because of increased surveillance and use of diagnostic technologies, like the introduction of neck ultrasound in the 1980s and of computed tomography (CT) scanning and magnetic resonance imaging (MRI) in the 1990s.[45] This may mean that a greater number of earlier stage, asymptomatic thyroid cancers are being diagnosed.[45, 46]

The potential over-diagnosis and over-treatment of thyroid cancer may have important implications for the individual and for health system resources. For example, potentially unnecessary treatment resulting from enhanced surveillance of the thyroid gland, such as a total thyroidectomy, is associated with substantial side effects and without proven improvements in survival rates. Also, increasing exposure to diagnostic ionizing radiation could promote the initiation of new tumours.[47]

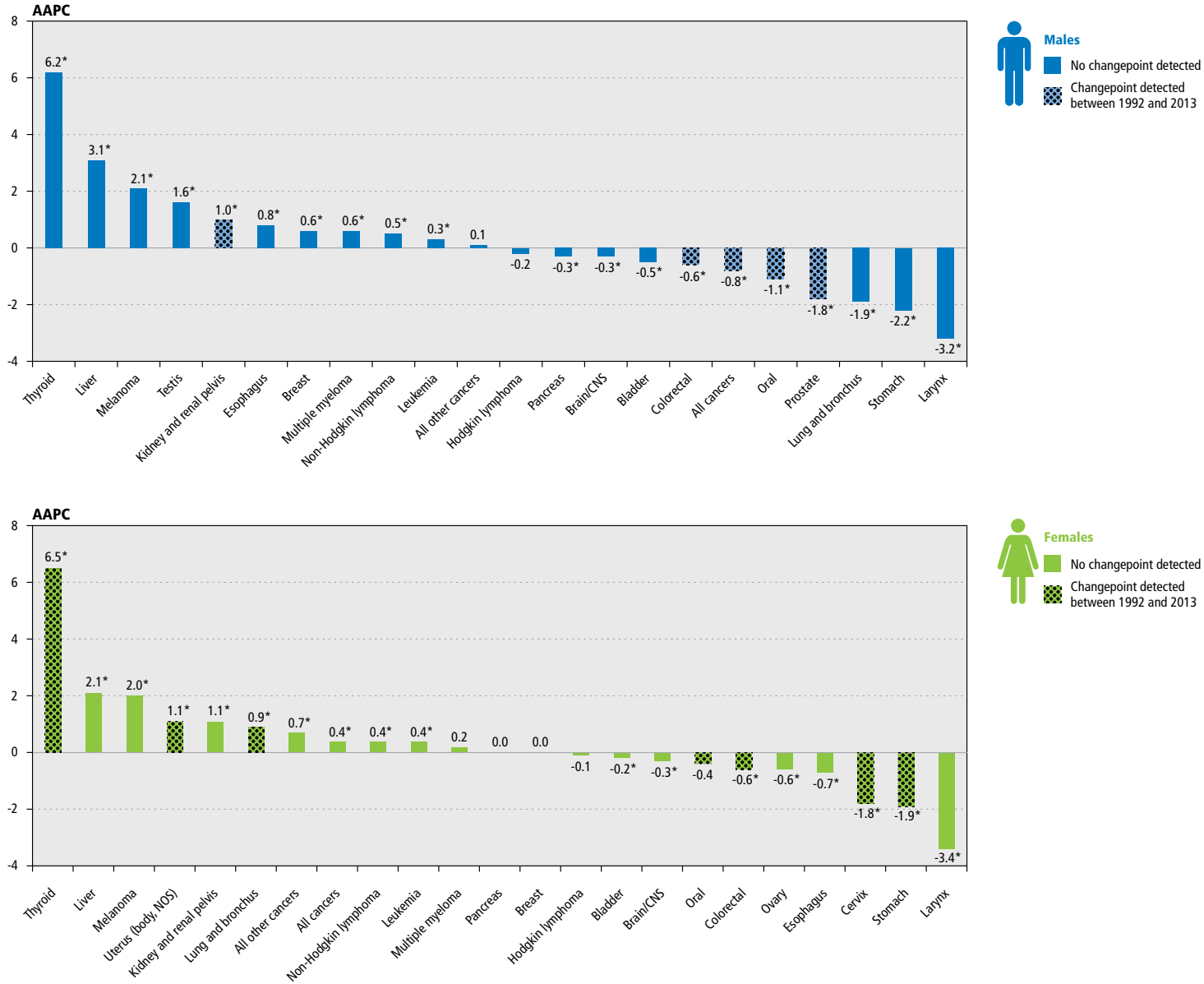
Uterine cancer [body, not otherwise specified (NOS)]

The majority of uterine cancers occur in the lining of the uterus (called the endometrium). Incidence rates of uterine cancer increased by 2.3% per year among women between 2005 and 2013. This is consistent with recent reports from the United States.[48] Exposure to estrogen appears to increase the risk for uterine cancer. Reduced risk is associated with lower cumulative estrogen exposure, higher exposure to progesterone (such as with increased number of full-term pregnancies and shorter menstrual lifespan) or both.[49] Other risk factors include being overweight or obese, having a genetic predisposition, diabetes, endometrial hyperplasia, chronic anovulation, previous pelvic radiation, estrogen-secreting ovarian tumours and Lynch syndrome.

Average annual percent change

Figure 1.6 shows the average annual percent change (AAPC) in cancers between 1992 and 2013 by sex. By summarizing changes in trends, the AAPC enables the comparison of changes in incidence across cancers for the same defined time period. In both males and females, the greatest increases were observed for thyroid cancer (6.2% and 6.5%, respectively), followed by liver cancer and melanoma. The greatest decreases were observed for cancers of the larynx (3.2% in males and 3.4% in females) and stomach (2.2% in males and 1.9% in females).

FIGURE 1.6 Average annual percent change (AAPC)† in age-standardized incidence rates (ASIR), by sex, Canada, 1992–2013



CNS=central nervous system; NOS=not otherwise specified

* AAPC differs significantly from 0, $p<0.05$

† AAPC summarizes the trend over a specified interval, in this case 1992–2013. It is computed as a weighted average of the APCs in effect during the interval with the weights equal to the proportion of time accounted for by each APC in the interval.

Note: Actual incidence data were available to 2013 for all provinces and territories except Quebec, for which data were available to 2010 and projected thereafter. "All cancers" excludes non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). The complete definition of the specific cancers included here can be found in Table A2. Rates are age-standardized to the 2011 Canadian population. For further details, see *Appendix II: Data sources and methods*.

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry database at Statistics Canada

Incidence by sex

A roughly equal number of new cases are expected to be diagnosed in males and females in 2017 (Table 1.2). Prostate and breast cancer are the most frequently diagnosed cancers for males and females, respectively, followed by colorectal and lung cancers.

Trends over time by sex

Figure 1.3 shows the trend in cancer incidence rates by sex from 1988 to 2017.

- Since the early 1990s, there has been an overall decline in cancer incidence rate in males, primarily due to the decline in lung cancer and prostate cancer (Table 1.3).
- Among females, the overall cancer incidence rate has been increasing slowly since the early 1990s. This increase primarily reflects the rise in lung cancers that occurred until 2006. Thyroid cancer, uterine cancer and melanoma are also increasing (Table 1.4).

Incidence by age

Cancer primarily affects Canadians age 50 and over – 89% of all new cases are diagnosed in people in this age group. For both males and females, the median age of cancer diagnosis is between 65 and 69 years of age.

Based on the data in Table 1.6, it is projected that in 2017:

- 45% of all new cases will occur in people aged 70 years or older.
- 28% of all new cases will occur in people aged 60–69 years.
- 17% of all new cases will occur in people aged 50–59 years.
- 10% of all new cancers will occur in people aged 20–49 years
- 0.7% of all new cases will occur in children and youth aged 0–19 years.

Figure 1.7 shows that the distribution of the types of new cancer cases varies between age groups.

- Between 2006 and 2010, the most commonly diagnosed cancer in children aged 0–14 years was leukemia (32%), followed by cancers of the central nervous system (CNS) and lymphomas (19% and 11%, respectively).
- New cancer cases among older adolescents and young adults aged 15–29 years account for approximately 1.5% of all new cancer cases. The most commonly diagnosed cancers in this age group are thyroid (17%), testicular (14%), Hodgkin lymphoma (11%) and melanoma (7%).
- Among individuals aged 30 years and over, the distribution of cancers shifts more toward tumours that are epithelial in origin and arise frequently within solid organs in the body. For both sexes combined, the most common cancer for people aged 30–49 years was breast (24%), for people aged 50–69 years was prostate (16%), for people aged 70–84 years was lung (18%) and for people 85 years and older was colorectal (17%). From age 50 onward, breast, colorectal, lung and prostate account for over 47% of all new cancer cases (Table 1.7).

The largest proportion of new cases of lung, breast, prostate and colorectal cancers occurs in adults aged 50 years and older (Table 1.7).

- Over half of all newly diagnosed cases of lung cancer (56%) or colorectal cancer (54%) will occur among people aged 70 years or older.
- The majority of breast cancers occur in females 50–69 years of age (51%). Approximately 32% of breast cancers are diagnosed in females aged 70 years and older, while 17% occur in females younger than 50 years of age. Less than 1% of breast cancers occur in males.
- The greatest number of prostate cancers are diagnosed in males aged 60-69 years (38%).

Cancer incidence among children, adolescents and young adults

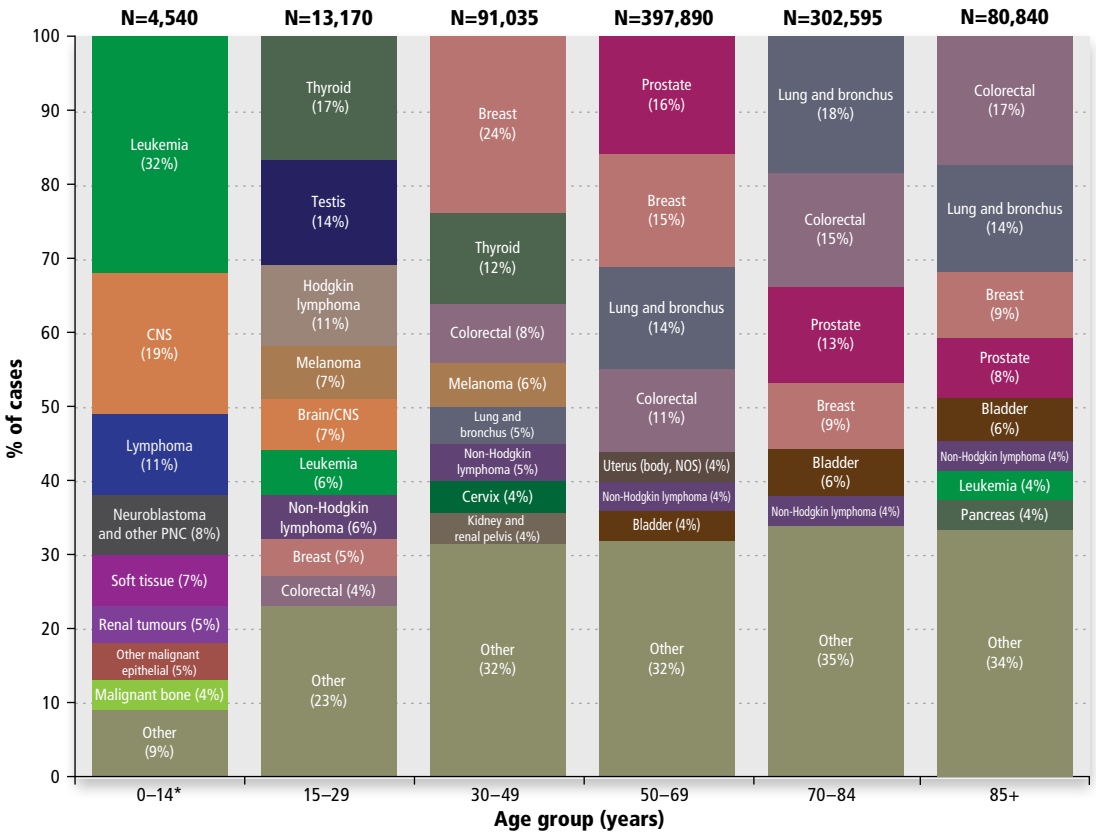
Although childhood cancers represent a small percentage of new cancer cases, these cancers have a significant impact on both children and their families.[50]

- Cancers in children (0–14 years of age; see Table A1) differ from those occurring in adults in both their type and their behaviour. Generally, tumours in children have shorter latency periods and are more aggressive and invasive than tumours in adults.
- Childhood tumours are more likely to be embryonic or hematopoietic in origin, and the most common types are leukemia, lymphoma and cancers of the central nervous system (CNS). To account for these differences, a separate classification scheme of diagnostic groupings has been created.[51]

Adolescents and young adults (15–29 years of age) represent a transitional phase where some tumours still closely resemble those found in childhood, while others have characteristics more common in adults. Consequently, diagnosis and treatment in this age group can be challenging and there have been limited advancements in overall survival in this age group in recent years.[52, 53]

For more discussion about the burden of childhood and adolescent and young adult cancers, see the 2008 and 2009 editions of the *Canadian Cancer Statistics*.[54, 31]

FIGURE 1.7 Distribution of new cancer cases for selected cancers by age group, Canada, 2009–2013



Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada and Health Statistics Division, Statistics Canada

Data source: Canadian Cancer Registry database at Statistics Canada

N is the total number of cases over 5 years: 2009–2013 for each age group except ages 0–14 for which cases are over 2006–2010; CNS=central nervous system; PNC=peripheral nervous cell tumours; NOS=not otherwise specified

* Cancers in children (ages 0–14 years) are classified according to ICCC Recode ICD-O-3/WHO 2008.

Note: Actual incidence data were available to 2013 for all provinces and territories except Quebec, for which data were available to 2010 and projected thereafter. The complete definition of the specific cancers included here can be found in Table A2.

Trends over time by age

Trends in incidence rates over time vary by sex and age group (Figure 1.8).

- For all years presented, incidence rates are higher in females between the ages of 20 and 59, primarily due to breast cancer. Incidence rates are higher in males compared to females in all other age groups.
- Incidence rates in females have been stable or slowly increasing in every age category over time.
- Incidence rates in males have been stable or slowly increasing in all age groups under the age of 50. The recent trend in incidence rates for ages 50–69 appears to be decreasing slightly.
- Incidence rates in males older than 70 years of age have been decreasing over time, in part due to the declining rate of lung cancer, which is the result of decreased tobacco use in past decades.[55]

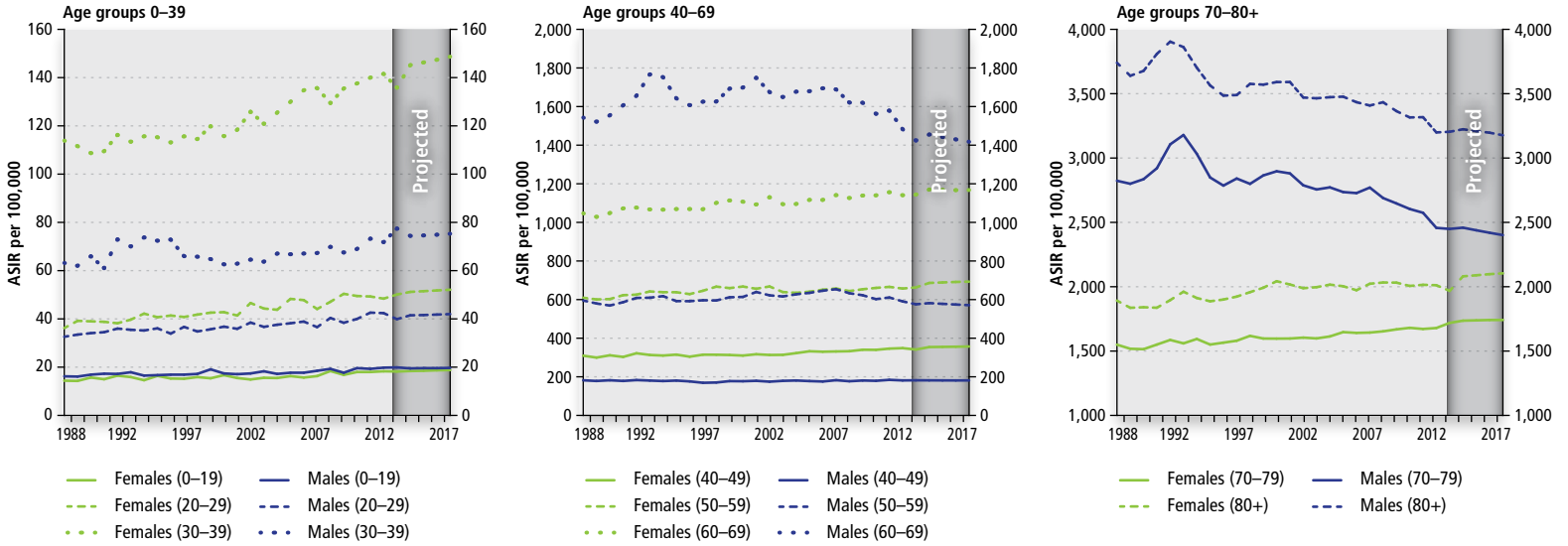
Incidence by geographic region

The estimated distribution of new cases for all cancers combined by geography for 2017 is depicted in Figure 1.9, with data in Tables 1.8 and 1.9. Sex-specific rates (Table 1.10) indicate that ASIRs for females are lowest in Alberta and British Columbia and highest in Newfoundland and Labrador and Quebec. Newfoundland and Labrador and Quebec also had the highest rates for males, with British Columbia and Saskatchewan reporting the lowest rates. These inter-provincial variations are likely more a function of differences in the prevalence of risk factors (like smoking and obesity) and possibly opportunistic testing patterns (like PSA or thyroid cancer testing) than differences in population genetic profiles.

Province or territory

Refers to the province or territory of a person's permanent residence at the time of cancer diagnosis. The most recent actual data used for all provinces and territories are to 2013 (except Quebec, for which data are to 2010) and projected thereafter.

FIGURE 1.8 Age-standardized incidence rates (ASIR) for all cancers, by age group, Canada, 1988–2017



Note: The range of rate scales differs widely between the age groups. Incidence rates exclude non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). Rates are age-standardized to the 2011 Canadian population. Rates are projected based on long-term historic data and may not always reflect recent changes in trends. Actual incidence data were available to 2013 for all provinces and territories except Quebec, for which data were available to 2010 and projected thereafter. For further details, see *Appendix II: Data sources and methods*.

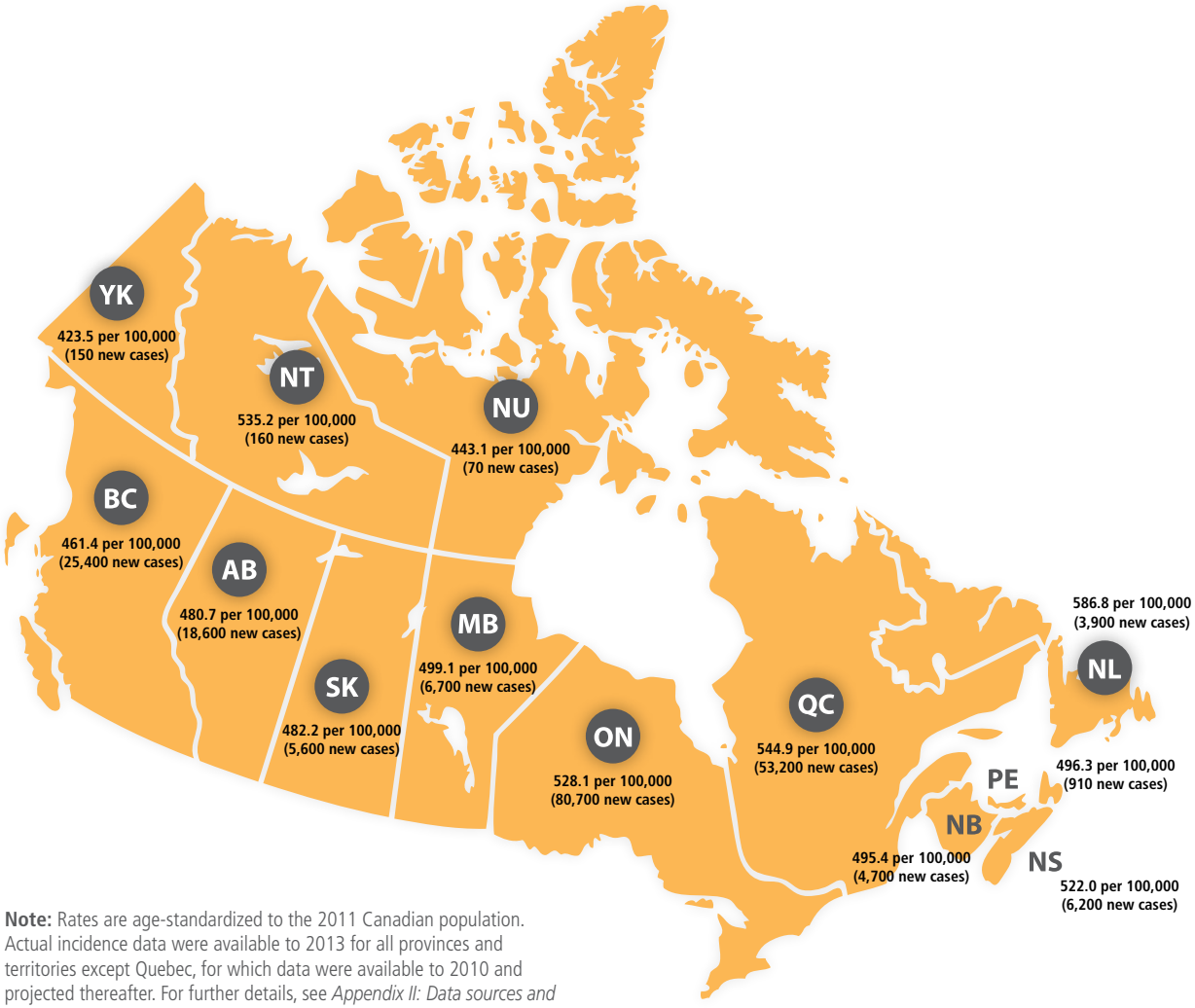
Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry and National Cancer Incidence Reporting System databases at Statistics Canada

View data

Estimated new cases (Table 1.9) and ASIR (Table 1.10) by sex and province show there are geographic differences by cancer type across Canada.

- Prostate cancer incidence rates vary considerably between provinces, possibly due to variations in prostate-specific antigen (PSA) testing across the country.
- Among males, the projected lung cancer incidence rates are highest in Newfoundland and Labrador and Quebec. Incidence rates for females are highest in Quebec and Nova Scotia. British Columbia and Alberta have the lowest lung cancer incidence rates in Canada for both males and females. This difference in incidence rates is likely linked in large part to the past prevalence of smoking in each province.[55]
- Colorectal cancer incidence rates for both males and females are highest in Newfoundland and Labrador. For females, the second highest rates are in Nova Scotia, while the second highest rates among males are in Saskatchewan. The lowest rates are reported for British Columbia and Alberta (along with Manitoba for females).
- Female breast cancer incidence rates are highest in Newfoundland and Labrador and lowest in New Brunswick.

FIGURE 1.9 Geographic distribution of projected new cancer cases and age-standardized incidence rates (ASIR) by province and territory, both sexes, Canada, 2017



Note: Rates are age-standardized to the 2011 Canadian population. Actual incidence data were available to 2013 for all provinces and territories except Quebec, for which data were available to 2010 and projected thereafter. For further details, see *Appendix II: Data sources and methods*.

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry and National Cancer Incidence Reporting System databases at Statistics Canada

Trends over time by geographic region

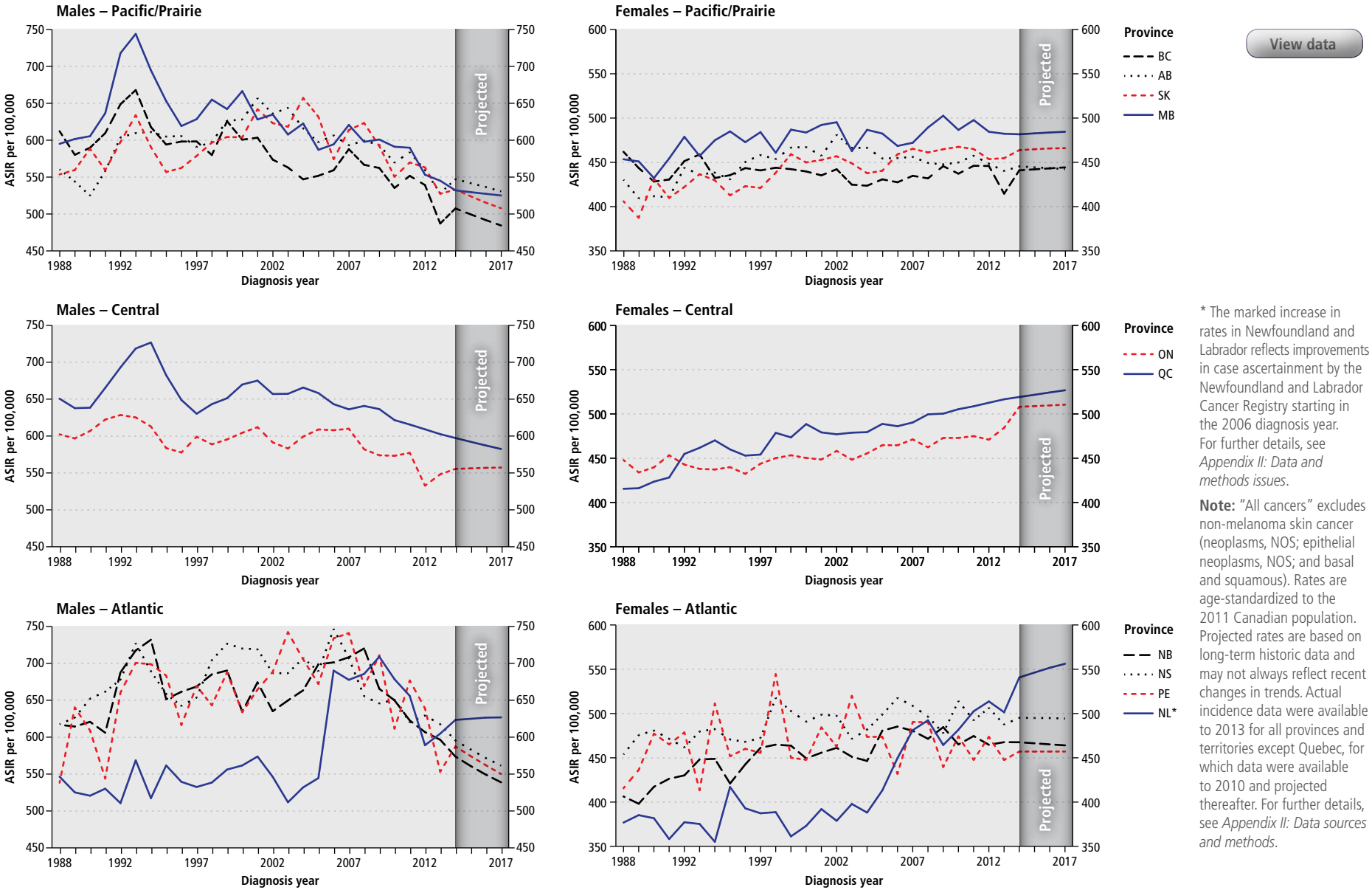
Provincial and territorial trends identified in Figure 1.10 demonstrate patterns similar to overall trends in Canada. More specifically, there is generally an upward trend in ASIR in females and a downward trend in ASIR in males in the Pacific/Prairie, Central and Atlantic regions. The year-by-year variability in ASIR within each province or territory can be explained by small numbers of new cases in some regions that lead to relatively large changes in incidence rates. Differences in provincial trends for all cancers combined can reflect differences in the underlying trends for certain cancers, such as for lung cancer (influenced by smoking rates), colorectal cancer (influenced by screening) and thyroid cancer in females (influenced by over-diagnosis).

Geographic variations in incidence rates may also be due to differences in the prevalence of modifiable risk factors, such as unhealthy diet, smoking, obesity and physical inactivity. Differences in incidence rates may also be related to different provincial or territorial programs or procedures for the diagnosis and early detection of cancer, such as organized screening programs and the availability of diagnostic services.

Other factors may impact the interpretation of variations in projected rates between the provinces, including the following:

- Cancer frequency – When a cancer is rare or the population is small, the estimated number of new cases of a cancer type is subject to greater statistical variation.
- Cancer registration method – While the registration of new cancer cases is generally very good across the country, there are exceptions. Incomplete registration is linked to the number of data sources that registries can access, the availability and accuracy of death certificate information and specific diagnostic information in some provinces and territories.
- Method of projection – The method of projection for provincial data can vary across provinces and across cancer types (see Tables A4 and A5 in *Appendix II: Data sources and methods*).
- Ascertainment of *in situ* cases – The large variation seen in bladder cancer incidence rates between provinces is likely due to differences in reporting of *in situ* cases, especially in Ontario, where such cases were not included for the period being examined.

FIGURE 1.10 Age-standardized incidence rates (ASIR) for all cancers, by sex and geographic region, Canada, 1988–2017



* The marked increase in rates in Newfoundland and Labrador reflects improvements in case ascertainment by the Newfoundland and Labrador Cancer Registry starting in the 2006 diagnosis year. For further details, see *Appendix II: Data and methods issues*.

Note: "All cancers" excludes non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). Rates are age-standardized to the 2011 Canadian population. Projected rates are based on long-term historic data and may not always reflect recent changes in trends. Actual incidence data were available to 2013 for all provinces and territories except Quebec, for which data were available to 2010 and projected thereafter. For further details, see *Appendix II: Data sources and methods*.

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry and National Cancer Incidence Reporting System databases at Statistics Canada

What do these statistics mean?

The ASIR (or population risk) for all cancers combined in males has been decreasing, while the incidence rate in females has continued to slowly increase. This increase is in part driven by the rise in the incidence of melanoma, thyroid, uterine and liver cancers. Although overall incidence rates for both sexes combined have not changed dramatically during the past 30 years, the number of new cancer cases continues to increase with the aging and growing population.[8] With the rising number of new cancer cases, there will be a corresponding increase in the need for screening, diagnostic, treatment and support services, including palliative care. It will also be important to promptly develop strategies to address the cancers that are showing significant increases in incidence rates, such as liver, thyroid and melanoma.

An increased focus on primary prevention efforts, including vaccination and screening for precancerous lesions, should be employed to minimize the risk of developing cancers. In addition, a sustained focus on screening and early detection should be maintained to diagnose and treat these cancers at an earlier stage when treatments are more effective and more likely to be successful.

This chapter provides a picture of the cancer distribution in Canada by presenting incidence rates and counts by sex, age and geographic region. These data can support informed decision-making to ensure that healthcare services meet the needs of a specific population and opportunities to target prevention and cancer control initiatives are identified. For example, nearly half of all people diagnosed with cancer will be over the age of 70, and it must be recognized that evidence-based treatment guidelines may vary by age.

The data indicate that females are more likely than males to be diagnosed with cancer in the prime of their lives (between the ages of 20 and 59 years), which reflects patterns for specific cancers, such as breast and thyroid. Incidence rates are not decreasing in any age category in females, while incidence rates are decreasing in older males. The priorities of people with cancer and their needs for services can be expected to vary at different points in the age continuum.

Finally, cancer incidence rates across the country vary, with generally higher rates in the east and lower rates in the west. To better target prevention efforts, these data can be correlated with data on risk factors, such as tobacco and alcohol consumption, physical inactivity or obesity rates.

Other resources

Publications

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Databases

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- Statistics Canada. Table 103-0554. New cases and 2011 age-standardized rate for primary cancer, by cancer type and sex, Canada, provinces and territories, annual. CANSIM (database).
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TABLE 1.1 Lifetime probability (%) of developing cancer overall and at selected ages, Canada, 2010

	Lifetime probability of developing cancer		Probability (%) of developing cancer in the next 10 years at selected ages					
	%	One in:	30	40	50	60	70	80
Males								
All cancers*	**49.4**	**2.0**	**0.7**	**1.8**	**6.0**	**14.6**	**22.7**	**25.6**
Prostate	14.1	7	—	0.2	1.7	5.0	6.2	5.0
Lung and bronchus	8.7	11	—	0.1	0.7	2.2	4.0	3.9
Colorectal	7.4	13	0.1	0.2	0.8	1.9	3.1	3.4
Bladder	4.0	25	—	0.1	0.3	0.9	1.7	2.1
Non-Hodgkin lymphoma	2.3	43	0.1	0.1	0.3	0.6	0.9	0.9
Leukemia	2.0	51	—	0.1	0.2	0.4	0.7	0.9
Kidney and renal pelvis	1.8	54	—	0.1	0.3	0.5	0.6	0.5
Melanoma	1.8	56	0.1	0.1	0.2	0.4	0.6	0.7
Oral	1.5	68	—	0.1	0.3	0.4	0.5	0.4
Pancreas	1.3	74	—	—	0.1	0.3	0.6	0.6
Stomach	1.3	78	—	0.1	0.1	0.3	0.5	0.6
Esophagus	0.9	112	—	—	0.1	0.2	0.3	0.4
Multiple myeloma	0.9	117	—	—	0.1	0.2	0.4	0.4
Brain/CNS	0.8	123	—	0.1	0.1	0.2	0.2	0.2
Liver	0.8	127	—	—	0.1	0.2	0.3	0.3
Larynx	0.6	170	—	—	0.1	0.2	0.2	0.2
Thyroid	0.5	189	0.1	0.1	0.1	0.1	0.1	0.1
Testis	0.4	247	0.1	0.1	—	—	—	—
Hodgkin lymphoma	0.2	426	—	—	—	—	—	—
Breast	0.1	756	—	—	—	—	0.1	0.1
Females								
All cancers*	**45.4**	**2.2**	**1.4**	**3.3**	**6.5**	**11.1**	**16.0**	**17.8**
Breast	12.4	8	0.4	1.3	2.3	3.3	3.6	2.9
Lung and bronchus	7.1	14	—	0.2	0.7	1.8	2.9	2.3
Colorectal	6.4	16	0.1	0.2	0.6	1.2	2.2	2.8
Uterus (body, NOS)	2.8	35	0.1	0.2	0.6	0.9	0.8	0.5
Non-Hodgkin lymphoma	2.0	51	—	0.1	0.2	0.4	0.7	0.7
Thyroid	1.8	56	0.3	0.4	0.4	0.3	0.3	0.1
Ovary	1.4	69	—	0.1	0.2	0.3	0.4	0.4
Leukemia	1.4	70	—	0.1	0.1	0.2	0.4	0.6
Pancreas	1.4	72	—	—	0.1	0.2	0.5	0.6
Melanoma	1.4	74	0.1	0.2	0.2	0.3	0.3	0.3
Bladder	1.2	82	—	—	0.1	0.2	0.4	0.5
Kidney and renal pelvis	1.1	88	—	0.1	0.2	0.2	0.4	0.3
Stomach	0.8	133	—	—	0.1	0.1	0.2	0.4
Oral	0.7	136	—	—	0.1	0.2	0.2	0.2
Multiple myeloma	0.7	141	—	—	0.1	0.1	0.3	0.3
Brain/CNS	0.7	151	—	—	0.1	0.1	0.2	0.2
Cervix	0.7	152	0.1	0.1	0.1	0.1	0.1	0.1
Esophagus	0.3	349	—	—	—	0.1	0.1	0.1
Liver	0.3	359	—	—	—	0.1	0.1	0.1
Hodgkin lymphoma	0.2	497	—	—	—	—	—	—
Larynx	0.1	966	—	—	—	—	—	—

— Value less than 0.05

CNS=central nervous system; NOS=not otherwise specified

*"All cancers" includes *in situ* bladder cancer, except for Ontario, and excludes non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous).

Note: The probability of developing cancer is calculated based on age- and sex-specific cancer incidence and mortality rates for Canada in 2010. For further details, see *Appendix II: Data sources and methods*. The complete definition of the specific cancers included here can be found in Table A2.

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry and Canadian Vital Statistics Death databases at Statistics Canada

TABLE 1.2 Projected new cases and age-standardized incidence rates (ASIR) for cancers, by sex, Canada, 2017

	New cases (2017 estimates)			Cases per 100,000		
	Total*	Males	Females	Total	Males	Females
All cancers	**206,200**	**103,100**	**103,200**	**515.9**	**548.4**	**495.6**
Lung and bronchus	28,600	14,400	14,200	69.9	76.5	65.3
Colorectal	26,800	14,900	11,900	66.3	79.6	54.9
Breast	26,500	230	26,300	68.1	1.2	130.3
Prostate	21,300	21,300	—	—	110.4	—
Bladder†	8,900	6,700	2,200	21.8	36.3	9.8
Non-Hodgkin lymphoma	8,300	4,600	3,700	20.8	24.6	17.6
Uterus (body, NOS)	7,300	—	7,300	—	—	35.7
Melanoma	7,200	4,000	3,300	18.5	21.3	16.3
Thyroid	7,100	1,650	5,400	19.0	8.8	29.1
Kidney and renal pelvis	6,600	4,200	2,400	16.5	22.3	11.3
Leukemia	6,200	3,600	2,600	15.5	19.6	12.0
Pancreas	5,500	2,800	2,700	13.5	14.7	12.4
Oral	4,700	3,200	1,450	11.9	17.1	7.1
Stomach	3,500	2,200	1,300	8.6	11.8	5.9
Brain/CNS	3,000	1,700	1,300	7.8	9.2	6.6
Multiple myeloma	2,900	1,700	1,200	7.1	9.1	5.6
Ovary	2,800	—	2,800	—	—	13.7
Liver	2,500	1,900	580	6.1	9.9	2.7
Esophagus	2,300	1,800	530	5.7	9.5	2.4
Cervix	1,550	—	1,550	—	—	8.3
Larynx	1,150	970	180	2.8	5.1	0.8
Testis	1,100	1,100	—	—	6.1	—
Hodgkin lymphoma	990	570	430	2.7	3.1	2.3
All other cancers	19,500	9,600	9,900	48.5	52.4	45.6

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry and National Cancer Incidence Reporting System databases at Statistics Canada

— Not applicable; CNS=central nervous system; NOS=not otherwise specified

* Column totals may not sum to row totals due to rounding.

† Bladder cancer is underprojected because insufficient data were available to include Ontario's in situ bladder cancer cases (see *Appendix II: Data and methods issues*).

Note: "All cancers" excludes non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). Rates are age-standardized to the 2011 Canadian population. The complete definition of the specific cancers listed here can be found in Table A2.

TABLE 1.3 Age-standardized incidence rates (ASIR) for selected* cancers, males, Canada, 1988–2017†

Year	Cases per 100,000									
	All cancers	Prostate	Colorectal	Lung and bronchus	Bladder	Melanoma	Stomach	Liver	Thyroid	Larynx
1988	608.9	122.3	84.9	126.3	44.2	12.6	23.1	3.9	2.5	11.6
1989	598.5	123.3	83.2	123.6	40.7	11.5	22.5	4.1	2.4	10.9
1990	605.4	133.6	83.0	122.5	40.2	12.6	21.2	4.4	2.5	10.2
1991	622.6	150.0	83.0	120.1	40.8	11.3	21.0	4.6	2.8	11.1
1992	648.4	167.5	85.5	121.5	40.8	13.0	19.7	4.6	2.3	10.9
1993	662.2	186.4	82.1	122.5	40.6	13.0	19.4	5.0	3.0	10.0
1994	646.6	171.9	83.3	115.9	40.7	13.5	19.3	5.7	3.1	10.1
1995	615.2	149.4	81.3	113.3	39.9	13.8	18.0	5.5	3.0	9.8
1996	603.7	146.7	79.8	110.4	38.3	14.0	18.4	5.6	3.0	9.3
1997	608.2	154.1	79.7	106.9	39.7	14.4	17.6	6.1	3.1	8.8
1998	608.9	154.0	82.5	108.2	38.0	14.1	17.2	5.7	3.2	8.8
1999	623.6	159.5	83.8	107.3	40.5	16.4	17.0	6.1	3.7	8.8
2000	626.5	166.3	85.9	102.4	38.8	16.0	16.7	6.1	4.1	7.8
2001	634.8	177.4	84.7	102.5	37.6	16.4	16.1	7.0	4.0	8.2
2002	614.2	165.4	83.8	99.3	37.7	15.5	14.8	7.0	4.6	7.7
2003	608.9	161.1	81.0	96.4	38.4	16.4	15.9	6.7	4.3	7.1
2004	615.4	164.2	82.6	96.5	38.6	16.3	15.3	7.2	4.6	7.1
2005	614.4	163.5	82.5	95.0	37.4	16.2	15.1	7.8	5.5	7.0
2006	615.3	169.1	81.4	93.0	37.4	17.5	14.6	7.9	5.8	6.3
2007	618.3	168.0	81.7	92.6	36.7	17.8	14.4	8.5	6.0	6.4
2008	604.4	154.6	82.3	89.9	38.2	18.7	14.0	8.3	6.6	6.5
2009	597.2	151.3	80.2	88.4	37.6	19.2	13.6	8.7	6.6	6.2
2010	584.3	146.1	76.3	86.1	37.7	19.2	12.8	8.5	6.8	6.3
2011†	587.3	147.7	77.3	83.2	38.0	19.5	12.9	9.2	8.0	5.9
2012†	562.0	128.8	75.4	82.1	36.5	19.0	12.4	9.3	8.5	5.5
2013†	553.8	117.2	75.3	78.9	35.7	20.0	12.6	8.7	8.6	5.3
2014‡	559.1	117.7	80.1	79.8	36.6	21.1	12.2	9.4	8.3	5.4
2015‡	555.4	115.1	79.9	78.7	36.5	21.2	12.1	9.6	8.5	5.3
2016‡	551.9	112.7	79.7	77.5	36.4	21.3	11.9	9.8	8.6	5.2
2017‡	548.4	110.4	79.6	76.5	36.3	21.3	11.8	9.9	8.8	5.1

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry and National Cancer Incidence Reporting System databases at Statistics Canada

* Five most frequent cancers (both sexes combined) and cancers with a statistically significant change in incidence rate of at least 2% per year (see Table 1.5).

† Actual incidence data were available to 2013 for all provinces and territories except Quebec, for which data were available to 2010 and projected thereafter.

‡ Rates were projected based on long-term historic data and may not always reflect recent changes in trends. For further details, see *Appendix II: Data sources and methods*.

Note: "All cancers" excludes non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). Rates are age standardized to the 2011 Canadian population. The complete definition of the specific cancers included here can be found in Table A2.

TABLE 1.4 Age-standardized incidence rates (ASIR) for selected* cancers, females, Canada, 1988–2017†

Year	Cases per 100,000										
	All cancers	Breast	Lung and bronchus	Colorectal	Uterus (body,NOS)	Thyroid	Melanoma	Bladder	Cervix	Liver	Larynx
1988	435.9	126.2	45.7	60.8	26.6	5.7	10.6	12.0	11.2	1.4	2.0
1989	427.2	124.2	46.1	59.8	24.7	6.1	10.0	10.4	11.1	1.5	2.1
1990	431.2	124.0	47.9	60.0	25.1	6.3	9.9	10.5	11.5	1.3	1.9
1991	437.4	130.0	49.4	58.3	24.9	6.5	10.2	10.6	10.6	1.4	2.2
1992	446.6	132.7	52.8	58.7	25.0	7.4	10.0	10.1	10.8	1.8	1.8
1993	447.4	129.5	54.0	58.7	26.2	7.7	10.6	10.9	10.6	1.6	1.7
1994	446.8	129.2	52.8	57.6	25.8	8.2	10.7	10.5	10.3	1.8	1.9
1995	444.3	129.0	54.1	56.1	24.8	8.3	11.0	10.6	10.2	1.7	1.9
1996	442.3	129.1	55.8	54.7	24.8	8.4	11.3	9.9	10.2	1.8	1.8
1997	448.4	134.1	56.0	55.0	25.5	8.5	11.2	10.2	9.4	1.7	1.8
1998	458.7	135.6	57.9	58.1	26.0	8.8	11.3	11.0	9.3	2.1	1.6
1999	459.5	138.0	57.9	56.9	25.7	10.3	11.9	10.3	9.3	1.6	1.6
2000	461.2	133.7	59.8	58.3	26.1	11.1	12.2	9.8	9.1	2.0	1.4
2001	457.9	131.5	59.6	57.3	25.5	12.0	12.3	10.0	9.0	2.0	1.5
2002	464.0	134.0	60.4	56.7	26.4	14.2	11.9	9.9	8.7	1.9	1.4
2003	455.2	126.5	60.4	55.7	26.3	14.7	11.9	10.5	8.5	2.1	1.5
2004	458.3	127.0	61.3	56.3	25.9	16.1	12.4	10.3	8.3	1.9	1.3
2005	465.7	127.8	63.1	56.0	26.1	18.2	12.9	10.4	7.9	2.1	1.2
2006	465.7	127.8	63.5	54.4	26.9	18.4	13.1	10.2	8.1	2.4	1.1
2007	471.4	128.4	63.7	55.0	27.9	19.6	13.7	10.5	8.4	2.3	1.3
2008	468.9	126.0	64.6	54.9	27.7	21.1	14.2	9.8	8.1	2.5	1.1
2009	474.6	128.7	64.1	54.4	28.3	21.7	14.8	10.5	8.4	2.2	1.1
2010	475.8	130.2	63.1	53.9	30.2	22.7	14.4	9.8	8.2	2.4	1.0
2011†	479.4	130.8	63.3	53.1	30.6	25.8	15.0	10.2	7.9	2.5	1.1
2012†	477.3	127.2	64.4	53.0	31.3	27.1	14.6	10.2	7.6	2.7	0.9
2013†	477.5	126.9	63.6	51.7	30.6	27.1	15.9	9.5	7.5	2.3	0.8
2014‡	492.5	129.7	66.0	55.1	34.7	27.4	16.1	9.9	8.4	2.6	0.9
2015‡	493.6	129.9	65.8	55.0	35.0	28.0	16.2	9.9	8.4	2.6	0.9
2016‡	494.6	130.0	65.6	54.9	35.4	28.5	16.3	9.8	8.3	2.6	0.9
2017‡	495.6	130.3	65.3	54.9	35.7	29.1	16.3	9.8	8.3	2.7	0.8

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry and National Cancer Incidence Reporting System databases at Statistics Canada

* Five most frequent cancers (both sexes combined) and cancers with a statistically significant change in incidence rate of at least 2% per year (see Table 1.5).

† Actual incidence data were available to 2013 for all provinces and territories except Quebec, for which data were available to 2010 and projected thereafter.

‡ Rates were projected based on long-term historic data and may not always reflect recent changes in trends. For further details, see *Appendix II: Data sources and methods*.

Note: "All cancers" excludes non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). Rates are age standardized to the 2011 Canadian population. The complete definition of the specific cancers included here can be found in Table A2.

TABLE 1.5 Annual percent change (APC) in age-standardized incidence rates for selected cancers, by sex, Canada, most recent trends to 2013[†]

	Males			Females		
	APC[†]	(95% CL)	Reference year	APC[†]	(95% CL)	Reference year
All cancers	-1.7**	**(-2.4, -1.0)**	**2007**	0.4**	**(0.3, 0.4)**	**1992**
Lung and bronchus	-1.9**	(-2.0, -1.8)	1992	0.0	(-0.4, 0.4)	2006
Colorectal	-1.6*	(-2.5, -0.8)	2008	-0.8**	(-1.0, -0.6)	2000
Breast	0.6*	(0.1, 1.2)	1992	0.1	(-0.3, 0.5)	2004
Prostate	-5.3**	(-7.6, -2.9)	2007	—	—	—
Bladder	-0.5**	(-0.6, -0.3)	1992	-0.2*	(-0.5, -0.0)	1992
Non-Hodgkin lymphoma	0.5**	(0.3, 0.8)	1992	0.4*	(0.2, 0.6)	1992
Uterus (body, NOS)	—	—	—	2.3**	(1.7, 2.9)	2005
Melanoma	2.1**	(1.9, 2.3)	1992	2.0**	(1.8, 2.2)	1992
Thyroid	6.2**	(5.8, 6.7)	1992	5.9**	(5.2, 6.7)	2004
Kidney and renal pelvis	1.4**	(1.1, 1.6)	1998	1.1**	(0.8, 1.4)	1992
Leukemia	0.3*	(0.1, 0.5)	1992	0.4**	(0.2, 0.7)	1992
Pancreas	-0.3*	(-0.5, -0.1)	1992	0.0	(-0.2, 0.3)	1992
Oral	0.4	(-0.1, 0.9)	2002	0.3	(-0.1, 0.6)	1996
Stomach	-2.2**	(-2.4, -2.1)	1992	-1.3**	(-1.7, -0.8)	2001
Brain/CNS	-0.3**	(-0.5, -0.2)	1992	-0.3*	(-0.5, -0.1)	1992
Multiple myeloma	0.6**	(0.3, 0.9)	1992	0.2	(-0.0, 0.5)	1992
Ovary	—	—	—	-0.6**	(-0.8, -0.5)	1992
Liver	3.1**	(2.7, 3.5)	1992	2.1**	(1.6, 2.7)	1992
Esophagus	0.8**	(0.5, 1.0)	1992	-0.7**	(-1.0, -0.3)	1992
Cervix	—	—	—	-3.0**	(-4.4, -1.5)	2009
Larynx	-3.2**	(-3.4, -2.9)	1992	-3.4**	(-3.9, -3.0)	1992
Testis	1.6**	(1.3, 1.9)	1992	—	—	—
Hodgkin lymphoma	-0.2	(-0.5, 0.1)	1992	-0.1	(-0.4, 0.2)	1992
All other cancers	0.1	(-0.0, 0.3)	1992	0.7**	(0.6, 0.8)	1992

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data source: Canadian Cancer Registry database at Statistics Canada

CNS=central nervous system; CL=confidence limits; NOS=not otherwise specified

— not applicable

* APC significantly differs from 0, $p<0.05$

** APC significantly differs from 0, $p<0.001$

[†] The APC was calculated using the Joinpoint Regression Program using rates from 1992 to 2013. If one or more significant change in the trend of rates was detected, the APC reflects the trend from the more recent significant change (reference year) to 2013. Otherwise, the APC reflects the trend in rates over the entire period (1992–2013). Actual incidence data were available to 2013 for all provinces and territories except QC, for which data were available to 2010 and projected thereafter. For further details, see *Appendix II: Data sources and methods*.

Note: "All cancers" excludes non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). The complete definition of the specific cancers listed here can be found in Table A2. Rates are age-standardized to the 2011 Canadian population.

TABLE 1.6 Projected population and new cases for all cancers, by age group and sex, Canada, 2017

Age	Population (in thousands)			New cases		
	Total*	Males	Females	Total*	Males	Females
All ages	**36,585**	**18,146**	**18,439**	**206,200**	**103,100**	**103,200**
0–19	7,938	4,073	3,866	1,500	790	720
20–29	4,962	2,524	2,438	2,300	1,050	1,300
30–39	5,008	2,492	2,515	5,600	1,900	3,700
40–49	4,793	2,392	2,400	12,700	4,300	8,500
50–59	5,335	2,672	2,663	34,200	15,600	18,700
60–69	4,365	2,147	2,219	56,800	30,700	26,100
70–79	2,617	1,231	1,386	53,400	29,300	24,000
80+	1,567	614	953	39,600	19,500	20,100

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry and National Cancer Incidence Reporting System databases at Statistics Canada and Census and Demographics Branch at Statistics Canada

* Column totals may not sum to row totals due to rounding.

Note: "New cases" excludes non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous).

TABLE 1.7 Projected new cases for the most common cancers, by age group and sex, Canada, 2017

Age	Lung and bronchus			Colorectal			Prostate	Breast
	Total*	Males	Females	Total*	Males	Females	Males	Females
All ages	**28,600**	**14,400**	**14,200**	**26,800**	**14,900**	**11,900**	**21,300**	**26,300**
0–19	5	5	5	15	5	10	—	5
20–29	25	10	10	95	50	45	—	150
30–39	100	35	60	350	190	160	5	1,050
40–49	610	270	340	1,150	590	550	360	3,300
50–59	3,600	1,650	1,950	3,800	2,200	1,600	3,600	6,100
60–69	8,500	4,300	4,200	7,000	4,300	2,700	8,200	7,200
70–79	9,600	5,000	4,600	7,800	4,500	3,300	6,200	5,300
80+	6,300	3,200	3,100	6,700	3,100	3,600	3,000	3,200

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry and National Cancer Incidence Reporting System databases at Statistics Canada

— Fewer than 3 cases.

* Column totals may not sum to row totals due to rounding.

Note: The complete definition of the specific cancers listed here can be found in Table A2.

TABLE 1.8 Projected population and new cases for all cancers, by sex and geographic region, Canada, 2017

	Population (in thousands)			New cases		
	Total*	Males	Females	Total*	Males	Females
CANADA	**36,585**	**18,146**	**18,439**	**206,200**	**103,100**	**103,200**
British Columbia (BC)	4,806	2,385	2,420	25,400	12,900	12,600
Alberta (AB)	4,355	2,214	2,141	18,600	9,700	8,800
Saskatchewan (SK)	1,144	577	567	5,600	2,800	2,800
Manitoba (MB)	1,320	657	663	6,700	3,300	3,400
Ontario (ON)†	14,059	6,903	7,156	80,700	39,800	40,900
Quebec (QC)†	8,403	4,180	4,223	53,200	26,300	26,900
New Brunswick (NB)	761	376	385	4,700	2,400	2,300
Nova Scotia (NS)	947	464	483	6,200	3,100	3,100
Prince Edward Island (PE)	151	74	77	910	470	440
Newfoundland and Labrador (NL)	519	255	264	3,900	2,000	1,850
Yukon (YT)	38	19	19	150	80	70
Northwest Territories (NT)	44	23	22	160	85	75
Nunavut (NU)	37	19	18	70	35	35

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry and National Cancer Incidence Reporting System databases and Census and Demographics Branch at Statistics Canada

* Column totals may not sum to row totals due to rounding.

† The number of cases for some cancers used to calculate the overall 2017 estimates for this province was underestimated. For further details, see *Appendix II: Data sources and methods*.

Note: New cases excludes non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous)

TABLE 1.9 Projected new cases for selected cancers, by sex and province, Canada, 2017

	Canada*	BC	AB	SK	MB	ON†	QC‡	NB	NS	PE	NL
Males											
All cancers	**103,100**	**12,900**	**9,700**	**2,800**	**3,300**	**39,800**	**26,300**	**2,400**	**3,100**	**470**	**2,000**
Prostate	21,300	2,800	2,400	590	700	8,500	4,800	370	620	95	450
Colorectal	14,900	1,850	1,250	500	510	5,700	3,800	380	470	70	360
Lung and bronchus	14,400	1,500	1,100	370	430	5,300	4,400	420	470	75	320
Bladder	6,700	970	650	220	230	1,850	2,200	210	240	30	140
Non-Hodgkin lymphoma	4,600	580	460	100	150	1,850	1,050	110	150	20	90
Kidney and renal pelvis	4,200	490	410	130	140	1,550	1,100	110	150	20	85
Melanoma	4,000	590	360	80	110	1,900	560	90	160	25	55
Leukemia	3,600	460	420	130	110	1,500	770	110	90	10	40
Oral	3,200	420	310	80	130	1,350	700	70	100	20	50
Pancreas	2,800	380	240	80	80	1,050	700	75	75	15	40
Stomach	2,200	250	180	70	85	850	570	60	60	10	65
Liver	1,900	300	180	30	45	760	480	20	40	5	20
Esophagus	1,800	240	190	45	50	760	380	40	65	10	25
Brain/CNS	1,700	210	160	50	50	650	460	35	45	10	30
Multiple myeloma	1,700	210	170	45	55	700	400	40	45	10	25
Thyroid	1,650	140	160	25	35	710	450	35	35	5	30
Testis	1,100	160	140	35	40	420	250	20	25	5	10
Larynx	970	120	85	25	35	330	290	30	35	5	20
Hodgkin lymphoma	570	60	60	20	20	210	160	10	15	—	10
Breast	230	30	15	5	5	95	60	5	10	—	5
Females											
All cancers	**103,200**	**12,600**	**8,800**	**2,800**	**3,400**	**40,900**	**26,900**	**2,300**	**3,100**	**440**	**1,850**
Breast	26,300	3,500	2,600	750	860	10,100	6,500	580	730	120	510
Lung and bronchus	14,200	1,550	1,100	420	480	5,300	4,300	290	480	60	220
Colorectal	11,900	1,500	970	380	360	4,700	3,000	270	400	60	270
Uterus (body, NOS)	7,300	970	650	180	280	3,200	1,450	150	180	20	150
Thyroid	5,400	360	390	90	110	2,500	1,650	100	120	10	100
Non-Hodgkin lymphoma	3,700	520	290	110	130	1,550	830	95	110	15	80
Melanoma	3,300	510	310	75	100	1,500	470	90	130	25	45
Ovary	2,800	350	210	75	90	1,200	710	55	75	10	40
Pancreas	2,700	330	260	75	95	1,100	690	70	75	10	35
Leukemia	2,600	330	240	80	85	1,100	550	75	60	10	20
Kidney and renal pelvis	2,400	210	200	80	95	900	610	80	110	10	60
Bladder	2,200	290	200	70	75	560	790	60	90	10	35
Cervix	1,550	180	170	50	50	710	280	25	45	5	30
Oral	1,450	180	120	35	60	600	370	30	40	5	15
Brain/CNS	1,300	150	110	35	40	510	380	30	30	5	20
Stomach	1,300	140	95	30	40	540	330	30	30	5	35
Multiple myeloma	1,200	150	110	35	40	510	270	30	35	5	20
Liver	580	85	50	10	15	210	180	10	10	—	10
Esophagus	530	80	45	10	15	220	120	10	20	5	5
Hodgkin lymphoma	430	50	40	15	15	180	100	10	10	—	5
Larynx	180	20	15	5	5	55	55	5	10	—	5

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry database and National Cancer Incidence Reporting System databases at Statistics Canada

— Fewer than 3 cases.

CNS=central nervous system; NOS=not otherwise specified

* Column totals may not sum to row totals due to rounding. Canada totals include provincial and territorial estimates. Territories are not included separately due to small numbers.

† Bladder cancer is underestimated because insufficient data were available to include Ontario's *in situ* bladder cancer cases; this should be considered when making comparisons across provinces (see *Appendix II: Data and methods issues*).

‡ The number of cases for some cancers used to calculate the overall 2017 projections for this province were underestimated, particularly those where pathology reports represent the main source of diagnostic information.

Note: "All cancers" excludes non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). The complete definition of the specific cancers included here can be found in Table A2.

TABLE 1.10 Projected age-standardized incidence rates (ASIR) for selected cancers, by sex and province, Canada, 2017

	Cases per 100,000										
	Canada*	BC	AB	SK	MB	ON†	QC‡	NB	NS	PE	NL
Males											
All cancers	**548.4**	**484.4**	**530.7**	**507.8**	**525.1**	**557.3**	**582.4**	**539.3**	**562.1**	**550.7**	**627.4**
Prostate	110.4	102.5	124.1	104.5	109.1	115.7	104.4	81.3	106.3	104.7	132.9
Colorectal	79.6	70.3	70.6	89.9	80.8	80.3	82.5	84.0	84.3	83.0	112.2
Lung and bronchus	76.5	56.0	62.2	67.6	68.4	74.1	96.2	90.7	83.5	88.3	98.0
Bladder	36.3	36.4	37.7	40.9	37.6	26.2	48.2	46.8	43.5	37.5	47.1
Non-Hodgkin lymphoma	24.6	22.3	25.1	18.2	24.8	26.0	23.5	24.2	28.1	21.9	30.4
Kidney and renal pelvis	22.3	18.7	21.9	23.9	22.4	21.8	24.0	24.6	27.4	22.7	27.4
Melanoma	21.3	22.8	19.6	14.5	17.7	27.3	12.5	20.8	29.2	27.8	17.0
Leukemia	19.6	17.7	22.9	22.9	17.9	21.1	17.3	24.3	16.7	12.9	13.5
Oral	17.1	15.9	15.8	14.9	20.2	18.9	15.2	15.4	18.4	21.3	16.8
Pancreas	14.7	14.3	13.8	14.9	13.4	15.0	15.4	16.3	13.4	15.9	11.9
Stomach	11.8	9.4	10.1	12.3	13.5	12.0	12.5	13.0	10.5	13.1	20.7
Liver	9.9	11.3	9.4	5.7	7.1	10.4	10.4	4.5	7.4	7.6	6.2
Esophagus	9.5	8.9	10.2	7.9	8.1	10.5	8.1	9.3	12.1	11.7	7.2
Brain/CNS	9.2	8.5	8.0	8.5	8.1	9.2	10.4	8.4	9.1	9.5	9.2
Multiple myeloma	9.1	7.9	9.3	8.0	8.8	9.8	8.8	8.5	8.0	10.8	8.1
Thyroid	8.8	5.4	7.9	4.8	5.8	10.2	10.1	8.4	6.5	5.0	10.0
Testis	6.1	6.7	5.8	6.1	5.9	6.2	6.0	5.1	5.7	4.8	3.8
Larynx	5.1	4.4	4.7	4.5	5.1	4.5	6.2	6.1	5.9	5.7	6.2
Hodgkin lymphoma	3.1	2.5	2.8	3.3	3.0	3.1	3.7	2.6	3.2	—	3.3
Breast	1.2	1.1	0.8	1.3	1.1	1.3	1.3	1.6	1.8	—	1.2
Females											
All cancers	**495.6**	**444.3**	**442.4**	**466.0**	**484.5**	**510.4**	**526.7**	**463.4**	**493.7**	**456.4**	**555.5**
Breast	130.3	129.1	129.0	129.7	126.9	129.5	133.6	120.9	123.1	132.4	152.0
Lung and bronchus	65.3	51.9	54.6	66.0	67.1	63.3	80.4	54.9	72.8	58.6	61.6
Colorectal	54.9	50.0	48.8	60.6	49.4	56.0	55.6	51.9	62.0	60.3	76.5
Uterus (body, NOS)	35.7	35.0	32.7	30.9	41.5	41.0	29.5	29.9	29.8	22.8	45.0
Thyroid	29.1	14.2	18.6	16.5	16.9	34.7	37.8	24.6	22.4	11.5	34.9
Non-Hodgkin lymphoma	17.6	17.9	14.6	17.6	18.6	18.9	16.0	19.2	17.6	18.2	22.8
Melanoma	16.3	18.9	15.3	12.9	14.8	19.4	10.0	19.1	23.4	26.0	14.7
Ovary	13.7	12.4	10.5	13.2	13.1	15.1	14.0	11.5	11.7	11.4	13.2
Pancreas	12.4	11.0	12.9	11.6	12.5	13.1	12.5	12.8	11.1	10.2	9.3
Leukemia	12.0	11.6	12.0	12.9	11.5	13.4	10.4	15.6	9.9	10.2	6.9
Kidney and renal pelvis	11.3	7.3	9.8	13.5	13.8	11.2	11.8	16.7	17.3	8.0	17.0
Bladder	9.8	9.6	9.9	11.0	10.2	6.4	14.6	11.1	13.6	12.1	10.5
Cervix	8.3	7.1	8.2	8.7	8.2	9.8	6.5	6.8	8.3	8.3	10.7
Oral	7.1	6.4	6.0	6.0	8.8	7.5	7.4	6.6	6.4	6.2	5.1
Brain/CNS	6.6	5.8	5.3	6.2	6.2	6.6	7.8	6.0	5.5	4.6	6.1
Stomach	5.9	4.9	4.9	5.2	5.6	6.5	5.9	5.7	4.8	3.6	10.0
Multiple myeloma	5.6	5.2	5.4	5.8	5.3	6.1	5.0	5.7	5.3	6.4	5.0
Liver	2.7	2.9	2.6	1.7	2.4	2.5	3.2	1.6	1.4	—	3.1
Esophagus	2.4	2.7	2.2	2.0	1.9	2.6	2.2	2.0	3.0	2.9	2.2
Hodgkin lymphoma	2.3	2.1	2.0	2.5	2.1	2.4	2.5	2.0	2.1	—	2.1
Larynx	0.8	0.8	0.7	1.0	0.8	0.7	1.1	0.7	1.4	—	1.1

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry and National Cancer Incidence Reporting System databases at Statistics Canada

— ASIR based on fewer than 3 cases.

CNS=central nervous system; NOS=not otherwise specified

* Canada totals include provincial and territorial estimates. Territories are not included separately due to small numbers.

† Bladder cancer is underestimated because insufficient data were available to include Ontario's *in situ* bladder cancer cases; this should be considered when making comparisons across provinces (see *Appendix II: Data and methods issues*).

‡ The number of cases for some cancers used to calculate the 2017 projections were underestimated, particularly those where pathology reports represent the main source of diagnostic information.

Note: "All cancers" excludes non-melanoma skin cancer (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). Rates are age-standardized to the 2011 Canadian population. The complete definition of the specific cancers included here can be found in Table A2.

CHAPTER 2
Mortality: How many people die of cancer in Canada by sex, age and geography?

Highlights

- An estimated 80,800 Canadians are expected to die of cancer in 2017.
- It is expected that 1 in 4 Canadians will die of cancer. Males have a 28% lifetime probability (approximately a 1 in 3.5 chance) of dying from cancer. Females have a 24% lifetime probability (approximately a 1 in 4.2 chance) of dying from cancer.
- More people are expected to die of lung cancer (21,100 in 2017) than from colorectal, breast and pancreatic cancers combined (19,200 in 2017).
- In 2017, it is estimated that 53% of all cancer deaths will occur among males and 47% among females. Almost all cancer deaths in Canada (96%) will occur in people aged 50 years and older. Most of these cancer deaths (63%) will occur in people 70 years of age and older.
- The mortality rates for all cancers combined have been decreasing in Canada for both sexes, but the rate of decrease varies by sex and age group.
- Specific cancers with notable mortality rate declines include lung, colorectal, prostate and oral in males, breast and ovarian in females, and non-Hodgkin lymphoma, Hodgkin lymphoma, stomach and laryngeal in both males and females. Mortality rates have increased for select cancers, including uterine cancer in females and liver cancer in both males and females.
- Decreases in the mortality rates are a result of improvements in detection and treatment. Nevertheless, the number of cancer deaths continues to increase due to the growing and aging population. Increases in the number of cancer deaths have implications for the healthcare and support services needed, particularly for people with cancer who are at the end of life.

Introduction

Each hour of 2017, an estimated nine people will die of cancer in Canada. Monitoring cancer deaths over time allows us to measure progress in reducing cancer deaths and contemplate what the impacts changing patterns will have on the Canadian healthcare system. As with new diagnoses of cancer, cancer deaths are not distributed equally by sex, age group or province or territory. Examining cancer deaths by these demographics provides a better sense of who is dying from cancer and can help direct cancer control services to address the needs of specific populations.

Probability of dying from cancer

The probability of dying from a specific type of cancer depends on many factors, including the probability of developing that cancer and the treatments available. The estimated probabilities are for the general Canadian population and should not be interpreted as an individual's risk.

While approximately 1 in 2 Canadians is expected to develop cancer in their lifetime, approximately 1 in 4 Canadians is expected to die of the disease (data not shown). The chance of dying from cancer differs slightly by sex (see Figure 2.1), where males have a higher probability than females.

FIGURE 2.1 Lifetime probability of dying from cancer, Canada, 2012

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

As shown in Table 2.1, males have a 28% (or 1 in 3.5) chance of dying from cancer during their lifetime. Lung and bronchus (lung cancer) is the most likely cause of cancer death, with a 1 in 14 chance, followed by prostate (1 in 29) and colorectal cancer (1 in 29).

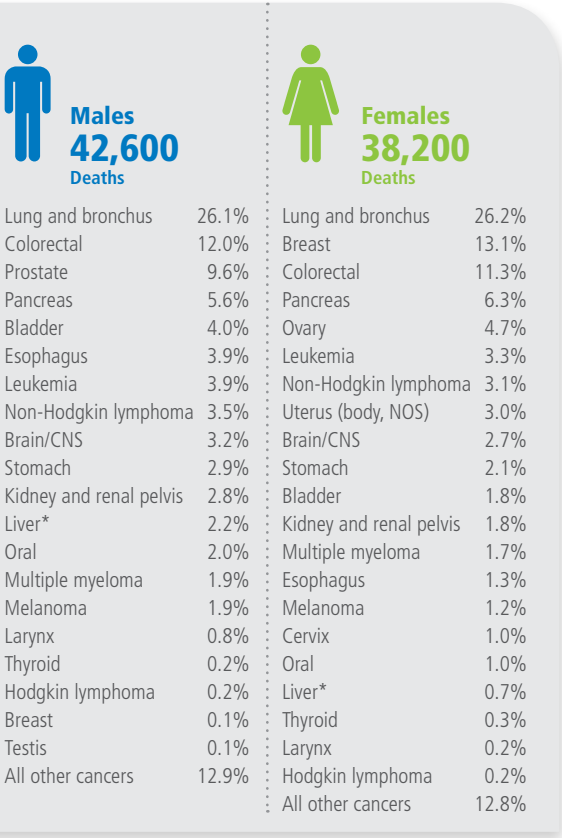
Table 2.1 also shows that females in Canada have a 24% (or 1 in 4.2) chance of dying from cancer during their lifetime. Lung cancer is the most likely cause of cancer death in females, with a 1 in 17 chance. Females have a 1 in 31 chance of dying from breast cancer and a 1 in 34 chance of dying from colorectal cancer.

New cancer deaths in 2017

An estimated 80,800 Canadians are expected to die of cancer in 2017 (Table 2.2).

- Lung, colorectal, breast and prostate cancers account for almost 50% of all cancer deaths for both sexes combined.
- Lung cancer is the leading cause of cancer death for both sexes, accounting for approximately 26% of all cancer deaths in both males and females (Figure 2.2).
- Colorectal cancer is the second most common cause of cancer death for males and the third most common cause of cancer death for females. It accounts for 12% of all cancer deaths.
- Breast cancer is the second most common cause of cancer death in females, accounting for 13% of all female cancer deaths.
- Prostate cancer is the third most common cause of cancer death in males, accounting for 10% of all male cancer deaths.
- Although it is much less commonly diagnosed than many other cancers, because of its low survival rate, pancreatic cancer is the fourth leading cause of cancer death in Canada, accounting for 6% of all cancer deaths.

FIGURE 2.2 Percent distribution of projected cancer deaths, by sex, Canada, 2017



CNS=central nervous system; NOS=not otherwise specified

* Liver cancer deaths are underestimated; see *Appendix II: Data sources and methods*.

Note: The complete definition of the specific cancers included here can be found in Table A2.

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

Probability
The chance of dying from cancer measured over a defined period of time. The probability of dying from cancer is expressed as a percentage or as a chance (e.g., 20% or 1 in 5 people over a lifetime).

Deaths
The number of cancer deaths in a given period of time, often a year.

Age-standardized mortality rate (ASMR)
The number of cancer deaths per 100,000 people, standardized to the age structure of the 2011 Canadian population. In this publication, ASMR is also referred to as "mortality rate."

Annual percent change (APC)
The estimated change in the age-standardized mortality rate per year over a defined period of time in which there is no significant change in trend (i.e. no changepoint). It is reported as a percentage.

Average annual percent change (AAPC)
The weighted average of the APCs in effect during a period of time, where the weights equal the proportion of time accounted for by each APC in the interval. AAPC summarizes the change in age-standardized rates over a specified interval. It is reported as a percentage.

Changepoint
The year corresponding to a significant change in trend of age-standardized rates. The changepoint year is determined by an algorithm and may not correspond identically to patterns in the data in Tables 2.3 and 2.4.

Statistical significance
Refers to a result that is unlikely due to chance given a predetermined threshold (e.g., fewer than 1 out of 20 times, which is expressed as $p<0.05$).

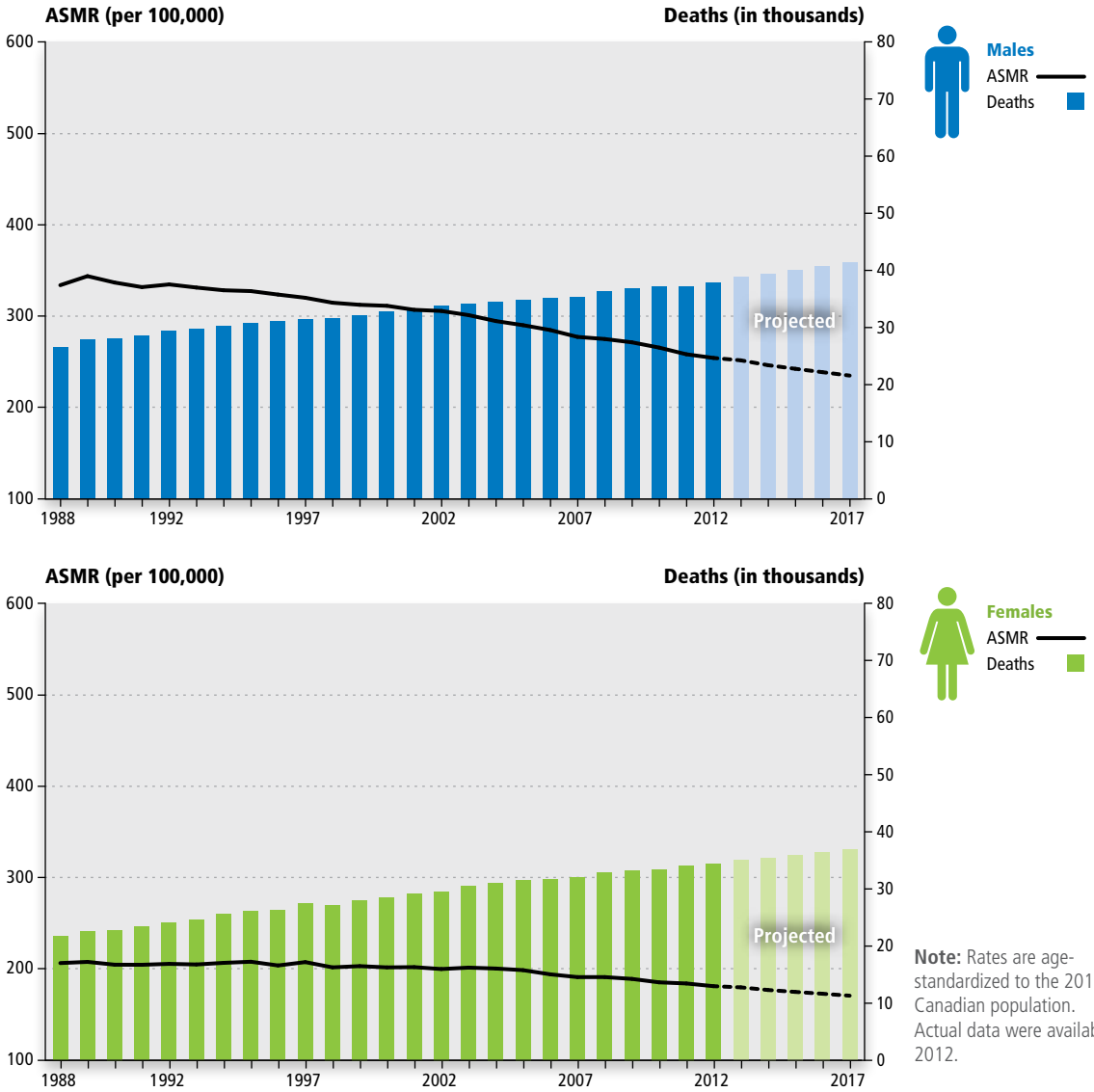
Confidence limits (CL)
Upper and lower values of a range that provide an indication of the precision of an estimate. Confidence limits are usually 95%, which means that, assuming no other sources of bias, one can be 95% confident the limits contain the true value for the estimate of interest.

Mortality over time

While the number of deaths from cancer continues to increase due the growing and aging population, the age-standardized mortality rate (ASMR) for all cancers combined has been decreasing in both sexes over the past several decades (Figure 2.3). During this period, the ASMR for some cancers varied between the sexes (Table 2.3 and Table 2.4).

- For males, the mortality rate for all cancers has been decreasing since1988. This is largely due to decreases in mortality rates for lung cancer and, to a lesser extent, decreases in deaths from colorectal and prostate cancers.
- For females, the cancer mortality rate for all cancers has also declined, but to a lesser degree than for males. The ASMR for females has dropped since the mid-1990s as a result of declines in the mortality rates for breast and colorectal cancers.
- Cancer mortality rates continue to increase for liver cancer in both sexes.

FIGURE 2.3 Deaths and age-standardized mortality rates (ASMR) for all cancers, Canada, 1988–2017



Note: Rates are age-standardized to the 2011 Canadian population. Actual data were available to 2012.

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics database at Statistics Canada

View data

Trends for selected cancers

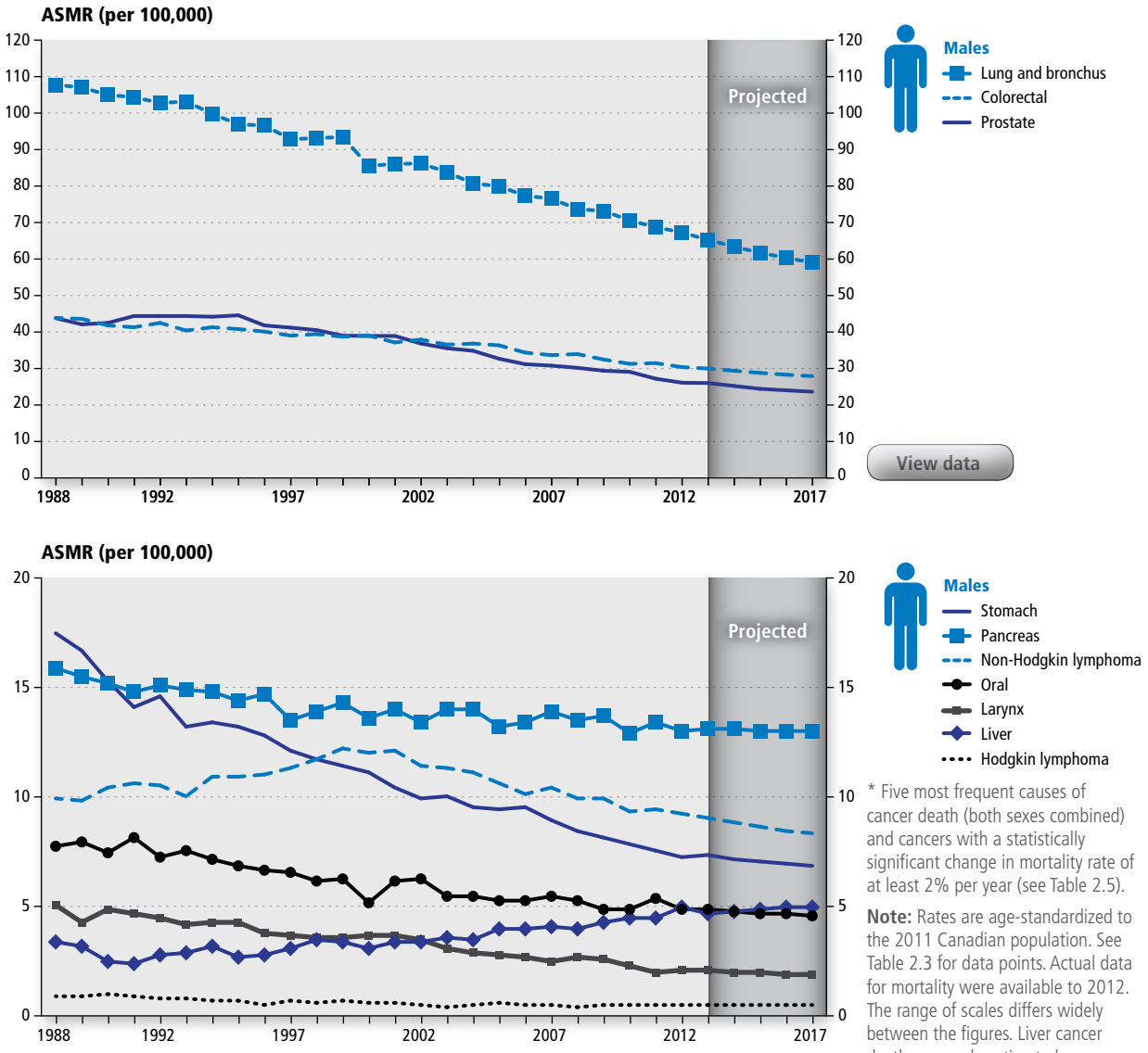
Table 2.5 shows the annual percent change (APC) in ASMR for selected cancers. Figures 2.4 and 2.5 show trends in males and females for the five cancers responsible for the greatest number of cancer deaths in Canada (lung, colorectal, breast, pancreas and prostate). The figures also display trends for cancers with statistically significant APC of at least 2% per year in either sex (liver and oral in males; ovary and uterus in females; and Hodgkin and non-Hodgkin lymphoma, stomach and larynx in both sexes). Further discussion of mortality rates for cancers displayed in Figure 2.4 and 2.5 is provided in the following text.

Colorectal cancer

Table 2.5 shows that the mortality rate for colorectal cancer has declined significantly for both males (2.3% per year between 2004 and 2012) and females (1.7% per year between 1992 and 2012). Part of this decline may be driven by the decrease in incidence reported in *Chapter 1*. Additionally, it is likely that a significant portion of the decline in mortality is due to improvements in diagnosis and treatment.[1] A recent study from one Canadian province identified higher colorectal cancer mortality rates in areas of lower income, despite universal access to healthcare.[2] This association may be explained by differences in colorectal cancer risk factors and other health behaviours (e.g., colorectal screening) that exist across socio-economic groups. Physical activity is associated with a reduction in colorectal cancer mortality.[2, 3]

For more discussion about the burden of colorectal cancer, see *Canadian Cancer Statistics 2011*.[4]

FIGURE 2.4 Age-standardized mortality rates (ASMR) for selected* cancers, males, Canada, 1988–2017



Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

* Five most frequent causes of cancer death (both sexes combined) and cancers with a statistically significant change in mortality rate of at least 2% per year (see Table 2.5).

Note: Rates are age-standardized to the 2011 Canadian population. See Table 2.3 for data points. Actual data for mortality were available to 2012. The range of scales differs widely between the figures. Liver cancer deaths are underestimated; see *Appendix II: Data sources and methods*. The complete definition of the specific cancers included here can be found in Table A2.

Female breast cancer

The female breast cancer mortality rate has been declining since the mid-1980s. After its peak in 1986, the ASMR has fallen 44%, from 41.7 deaths per 100,000 in 1988 to a projected rate of 23.2 deaths per 100,000 in 2017. The downward trend is estimated at 2.3% per year between 1992 and 2012, which is likely due to a combination of increased mammography screening[5] and the use of more effective therapies following breast cancer surgery.[6, 7]

Physical activity both before and after diagnosis is associated with reduced breast cancer mortality,[8, 9] while a high body mass index (BMI) is associated with a poor prognosis in women of all ages.[10] The breast cancer mortality rate in Canada is the lowest it has been since 1950. Similar declines have been observed in the United States, United Kingdom and Australia.[11]

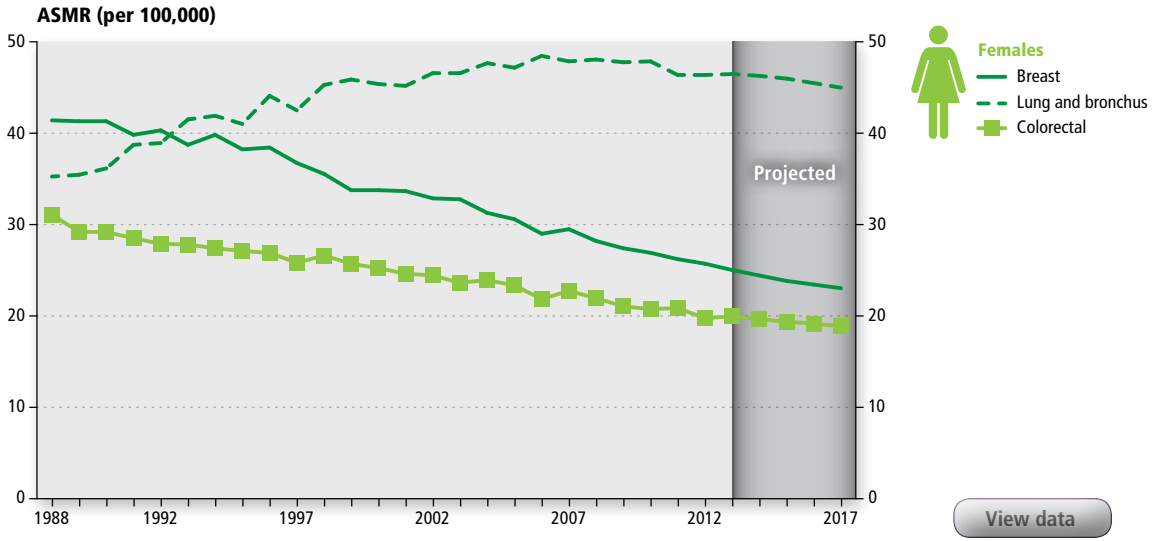
Hodgkin lymphoma

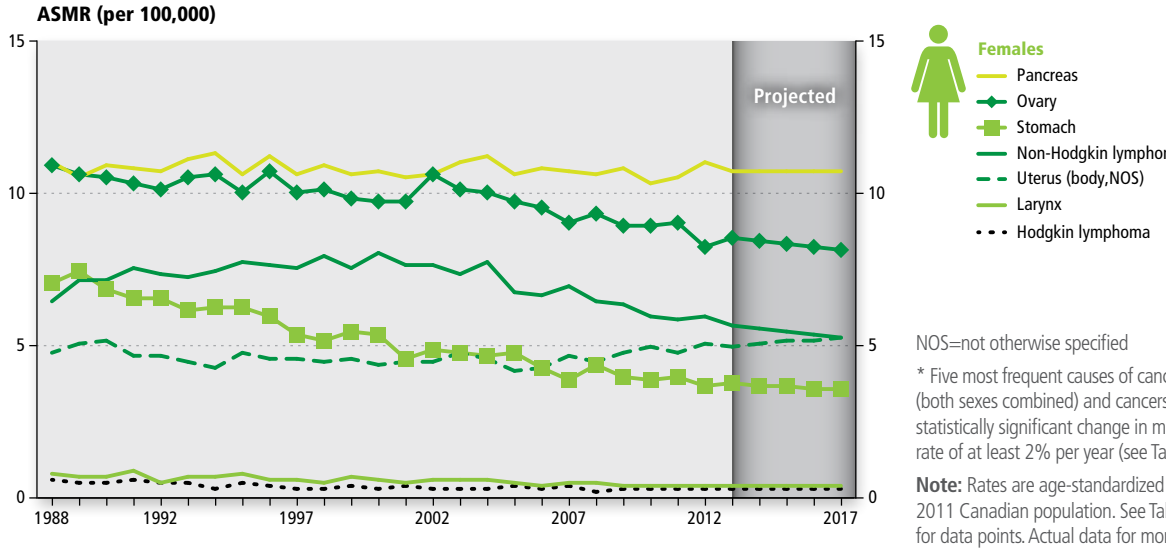
Hodgkin lymphoma mortality has been declining in both males and females by 2.6% per year since 1992. Despite stable incidence rates, treatment improvements for Hodgkin lymphoma have improved survival for this cancer, leading to reductions in mortality rates.[12]

Laryngeal cancer

Deaths due to laryngeal cancer have declined by 4.7% per year in males between 2001 and 2012 and 2.7% per year in females between 1992 and 2012. The trend in mortality rates has followed the reduction in the laryngeal cancer incidence. Sustained reductions in tobacco use have had a major impact on the mortality rates of tobacco-related cancers, including those of the larynx.

FIGURE 2.5 Age-standardized mortality rates (ASMR) for selected* cancers, females, Canada, 1988–2017





Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

NOS=not otherwise specified

* Five most frequent causes of cancer death (both sexes combined) and cancers with a statistically significant change in mortality rate of at least 2% per year (see Table 2.5).

Note: Rates are age-standardized to the 2011 Canadian population. See Table 2.4 for data points. Actual data for mortality were available to 2012. The range of scales differs widely between the figures. The complete definition of the specific cancers included here can be found in Table A2.

Liver cancer

Between 1992 and 2012, the mortality rate of liver cancer has increased significantly for both males (2.8% per year) and females (1.7% per year). The upward trend in mortality rates has followed the increase in liver cancer incidence rates (Table 1.5). Causes of this increase are not well known, though risk factors for liver cancer include chronic hepatitis B and C infections, exposure to aflatoxin and cirrhosis from heavy alcohol consumption.

For more discussion about the burden of liver cancer, see *Canadian Cancer Statistics 2013*.[13]

Lung and bronchus (lung)

In males, the mortality rate of lung cancer began to level off in the late 1980s and has been declining ever since. Since 1992, the rate has been decreasing by 2.1% per year. The mortality rate for females was increasing until recently. The rate decreased 0.8% per year between 2006 and 2012, but the change is not yet statistically significant. Despite the converging trends, males are projected to continue to have a higher lung cancer mortality rate (59 per 100,000) than females (45 per 100,000) in 2017. Sustained reductions in tobacco use have had a major impact on lung cancer mortality rates in North America. However, tobacco control efforts are still needed to further reduce the burden of lung cancer[14] as approximately 15% of the Canadian population continues to smoke on a daily basis.[15]

While smoking remains the most important risk factor for lung cancer, asthma may be a risk factor for lung cancer mortality among non-smokers.[16] Areas with higher residential measurement of radon also appear to have higher lung cancer mortality rates.[17]

Non-Hodgkin lymphoma

Between 2000 and 2012, mortality rates for non-Hodgkin lymphoma have declined by 2.3% and 2.5% per year for males and females, respectively. Declines in mortality may reflect recent improvements in treatment, such as immunotherapy (e.g., rituximab). In addition, the introduction of highly active antiretroviral therapy (HAART) in the late 1990s[18] for the human immunodeficiency virus (HIV) has resulted in a decline of the aggressive forms of non-Hodgkin lymphoma attributable to HIV infection.

Oral cancer

Mortality rates for oral cancers (which includes the oral cavity and pharynx) declined by 1.3% per year for females and 2.0% per year for males between 1992 and 2012. The ASMR in males has fallen over 40%, from 7.8 deaths per 100,000 in 1988 to a projected 4.6 deaths per 100,000 in 2017. These rates likely reflect past patterns of smoking prevalence.[19]

Ovarian cancer

Mortality rates for ovarian cancer have declined 2% per year between 2004 and 2012. The ASMR has fallen more than 25% over the past 30 years, from 11 deaths per 100,000 in 1988 to a projected 8.2 deaths per 100,000 in 2017. Declines have also been observed elsewhere in North America and in Europe. This declining mortality rate may be attributed to use of oral contraceptives (which can protect against ovarian cancer), declining use of hormone replacement therapy (HRT) and improvements in the treatment and management of this disease. [20]

Pancreatic cancer

Although it is much less commonly diagnosed than many other cancers, pancreatic cancer is the fourth leading cause of cancer death in both sexes. Between 1992 and 2012, there was a small but statistically significant decrease (0.6% per year) in mortality rates for men, while rates have remained unchanged in females. The mortality rates for pancreatic cancer are almost as high as the incidence rates for this cancer due to the low survival.[21] In other countries, trends in pancreatic cancer mortality rates varied widely in the past decade. For example, the United Kingdom experienced decreases in pancreatic cancer mortality rates,[22] while the United States showed increases in these rates.[23]

For more discussion about the burden of pancreatic cancer, see this year's special topic (*Chapter 6: Pancreatic cancer*).

Prostate cancer

The mortality rate for prostate cancer rose slowly between 1988 and the late 1990s, but it has been declining by an average of 3.3% per year since 2001. The decline likely reflects improved treatment following the introduction of hormonal therapy for early and advanced-stage disease[24, 25] and advances in radiation therapy.[26] The role that screening with the prostate-specific antigen (PSA) test played in the reduced mortality rate remains unclear. In 2009, two large randomized trials in the United States and Europe on the use of PSA testing in males over the age of 55 reported conflicting results. [27, 28] The ongoing follow-up of the men in these studies may help clarify whether PSA testing has a role in reducing deaths from prostate cancer. Diabetes and increasing BMI may increase the risk of death among men diagnosed with prostate cancer. [29-31]

Stomach cancer

Between 1992 and 2012, mortality rates for stomach cancer declined for both males (3.3% per year) and females (2.8% per year). Mortality rates in males are less than half of what they were in 1988 and almost half in females. The trend in mortality rates has followed the reduction in stomach cancer incidence rates during the same time period and may reflect a reduction in tobacco use, among other factors.[32]

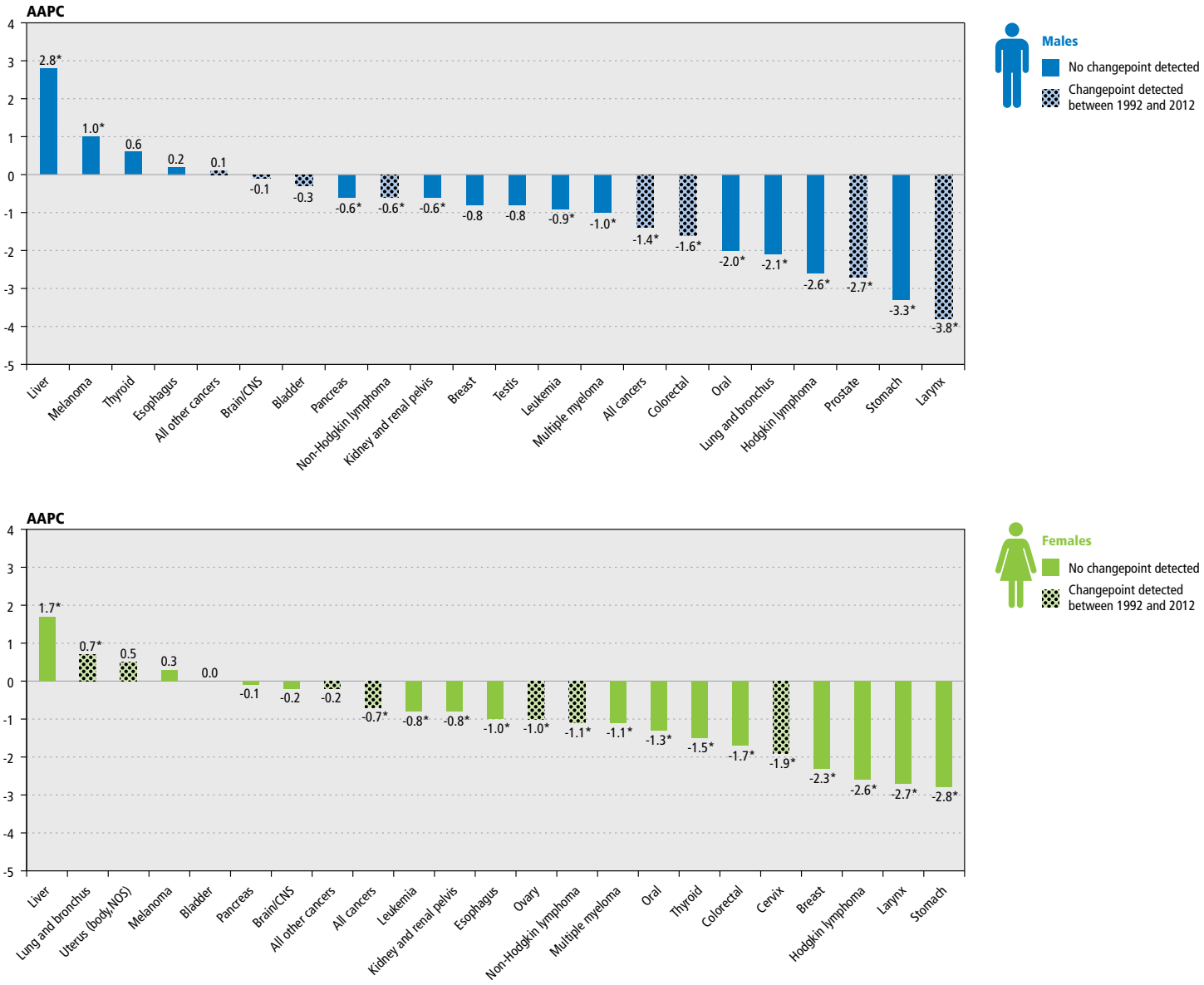
Uterine cancer [body, not otherwise specified (NOS)]

The mortality rate for uterine cancer increased by 2.2% per year between 2006 and 2012. The increase in the mortality rate has followed the increase in the incidence rate of uterine cancer over the same period of time.

Average annual percent change

Figure 2.6 shows the average annual percent change (AAPC) in cancers between 1992 and 2012 for males and females. By summarizing any changes in trends, the AAPC enables the comparison of changes in mortality across cancers for the same defined time period. The greatest increase was observed for liver cancer in males (2.8%) and females (1.7%). The second greatest increase in males was for melanoma (1.0% per year). In females, the second greatest increase was for lung cancer (0.7%), though mortality rates have not changed significantly since 2006 (Table 2.5). The greatest decreases were observed for laryngeal cancer in males (3.8%) and stomach cancer in females (2.8%).

FIGURE 2.6 Average annual percent change (AAPC)† in age-standardized mortality rates (ASMR), by sex, Canada, 1992–2012



CNS=central nervous system; NOS=not otherwise specified

* AAPC differs significantly from 0, $p<0.05$

† AAPC summarizes the trend over a specified interval, in this case 1992–2012. It is computed as a weighted average of the APCs in effect during the interval with the weights equal to the proportion of time accounted for by each APC in the interval.

Note: Actual mortality data were available to 2012. The complete definition of the specific cancers included here can be found in Table A2. Rates are age-standardized to the 2011 Canadian population. For further details, see *Appendix II: Data sources and methods*.

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

Mortality by sex

In 2017, it is estimated that 53% of all cancer deaths will occur among males and 47% among females. However, the distribution of cancer deaths between the sexes differs according to age. Among people aged 30–49 years, females represent a larger proportion of total cancer deaths than males (Table 2.6). This is mainly due to the higher number of deaths from female breast cancer.

Trends over time by sex

Figure 2.3 shows the trend in cancer mortality rates by sex from 1988 to 2017.

- The overall cancer mortality rate for males has been declining since 1988. This decline is primarily due to the decline in lung cancer mortality rates (Table 2.3), which is closely linked to decreases in smoking prevalence.
- Among females, the overall cancer mortality rate has been slowly decreasing since 1988 with a stronger declining trend emerging after 2003 (Table 2.4). The decrease in mortality rate in females is attributed to declines in breast cancer mortality (most likely due to improvements in early detection and screening, as well as advances in treatment and corresponding improvements in treatment outcomes).[33, 34]

Mortality by age

In 2017, almost 96% of cancer deaths in Canada will occur in people 50 years of age and older, with the median age of death estimated to be between 70 and 79 years for both sexes (Table 2.6).

In 2017 it is estimated that:

- 63% of all cancer deaths will occur in people aged 70 years or older.
- 23% of all cancer deaths will occur in people aged 60–69 years.
- 11% of all cancer deaths will occur in people aged 50–59 years.
- 4% of all cancer deaths will occur in people aged 20–49 years.
- 0.2% of all cancer deaths will occur in children and youth aged 0–19 years.

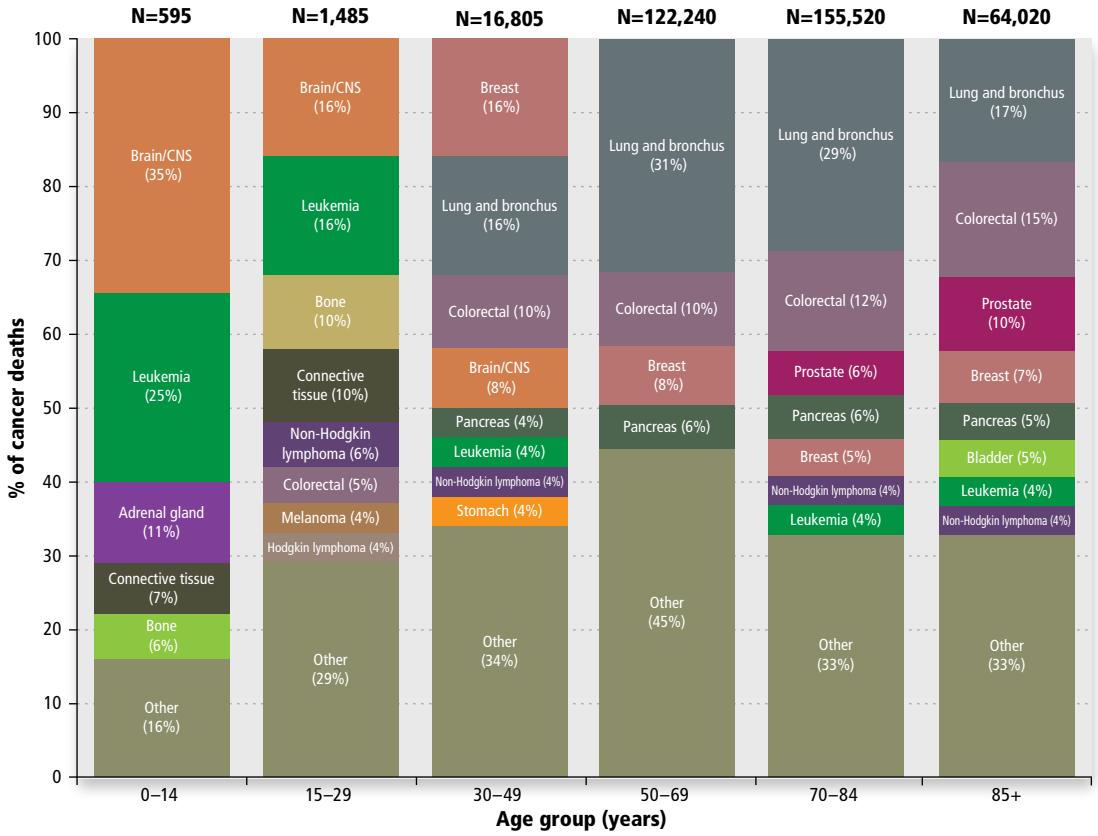
Older adults account for the largest proportion of deaths from the most common cancers (Table 2.7):

- While the majority of new breast cancer cases (68% of all female cancer cases) occur in females younger than 70 years (Table 1.7), breast cancer deaths are proportionately lower (47% of the total breast cancer deaths) in that age group compared with women aged 70 years and older. Breast cancer, however, causes a higher proportion of female cancer deaths in the younger age groups (21% of all cancer deaths in women aged 30–59 years) compared with older age groups (12% of cancer deaths for women aged 60 years and older). The reasons for higher mortality observed for younger women are complex but have been linked to aggressive tumour biology[35, 36] and delayed diagnosis.[37]
- Similarly, prostate cancer will be diagnosed most frequently in males aged 60–69 years (Table 1.7), but most prostate cancer deaths will occur in males aged 80 years and older. These mortality patterns likely reflect the often slow progression of the disease.
- Unlike many other cancers where the number of deaths increases with age, deaths for lung cancer peak in both males and females aged 70–79 years. This peak occurs because the largest proportion of new cases is diagnosed in the same age group (Table 1.7) and survival is poor (Table 3.1), with deaths typically occurring within a short period after diagnosis.

Cancer deaths among children, adolescents and young adults

- Cancer deaths among children (aged 0–14 years) accounted for less than 0.2% of all cancer deaths in Canada (Figure 2.7). Males are more likely to die of cancer than females in that age group.[38]
- Cancer deaths among adolescents and young adults (aged 15–29 years) accounted for about 0.4% of all cancer deaths in Canada. An average of approximately 300 people in Canada between the ages of 15 and 29 die of cancer each year. Adolescent and young adult males are more likely to die of cancer than females in that age group (Table 2.6).
- The leading causes of cancer deaths among children, adolescents and young adults were cancers of the brain and central nervous system (CNS) and leukemia. These two types of cancer accounted for 60% of all childhood cancer deaths (ages 0–14) and 32% of all adolescent and young adult cancer deaths (ages 15–29) (Figure 2.7).

FIGURE 2.7 Distribution of cancer deaths for selected cancers, by age group, Canada, 2008–2012



Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

N is the total number of deaths over five years (2008–2012) for each age group; CNS=central nervous system; NOS=not otherwise specified.

Note: The complete definition of the specific cancers included here can be found in Table A2. Adrenal gland cancers (C74) in the 0–14 year age group most likely represent neuroblastomas.

Trends over time by age

Cancer mortality rates have been decreasing since 1988 for all age groups in males and for females aged 0–69 years (Figure 2.8). For females aged 70–79 years and older than 80 years, the mortality rates have been decreasing since the mid-2000s.

- The ASMR for males aged 60–69, for example, has dropped by 42% from 798 per 100,000 in 1988 to 465 per 100,000 in 2017.
- By comparison, the mortality rate for females of the same age group (60–69) dropped by 25% over the same time period (from 492 to 370 per 100,000).

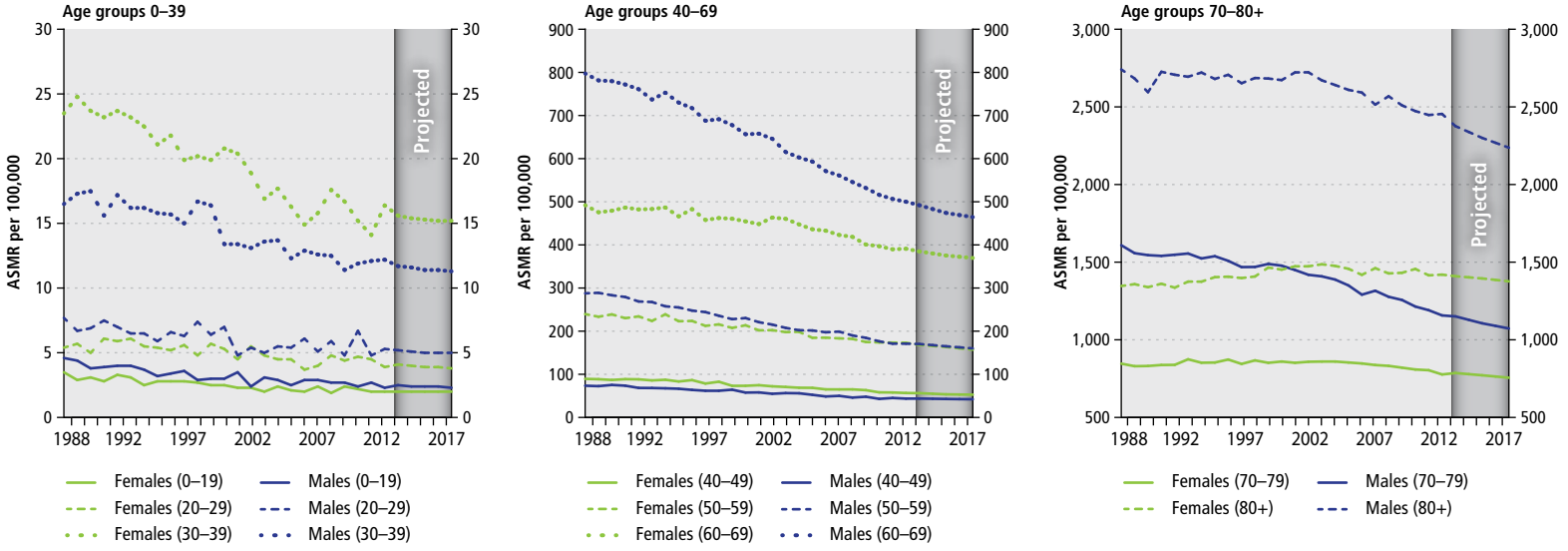
Mortality by geographic region

The projected number of cancer deaths for all cancers and both sexes combined by province and territory are shown in Table 2.8, with ASMRs shown in Figure 2.9. Similar to the pattern for incidence rates, the mortality rate for all cancers combined generally was lowest in the west and highest in the east. These patterns most likely reflect differences in incidence due to regional variations in modifiable risk factors, as discussed in *Chapter 1*. These patterns may also be due to differences in access to and outcomes of cancer control activities, such as screening, diagnosis, treatment and follow-up.

Projected deaths (Table 2.9) and ASMR (Table 2.10) for selected cancer types by sex and province show that there are several geographic differences by cancer type:

- Lung cancer mortality rates for both males and females are generally highest in Quebec and the Atlantic provinces. The mortality rates for this cancer are lowest in British Columbia and Alberta for males and British Columbia, Alberta, Ontario and Newfoundland and Labrador for females. This pattern closely mirrors variations in past tobacco smoking prevalence in these provinces.

FIGURE 2.8 Age-standardized mortality rates (ASMR) for all cancers, by age group, Canada, 1988–2017



Note: The range of rate scales differs widely between the age groups. Rates are age-standardized to the 2011 Canadian population. Actual mortality data were available up to 2012.

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

View data

- Colorectal cancer mortality rates are highest in Newfoundland and Labrador for males and in Newfoundland and Labrador and Prince Edward Island for females. Newfoundland and Labrador also has the highest incidence rate of colorectal cancer for males and females (Table 1.10)
- Prostate cancer mortality rates are highest in Prince Edward Island, Saskatchewan and Manitoba. Mortality rates for prostate cancer are lowest in Quebec and British Columbia.

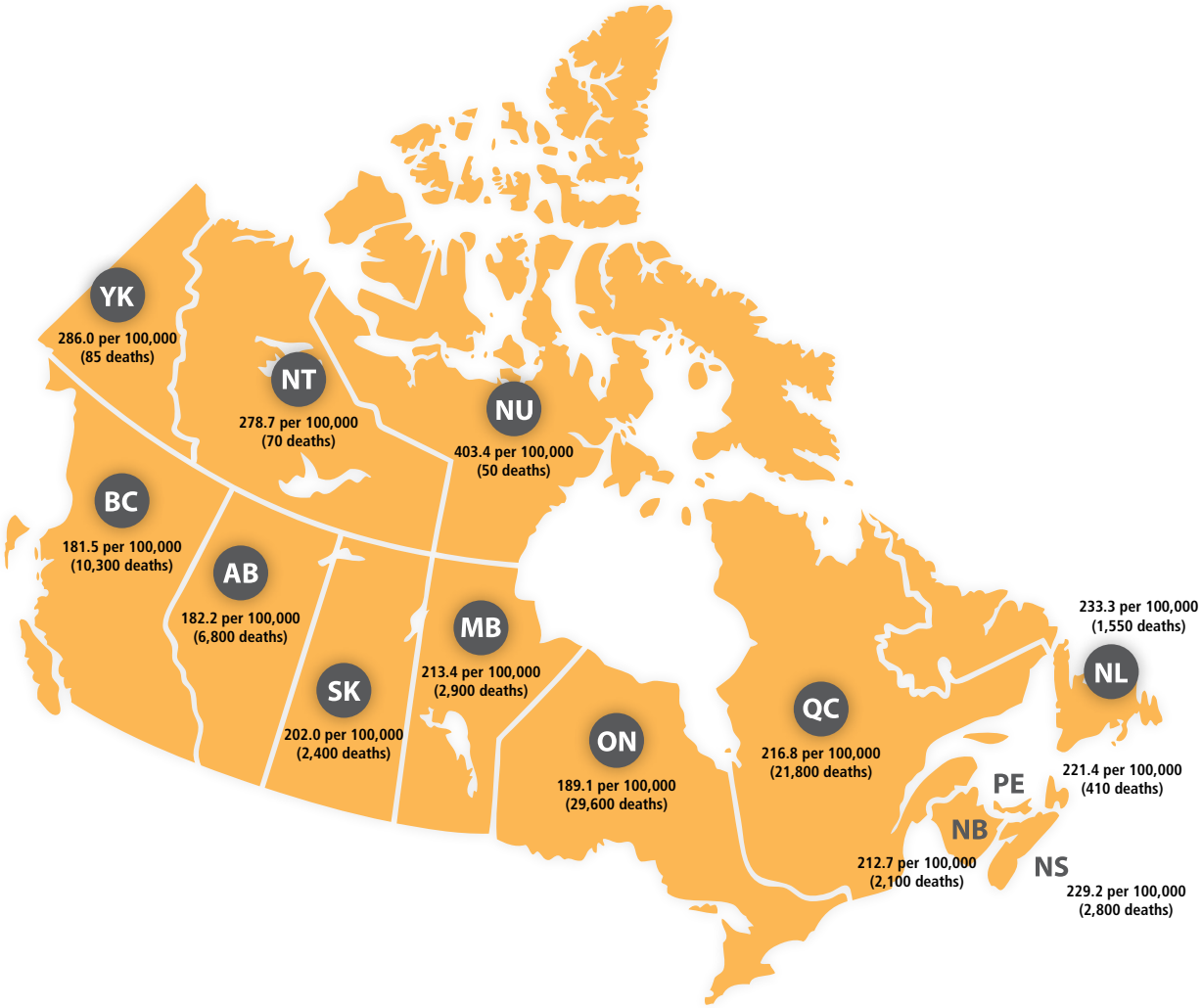
Province or territory

Refers to the province or territory of a person's permanent residence at the time of their death. The most recent actual data available for all provinces and territories are to 2012.

Trends over time by geographic region

Interprovincial differences in mortality rates could reflect variations in the prevalence of risk factors, the availability and use of screening and early detection services, and access to treatment. Figure 2.10 presents trends for ASMR for all cancers by geographic region. Generally, for males there is a consistent pattern of declining mortality rates over time in all regions. For females, the decline in all cancer mortality rates is not as notable as in males, but the pattern is fairly consistent across geographic regions with most provinces showing a modest decline in mortality rates since the early 2000s.

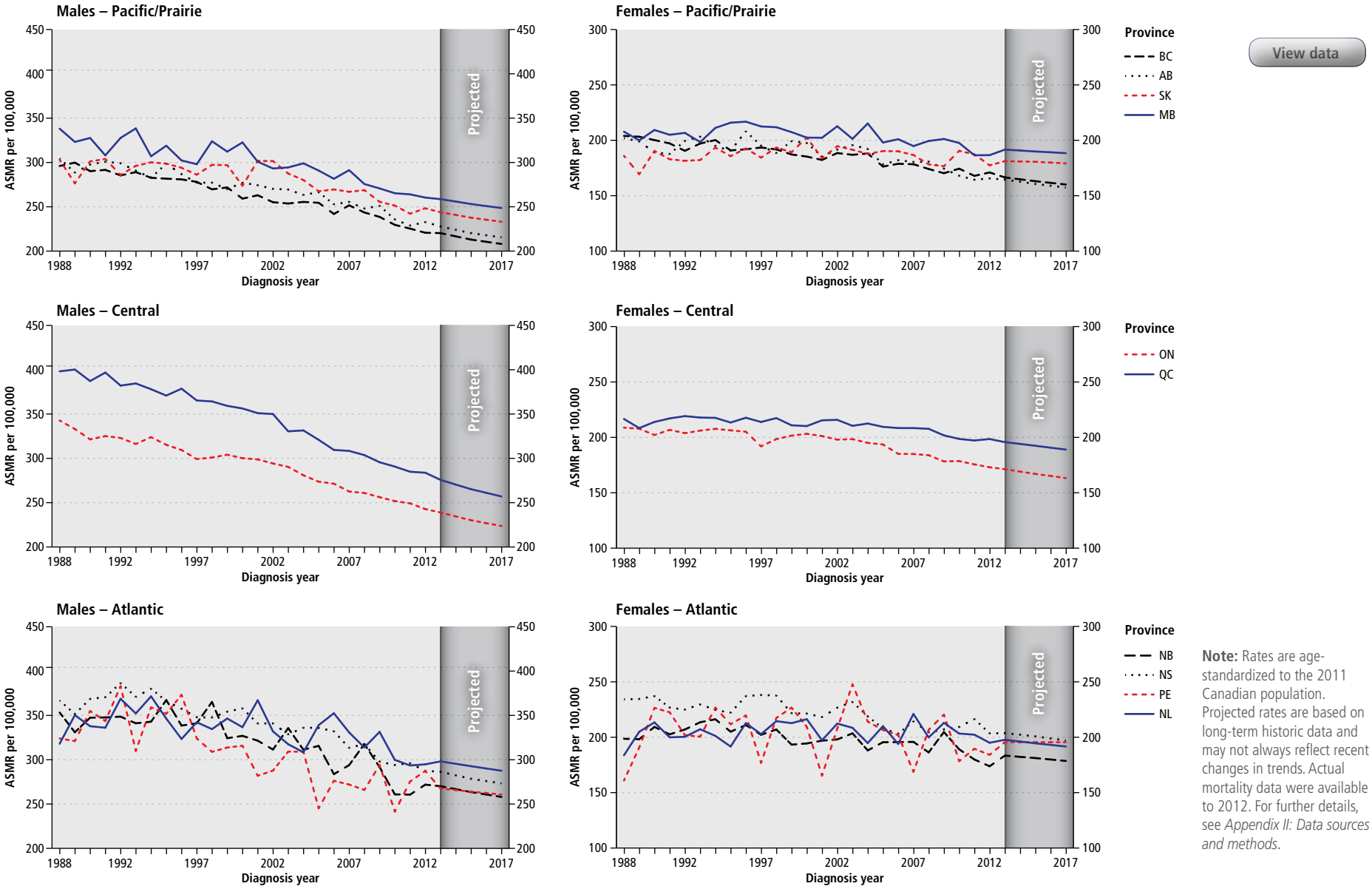
FIGURE 2.9 Geographic distribution of projected cancer deaths and age-standardized mortality rates (ASMR), by province and territory, both sexes, Canada, 2017



Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

Note: Rates are age-standardized to the 2011 Canadian population.

FIGURE 2.10 Age-standardized mortality rates (ASMR) for all cancers, by sex and geographic region, Canada, 1988–2017



Note: Rates are age-standardized to the 2011 Canadian population. Projected rates are based on long-term historic data and may not always reflect recent changes in trends. Actual mortality data were available to 2012. For further details, see *Appendix II: Data sources and methods*.

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

What do these statistics mean?

While the overall incidence rate of cancer in Canada has been relatively stable for females and decreasing for males in recent years, encouragingly, the overall cancer mortality rate has been decreasing for decades for both males and females. A decrease in the mortality rate for a specific cancer can result from a decrease in the incidence rate or improvement in the survival rate. For example, the relatively large reduction in mortality rates for lung, oral and laryngeal cancers reflect the reduction in smoking rates, which led to a large reduction in cancer incidence rates, particularly among males. The decrease in the mortality rate for a specific cancer can also reflect the availability of better treatment options, leading to improved or longer survival, particularly for cancers that are detected at an early stage of disease when they are most likely to respond to treatment. Although the ASMRs continue to decline, the actual number of cancer deaths continues to increase due to the growth and aging of the population. This has implications for health policy and resource planning.

Differences in cancer mortality rates by age, sex and geographic region can be driven by a broad range of factors. These factors include those that are inherent to the epidemiology of different cancers, particularly the age at which the cancer tends to occur in populations of males versus females. For example, prostate cancer deaths typically occur in older males, whereas breast cancer deaths occur in relatively younger females. Modifiable and non-modifiable risk factors, such as smoking, alcohol consumption, obesity and environmental carcinogen exposure, have a major impact on both incidence and mortality rates. Lung cancer mortality in men has dropped substantially over the last 20 years because of the sharp decline in smoking rates.[39] Lung cancer mortality in females is no longer increasing, mirroring lung cancer incidence trends among women. Other factors such as access to cancer control interventions (e.g., screening) or variations in clinical practice patterns by province, age or sex can further contribute to variations in mortality rates. There are likely also age and sex differences in the response to cancer treatment,[40] which may further contribute to variations in the mortality rate.

Other resources

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Databases

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TABLE 2.1 Lifetime probability of dying from cancer overall and at selected ages, Canada, 2012

	Lifetime probability of dying from cancer overall		Probability (%) of dying from cancer in the next 10 years at selected ages					
	%	One in:	30	40	50	60	70	80
Males								
All cancers	**28.3**	**3.5**	**0.1**	**0.5**	**1.8**	**5.0**	**10.4**	**15.9**
Lung and bronchus	7.4	14	—	0.1	0.5	1.6	3.2	3.8
Prostate	3.5	29	—	—	0.1	0.3	0.9	2.6
Colorectal	3.5	29	—	0.1	0.2	0.6	1.3	2.0
Pancreas	1.4	72	—	—	0.1	0.3	0.5	0.7
Bladder	1.2	83	—	—	—	0.1	0.4	0.9
Leukemia	1.1	90	—	—	0.1	0.2	0.4	0.7
Non-Hodgkin lymphoma	1.1	95	—	—	0.1	0.2	0.4	0.6
Esophagus	0.9	112	—	—	0.1	0.2	0.3	0.4
Stomach	0.8	126	—	—	0.1	0.1	0.3	0.4
Kidney and renal pelvis	0.7	142	—	—	0.1	0.2	0.2	0.4
Brain/CNS	0.6	163	—	—	0.1	0.2	0.2	0.2
Multiple myeloma	0.6	179	—	—	—	0.1	0.2	0.3
Liver*	0.5	199	—	—	0.1	0.1	0.2	0.2
Oral	0.5	206	—	—	0.1	0.1	0.2	0.2
Melanoma	0.4	241	—	—	—	0.1	0.1	0.2
Larynx	0.2	459	—	—	—	0.1	0.1	0.1
Thyroid	0.1	1,512	—	—	—	—	—	—
Females								
All cancers	**23.7**	**4.2**	**0.2**	**0.6**	**1.8**	**3.9**	**7.3**	**10.4**
Lung and bronchus	5.7	17	—	0.1	0.5	1.2	2.2	2.2
Breast	3.2	31	0.1	0.2	0.3	0.5	0.8	1.2
Colorectal	2.9	34	—	0.1	0.2	0.4	0.7	1.5
Pancreas	1.5	66	—	—	0.1	0.3	0.5	0.7
Ovary	1.0	100	—	—	0.1	0.2	0.3	0.4
Non-Hodgkin lymphoma	0.9	116	—	—	—	0.1	0.3	0.5
Leukemia	0.8	122	—	—	—	0.1	0.3	0.4
Uterus (body,NOS)	0.6	154	—	—	0.1	0.1	0.2	0.2
Stomach	0.5	199	—	—	—	0.1	0.1	0.3
Brain/CNS	0.5	203	—	—	0.1	0.1	0.1	0.2
Bladder	0.5	219	—	—	—	—	0.1	0.3
Kidney and renal pelvis	0.5	221	—	—	—	0.1	0.1	0.2
Multiple myeloma	0.4	234	—	—	—	0.1	0.1	0.2
Esophagus	0.3	333	—	—	—	0.1	0.1	0.1
Melanoma	0.3	397	—	—	—	—	0.1	0.1
Cervix	0.2	426	—	—	—	—	0.1	0.1
Oral	0.2	443	—	—	—	—	0.1	0.1
Liver*	0.1	672	—	—	—	—	0.1	0.1
Larynx	0.1	1,662	—	—	—	—	—	—
Thyroid	0.1	1,703	—	—	—	—	—	—

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

— Value less than 0.05; CNS=central nervous system; NOS=not otherwise specified

* Liver cancer mortality may be underestimated because deaths from liver cancer, unspecified (ICD-10 code C22.9), were excluded; see *Appendix II: Data sources and methods*.

Note: The probability of dying from cancer represents the proportion of Canadians who die of cancer in a cohort based on age-, sex-, and cause-specific mortality rates for Canada in 2012. For further details, see *Appendix II: Data sources and methods*. The complete definition of the specific cancers included here can be found in Table A2.

TABLE 2.2 Projected deaths and age-standardized mortality rates (ASMR) for selected cancers, by sex, Canada, 2017

	Deaths			Deaths per 100,000		
	Total*	Males	Females	Total*	Males	Females
All cancers	**80,800**	**42,600**	**38,200**	**198.1**	**233.3**	**172.1**
Lung and bronchus	21,100	11,100	10,000	51.4	59.4	45.3
Colorectal	9,400	5,100	4,300	23.1	28.1	19.0
Breast	5,000	60	5,000	12.6	0.3	23.2
Pancreas	4,800	2,400	2,400	11.9	13.1	10.8
Prostate	4,100	4,100	—	—	23.8	—
Leukemia	2,900	1,650	1,250	7.2	9.2	5.5
Non-Hodgkin lymphoma	2,700	1,500	1,200	6.7	8.4	5.3
Bladder	2,400	1,700	680	5.7	9.5	2.9
Brain/CNS	2,400	1,350	1,050	6.0	7.1	5.0
Esophagus	2,200	1,650	480	5.3	8.9	2.1
Stomach	2,100	1,250	790	5.1	6.9	3.6
Kidney and renal pelvis	1,900	1,200	670	4.6	6.6	3.0
Ovary	1,800	—	1,800	—	—	8.2
Multiple myeloma	1,450	810	650	3.5	4.4	2.9
Oral	1,250	860	400	3.1	4.6	1.8
Melanoma	1,250	790	450	3.1	4.3	2.1
Liver†	1,200	950	270	3.0	5.0	1.2
Uterus (body, NOS)	1,150	—	1,150	—	—	5.3
Larynx	440	350	95	1.1	1.9	0.4
Cervix	400	—	400	—	—	2.0
Thyroid	220	95	120	0.5	0.5	0.5
Hodgkin lymphoma	140	85	60	0.4	0.5	0.3
Testis	45	45	—	—	0.2	—
All other cancers	10,400	5,500	4,900	25.5	30.7	21.6

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

CNS=central nervous system; NOS=not otherwise specified

— Not applicable

* Column totals may not sum to row totals due to rounding.

† Liver cancer mortality was underestimated because deaths from liver cancer, unspecified (ICD-10 code C22.9), were excluded; see *Appendix II: Data sources and methods*.

Note: Rates are age-standardized to the 2011 Canadian population. The complete definition of the specific cancers included here can be found in Table A2.

TABLE 2.3 Age-standardized mortality rates (ASMR) for selected* cancers, males, Canada, 1988–2017

Year	Deaths per 100,000										
	All cancers	Lung and bronchus	Colorectal	Prostate	Pancreas	Non-Hodgkin lymphoma	Stomach	Liver†	Oral	Larynx	Hodgkin lymphoma
1988	345.2	108.5	44.2	44.1	16.0	10.0	17.6	3.4	7.8	5.1	0.9
1989	338.1	107.8	43.9	42.4	15.6	9.9	16.8	3.2	8.0	4.3	0.9
1990	333.2	105.7	42.1	42.8	15.3	10.5	15.4	2.5	7.5	4.9	1.0
1991	336.3	105.1	41.6	44.7	14.9	10.7	14.2	2.4	8.2	4.7	0.9
1992	332.7	103.5	42.8	44.7	15.2	10.6	14.7	2.8	7.3	4.5	0.8
1993	329.7	103.9	40.7	44.7	15.0	10.1	13.3	2.9	7.6	4.2	0.8
1994	328.9	100.5	41.6	44.5	14.9	11.0	13.5	3.2	7.2	4.3	0.7
1995	325.0	97.6	41.1	44.9	14.5	11.0	13.3	2.7	6.9	4.3	0.7
1996	321.5	97.3	40.4	42.1	14.8	11.1	12.9	2.8	6.7	3.8	0.5
1997	313.0	93.5	39.3	41.5	13.6	11.4	12.2	3.1	6.6	3.7	0.7
1998	313.8	93.8	39.7	40.8	14.0	11.8	11.8	3.5	6.2	3.6	0.6
1999	312.5	94.1	39.0	39.3	14.4	12.3	11.5	3.4	6.3	3.6	0.7
2000	308.2	86.1	39.3	39.2	13.7	12.1	11.2	3.1	5.2	3.7	0.6
2001	307.1	86.7	37.4	39.2	14.1	12.2	10.5	3.4	6.2	3.7	.0.6
2002	302.5	86.8	38.2	37.1	13.5	11.5	10.0	3.4	6.3	3.5	0.5
2003	295.9	84.4	36.8	35.8	14.1	11.4	10.1	3.6	5.5	3.1	0.4
2004	291.4	81.3	37.1	35.1	14.1	11.2	9.6	3.5	5.5	2.9	0.5
2005	286.0	80.5	36.6	32.9	13.3	10.7	9.5	4.0	5.3	2.8	0.6
2006	278.5	77.9	34.6	31.4	13.5	10.2	9.6	4.0	5.3	2.7	0.5
2007	276.2	77.1	33.9	31.0	14.0	10.5	9.0	4.1	5.5	2.5	0.5
2008	272.5	74.2	34.2	30.4	13.6	10.0	8.5	4.0	5.3	2.7	0.4
2009	266.7	73.7	32.7	29.6	13.8	10.0	8.2	4.3	4.9	2.6	0.5
2010	259.4	71.1	31.5	29.3	13.0	9.4	7.9	4.5	4.9	2.3	0.5
2011	255.3	69.2	31.7	27.4	13.5	9.5	7.6	4.5	5.4	2.0	0.5
2012	252.6	67.8	30.6	26.3	13.1	9.3	7.3	5.0	4.9	2.1	0.5
2013‡	248.2	65.7	30.2	26.2	13.2	9.1	7.4	4.7	4.9	2.1	0.5
2014‡	244.0	63.9	29.6	25.4	13.2	8.9	7.2	4.8	4.8	2.0	0.5
2015‡	239.7	62.1	29.0	24.6	13.1	8.7	7.1	4.9	4.7	2.0	0.5
2016‡	236.5	60.8	28.5	24.2	13.1	8.5	7.0	5.0	4.7	1.9	0.5
2017‡	233.3	59.4	28.1	23.8	13.1	8.4	6.9	5.0	4.6	1.9	0.5

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

* Five most frequent causes of cancer death (both sexes combined) and cancers with a statistically significant change in mortality rate of at least 2% per year (see Table 2.5).

† Liver cancer deaths are underestimated; see *Appendix II: Data sources and methods*.

‡ Rates were projected based on long-term historic data and may not always reflect recent changes in trends. Actual mortality data were available to 2012. For further details, see *Appendix II: Data sources and methods*.

Note: Rates are age-standardized to the 2011 Canadian population. The complete definition of the specific cancers listed here can be found in Table A2.

TABLE 2.4 Age-standardized mortality rates (ASMR) for selected* cancers, females, Canada, 1988–2017

Year	Deaths per 100,000										
	All cancers	Lung and bronchus	Breast	Colorectal	Pancreas	Ovary	Non-Hodgkin lymphoma	Uterus (body,NOS)	Stomach	Larynx	Hodgkin lymphoma
1988	208.3	35.5	41.7	31.3	11.1	11.0	6.5	4.8	7.1	0.8	0.6
1989	205.2	35.7	41.6	29.4	10.6	10.7	7.2	5.1	7.5	0.7	0.5
1990	205.2	36.4	41.6	29.4	11.0	10.6	7.2	5.2	6.9	0.7	0.5
1991	206.3	39.0	40.1	28.7	10.9	10.4	7.6	4.7	6.6	0.9	0.6
1992	205.6	39.2	40.6	28.1	10.8	10.2	7.4	4.7	6.6	0.5	0.5
1993	207.4	41.8	39.0	28.0	11.2	10.6	7.3	4.5	6.2	0.7	0.5
1994	208.5	42.2	40.1	27.6	11.4	10.7	7.5	4.3	6.3	0.7	0.3
1995	204.5	41.3	38.5	27.3	10.7	10.1	7.8	4.8	6.3	0.8	0.5
1996	208.2	44.4	38.7	27.1	11.3	10.8	7.7	4.6	6.0	0.6	0.4
1997	200.4	42.8	37.0	26.0	10.7	10.1	7.6	4.6	5.4	0.6	0.3
1998	203.7	45.6	35.8	26.8	11.0	10.2	8.0	4.5	5.2	0.5	0.3
1999	202.3	46.2	34.0	25.9	10.7	9.9	7.6	4.6	5.5	0.7	0.4
2000	202.6	45.7	34.0	25.4	10.8	9.8	8.1	4.4	5.4	0.6	0.3
2001	200.6	45.5	33.9	24.8	10.6	9.8	7.7	4.5	4.6	0.5	0.4
2002	202.2	46.9	33.1	24.6	10.7	10.7	7.7	4.5	4.9	0.6	0.3
2003	201.1	46.9	33.0	23.8	11.1	10.2	7.4	4.8	4.8	0.6	0.3
2004	199.4	48.0	31.5	24.1	11.3	10.1	7.8	4.6	4.7	0.6	0.3
2005	194.8	47.5	30.8	23.5	10.7	9.8	6.8	4.2	4.8	0.5	0.4
2006	191.7	48.8	29.2	22.0	10.9	9.6	6.7	4.3	4.3	0.4	0.3
2007	191.7	48.2	29.7	22.9	10.8	9.1	7.0	4.7	3.9	0.5	0.4
2008	189.7	48.4	28.4	22.1	10.7	9.4	6.5	4.5	4.4	0.5	0.2
2009	185.9	48.1	27.6	21.2	10.9	9.0	6.4	4.8	4.0	0.4	0.3
2010	184.7	48.2	27.1	20.9	10.4	9.0	6.0	5.0	3.9	0.4	0.3
2011	181.7	46.7	26.4	21.0	10.6	9.1	5.9	4.8	4.0	0.4	0.3
2012	180.4	46.7	25.9	19.9	11.1	8.3	6.0	5.1	3.7	0.4	0.3
2013†	179.0	46.8	25.2	20.1	10.8	8.6	5.7	5.0	3.8	0.4	0.3
2014†	177.2	46.6	24.6	19.8	10.8	8.5	5.6	5.1	3.7	0.4	0.3
2015†	175.4	46.3	24.0	19.5	10.8	8.4	5.5	5.2	3.7	0.4	0.3
2016†	173.7	45.8	23.6	19.3	10.8	8.3	5.4	5.2	3.6	0.4	0.3
2017†	172.1	45.3	23.2	19.0	10.8	8.2	5.3	5.3	3.6	0.4	0.3

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

* Five most frequent causes of cancer death (both sexes combined) and cancers with a statistically significant change in mortality rate of at least 2% per year (see Table 2.5).

† Rates were projected based on long-term historic data and may not always reflect recent changes in trends. Actual mortality data were available to 2012. For further details, see *Appendix II: Data sources and methods*.

Note: Rates are age-standardized to the 2011 Canadian population. The complete definition of the specific cancers included here can be found in Table A2.

TABLE 2.5 Annual percent change (APC) in age-standardized mortality rates for selected cancers, by sex, Canada, most recent trends to 2012[†]

	Males			Females		
	APC	(95% CL)	Reference year	APC	(95% CL)	Reference year
All cancers	**–1.8****	**(–1.9,–1.7)**	**2002**	**–1.2****	**(–1.4,–1.0)**	**2003**
Lung and bronchus	–2.1**	(–2.2,–2.0)	1992	–0.8	(–1.6,0.1)	2006
Colorectal	–2.3**	(–2.8,–1.8)	2004	–1.7**	(–1.8,–1.6)	1992
Breast	–0.8	(–2.0,0.3)	1992	–2.3**	(–2.4,–2.2)	1992
Pancreas	–0.6**	(–0.8,–0.4)	1992	–0.1	(–0.3,0.0)	1992
Prostate	–3.3**	(–3.7,–2.9)	2001	—	—	—
Leukemia	–0.9**	(–1.1,–0.7)	1992	–0.8**	(–1.1,–0.5)	1992
Non-Hodgkin lymphoma	–2.3**	(–2.7,–2.0)	2000	–2.5**	(–3.1,–2.0)	2000
Bladder	–1.5	(–3.3,0.4)	2008	–0.0	(–0.3,0.3)	1992
Brain/CNS	–1.1	(–2.9,0.7)	2008	–0.2	(–0.6,0.1)	1992
Esophagus	0.2	(–0.1,0.4)	1992	–1.0**	(–1.3,–0.6)	1992
Stomach	–3.3**	(–3.4,–3.1)	1992	–2.8**	(–3.1,–2.5)	1992
Kidney and renal pelvis	–0.6**	(–1.0,–0.3)	1992	–0.8**	(–1.1,–0.4)	1992
Ovary	—	—	—	–2.0**	(–2.9,–1.0)	2004
Multiple myeloma	–1.0**	(–1.5,–0.6)	1992	–1.1**	(–1.5,–0.8)	1992
Oral	–2.0**	(–2.4,–1.6)	1992	–1.3**	(–1.8,–0.7)	1992
Melanoma	1.0**	(0.7,1.4)	1992	0.3	(–0.1,0.6)	1992
Liver[‡]	2.8**	(2.4,3.2)	1992	1.7**	(1.2,2.3)	1992
Uterus (body, NOS)	—	—	—	2.2*	(0.6,3.8)	2006
Larynx	–4.7**	(–5.6,–3.8)	2001	–2.7**	(–3.6,–1.9)	1992
Cervix	—	—	—	1.8	(–3.1,6.9)	2008
Thyroid	0.6	(–0.6,1.9)	1992	–1.5*	(–2.5,–0.5)	1992
Hodgkin lymphoma	–2.6**	(–3.4,–1.8)	1992	–2.6**	(–3.6,–1.6)	1992
Testis	–0.8	(–2.2,0.7)	1992	—	—	—
All other cancers	–1.5**	(–2.0,–1.0)	2001	–1.6**	(–2.1,–1.1)	2001

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Vital Statistics Death database at Statistics Canada

CNS=central nervous system; CL=confidence limits; NOS=not otherwise specified

— not applicable

* APC significantly differs from 0, p<0.05

** APC significantly differs from 0, p<0.001

[†] The APC was calculated using the Joinpoint Regression Program using rates from 1992 to 2012. If one or more significant change in the trend of rates was detected, the APC reflects the trend from the more recent significant change (reference year) to 2012. Otherwise, the APC reflects the trend in rates over the entire period (1992–2012).

[‡] Liver cancer deaths are underestimated; see *Appendix II: Data sources and methods*.

Note: The complete definition of the specific cancers listed here can be found in Table A2. Rates are age-standardized to the 2011 Canadian population.

TABLE 2.6 Projected population and deaths for all cancers, by age group and sex, Canada, 2017

Age	Population (in thousands)			Deaths		
	Total*	Males	Females	Total*	Males	Females
All ages	**36,585**	**18,146**	**18,439**	**80,800**	**42,600**	**38,200**
0–19	7,938	4,073	3,866	170	95	75
20–29	4,962	2,524	2,438	220	130	95
30–39	5,008	2,492	2,515	660	280	380
40–49	4,793	2,392	2,400	2,200	990	1,250
50–59	5,335	2,672	2,663	8,600	4,400	4,300
60–69	4,365	2,147	2,219	18,400	10,100	8,300
70–79	2,617	1,231	1,386	23,400	13,000	10,400
80+	1,567	614	953	27,100	13,700	13,400

* Column totals may not sum to row totals due to rounding.

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Vital Statistics Death database and Census and Demographics Branch at Statistics Canada

TABLE 2.7 Projected deaths for the most common cancers, by age group and sex, Canada, 2017

Age	Lung and bronchus			Colorectal			Prostate	Breast
	Total*	Males	Females	Total*	Males	Females	Males	Females
All ages	**21,100**	**11,100**	**10,000**	**9,400**	**5,100**	**4,300**	**4,100**	**5,000**
0–19	—	—	—	—	—	—	—	—
20–29	5	—	5	15	10	5	—	5
30–39	40	20	20	65	35	30	—	110
40–49	320	160	160	260	140	120	10	340
50–59	2,300	1,150	1,100	910	520	390	130	800
60–69	5,700	3,000	2,700	1,900	1,150	720	540	1,100
70–79	7,100	3,800	3,300	2,600	1,500	1,050	1,150	1,100
80+	5,700	2,900	2,800	3,700	1,700	2,000	2,300	1,550

— Fewer than 3 deaths.

* Column totals may not sum to row totals due to rounding.

Note: The complete definition of the specific cancers listed here can be found in Table A2.

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

TABLE 2.8 Projected population and deaths for all cancers, by sex and geographic region, Canada, 2017

	Population (in thousands)			Deaths		
	Total*	Males	Females	Total*	Males	Females
CANADA	**36,585**	**18,146**	**18,439**	**80,800**	**42,600**	**38,200**
British Columbia (BC)	4,806	2,385	2,420	10,300	5,500	4,800
Alberta (AB)	4,355	2,214	2,141	6,800	3,600	3,100
Saskatchewan (SK)	1,144	577	567	2,400	1,250	1,150
Manitoba (MB)	1,320	657	663	2,900	1,500	1,400
Ontario (ON)	14,059	6,903	7,156	29,600	15,600	14,000
Quebec (QC)	8,403	4,180	4,223	21,800	11,400	10,400
New Brunswick (NB)	761	376	385	2,100	1,150	950
Nova Scotia (NS)	947	464	483	2,800	1,450	1,300
Prince Edward Island (PE)	151	74	77	410	210	200
Newfoundland and Labrador (NL)	519	255	264	1,550	850	670
Yukon (YT)	38	19	19	85	50	40
Northwest Territories (NT)	44	23	22	70	40	30
Nunavut (NU)	37	19	18	50	30	25

* Column totals may not sum to row totals due to rounding.

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Vital Statistics Death database and Census and Demographics Branch at Statistics Canada

TABLE 2.9 Projected deaths for selected cancers, by sex and province, Canada, 2017

	Canada*	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL
Males											
All cancers	**42,600**	**5,500**	**3,600**	**1,250**	**1,500**	**15,600**	**11,400**	**1,150**	**1,450**	**210**	**850**
Lung and bronchus	11,100	1,300	830	300	340	3,700	3,600	350	380	60	230
Colorectal	5,100	690	460	150	190	1,750	1,350	120	200	25	140
Prostate	4,100	570	420	160	170	1,600	880	95	120	20	75
Pancreas	2,400	350	190	75	75	940	590	60	75	10	40
Bladder	1,700	250	140	55	55	630	420	40	55	10	25
Esophagus	1,650	250	180	55	70	670	300	45	65	10	25
Leukemia	1,650	210	140	55	60	670	400	40	55	10	25
Non-Hodgkin lymphoma	1,500	190	120	50	55	550	410	45	60	5	25
Brain/CNS	1,350	160	120	30	35	560	330	30	45	5	20
Stomach	1,250	130	110	35	50	470	340	35	40	5	45
Kidney and renal pelvis	1,200	180	110	45	55	410	290	35	50	5	25
Liver†	950	160	85	15	25	400	220	10	25	—	10
Oral	860	130	75	20	25	350	190	20	25	5	15
Multiple myeloma	810	100	70	25	35	310	200	20	30	5	10
Melanoma	790	95	65	20	25	320	200	20	30	—	10
Larynx	350	40	30	10	10	120	110	10	15	—	10
Thyroid	95	15	5	5	5	35	20	5	5	—	—
Hodgkin lymphoma	85	10	5	5	—	35	25	—	5	—	—
Breast	60	5	5	5	—	20	15	—	5	—	—
Testis	45	5	5	—	—	15	10	—	—	—	—
Females											
All cancers	**38,200**	**4,800**	**3,100**	**1,150**	**1,400**	**14,000**	**10,400**	**950**	**1,300**	**200**	**670**
Lung and bronchus	10,000	1,200	810	300	350	3,400	3,100	250	350	55	140
Breast	5,000	610	410	160	190	1,900	1,300	120	160	25	100
Colorectal	4,300	630	330	130	160	1,500	1,200	95	170	30	95
Pancreas	2,400	300	220	70	80	940	630	65	75	10	35
Ovary	1,800	250	160	55	65	690	430	45	60	10	30
Leukemia	1,250	160	110	40	40	500	300	30	40	10	20
Non-Hodgkin lymphoma	1,200	160	95	40	50	460	270	35	50	5	20
Uterus (body, NOS)	1,150	140	90	25	35	470	320	25	40	5	20
Brain/CNS	1,050	140	70	25	25	450	250	20	30	5	15
Stomach	790	95	60	20	25	310	220	20	25	—	25
Bladder	680	100	45	20	25	260	180	15	20	5	10
Kidney and renal pelvis	670	75	60	15	25	250	170	20	25	5	20
Multiple myeloma	650	85	60	20	25	240	170	20	20	5	15
Esophagus	480	75	45	15	15	200	95	10	20	—	10
Melanoma	450	50	35	10	10	190	110	10	15	5	5
Cervix	400	50	45	20	20	150	80	10	15	5	10
Oral	400	55	35	10	15	140	110	10	15	—	5
Liver†	270	35	20	5	10	120	65	5	5	—	5
Thyroid	120	20	10	—	5	50	25	5	5	—	5
Larynx	95	10	5	—	—	30	40	—	5	—	—
Hodgkin lymphoma	60	5	5	—	—	25	20	—	—	—	—

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

CNS=central nervous system; NOS=not otherwise specified

— Fewer than 3 deaths.

* Column totals may not sum to row totals due to rounding. Canada totals include provincial and territorial estimates. Territories are not listed due to small numbers.

† Liver cancer deaths are underestimated; see *Appendix II: Data sources and methods*.

Note: The complete definition of the specific cancers listed here can be found in Table A2.

TABLE 2.10 Projected age-standardized mortality rates (ASMR) for selected cancers, by sex and province, Canada, 2017

	Deaths per 100,000										
	Canada*	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL
Males											
All cancers	**233.3**	**208.1**	**215.5**	**233.1**	**248.6**	**223.7**	**257.0**	**258.0**	**273.3**	**260.7**	**287.6**
Lung and bronchus	59.4	47.7	48.6	55.1	55.1	52.8	77.9	76.6	67.6	70.7	72.3
Colorectal	28.1	26.5	27.3	28.0	31.6	25.2	30.7	28.3	38.7	32.4	47.7
Prostate	23.8	22.2	27.4	30.2	29.5	23.8	21.1	23.9	24.9	31.2	28.2
Pancreas	13.1	13.3	11.4	13.5	12.5	13.3	13.1	13.9	13.7	14.9	13.8
Bladder	9.5	9.7	8.7	10.5	9.3	9.3	10.0	10.2	11.1	10.2	9.5
Esophagus	8.9	9.5	10.0	10.3	10.9	9.4	6.5	9.6	11.9	11.3	8.9
Leukemia	9.2	8.2	8.6	10.0	10.1	9.7	9.1	9.0	10.7	8.9	8.3
Non-Hodgkin lymphoma	8.4	7.4	7.2	8.9	9.4	7.9	9.4	10.0	10.7	9.3	9.0
Brain/CNS	7.1	6.1	6.2	5.6	5.4	7.8	7.2	6.5	8.5	7.1	6.5
Stomach	6.9	4.9	6.6	6.5	8.4	6.7	7.7	8.0	7.3	7.6	14.8
Kidney and renal pelvis	6.6	6.9	6.3	7.9	9.1	5.9	6.5	7.8	9.0	8.3	8.9
Liver†	5.0	6.1	4.6	2.3	3.6	5.5	4.8	2.2	3.9	—	3.4
Oral	4.6	5.0	4.0	3.3	3.9	4.9	4.2	4.5	5.0	6.0	4.7
Multiple myeloma	4.4	3.8	4.2	4.6	5.5	4.4	4.6	4.1	5.4	5.6	3.8
Melanoma	4.3	3.6	3.6	3.6	3.8	4.7	4.5	4.1	5.5	—	3.4
Larynx	1.9	1.5	1.6	1.8	1.3	1.7	2.4	2.5	2.3	—	3.7
Thyroid	0.5	0.6	0.4	0.5	0.5	0.5	0.4	0.8	0.7	—	—
Hodgkin lymphoma	0.5	0.3	0.4	0.5	—	0.5	0.6	—	0.7	—	—
Breast	0.3	0.3	0.3	0.5	—	0.3	0.4	—	0.6	—	—
Testis	0.2	0.3	0.2	—	—	0.2	0.2	—	—	—	—
Females											
All cancers	**172.1**	**160.1**	**157.4**	**179.2**	**188.4**	**163.3**	**189.0**	**178.6**	**197.0**	**195.4**	**191.6**
Lung and bronchus	45.3	40.3	41.2	46.1	47.7	39.9	57.2	46.9	52.2	52.4	38.5
Breast	23.2	20.9	20.5	25.6	26.7	23.1	24.3	22.9	24.6	25.5	28.6
Colorectal	19.0	20.3	16.4	19.6	20.9	17.0	20.8	17.7	24.5	26.4	26.7
Pancreas	10.8	9.8	10.9	10.9	10.8	10.8	11.1	12.0	11.4	11.9	9.4
Ovary	8.2	8.5	7.9	8.7	9.4	8.2	7.9	8.8	8.8	8.9	8.7
Leukemia	5.5	5.2	5.4	5.8	5.5	5.8	5.3	6.0	5.9	7.4	5.0
Non-Hodgkin lymphoma	5.3	5.2	4.9	5.7	6.7	5.2	4.8	6.4	7.3	6.1	5.6
Uterus (body, NOS)	5.3	4.6	4.5	3.8	4.8	5.5	5.8	4.7	6.0	4.3	5.1
Brain/CNS	5.0	4.9	3.4	4.1	3.4	5.7	4.9	4.6	5.1	2.7	5.0
Stomach	3.6	3.1	3.0	3.0	3.4	3.6	3.9	4.1	3.4	—	6.5
Bladder	2.9	3.1	2.3	3.0	3.0	2.8	3.1	2.6	3.1	5.0	3.0
Kidney and renal pelvis	3.0	2.5	2.9	2.6	3.4	2.9	3.0	4.0	3.7	4.5	5.9
Multiple myeloma	2.9	2.7	2.9	3.3	3.1	2.7	3.0	3.3	2.6	3.4	3.8
Esophagus	2.1	2.5	2.1	2.1	2.0	2.2	1.7	2.1	3.2	—	2.5
Melanoma	2.1	1.8	1.8	1.9	1.5	2.3	2.2	2.0	2.7	3.8	1.9
Cervix	2.0	1.8	2.1	4.0	2.6	2.0	1.6	2.6	2.6	3.0	2.8
Oral	1.8	1.9	1.7	1.7	2.1	1.7	2.0	2.0	1.9	—	0.9
Liver†	1.2	1.3	1.1	0.6	1.1	1.4	1.2	0.7	0.7	—	0.8
Thyroid	0.5	0.6	0.5	—	0.6	0.5	0.5	0.5	0.5	—	1.3
Larynx	0.4	0.3	0.2	—	—	0.4	0.7	—	0.4	—	—
Hodgkin lymphoma	0.3	0.2	0.2	—	—	0.3	0.3	—	—	—	—

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

— ASMR based on fewer than 3 deaths.

CNS=central nervous system; NOS=not otherwise specified

* Canada totals include provincial and territorial estimates. Territories are not listed due to small numbers.

† Liver cancer deaths are underestimated; see *Appendix II: Data sources and methods*.

Note: Rates are age-standardized to the 2011 Canadian population. The complete definition of the specific cancers listed here can be found in Table A2.

CHAPTER 3
Net survival: What is the probability of surviving cancer?

This section of the publication has been reproduced, as is, from *Chapter 5* in last year's publication (*Canadian Cancer Statistics 2016*). As such, the analytical techniques used and the interpretation of the results reflect the state of knowledge at the time of the production of that publication.

Net survival

The survival probability that would be observed in the hypothetical situation where the cancer of interest is the only possible cause of death (i.e., the survival as far as the cancer of interest is concerned). Net survival is the preferred method for comparing cancer survival in population-based cancer studies because it adjusts for the fact that different populations may have different levels of background risk of death. It can be measured over various timeframes, but as is standard in other reports, five years has been chosen as the primary duration of analysis for this publication.

Age-standardized net survival

The net survival that would have occurred if the age distribution at diagnosis of the group of people with the cancer under study had been the same as that of the standard population. For each cancer, the standard population was based on persons diagnosed with that cancer in Canada from 2004 to 2008. While every estimate of net survival has been age-standardized except the age-specific ones, this terminology is applied in the text only where results concern comparisons over time, sex or geography.

Confidence interval (CI)

A range of values that provides an indication of the precision of an estimate. Confidence intervals are usually 95%, which means that, assuming no other sources of bias, one can be 95% confident the range contains the true value for the estimate of interest.

Observed survival proportion (OSP)

The proportion of people with cancer who are alive after a given period of time (e.g., five years) after diagnosis.

Conditional net survival

A measure that reflects the probability of surviving an additional number of years (e.g., five years), given that a fixed number of years have already been survived. This is measured in the hypothetical situation where the cancer of interest is the only possible cause of death.

Highlights

- For 2006 to 2008, the five-year age-standardized net survival for people diagnosed with cancer was 60%, an increase of 7 percentage points from 1992 to 1994.
- Five-year net survival is highest for thyroid (98%), testicular (96%) and prostate (95%) cancers. It is lowest for pancreatic (8%), esophageal (14%) and lung and bronchus (lung) (17%) cancers.
- A significant survival advantage for females compared to males was observed for most of the cancers studied.
- Five-year net survival generally decreases with age.
- Between 2006 and 2008, the five-year net survival for all cancers combined increased from 60% when measured from the date of diagnosis, to 76% when measured among those who had survived the first year after a cancer diagnosis.

Introduction

Five-year net survival provides a measure of disease severity and prognosis. Net survival estimates, when examined across cancer types and geographic regions, can be used to establish priorities for improving prognosis. Examining net survival over time, and in conjunction with cancer incidence and mortality trends, can also give important information about progress in cancer treatment and control.[1]

Several factors can work together to influence the probability of surviving cancer. These factors include stage of the cancer at diagnosis and aggressiveness of the tumour, as well as the availability and quality of early detection, diagnostic and treatment services. In addition, factors such as age, sex, existence of other

health conditions, socio-economic status and lifestyle can also affect survival.

Population-based estimates of survival provide useful "average" indicators of survival[2] and do not reflect any individual's prognosis. They are based on the experiences of a group of people rather than a specific person's chance of surviving for a given period of time. Moreover, confidence intervals around survival estimates represent statistical variation rather than the range of possible prognoses for individual people with cancer.

It is also important to remember that survival estimates do not distinguish among people who are free from cancer, in a state of relapse or still undergoing treatment. In addition, because survival statistics describe the survival experience of people diagnosed in the past, they do not reflect more recent advances in detection and treatment that could lead to improved cancer survival. Finally, five-year net survival estimates are different from five-year observed survival proportions (OSPs), which refer to the proportion of people with cancer, who are alive five years after their diagnosis. The current estimate for observed survival for all cancers combined is 55% (Table 3.1).

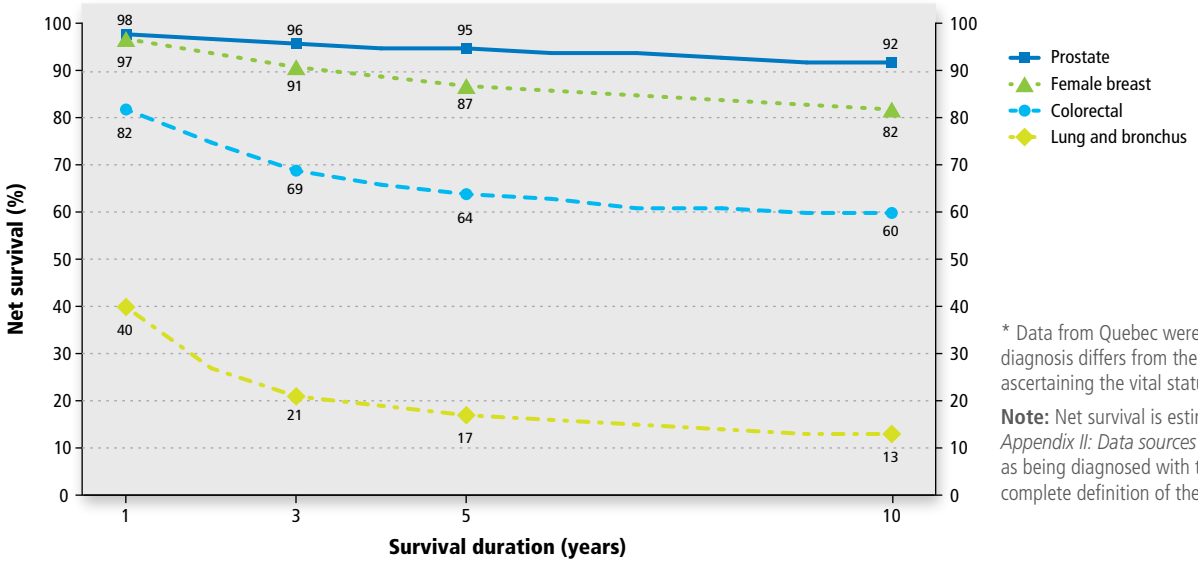
Five-year net survival

Table 3.1 shows five-year net survival estimates for people diagnosed with selected cancers in Canada between 2006 and 2008.

- For all cancers combined, five-year survival is 60%. This figure was overestimated in previous editions as 63% (see *Appendix II: Data sources and methods*).
- Five-year survival estimates are highest for thyroid (98%), testicular (96%) and prostate (95%) cancers.
- Five-year survival estimates are lowest for pancreatic (8%), esophageal (14%) and lung (17%) cancers.
- For most of the cancers examined, five-year survival tends to be higher among females.

Other follow-up times commonly used to measure net survival include 1, 3 and 10 years. For colorectal and lung cancers, survival estimates demonstrate a general pattern of substantial decline in the first year after diagnosis, a more gradual fall over the next two years and then smaller declines over the intervals from 3 to 5 years and 5 to 10 years (Figure 3.1).

FIGURE 3.1 Age-standardized net survival for the most common cancers by survival duration, ages 15–99, Canada (excluding Quebec*), 2006–2008



* Data from Quebec were excluded, in part, because the method for ascertaining the date of cancer diagnosis differs from the method used by other provinces/territories and because of issues in correctly ascertaining the vital status of cases.

Note: Net survival is estimated using age-standardized relative survival ratios. For further details, see *Appendix II: Data sources and methods*. For each cancer in turn, the age distribution of persons recorded as being diagnosed with the given cancer in Canada from 2004–2008 was used as the standard. The complete definition of the specific cancers listed here can be found in Table A2.

Analysis by: Health Statistics Division, Statistics Canada
Data sources: Canadian Cancer Registry database and Canadian Vital Statistics Death databases and life tables at Statistics Canada

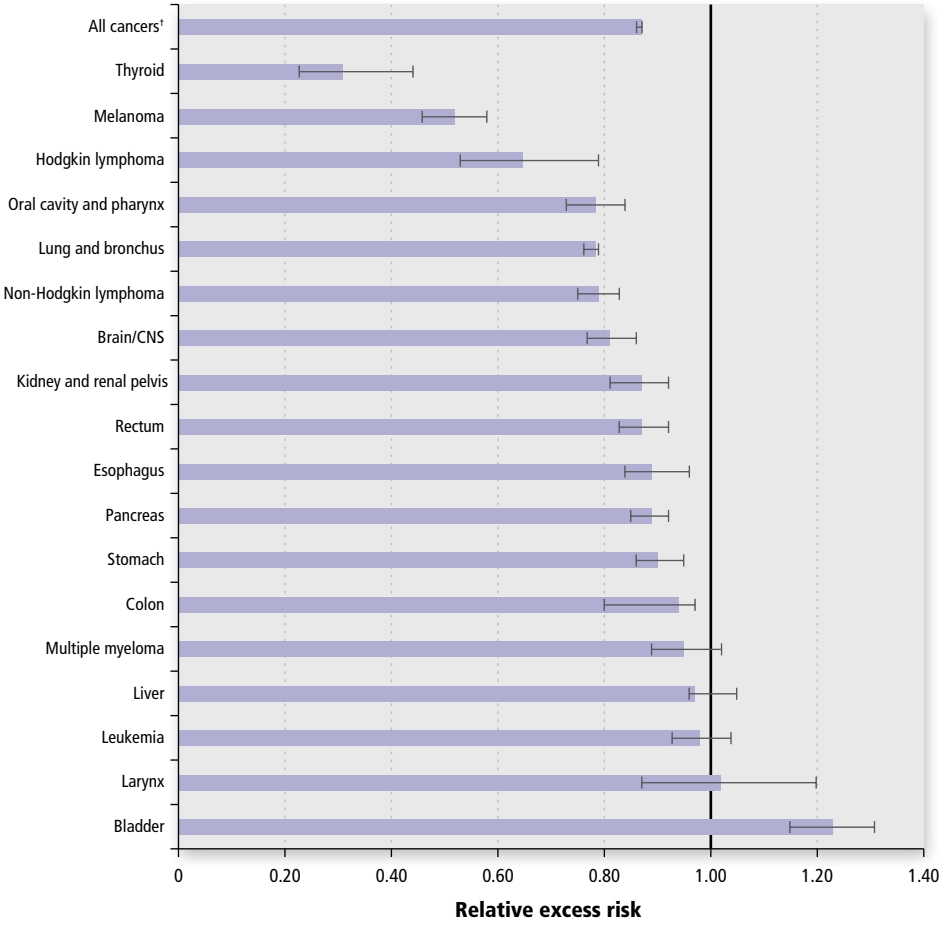
Survival by sex

For cancers common to both sexes, the cancers for which five-year age-standardized net survival is highest and lowest is similar between females and males (Table 3.1).

- For both females and males, five-year survival was highest for thyroid cancer (females 98%, males 95%) followed by melanoma (92%, 85%) and Hodgkin lymphoma (87%, 83%). For females, breast cancer five-year survival was also 87%.
- For both females and males, five-year survival was lowest for pancreatic cancer (females 8%, males 7%), followed by esophageal (17%, 13%) and lung cancer (20%, 14%). For females, liver cancer five-year survival was also 20%.

Figure 3.2 provides data excerpted from a study published earlier this year that examined survival differences between the sexes in Canada in detail.[3] The study considered all of the non-sex-specific cancers listed in Table 3.1 with the exception of breast cancer. The primary outcome measure was the five-year relative excess risk (RER) of death—the ratio of the excess risk of death experienced by females after a cancer diagnosis compared (relative) to that of males.

FIGURE 3.2 Five-year relative excess risks (RERs) of death for women compared to men, by cancer, ages 15–99, Canada (excluding Quebec*), 2004–2008



CNS=central nervous system

* Data from Quebec were excluded, in part, because the method for ascertaining the date of cancer diagnosis differs from the method used by other provinces/territories and because of issues in correctly ascertaining the vital status of cases.

† Excludes genital system cancers and breast cancer.

Note: All results adjusted for age group; all cancers' result also adjusted for case mix.

Source: Adapted from Table 4 in Ellison LF. Differences in cancer survival in Canada by sex. *Health Reports* 2016;27(4):19–27.

- A significant survival advantage for females compared to males was observed for most of the cancers studied. The advantage was greatest for thyroid cancer (RER = 0.31), skin melanoma (0.52) and Hodgkin lymphoma (0.65).
- For all cancers combined, females had a 13% lower excess risk of death (RER = 0.87), which increased to 23% lower (RER = 0.77) when the analysis was restricted to those diagnosed before the age of 55.
- In the study, cancer-specific point estimates of RER were "almost uniformly lower" among those diagnosed between the ages of 15 and 54 (data not shown)[3] lending indirect support for a hypothesized hormonal influence.[4]
- Bladder cancer was the only cancer for which females had a significant disadvantage (RER = 1.23).
- The underlying reasons behind differences in cancer survival between the sexes are not well understood and are best examined on a cancer-specific level.

Survival by province

Table 3.2 shows age-standardized five-year net survival estimates for the four most common cancer types (prostate, breast, colorectal and lung cancers). The following exceptions and caveats should be considered when examining these data:

- Cancer cases in Newfoundland and Labrador may be under-reported due to incomplete linkage of cancer incidence data with death data. Such underreporting is likely to result in overestimation of survival because these missed cases tend to have less favourable survival. Consequently, survival ratios for Newfoundland and Labrador are not shown.
- Territorial estimates are not presented because there were too few cancer cases to calculate reliable estimates. Territorial cases are, however, included in the estimates for all of Canada.
- Survival estimates for Prince Edward Island are less precise than for other provinces because of the relatively small number of cancer cases in this province.
- Despite these constraints, several patterns are worth mentioning:
  - The highest survival for prostate cancer is in Ontario (96%); the lowest are in Manitoba (89%), Saskatchewan (90%) and Prince Edward Island (90%).
  - There is little provincial variation in survival for female breast cancer.
  - Survival for colorectal cancer ranges from 60% to 62% in all provinces except Ontario (67%).
  - Survival for lung cancer ranges from a low of 14% in Alberta and Nova Scotia, to a high of 20% in Manitoba.
- The variation across provinces may be related to differences in the following factors:
  - the availability and patterns of use of screening, early detection and diagnostic services that affect how early cancer is diagnosed
  - the availability of and access to specialized cancer treatments
  - population attributes (such as socio-economic status and lifestyle factors) that affect survival
  - provincial resources available to ensure registration of all cancers and up-to-date vital status information on registered cases.

Survival by age at diagnosis

Net survival is generally poorer among those diagnosed with cancer at an older age. Poorer survival among older people may be because they receive less therapy due to the presence of other diseases or conditions that reduce the body's ability to tolerate and respond to cancer treatments. Older people may also receive less aggressive treatment, independent of any other conditions, due to their advanced age.[5]

Table 3.3 shows five-year net survival estimates by age group for the four most common cancers.

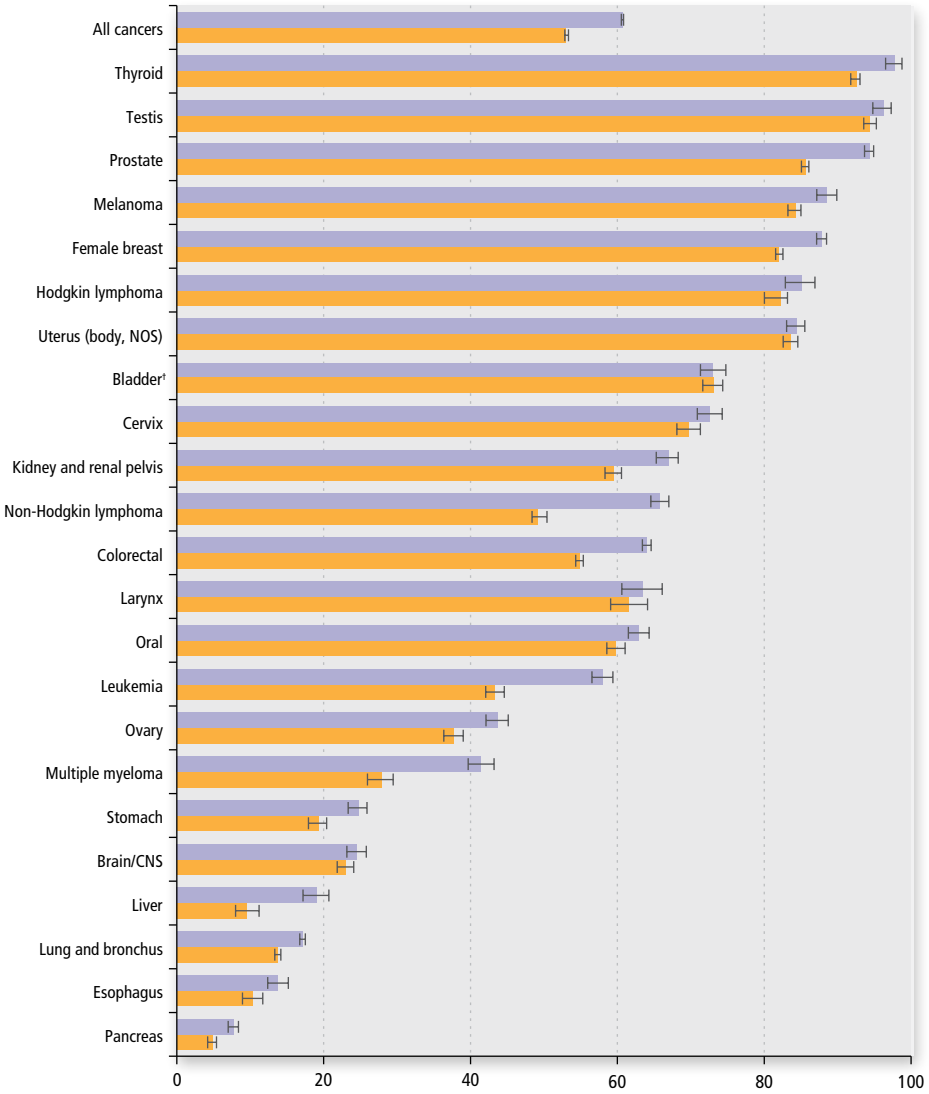
- Survival for prostate cancer is consistently high (≥95%) among males diagnosed between the ages of 40 and 79 years; at older ages, survival is significantly lower.
- Survival is highest for female breast cancer among women diagnosed between the ages of 40 and 69 years (89%–90%). Lower survival is particularly evident among women 80–99 years (78%).
- Survival estimates for colorectal cancer are consistent at 68% among people diagnosed between the ages of 15 and 69 years, then decrease with advancing age.
- For lung cancer, survival decreases with advancing age. People aged 15–39 years at diagnosis have the highest survival at 45%, while people aged 80–99 years have the lowest at 10%.

Trends over time

Figure 3.3 shows that there was substantial improvement in five-year age-standardized net survival between 1992 to 1994 and 2006 to 2008 for many of the most commonly diagnosed cancers of today.

- Survival for all cancers combined has risen by 7.3 percentage points to 60.3% in 2006 to 2008 from 53.0% in 1992 to 1994.
- The largest increases between the two time periods among the cancers presented are seen for non-Hodgkin lymphoma (16 percentage points), leukemia (15 percentage points) and multiple myeloma (14 percentage points).
- A few factors have contributed to the increased survival for non-Hodgkin lymphoma. First is the advance in therapy, particularly the introduction of antibody therapy with rituximab. Second is the recent decrease in the number of cases of non-Hodgkin lymphoma related to human immunodeficiency virus (HIV). The lower number of cases related to HIV is a consequence of improved treatment, specifically with highly active antiretroviral therapy (HAART) developed in the late 1990s.[6]
- Improvements in survival among adolescents and adults diagnosed with leukemia in Canada were examined in a 2016 study.[7] The study reported that adjusting for case-mix in addition to age reduced the overall increase from 14.6% to 12.8%. Additionally, increases in five-year survival, ranging from 9 (acute myeloid) to 25 percentage points (chronic myeloid), were found to be significant for all four main subtypes of leukemia.

FIGURE 3.3 Five-year age-standardized net survival for selected cancers by time period, ages 15–99, Canada (excluding Quebec*), 2006–2008 versus 1992–1994



Analysis by: Health Statistics Division, Statistics Canada
Data sources: Canadian Cancer Registry database and life tables at Statistics Canada

View data

CNS=central nervous system; NOS=not otherwise specified

* Data from Quebec were excluded, in part, because the method for ascertaining the date of cancer diagnosis differs from the method used by other provinces/territories and because of issues in correctly ascertaining the vital status of cases.

† Excludes data from Ontario, which did not report *in situ* bladder cancers for the time period considered.

Note: Age-standardized net survival is estimated using age-standardized relative survival ratios. For further details, see *Appendix II: Data sources and methods*. For each cancer in turn, the age distribution of persons recorded as being diagnosed with the given cancer in Canada from 2004–2008 was used as the standard. "All cancers" excludes adolescent (15–19 years) bone cancers, which are dissimilar to those diagnosed in older adults, and non-melanoma skin cancers (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). Error bars refer to 95% confidence intervals. The complete definition of the specific cancers listed here can be found in Table A2.

- Reasons for improvements in survival for leukemia vary somewhat depending on the subtype considered.[7] Increases for chronic myeloid leukemia have been attributed to advances in treatment – particularly imatinib, the first targeted treatment for this cancer.[8]
- Survival for colorectal, prostate and liver cancers each increased by nine percentage points. The improvement in colorectal cancer survival is mainly due to the increased use of screening and early detection that have helped identify cancers at a treatable stage.
- There has been virtually no change (less than one percentage point) for cancers of the bladder and body of uterus between 1992 to 1994 and 2006 to 2008.

Five-year conditional net survival

The five-year conditional net survival for people with cancer who have already survived one to three years after their diagnosis is often more meaningful for clinical management and prognosis than the five-year net survival measured from the date of diagnosis. Since the risk of death due to cancer is often greatest in the first few years after diagnosis, prognosis can substantially improve among people surviving one or more years. For these people, the five-year net survival measured at diagnosis no longer applies.[9,10]

Table 3.4 presents five-year net survival estimated from the date of cancer diagnosis and five-year conditional net survival calculated using people who have survived the first, second, third, fourth and fifth year after a cancer diagnosis. Five-year conditional survival estimates demonstrate that the survival experience of people diagnosed with cancer generally improves with time since diagnosis.

- The five-year survival for all cancers combined increased from 60% when measured from the date of diagnosis to 76% when measured among those who survived the first year after a cancer diagnosis.
- Each additional year survived resulted in further, although less dramatic, increases in the five-year conditional survival.
- The impact of time survived on the five-year conditional RSR varied by type of cancer. Cancers with low initial five-year survival (e.g., stomach, brain, liver, lung, esophagus and pancreas) showed the most dramatic increases in five-year conditional survival.
- Conversely, since the potential for improvement is limited for cancers that have an excellent prognosis at diagnosis, cancers with high initial five-year survival (e.g., thyroid, testis and prostate) showed little improvement in five-year conditional survival.

Five-year childhood cancer (0–14 years) survival

Table 3.5 shows the estimated five-year OSPs for children, by childhood cancer diagnostic group and selected subgroups,[11] diagnosed with cancer in Canada between 2004 and 2008. In general, survival for childhood cancer is higher than it is among adults. However, the rarity of childhood cancer results in less precise estimates, even when more years of data are considered.

- For all cancers combined, the five-year OSP is 83%.
- Among specific diagnostic groups, five-year OSPs are highest for retinoblastoma and for other malignant epithelial neoplasms – both at 94%. The five-year OSP is also over 90% for lymphomas, germ cell tumours and other and unspecified neoplasms.
- Among specific diagnostic groups, five-year OSPs are lowest for hepatic tumours at (68%), malignant bone tumours (70%), soft tissue (72%) and central nervous system (74%) cancers. The estimate for hepatic tumours, however, is less precise than the others in Table 3.5 as it is based on a small number of cases.

What do these statistics mean?

Despite improvements in survival from 1992 to 1994 and 2006 to 2008, some cancers continue to have lower net survival than others because of the aggressiveness of the disease, the late stage at which they tend to be diagnosed or the lack of effective treatment options.

Among the most common cancers, there is variation in five-year net survival across provinces for prostate, lung and colorectal cancers, while there is little provincial variation for breast cancer. These differences in five-year net survival across geographic regions and types of cancer help point to areas where greater effort is required to detect, diagnose and treat cancer at an early stage, or where more research is needed to develop better treatments. Cancer stage at diagnosis is an important prognostic indicator that is available for the most common cancers from most provincial cancer registries.

Other resources

Publications

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Databases

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- Statistics Canada. Table 103-1560 – Five-year survival estimates for all primary sites of cancer combined, ICD-O-3 (October 2011 CCR file), by age group and sex, population aged 15 to 99, 3 years of cases, Canada (excluding Quebec), annual (percent), 1992/1994 to 2001/2003, CANSIM (database).
- Statistics Canada. Table 103-1573 – Five-year survival estimates for primary sites of cancer, ICD-O-3 (October 2011 CCR file), by sex, population aged 15 to 99, 1 year of cases, selected provinces, annual (percent), 1992 to 2003, CANSIM (database).
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- Statistics Canada. Table 103-1571 – Age-standardized five-year survival estimates for primary sites of cancer, ICD-O-3 (October 2011 CCR file), by sex, 1 year of cases, Canada and selected provinces, annual (percent), 1992 to 2003, CANSIM (database).
- Statistics Canada. Table 103-1572 – Age-standardized five-year survival estimates for primary sites of cancer, ICD-O-3 (October 2011 CCR file), by sex, 3 years of cases, Canada and selected provinces, annual (percent), 1992/1994 to 2001/2003, CANSIM (database).

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TABLE 3.1 Five-year age-standardized net and observed survival for selected cancers by sex, ages 15–99, Canada (excluding Quebec*), 2006–2008

	Net survival (%) (95% confidence interval)			Observed survival proportion (%) (95% confidence interval)		
	Both sexes	Males	Females	Both sexes	Males	Females
All cancers	**60 (60–61)**	**60 (59–60)**	**61 (60–61)**	**55 (55–56)**	**54 (54–54)**	**56 (56–57)**
Thyroid	98 (97–98)	95 (94–97)	98 (98–99)	95 (94–95)	92 (91–93)	96 (95–96)
Testis	—	96 (95–97)	—	—	95 (94–96)	—
Prostate	—	95 (94–95)	—	—	81 (81–82)	—
Melanoma	88 (87–89)	85 (83–86)	92 (90–93)	79 (78–80)	75 (74–76)	84 (83–85)
Breast	87 (87–88)	79 (72–84)	87 (87–88)	80 (80–81)	71 (65–75)	80 (80–81)
Hodgkin lymphoma	85 (83–86)	83 (80–85)	87 (85–89)	83 (81–84)	80 (78–82)	86 (83–87)
Uterus (body, NOS)	—	—	84 (83–85)	—	—	78 (77–79)
Bladder†	73 (72–74)	74 (72–75)	71 (69–74)	60 (59–61)	59 (58–61)	61 (59–63)
Cervix	—	—	73 (71–74)	—	—	70 (69–72)
Kidney and renal pelvis	67 (66–68)	66 (64–67)	69 (68–71)	60 (59–61)	58 (56–59)	64 (62–65)
Non-Hodgkin lymphoma	66 (65–67)	63 (62–65)	69 (68–70)	59 (58–59)	55 (54–56)	63 (61–64)
Colorectal	64 (63–65)	63 (62–64)	65 (64–66)	54 (54–55)	52 (52–53)	56 (56–57)
Larynx	63 (61–66)	64 (61–66)	63 (57–68)	55 (53–57)	54 (52–57)	57 (52–62)
Oral	63 (62–64)	60 (59–62)	68 (65–70)	56 (55–57)	53 (52–55)	62 (60–63)
Leukemia	58 (57–59)	58 (56–59)	59 (57–60)	51 (50–52)	50 (48–51)	52 (51–54)
Ovary	—	—	44 (42–45)	—	—	41 (40–42)
Multiple myeloma	42 (40–43)	42 (40–45)	41 (38–43)	36 (35–38)	36 (34–38)	36 (34–39)
Stomach	25 (23–26)	23 (21–24)	28 (26–30)	21 (20–22)	19 (18–20)	25 (23–27)
Brain/CNS	24 (23–26)	22 (21–24)	28 (26–29)	24 (23–25)	21 (20–23)	27 (25–29)
Liver	19 (17–21)	19 (17–21)	20 (17–24)	17 (16–19)	17 (15–19)	19 (16–22)
Lung and bronchus	17 (17–17)	14 (14–15)	20 (19–20)	15 (15–15)	12 (12–13)	18 (17–18)
Esophagus	14 (12–15)	13 (12–15)	17 (14–20)	12 (11–13)	11 (10–13)	16 (13–19)
Pancreas	8 (7–8)	7 (6–8)	8 (7–9)	7 (6–7)	6 (5–7)	7 (6–8)

Analysis by: Health Statistics Division, Statistics Canada
Data sources: Canadian Cancer Registry database and life tables at Statistics Canada

CNS=central nervous system; NOS=not otherwise specified; — not applicable

* Data from Quebec were excluded, in part, because the method for ascertaining the date of cancer diagnosis differs from the method used by other provinces and territories and because of issues in correctly ascertaining the vital status of cases.

† Excludes data from Ontario, which did not report *in situ* bladder cancers for the time period considered.

Note: Net survival is estimated using age-standardized relative survival ratios. For further details, see *Appendix II: Data sources and methods*. For each cancer in turn, the age distribution of persons recorded as being diagnosed with the given cancer in Canada from 2004–2008 was used as the standard. "All cancers" excludes adolescent (15–19 years) bone cancers, which are dissimilar to those diagnosed in older adults, and non-melanoma skin cancers (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). The complete definition of the specific cancers listed here can be found in Table A2.

TABLE 3.2 Five-year age-standardized net survival for the most common cancers by province, ages 15–99, Canada (excluding Quebec*), 2006–2008

Province	Net survival (%) (95% confidence interval)			
	Prostate	Female breast	Colorectal	Lung and bronchus
Canada*	**95 (94–95)**	**87 (87–88)**	**64 (63–65)**	**17 (17–17)**
British Columbia (BC)	93 (92–94)	88 (87–89)	61 (60–62)	15 (15–16)
Alberta (AB)	92 (90–93)	86 (85–87)	61 (60–63)	14 (13–15)
Saskatchewan (SK)	90 (88–92)	86 (84–88)	61 (58–63)	16 (14–18)
Manitoba (MB)	89 (87–91)	85 (83–87)	60 (57–62)	20 (19–22)
Ontario (ON)	96 (96–97)	88 (87–89)	67 (66–67)	19 (18–19)
New Brunswick (NB)	93 (90–95)	88 (86–91)	62 (59–65)	15 (14–17)
Nova Scotia (NS)	93 (91–95)	87 (85–89)	60 (58–63)	14 (12–15)
Prince Edward Island (PE)	90 (84–93)	84 (78–89)	60 (53–67)	—

Analysis by: Health Statistics Division, Statistics Canada
Data sources: Canadian Cancer Registry database and life tables at Statistics Canada

— Estimate cannot be calculated.

* Data from Quebec were excluded, in part, because the method for ascertaining the date of cancer diagnosis differs from the method used by other provinces and territories and because of issues in correctly ascertaining the vital status of cases.

Note: Age-standardized net survival is estimated using age-standardized relative survival ratios. For further details, see *Appendix II: Data sources and methods*. For each cancer in turn, the age distribution of persons recorded as being diagnosed with the given cancer in Canada from 2004–2008 was used as the standard. Estimates for Newfoundland and Labrador are not shown as they are artefactually high. The complete definition of the specific cancers listed here can be found in Table A2.

TABLE 3.3 Five-year net survival for the most common cancers by age group, Canada (excluding Quebec*), 2006–2008

Age	Net survival (%) (95% confidence interval)			
	Prostate	Female breast	Colorectal	Lung and bronchus
15–39	*94 (63–99)*	85 (84–87)	68 (64–71)	45 (38–52)
40–49	96 (94–97)	90 (89–90)	68 (66–70)	23 (21–25)
50–59	98 (97–98)	89 (88–89)	68 (67–69)	21 (20–22)
60–69	98 (98–99)	90 (89–91)	68 (67–69)	19 (18–20)
70–79	95 (94–96)	87 (86–88)	64 (63–65)	16 (15–17)
80–99	79 (77–82)	78 (76–80)	56 (54–57)	10 (9–11)

Analysis by: Health Statistics Division, Statistics Canada
Data sources: Canadian Cancer Registry database and life tables at Statistics Canada

* Data from Quebec were excluded, in part, because the method for ascertaining the date of cancer diagnosis differs from the method used by other provinces and territories and because of issues in correctly ascertaining the vital status of cases.

Note: Net survival is estimated using relative survival ratios. For further details, see *Appendix II: Data sources and methods*. Estimates associated with a standard error > 0.05 and ≤ 0.10 are italicized. The complete definition of the specific cancers listed here can be found in Table A2.

TABLE 3.4 Five-year age-standardized net survival for selected cancers conditional on having survived the specified number of years, ages 15–99, Canada (excluding Quebec*), 2006–2008

	Conditional net survival (%) (95% confidence interval)					
	0	1	2	3	4	5
All cancers	**60 (60–61)**	**76 (76–77)**	**82 (82–82)**	**85 (85–85)**	**87 (87–87)**	**88 (88–89)**
Thyroid	98 (97–98)	99 (98–100)	100 (98–100)	99 (98–100)	99 (98–100)	99 (97–99)
Testis	96 (95–97)	98 (97–98)	99 (98–99)	99 (98–99)	99 (98–100)	99 (98–100)
Prostate	95 (94–95)	96 (95–96)	97 (96–97)	97 (96–97)	97 (96–97)	96 (95–97)
Melanoma	88 (87–89)	91 (90–92)	93 (92–94)	95 (93–96)	95 (94–97)	97 (95–98)
Female breast	87 (87–88)	89 (88–89)	90 (90–91)	91 (91–92)	93 (92–93)	94 (93–94)
Hodgkin lymphoma	85 (83–86)	91 (89–93)	92 (90–94)	92 (89–94)	93 (90–94)	93 (90–95)
Uterus (body, NOS)	84 (83–85)	90 (89–91)	94 (93–95)	96 (95–97)	98 (96–99)	99 (97–99)
Bladder†	73 (72–74)	81 (79–82)	84 (82–86)	86 (84–88)	88 (86–90)	88 (85–90)
Cervix	73 (71–74)	80 (78–82)	87 (85–88)	90 (89–92)	93 (91–95)	96 (94–97)
Kidney and renal pelvis	67 (66–68)	81 (79–82)	86 (84–87)	89 (87–90)	91 (89–93)	93 (91–95)
Non-Hodgkin lymphoma	66 (65–67)	81 (79–82)	84 (82–85)	85 (84–87)	87 (85–89)	89 (86–90)
Colorectal	64 (63–65)	76 (76–77)	83 (82–83)	88 (87–89)	91 (90–92)	94 (93–95)
Larynx	63 (61–66)	71 (68–74)	77 (74–80)	80 (76–83)	82 (78–85)	82 (78–86)
Oral	63 (62–64)	74 (73–76)	82 (80–84)	86 (84–87)	87 (85–89)	89 (86–91)
Leukemia	58 (57–59)	78 (77–80)	81 (79–83)	83 (81–85)	84 (81–86)	83 (80–86)
Ovary	44 (42–45)	53 (51–55)	62 (60–65)	70 (67–73)	78 (75–81)	84 (80–87)
Multiple myeloma	42 (40–43)	49 (47–51)	51 (48–54)	52 (48–55)	56 (52–61)	60 (55–65)
Stomach	25 (23–26)	51 (49–54)	72 (69–75)	85 (81–88)	92 (87–95)	95 (88–98)
Brain/CNS	24 (23–26)	45 (41–48)	63 (58–67)	72 (67–76)	74 (68–80)	80 (73–85)
Liver	19 (17–21)	39 (35–42)	51 (46–56)	63 (56–69)	74 (65–81)	82 (73–89)
Lung	17 (17–17)	38 (37–39)	54 (53–56)	64 (63–66)	70 (68–72)	75 (72–77)
Esophagus	14 (12–15)	33 (29–36)	53 (48–58)	67 (60–73)	75 (66–81)	80 (71–86)
Pancreas	8 (7– 8)	30 (26–33)	53 (47–59)	68 (60–75)	78 (68–85)	81 (70–89)

Analysis by: Health Statistics Division, Statistics Canada
Data sources: Canadian Cancer Registry database and life tables at Statistics Canada

CNS=central nervous system; NOS=not otherwise specified

* Data from Quebec were excluded, in part, because the method for ascertaining the date of cancer diagnosis differs from the method used by other provinces and territories and because of issues in correctly ascertaining the vital status of cases.

† Excludes data from Ontario, which did not report *in situ* bladder cancers for the time period considered.

Note: Net survival is estimated using age-standardized relative survival ratios. For further details, see *Appendix II: Data sources and methods*. For each cancer in turn, the age distribution of persons recorded as being diagnosed with the given cancer in Canada from 2004–2008 was used as the standard. "All cancers" excludes adolescent (15–19 years) bone cancers, which are dissimilar to those diagnosed in older adults, and non-melanoma skin cancers (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). The complete definition of the specific cancers listed here can be found in Table A2.

TABLE 3.5 Five-year observed survival proportions (OSP) by diagnostic group and selected subgroup, ages 0–14 years at diagnosis, Canada (excluding Quebec*), 2004–2008

Diagnostic group	OSP (%) (95% CI)
All groups	**83 (82–84)**
I. Leukemias, myeloproliferative diseases, and myelodysplastic diseases	88 (86–90)
a. Lymphoid leukemias	91 (89–93)
b. Acute myeloid leukemias	73 (65–79)
II. Lymphomas and reticuloendothelial neoplasms	92 (88–94)
a. Hodgkin lymphomas	98 (94–99)
b. Non-Hodgkin lymphomas (except Burkitt lymphoma)	88 (81–93)
c. Burkitt lymphoma	92 (79–97)
III. CNS and miscellaneous intracranial and intraspinal neoplasms	74 (70–77)
b. Astrocytomas	84 (80–88)
c. Intracranial and intraspinal embryonal tumours	55 (47–63)
IV. Neuroblastoma and other peripheral nervous cell tumours	77 (71–82)
V. Retinoblastoma	94 (86–98)
VI. Renal tumours	84 (78–89)
a. Nephroblastoma and other non-epithelial renal tumours	85 (78–90)
VII. Hepatic tumours	*68 (53–78)*
VIII. Malignant bone tumours	70 (62–77)
IX. Soft-tissue and other extraosseous sarcomas	72 (65–77)
a. Rhabdomyosarcomas	70 (60–78)
X. Germ cell tumours, trophoblastic tumours, and neoplasms of gonads	91 (84–95)
b. Malignant extracranial and extragonadal germ cell tumours	96 (76–99)
c. Malignant gonadal germ cell tumours	95 (82–99)
XI. Other malignant epithelial neoplasms and malignant melanomas	94 (88–97)
XII. Other and unspecified malignant neoplasms	91 (80–96)

Analysis by: Health Statistics Division, Statistics Canada
Data source: Canadian Cancer Registry database at Statistics Canada

CI=confidence interval; CNS=central nervous system

* Data from Quebec were excluded, in part, because the method for ascertaining the date of cancer diagnosis differs from the method used by other provinces and territories and because of issues in correctly ascertaining the vital status of cases.

† International classification of childhood cancer (ICCC) Recode ICD-O-3/WHO 2008. Surveillance, Epidemiology, and End Results Program (SEER). Only selected subgroups within each diagnostic group are listed.

Note: Estimates associated with a standard error > 0.05 and ≤ 0.10 are italicized.

CHAPTER 4
Prevalence: How many people diagnosed with cancer are alive today?

This section of the publication has been reproduced, as is, from the corresponding section in recent publications (Canadian Cancer Statistics 2014-2016). As such, the analytical techniques used reflect the state of knowledge at the time of the production of that publication.

Highlights

- At the beginning of 2009, a substantial number of people in Canada – just over 810,000 – had been diagnosed with cancer in the previous 10 years, (10-year person-based prevalence). Among these people, nearly 841,000 cancers were recorded (10-year tumour-based prevalence).
- Breast and prostate cancer accounted for 40% of the 10-year tumour-based prevalent cases.
- The 10-year tumour-based prevalence peaked among males aged 70–79 years and females aged 60–69 years. This sex difference is due to the high prevalence of prostate and breast cancers in each of these age groups.
- The majority of 10-year tumour-based prevalent cases were diagnosed in the previous five years. Such affected individuals were either undergoing treatment, recovering from its effects or still dealing with the physical and emotional consequences of cancer. This has significant implications for the planning and development of interdisciplinary healthcare services.

Introduction

The ongoing rise in the annual number of new cancer diagnoses (due to a growing and aging population), combined with an improving survival rate for most types of cancer, has meant that a substantial number of people are living with and beyond their cancer diagnosis. This prevalent population of people with cancer and cancer survivors is likely to have unique healthcare needs during the course of their cancer journey. Thus, prevalence statistics are required to estimate the needs for ongoing healthcare[1] and support services that improve the quality of life for people with cancer, cancer survivors and their families.

Recent diagnoses of cancer (within the past two years) include individuals who are either receiving primary treatment or recovering from its effects. People diagnosed in the more distant past (beyond two years) have likely completed their treatment but may still need clinical follow-up and supportive care.

Person-based estimates of prevalence are intuitively easier to understand than tumour-based estimates, although they may underestimate the true impact of cancer because one person can have more than a single diagnosis of a primary cancer.

Prevalence

Population-based cancer prevalence can be measured by the number of living individuals previously diagnosed with cancer or by the number of cancers diagnosed in such individuals. Tumour-based estimates refer to the number of cancers diagnosed among individuals living with or beyond cancer on a specified date (index date). Person-based estimates refer to the number of individuals living with or beyond cancer on an index date.

It is also possible to examine limited-duration prevalence. In limited-duration prevalence, tumour- or person-based prevalence estimates are limited to, respectively, cancers or persons diagnosed within a specified period prior to the index date. Limited-duration prevalence is generally measured in two-, five- or 10-year periods prior to an index date.

Tumour-based prevalence

Among Canadians alive on January 1, 2009, close to 841,000 cancers had been diagnosed in the previous 10 years (Table 4.1). These cases can be analyzed according to the type of cancer, the sex and age of the person and the amount of time since diagnosis.

Prevalence by type of cancer

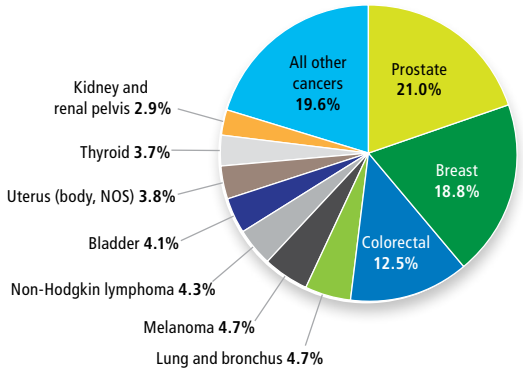
Figure 4.1 shows that prostate and breast cancers together accounted for 40% of all 10-year prevalent cancers. Other common cancers included colorectal cancer (13% of all 10-year prevalent cases), lung cancer (5%), melanoma (5%), non-Hodgkin lymphoma (4%) and bladder cancer (4%).

Prevalence reflects both the frequency of occurrence and prognosis for particular cancers. For example, even though the colorectal cancer incidence rate is lower than that of lung cancer, the colorectal 10-year cancer prevalence is 2.7 times greater, reflecting the poorer prognosis for lung cancer. Similarly, while melanoma accounts for 3% of all newly diagnosed cancer cases, it represents 5% of all 10-year prevalent cancer cases because of its high survival.

Prevalence by sex

Table 4.1 shows that 10-year tumour-based prevalence counts are similar among males and females for several types of cancer including lung, colorectal, non-Hodgkin lymphoma, melanoma, pancreas, brain, multiple myeloma and Hodgkin lymphoma. On the other hand, large differences were seen between the sexes for other types of cancer, including bladder, thyroid, oral, stomach, liver, esophagus and larynx. These sex differences primarily result from differences in cancer incidence rather than observed survival.

FIGURE 4.1 Distribution of 10-year tumour-based prevalence for selected cancers, Canada,* January 1, 2009



* During the estimation process, cases from Quebec were excluded because of issues in correctly ascertaining the vital status of cases. The presented estimates, however, are for all of Canada, including Quebec. These estimates assume that sex- and age-specific tumour-based prevalence proportions in Quebec are similar to the rest of Canada. Estimates for lung and bladder cancers may be lower than in previous editions of this publication because of the different method used to estimate Quebec's prevalence prior to 2013. For further details, see *Appendix II, Data sources and methods.*

Note: The complete definition of the specific cancers listed here can be found in Table A2.

Analysis by: Health Statistics Division, Statistics Canada
Data source: Canadian Cancer Registry database at Statistics Canada

Prevalence by age

Table 4.2 shows that the number of 10-year prevalence cases is generally highest in the 70–79 year age group. Exceptions include female breast cancer and all cancers combined among females – both of which peaked in the 60–69 year age group – as well as colorectal cancer among females (80 years or older age group).

Prevalence by duration

Of the approximately 841,000 10-year prevalent cancer cases at the beginning of 2009, 29% had been diagnosed within the previous two years (2007 to 2008), 32% within the previous two to five years and 38% within the previous five to 10 years (Table 4.1). These data have implications for planning healthcare and supportive services.

- In the first couple of years post diagnosis, individuals are likely receiving or recovering from treatment for their cancer.
- The third to fifth year after a cancer diagnosis is a period that typically requires close clinical follow-up for recurrence and supportive care.
- Individuals alive five to 10 years after a cancer diagnosis have likely completed their treatment but some may still require clinical monitoring.

Figure 4.2 shows that the prevalence of certain types of cancer depends on the length of the period considered. For example:

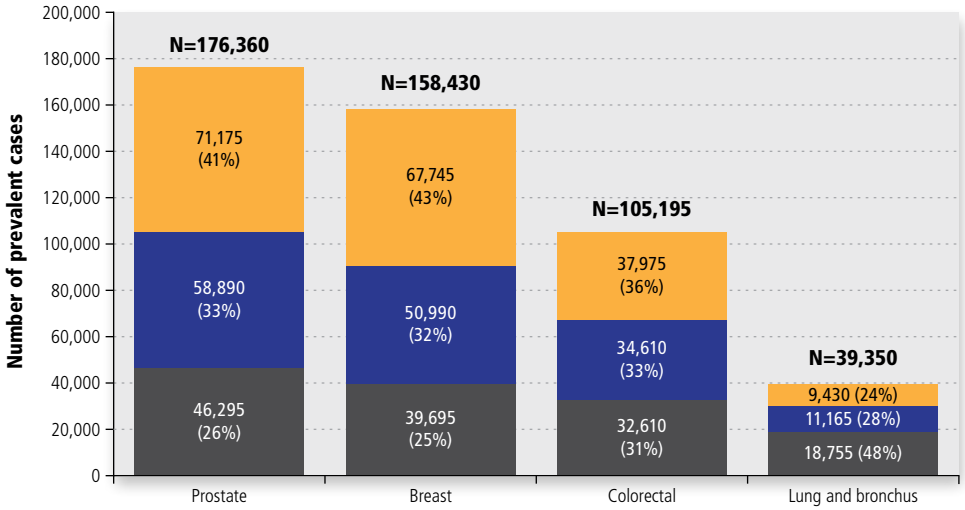
- The prevalence of breast cancer and prostate cancer rises with longer duration compared to other common cancers, such as colorectal and lung cancers.
- The poor prognosis for lung cancer cases means that proportionately fewer individuals with this cancer are alive beyond two years after diagnosis compared to most other cancers.

Person-based prevalence

Among Canadians alive on January 1, 2009, just over 810,000 had been diagnosed with cancer in the previous 10 years (Table 4.3). This number represents approximately 1 in 41 Canadians or 2.4% of the Canadian population (Table 4.4). More specifically, in the 10 years prior to January 1, 2009, among those alive:

- 1 in 94 males had been diagnosed with prostate cancer.
- 1 in 107 females had been diagnosed with breast cancer.
- 1 in 297 males and 1 in 351 females had been diagnosed with colorectal cancer.
- 1 in 907 males and 1 in 813 females had been diagnosed with lung cancer.

FIGURE 4.2 Tumour-based prevalence for the most common cancers by duration, Canada,* January 1, 2009



* During the estimation process, cases from Quebec were excluded because of issues in correctly ascertaining the vital status of cases. The presented estimates, however, are for all of Canada, including Quebec. These estimates assume that sex- and age-specific tumour-based prevalence proportions in Quebec are similar to the rest of Canada. Estimates for lung cancer may be lower than in previous editions of this publication because of the different method used to estimate Quebec's prevalence prior to 2013. For further details, see *Appendix II, Data sources and methods*.

Note: N is the total number of prevalent tumour cases for each cancer type. In the legend, 0 to 2 years refers to those diagnosed in 2007 and 2008; >2 to 5 years refers to those diagnosed between 2004 and 2006; >5 to 10 years refers to those diagnosed between 1999 and 2003. The complete definition of the specific cancers listed here can be found in Table A2.

Analysis by: Health Statistics Division, Statistics Canada
Data source: Canadian Cancer Registry database at Statistics Canada

Some of the individuals included in these numbers were cancer-free, while others were newly or recently diagnosed and were undergoing treatment.

What do these statistics mean?

Knowing the prevalence of cancer is important for estimating and planning healthcare services for cancer. For example, those diagnosed with cancer within the past two years have different needs than those diagnosed between two and five, five and 10 or more than 10 years ago.[1,2]

Earlier chapters and other sources[3] have shown ongoing increases in the number of newly diagnosed cancer cases in Canada and increases in survival from cancer.[4,5] The combined result of these factors is a rise in the number of people living with or beyond a cancer diagnosis. Long after the need for cancer treatment has passed, individuals may still require rehabilitation and supportive care services to address the physical, emotional and spiritual consequences of cancer. The growing demand for such services and the increased complexity of survivors' health needs are just two factors that need to be considered when planning and developing interdisciplinary healthcare.

For more information

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TABLE 4.1 Tumour-based prevalence for selected cancers by prevalence duration and sex, Canada,* January 1, 2009

	10-year (diagnosed since 1999)			5-year (diagnosed since 2004)			2-year (diagnosed since 2007)		
	Total	Males	Females	Total	Males	Females	Total	Males	Females
All cancers	**840,985**	**423,760**	**417,225**	**520,025**	**266,175**	**253,855**	**247,310**	**127,775**	**119,535**
Prostate	176,365	176,365	—	105,180	105,180	—	46,295	46,295	—
Breast	158,430	1,045	157,380	90,685	640	90,050	39,695	285	39,410
Colorectal	105,195	56,650	48,545	67,215	36,860	30,360	32,610	18,130	14,480
Melanoma	39,495	19,895	19,600	23,365	11,985	11,380	10,640	5,530	5,105
Lung and bronchus†	39,350	18,435	20,920	29,920	14,165	15,755	18,755	9,100	9,650
Non-Hodgkin lymphoma	36,220	19,140	17,080	23,145	12,440	10,705	10,760	5,900	4,865
Bladder†	34,255	25,650	8,610	21,130	15,945	5,180	9,940	7,530	2,410
Uterus (body, NOS)	31,610	—	31,610	18,540	—	18,540	8,450	—	8,450
Thyroid	30,930	6,515	24,410	19,240	4,125	15,120	8,625	1,935	6,695
Kidney and renal pelvis	24,175	14,435	9,740	15,195	9,205	5,995	7,480	4,500	2,980
Leukemia	22,510	13,040	9,470	14,620	8,505	6,120	7,150	4,180	2,970
Oral	19,510	12,835	6,675	12,145	8,070	4,080	5,960	4,005	1,950
Ovary	10,695	—	10,695	7,025	—	7,025	3,535	—	3,535
Cervix	10,200	—	10,200	5,500	—	5,500	2,480	—	2,480
Testis	7,935	7,935	—	4,210	4,210	—	1,755	1,755	—
Multiple myeloma	7,460	4,100	3,360	5,615	3,110	2,510	2,885	1,560	1,320
Stomach	7,420	4,625	2,790	5,170	3,250	1,920	3,045	1,955	1,095
Brain/CNS	7,385	4,015	3,370	4,790	2,680	2,110	2,735	1,580	1,155
Hodgkin lymphoma	7,160	3,890	3,270	3,905	2,100	1,805	1,685	900	785
Larynx†	5,575	4,625	955	3,415	2,830	585	1,645	1,375	275
Pancreas	3,750	1,845	1,905	3,140	1,560	1,575	2,320	1,165	1,155
Liver	2,985	2,245	745	2,295	1,725	575	1,455	1,080	370
Esophagus	2,740	2,035	710	2,165	1,610	555	1,485	1,130	355

Analysis by: Health Statistics Division, Statistics Canada
Data source: Canadian Cancer Registry database at Statistics Canada

CNS=central nervous system; NOS=not otherwise specified

— Not applicable

* During the estimation process, cases from Quebec were excluded because of issues in correctly ascertaining the vital status of cases. The presented estimates, however, are for all of Canada, including Quebec. These estimates assume that sex- and age-specific tumour-based prevalence proportions in Quebec are similar to the rest of Canada.

† Prevalence estimates for lung, bladder and larynx cancers may be lower than in previous editions of this publication because a different method was used to estimate Quebec's prevalence prior to 2013. For further details, see *Appendix II: Data sources and methods*.

Note: The complete definition of the specific cancers listed here can be found in Table A2.

TABLE 4.2 Age distribution for 10-year tumour-based prevalence for the most common cancers by sex, Canada,* January 1, 2009

	All cancers			Lung and bronchus†			Colorectal			Prostate	Breast
	Total N=840,985	Males N=423,760	Females N=417,225	Total N=39,350	Males N=18,435	Females N=20,920	Total N=105,195	Males N=56,650	Females N=48,545	Males N=176,365	Females N=157,380
Age (years)	%	%	%	%	%	%	%	%	%	%	%
0–19	0.9	1.0	0.8	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
20–29	1.3	1.2	1.3	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.2
30–39	3.0	2.2	3.9	0.5	0.5	0.6	0.8	0.8	0.9	0.0	2.0
40–49	8.0	5.0	11.1	3.3	2.7	3.9	4.1	3.9	4.3	0.7	11.9
50–59	17.1	13.9	20.5	13.8	12.0	15.5	13.1	13.5	12.6	10.2	24.3
60–69	25.9	27.7	24.0	29.7	30.1	29.4	24.4	27.0	21.4	31.8	26.1
70–79	26.3	31.3	21.2	33.7	35.7	31.9	30.7	32.6	28.4	38.5	20.4
80+	17.4	17.7	17.2	18.6	18.8	18.4	26.6	21.8	32.1	18.8	15.2

Analysis by: Health Statistics Division, Statistics Canada
Data source: Canadian Cancer Registry database at Statistics Canada

N is the total number of prevalent tumour cases for each cancer type by sex.

* During the estimation process, cases from Quebec were excluded because of issues in correctly ascertaining the vital status of cases. The presented estimates, however, are for all of Canada, including Quebec. These estimates assume that sex- and age-specific tumour-based prevalence proportions in Quebec are similar to the rest of Canada.

† Prevalence estimates for lung cancer may be lower than in previous editions of this publication because a different method was used to estimate Quebec's prevalence prior to 2013. For further details, see *Appendix II: Data sources and methods*.

Note: "All cancers" excludes non-melanoma skin cancers (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). Due to rounding, columns may not total 100%. The complete definition of the specific cancers listed here can be found in Table A2.

TABLE 4.3 Person-based prevalence for selected cancers by prevalence duration and sex, Canada,* January 1, 2009

	10-year (diagnosed since 1999)			5-year (diagnosed since 2004)			2-year (diagnosed since 2007)		
	Total	Males	Females	Total	Males	Females	Total	Males	Females
All cancers	**810,045**	**406,065**	**403,980**	**506,200**	**258,070**	**248,130**	**242,810**	**125,040**	**117,770**
Prostate	176,355	176,355	—	105,180	105,180	—	46,295	46,295	—
Breast	158,405	1,045	157,360	90,680	635	90,040	39,690	285	39,410
Colorectal	104,130	55,985	48,145	66,615	36,460	30,155	32,385	17,955	14,420
Melanoma	39,495	19,895	19,600	23,360	11,985	11,375	10,640	5,530	5,105
Lung and bronchus†	39,115	18,335	20,775	29,780	14,105	15,675	18,680	9,065	9,610
Non-Hodgkin lymphoma	36,175	19,110	17,060	23,100	12,410	10,685	10,720	5,875	4,850
Bladder†	34,245	25,640	8,605	21,115	15,940	5,180	9,940	7,530	2,410
Uterus (body, NOS)	31,605	—	31,605	18,535	—	18,535	8,445	—	8,445
Thyroid	30,845	6,500	24,350	19,190	4,100	15,085	8,605	1,925	6,680
Kidney and renal pelvis	24,165	14,420	9,740	15,195	9,200	5,995	7,480	4,495	2,980
Leukemia	22,510	13,040	9,470	14,620	8,500	6,115	7,150	4,180	2,970
Oral	19,320	12,730	6,590	12,055	8,020	4,040	5,925	3,985	1,935
Ovary	10,690	—	10,690	7,025	—	7,025	3,535	—	3,535
Cervix	10,190	—	10,190	5,495	—	5,495	2,480	—	2,480
Testis	7,935	7,935	—	4,210	4,210	—	1,755	1,755	—
Multiple myeloma	7,455	4,100	3,360	5,615	3,105	2,505	2,885	1,560	1,320
Stomach	7,415	4,620	2,790	5,170	3,245	1,920	3,045	1,955	1,090
Brain/CNS	7,375	4,015	3,365	4,785	2,675	2,105	2,735	1,580	1,155
Hodgkin lymphoma	7,160	3,890	3,270	3,905	2,095	1,805	1,685	900	785
Larynx†	5,575	4,620	950	3,415	2,825	585	1,645	1,370	275
Pancreas	3,750	1,845	1,905	3,135	1,560	1,575	2,320	1,165	1,155
Liver	2,985	2,240	745	2,295	1,720	575	1,450	1,080	370
Esophagus	2,740	2,035	710	2,165	1,610	555	1,485	1,130	355

Analysis by: Health Statistics Division, Statistics Canada
Data source: Canadian Cancer Registry database at Statistics Canada

CNS=central nervous system; NOS=not otherwise specified

— Not applicable

* During the estimation process, cases from Quebec were excluded because of issues in correctly ascertaining the vital status of cases. The presented estimates, however, are for all of Canada, including Quebec. These estimates assume that sex- and age-specific person-based prevalence proportions in Quebec are similar to the rest of Canada.

† Prevalence estimates for lung, bladder and larynx cancers may be lower than in previous editions of this publication because a different method was used to estimate Quebec's prevalence prior to 2013. For further details, see *Appendix II: Data sources and methods*.

Note: "All cancers" excludes non-melanoma skin cancers (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). The complete definition of the specific cancers listed here can be found in Table A2.

TABLE 4.4 Ten-year person-based prevalence proportions for the most common cancers by sex, Canada,* January 1, 2009

	Percentage of Canadian population			One in:		
	Total	Males	Females	Total	Males	Females
All cancers	**2.4**	**2.4**	**2.4**	**41**	**41**	**42**
Prostate	—	1.1	—	—	94	—
Lung and bronchus†	0.1	0.1	0.1	857	907	813
Female breast	—	—	0.9	—	—	107
Colorectal	0.3	0.3	0.3	322	297	351

Analysis by: Health Statistics Division, Statistics Canada
Data source: Canadian Cancer Registry database at Statistics Canada

— Not applicable.

* During the estimation process, cases from Quebec were excluded because of issues in correctly ascertaining the vital status of cases. The presented estimates, however, are for all of Canada, including Quebec. These estimates assume that sex- and age-specific person-based prevalence proportions in Quebec are similar to the rest of Canada.

† "One in:" estimates for lung cancer indicate a lower prevalence proportion for males than in previous editions of this publication because a different method was used to estimate Quebec's prevalence prior to the 2013 edition. For further details, see *Appendix II: Data sources and methods*.

Note: "All cancers" excludes non-melanoma skin cancers (neoplasms, NOS; epithelial neoplasms, NOS; and basal and squamous). The complete definition of the specific cancers listed here can be found in Table A2.

CHAPTER 5
Summary: How can these statistics help guide cancer control?

Cancer is a complex disease. While all cancers develop through the same general process of abnormal cell growth, they can have very different causes and outcomes. The risk factors of some cancers are known, like the link between smoking and lung cancer, but others are less clear.

Cancers are often categorized based on the organ, tissue or body system in which they originate (primary site) and their cellular characteristics (histology). Some types of cells are more susceptible to cancer than others, leading to higher incidence rates for those cancers. This is one reason cancer in the breast, for example, is much more common than cancer in the liver. Even in the same body system, some histological types of cancer have a propensity to grow faster and spread (metastasize) through other body systems than others, leading to higher mortality rates. For example, prostate cancers with a high Gleason score (which describes how differently the cancer cells look and behave relative to the normal cells of the prostate gland) tend to grow and spread faster than those with a low score. Different types of cancer also respond by varying degrees to available treatment, affecting survival. The success of treatment is also a function of how much the disease has developed, if it has spread at the time of diagnosis (often described by cancer stage) and other prognostic factors, such as genetics. Finally, the ability to detect cancers early depends on a number of factors, including the location and depth of the tumour, if the cancer causes noticeable symptoms and the availability and effectiveness of screening and early detection tools.

To show how differences between cancer types translate into the wide variation in incidence, mortality, survival and other key population-level statistics presented in this publication, a relative rating was given to each of the most common cancer types for each statistic, as described below.

- Incidence and mortality — Relative ratings were assigned based on the projected number of new cancer cases and cancer deaths reported in Chapters 1 and 2. The ratings were categorized into thirds (tertiles), where red represents the highest third, blue represents the middle third and green represents the lowest third.
- Survival — Relative ratings were assigned based on net five-year survival probabilities listed in Table 3.1. Green represents five-year net survival probabilities of 80% or more, blue represents 50%–79% and red represents less than 50%.
- Preventable — The extent to which the influence of known modifiable risk factors has an effect on the cancer rate. Relative ratings were assigned to each cancer type based on the population-attributable risk reported by Cancer Research UK[1], American Institute of Cancer Research[2], and Alberta Health Services.[3] Green represents cancers for which it is estimated that at least 50% of cases are preventable, blue represents those where 25%–49% are preventable and red where less than 25% are preventable.
- Detectable — The ability to find certain cancers depend on the extent to which organized population-based screening programs, early detection tests or symptoms of cancer are available for a broad population and can be used to detect the disease. Cancer types were assigned relative ratings of green (organized screening programs are available), blue (opportunistic early detection testing is available) and red (no organized screening and limited early detection procedures are available). This category does not include genetic tests or tests for infections like hepatitis C or *Helicobacter pylori* that identify individuals at high risk for cancer.

All cancers, no matter their categorization in Table 5.1, can impose an important burden on individuals diagnosed with cancer and on their families and loved ones. However, from a population-level surveillance perspective and to help focus cancer control efforts, it may be helpful to categorize cancers according to the relative magnitude of their population burden (incidence and mortality rates) and the extent to which they can be prevented or detected early when effectiveness of the treatment is higher and chance of survival is improved.

Lung cancer is a prime example of a high-burden disease (high incidence, high mortality and poor survival) that has the potential to be almost eradicated through preventive measures (e.g., eliminating tobacco use and exposure to radon and asbestos).[1, 3] Cervical cancer, which will be diagnosed in approximately 1,550 women in Canada this year, is also highly preventable and highly detectable. Virtually all cases of cervical cancer are caused by, at least in part, human papillomavirus (HPV).[4] There are now vaccines that can prevent 70%–90% of HPV infections that cause cervical cancer, while others can be prevented or detected early through population-based screening.

Other cancers with a relatively high burden and the potential for prevention are colorectal cancer (through screening) and esophageal cancer (through reductions in alcohol consumption and tobacco use). A large proportion of oral cancers can be prevented by reducing or eliminating tobacco use, including smokeless products.[1-3] Additionally, many oropharyngeal cancers may be preventable through HPV vaccination, which is particularly important among males, where incidence rates are higher and rising at an even faster pace than females.[5]

In contrast, there are many cancers with a medium to high burden that do not have definitively preventable risk factors, are not easily detected through current diagnostic modalities and do not have noticeable early symptoms, causing late-stage diagnoses and limited treatment options. Examples are brain and central nervous system (CNS) cancers, as well as pancreatic cancer. It is important to note that these cancers are not as well understood as others because of difficulties in conducting meaningful clinical research due to their poor prognoses. Nonetheless, there is a need to intensify efforts to better understand the etiology of these diseases and identify more effective diagnostic and treatment strategies.

On the other side of the spectrum are cancers with high incidence rates but relatively good survival (e.g., melanoma and thyroid cancer), which therefore have lower mortality rates (relative to their incidence) than cancers with a poorer prognosis. Other examples of cancers with higher incidence and lower mortality rates include testicular cancer (due to the relative ease with which it can be detected and diagnosed) and low-risk prostate cancer (due in part to widespread use of PSA testing).

Table 5.1 presents a simplified approach to categorizing cancers based on their relative burden in Canada and the extent to which they are preventable, can be detected early or both. The approach does not take into account the fact that rarer cancers can still have a devastating impact on individuals and their families and loved ones, as can those with relatively low mortality rates and high survival. Pediatric cancers and those affecting adolescents and young adults are clear examples of cancers with a lower population burden but high personal burden.

In light of the limitations to the approach presented here, it is important to consider other metrics when describing the burden of cancer, notably potential years of life lost (PYLL). PYLL measures the difference between potential life expectancy and life expectancy of those diagnosed with cancer. Cancers with high PYLL tend to be those that are diagnosed at an early age, particularly in children, adolescents and young adults. Estimates of PYLL are also considerable for the most common cancers. In fact, lung cancer was responsible for 25% of the PYLL due to cancer. For the most common cancers, estimates of PYLL were higher for males than females for both lung cancer (193,000 years versus 176,000 years) and colorectal cancer (81,000 years versus 59,000 years).[6] For female breast cancer, the PYLL was almost 137,000 years, reflecting the fact that women die of breast cancer at a relatively young age. Meanwhile, the PYLL for prostate cancer was considerably lower (24,000 years), reflecting the fact that deaths from prostate cancer tend to occur among men in the older age groups.

In conclusion, it is important to examine the relative burden of cancer measured in a variety of ways, including incidence, mortality and survival, but also potential years of life lost. It is also important to examine these metrics in the context of the extent to which we are currently able to reduce the burden through improved primary prevention, timely and effective early detection and screening, and evidence-based and patient-centred diagnosis and treatment. Such assessments can help highlight gaps and opportunities in population-based cancer control strategies and help identify priority areas for clinical and health services research.

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TABLE 5.1 Summary of key cancer control and outcome characteristics by cancer type

	Incidence		Mortality				
	Males	Females	Males	Females	Survival	Preventable	Detectable
Lung and bronchus							
Colorectal							
Breast							
Prostate							
Bladder							
Non-Hodgkin lymphoma							
Uterus (body, NOS)							
Melanoma							
Thyroid							
Kidney and renal pelvis							
Leukemia							
Pancreas							
Oral							
Stomach							
Brain/CNS							
Multiple myeloma							
Ovary							
Liver							
Esophagus							
Cervix							
Larynx							
Testis							
Hodgkin lymphoma							

CNS=central nervous system;
NOS=not otherwise specified

CHAPTER 6
Special topic: Pancreatic cancer

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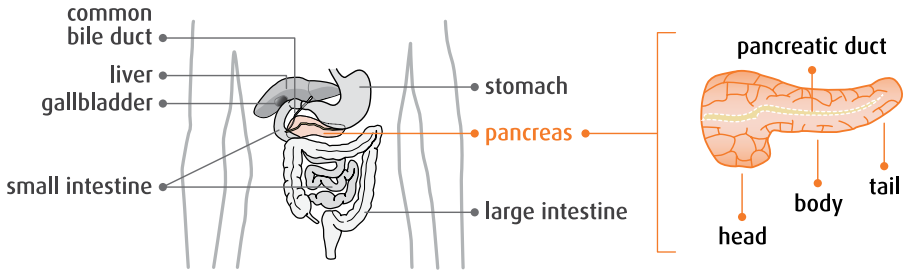
Highlights

- In 2017, it is expected that 5,500 Canadians will be diagnosed with pancreatic cancer and about 4,800 will die from the disease.
- The high number of pancreatic cancer deaths relative to cases reflects its very poor prognosis. Only 50% of people with pancreatic cancer survive beyond about four months, and five-year survival is only about 7%.
- Because the pancreas is so deep in the abdomen, more than 60% of pancreatic cancers are diagnosed at a late stage, limiting the chance that it can be successfully treated with surgery. Pancreatic cancer is relatively unresponsive to chemotherapy and radiation.
- Unlike the other leading causes of cancer death, there have been limited improvements in the prevention, detection and treatment of pancreatic cancer over time. In the near future, pancreatic cancer is expected to surpass breast cancer and become the third leading cause of cancer-related death in Canada.
- As detection and treatment options remain poor, primary prevention (which includes limiting exposure to smoke and avoiding excess body weight) may play an important role in reducing the burden of pancreatic cancer.

IMAGE A Anatomy of the pancreas and surrounding structures



Introduction

The pancreas is a long, tapered gland found deep in the abdomen (Image A). The head of the pancreas is surrounded by the duodenum, which is the first part of the small intestine. The tail is between the stomach and spine.

There are two types of cells in the pancreas: exocrine cells and endocrine cells. Exocrine cells produce enzymes that help the body digest food and absorb nutrients. Endocrine cells produce several hormones, including insulin, which helps the body regulate sugars in the blood.

Most pancreatic cancers start in exocrine cells. These cancers tend to be much more aggressive and have a poorer prognosis than pancreatic cancers that start in endocrine cells.

Because the pancreas lies deep in the abdomen, pancreatic cancer often grows for weeks or months without causing any symptoms. However, as the tumour grows larger, it may begin to press on nearby structures and cause symptoms. Pressure on nerves can cause pain; pressure on the intestines can cause nausea and weight loss; and pressure on the ducts in the pancreas can cause jaundice and itching. Because most pancreatic cancers are not detected until symptoms develop, they are often diagnosed at a stage when curative surgery is no longer an option. As a result, the prognosis for pancreatic cancer is often very poor.

While pancreatic cancer is the 12th most commonly diagnosed cancer in Canada (Table 1.2), it is the fourth leading cause of cancer-related death (Table 2.2). Its high mortality relative to incidence is the result of the very low survival rate among individuals diagnosed with pancreatic cancer. Pancreatic cancer has the lowest five-year age-standardized net survival of the 23 cancers reported in this publication (Table 3.1).

Knowledge on pancreatic cancer prevention is limited, but there are some known risk factors. For example, smoking and excess body weight are well-established risk factors for pancreatic cancer.[1] While having a family history of pancreatic cancer is not a modifiable risk factor, it is also associated with an increased risk for the disease. Interestingly, a history of allergies is associated with lower risk for pancreatic cancer.[2]

Limited progress has been made in preventing, detecting and treating pancreatic cancer, especially relative to other leading causes of cancer and cancer death. In the United States, pancreatic cancer is projected to become the second leading cause of cancer-related death by 2030, surpassed only by lung cancer.[3] To address the important burden of this disease, we need to better understand the impact of pancreatic cancer here in Canada.

Epidemiology of pancreatic cancer in Canada

In 2017, it is projected that 5,500 Canadians will be diagnosed with pancreatic cancer and 4,800 will die from the disease (Table 6.1). The age-standardized incidence rates are generally higher in males and in older age groups, but they are similar across the geographical regions of Canada. The following sections describe pancreatic cancer burden in greater detail. Results are generally based on actual (not projected) data.

Incidence

Based on the most recent data available (which excludes Quebec data), approximately 9.9% of pancreatic cancers in Canada are endocrine pancreatic cancers (data not shown; see *Appendix II: Data sources and methods* for details). While these represent only a small proportion of all pancreatic cancers, they have a much better prognosis than pancreatic cancers that originate in the exocrine cells.

The overall age-standardized incidence rate (ASIR) of pancreatic cancer has remained relatively unchanged since 1992 (Figure 6.1), suggesting there has been limited improvement in preventing the disease.

Incidence

The number of new cancer cases diagnosed in a given period of time, often a year.

Age-standardized incidence rate (ASIR)

The number of new cases of cancer per 100,000 people, standardized to the age structure of the 2011 Canadian population. In this publication, ASIR is also referred to as "incidence rate."

Annual percent change (APC)

The estimated change in the age-standardized rate per year over a defined period of time in which there is no significant change in trend (i.e., no changepoint). It is reported as a percentage.

Statistical significance

Refers to a result that is unlikely due to chance given a predetermined threshold (e.g., fewer than 1 out of 20 times, which is expressed as $p<0.05$).

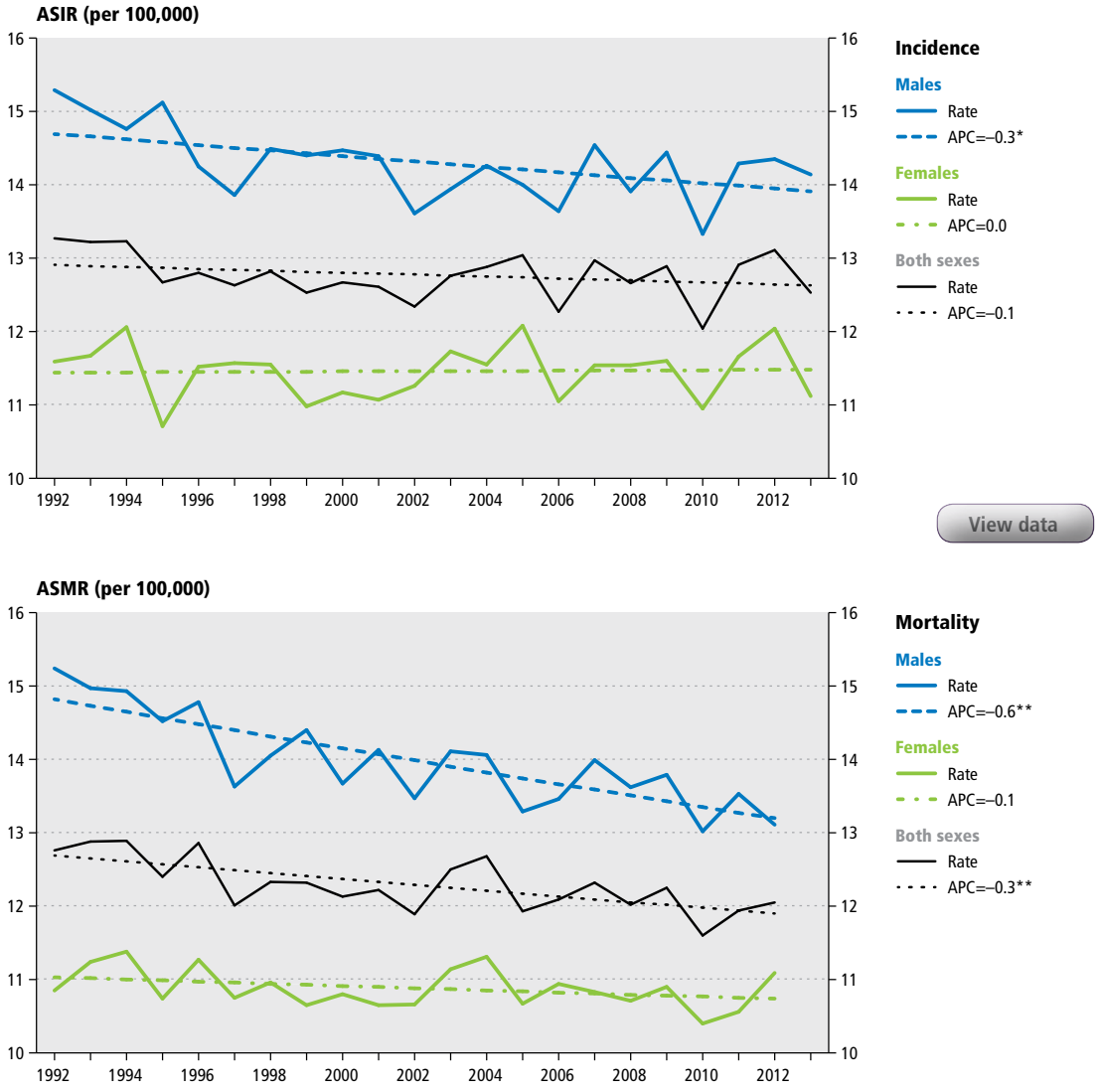
Province or territory

Refers to the province or territory of a person's permanent residence at the time of cancer diagnosis or cancer death. The most recent actual data on cancer cases used for all provinces and territories are to 2013 (except Quebec, for which data are to 2010) and projected thereafter. The most recent actual data for deaths are to 2012.

Incidence by sex, age and geographic region

The number of pancreatic cancers diagnosed is similar in males and females (Table 6.1), but the ASIR, for pancreatic cancer is higher in males (Figure 6.1). This higher rate in males is despite the fact that the rate of pancreatic cancer has been declining slightly in males since 1992 (by 0.3% per year) and has remained relatively stable among females. The sex differences in pancreatic cancer are not fully understood but are likely at least partially attributable to differences in exposure to risk factors, notably smoking.[4]

FIGURE 6.1 Trends in age-standardized incidence (1992–2013) and mortality (1992–2012) rates and annual percent change (APC) for pancreatic cancer, by sex, Canada



* APC significantly differs from 0, p<0.05

** APC significantly differs from 0, p<0.001

Note: Actual incidence data were available to 2013 for all provinces and territories except Quebec, for which data were available to 2010 and projected thereafter. Actual mortality data were available to 2012. Rates are age-standardized to the 2011 Canadian population. For further details, see *Appendix II: Data sources and methods.*

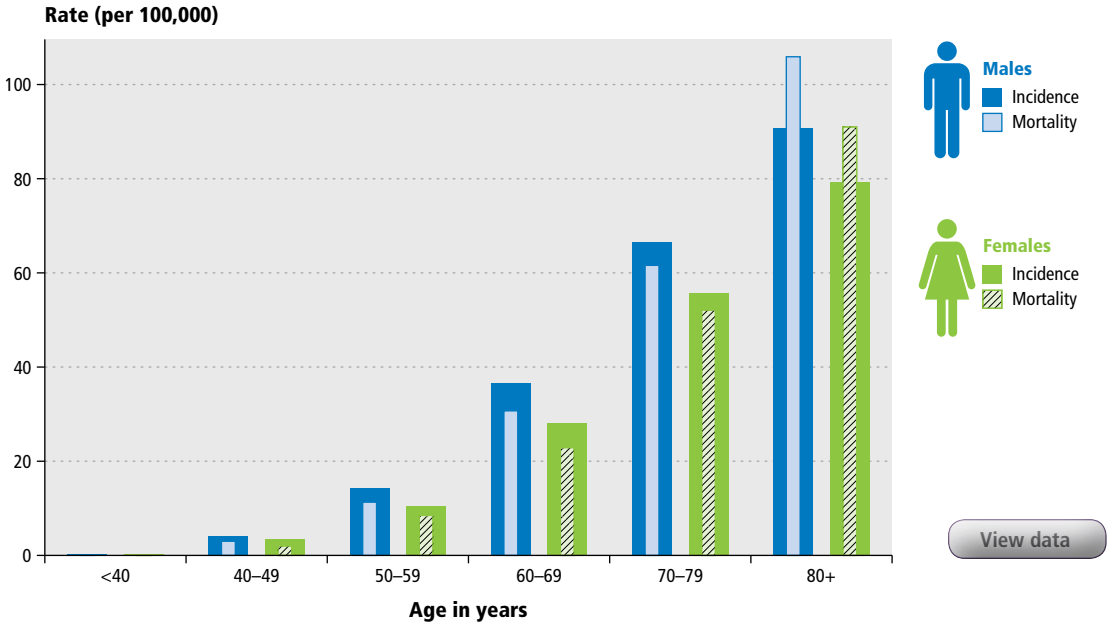
Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry, National Cancer Incidence Reporting System and Canadian Vital Statistics Death databases at Statistics Canada

The risk for pancreatic cancer increases dramatically with age. Over 80% of pancreatic cancers are diagnosed in Canadians 60 years of age and older, and rates are highest among those who are aged 80 years or more (Figure 6.2).

Figure 6.3 displays pancreatic cancer rates over time for different age groups (additional information is provided online). The risk for pancreatic cancer has increased since 1992 among Canadians under the age of 50 years, but overall incidence rates remain low at less than 4 per 100,000 (Table 6.1). In the oldest age group (80+ years) rates of pancreatic cancer are decreasing by a modest 0.5% per year.

Pancreatic cancer incidence rates vary slightly by province (Figure 6.4). Compared to the Canadian average, rates are significantly lower in Newfoundland and Labrador and Ontario, while they are significantly higher in Quebec and Manitoba. The reasons for these differences are not well understood.

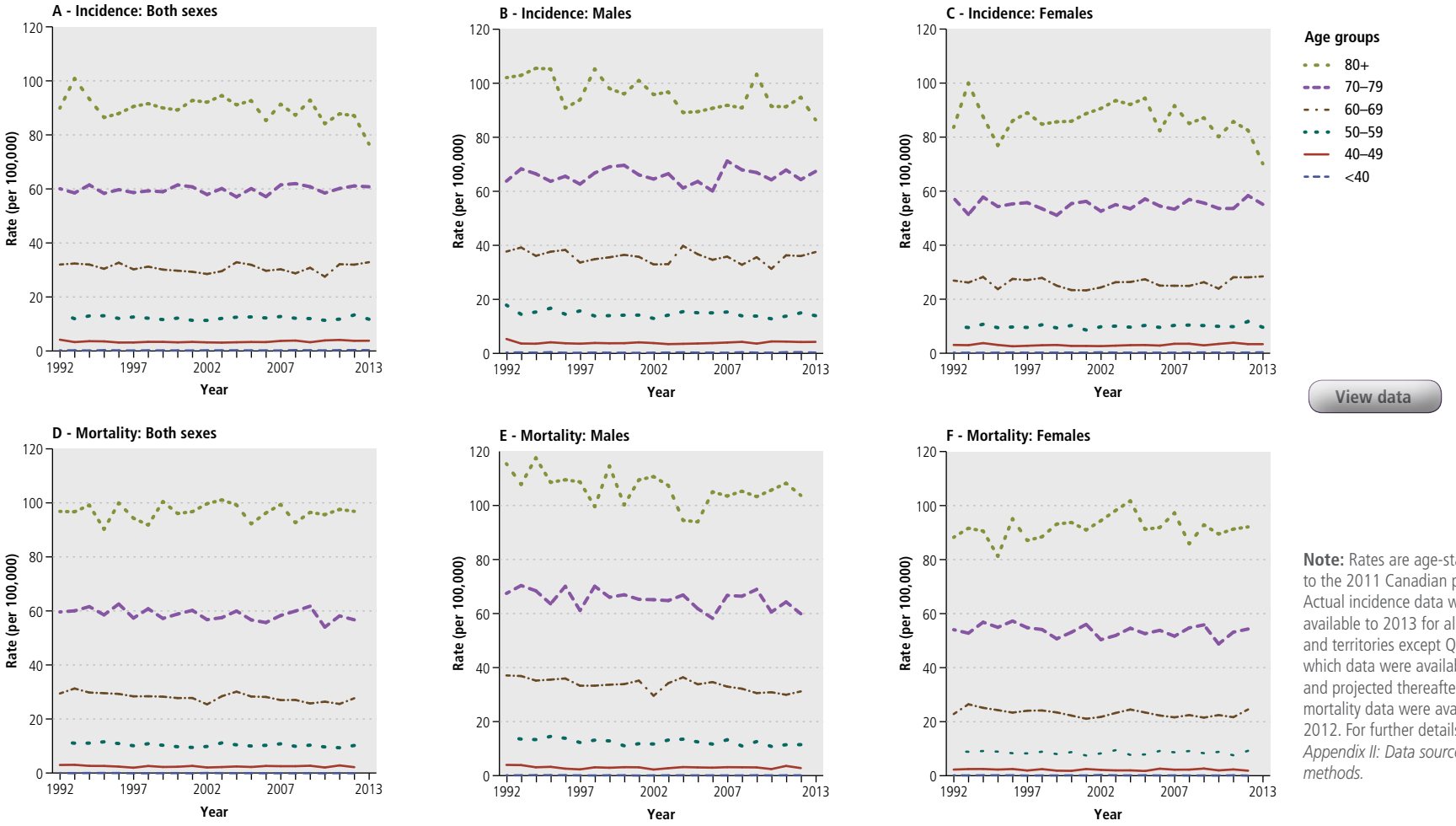
FIGURE 6.2 Age-standardized pancreatic cancer incidence (2011–2013) and mortality (2010–2012) rates, by age group, Canada



Note: Rates are based on three years of pooled data from 2011–2013 for incidence and 2010–2012 for mortality. Rates are age-standardized to the 2011 Canadian population. Actual incidence data were available to 2013 for all provinces and territories except Quebec, for which data were available to 2010 and projected thereafter. Actual mortality data were available to 2012. For further details, see *Appendix II: Data sources and methods*.

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry, National Cancer Incidence Reporting System and Canadian Vital Statistics Death databases at Statistics Canada

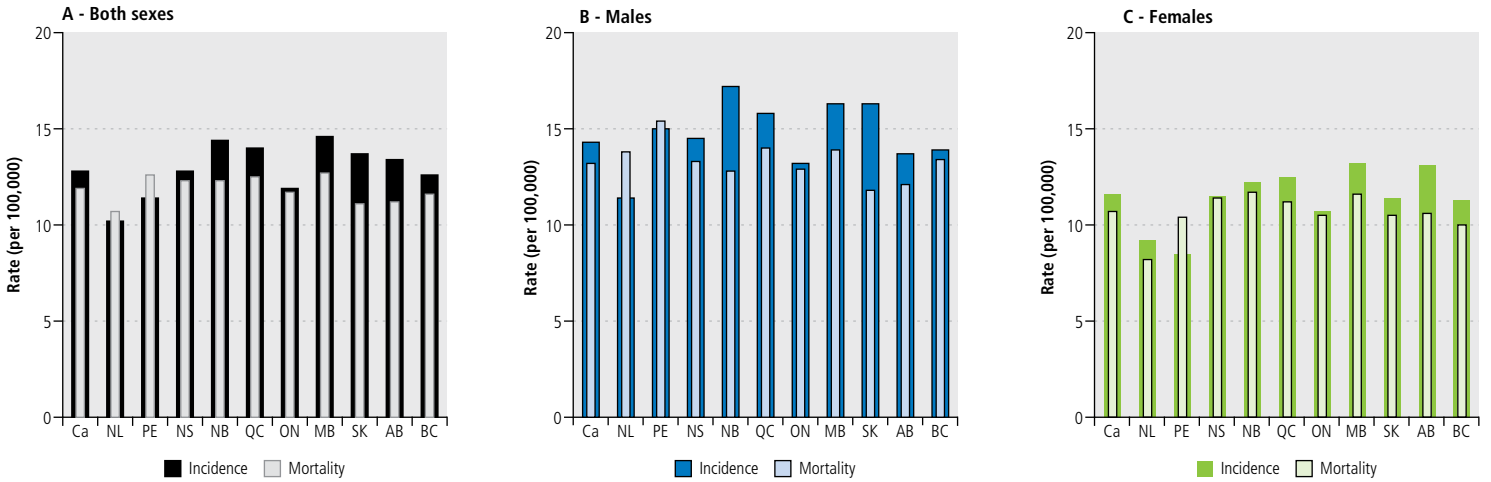
FIGURE 6.3 Age-specific pancreatic cancer incidence (1992–2013) and mortality (1992–2012) rates, by sex, Canada



Note: Rates are age-standardized to the 2011 Canadian population. Actual incidence data were available to 2013 for all provinces and territories except Quebec, for which data were available to 2010 and projected thereafter. Actual mortality data were available to 2012. For further details, see *Appendix II: Data sources and methods.*

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry, National Cancer Incidence Reporting System and Canadian Vital Statistics Death databases at Statistics Canada

FIGURE 6.4 Age-standardized pancreatic cancer incidence (2011–2013) and mortality (2010–2012) rates, by sex and geographic region



View data

Note: Rates are based on three years of pooled data from 2011–2013 for incidence and 2010–2012 for mortality. Actual incidence data were available to 2013 for all provinces and territories except Quebec, for which data were available to 2010 and projected thereafter. Rates are age-standardized to the 2011 Canadian population.

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry, National Cancer Incidence Reporting System and Canadian Vital Statistics Death databases at Statistics Canada

Stage at diagnosis

Table 6.2 shows the distribution of pancreatic cancer by stage at diagnosis for provinces from which data were available: Alberta, Manitoba, Saskatchewan, Nova Scotia, Prince Edward Island and Newfoundland and Labrador. These data excluded non-residents but were not restricted based on age, sex or method of diagnostic confirmation (e.g., death certificate only, clinical/radiological cases). The findings indicate that over 60% of pancreatic cancers were diagnosed at stage III or IV, stages at which curative treatment options are limited. The percentage of cancers diagnosed at a metastatic stage (stage IV) ranged from 52% in Manitoba to 59% in Prince Edward Island. Only 10% of pancreatic cancers were diagnosed at stage I. In 7% of cases, the stage at diagnosis was not known. Unknown stage can arise when, for example, the case is identified based on death certificate only or when insufficient data are available to the registry to assign stage. This distribution is similar to what is reported in the United States.[5] The high percentage of pancreatic cancers diagnosed at a late stage underscores the need for better early detection strategies.

Cancer stage

Staging is a way of classifying a cancer based on its size, location and if (or the extent to which) it has spread. Invasive cancers are often assigned a stage from I to IV (1 to 4). Stage I usually means the cancer is relatively small and contained to the organ or location where it originated. Stage II usually means the cancer is larger than stage I and it may have spread to a surrounding structure or the lymph nodes (localized spread). Stage III has likely spread to a surrounding structure or to the lymph nodes (regional spread). Stage IV (also called metastatic) cancer has spread to a distant part of the body. The most common site of pancreatic cancer metastases is the liver, but it can also spread to other organs, such as the lung or brain.

Cancer stage at diagnosis plays an important role in determining the appropriate treatment approach and assessing prognosis. In general, the earlier the stage at diagnosis, the better the prognosis.

Mortality

With a projected age-standardized mortality rate (ASMR) of 11.9 per 100,000 for 2017, the mortality rate of pancreatic cancer is almost as high as its incidence rate (13.5 per 100,000). However, whereas overall incidence rates have remained relatively unchanged since 1992, the mortality rates have been improving slowly, decreasing by about 0.3% per year (Figure 6.1). This decline in overall mortality is primarily driven by the decrease in mortality rate of approximately 0.6% per year (1992–2012) observed among males. Nevertheless, pancreatic cancer mortality rates remain higher among males than females. The patterns in pancreatic cancer mortality by sex mirror those of incidence.

Deaths

The number of cancer deaths in a given period of time, often a year.

Age-standardized mortality rate (ASMR)

The number of cancer deaths per 100,000 people, standardized to the age structure of the 2011 Canadian population. In this publication, ASMR is also referred to as "mortality rate."

Despite the modest decline in ASMRs, the number of pancreatic cancer deaths in Canada has been increasing. This is a reflection of Canada's growing and aging population and of the corresponding increase in the number (not rate) of cancers diagnosed in the country.[6] Figure 6.5 shows that if recent trends continue, pancreatic cancer will surpass breast cancer and become the third leading cause of cancer-related death in Canada in the very near future.

Mortality by age and geographic region

Mortality rates for pancreatic cancer increase dramatically with age (Figure 6.2). Among individuals aged 80 years and older, three-year average mortality rates for pancreatic cancer (96.9 per 100,000) are higher than incidence rates (83.7 per 100,000). This is likely due to an under-estimation of pancreatic cancer cases in this age group, rather than to an over-estimation of pancreatic cancer deaths.

Pancreatic cancer mortality rates are decreasing over time in three of the six age groups, but rates are not changing significantly in the oldest age groups, where mortality rates are highest (Figure 6.3). Rates are not increasing in any age group (see online data).

Figure 6.4 shows that the ASMR is significantly lower in Newfoundland and Labrador (9.6 per 100,000) compared to the Canadian average (12.0 per 100,000). This is primarily driven by the low pancreatic cancer death rate of females in Newfoundland and Labrador. Newfoundland and Labrador also has the lowest incidence rates for pancreatic cancer in the country.

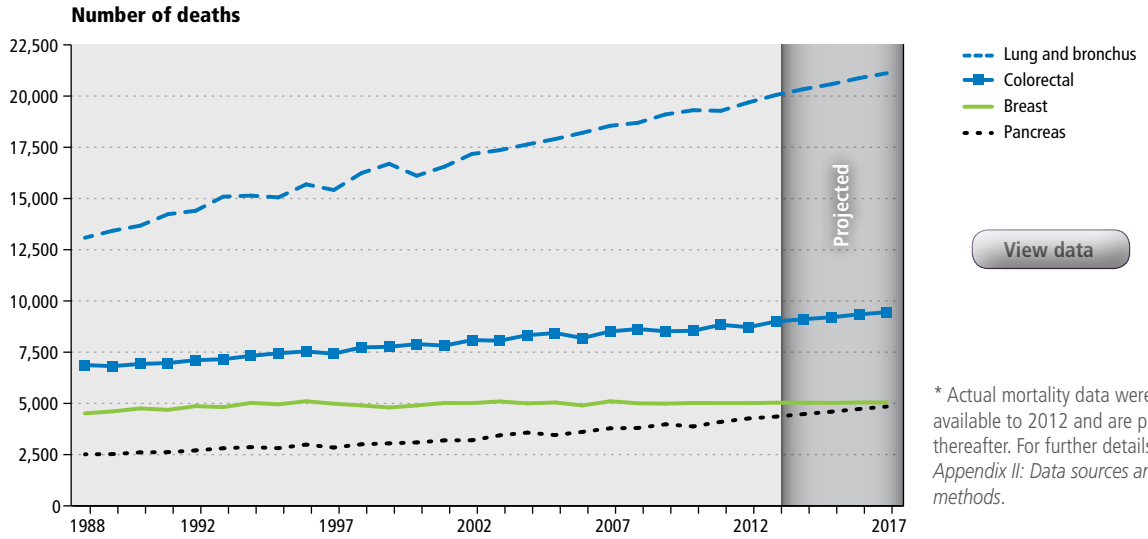
The burden of pancreatic cancer: A global perspective

Pancreatic cancer is the seventh leading cause of cancer-related death in the world.[7] It is estimated that more than 330,000 individuals died of the disease in 2012. The number of deaths is only about 3% lower than the number of individuals who were diagnosed with pancreatic cancer that year, reflecting the low pancreatic cancer survival rates globally.

It is estimated that the overall five-year survival rate for pancreatic cancer is about 5%–6%.[4] Given the limited opportunities for early detection and successful treatment for this disease, there tends to be little variation in survival rates between developed and less-developed countries.

In contrast, incidence and mortality rates for pancreatic cancer are generally much higher in developed countries than in less-developed countries.[7] ASIRs are highest in North America and Western Europe, followed by other regions in Europe and Australia and New Zealand. Similar patterns are reported for mortality, with the highest rates observed in North America and Europe. The lowest incidence and mortality rates are reported for South and Central Asia and Central Africa. The reasons for these geographic patterns are not fully understood, but they are at least partially attributed to higher tobacco consumption in higher-income countries as well as poorer quality data collection in less-developed countries.

FIGURE 6.5 Number of cancer deaths, top four leading causes of cancer death, 1988–2017,* Canada



* Actual mortality data were available to 2012 and are projected thereafter. For further details, see *Appendix II: Data sources and methods*.

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics death database at Statistics Canada

Survival

Survival from pancreatic cancer is very poor. The predicted five-year age-standardized net survival for pancreatic cancer was the lowest among the 23 cancers studied in this publication. It was approximately half the survival for esophageal cancer, which had the second lowest survival (Table 3.1). The predicted five-year age-standardized net survival for pancreatic cancer during the 2004 to 2008 period was 6.9%, up from 5.0% during the period of 1992 to 1996 (Table 6.3). These survival numbers are slightly different from those presented in Chapter 3 because a longer time period was used here. The lower net survival reported in this chapter for the 2004 to 2008 period (compared with 2006 to 2008 in Chapter 3) may reflect a slight increase in survival over time or statistical variation. Increases in net survival over this time period were similar in males and females with higher survival among females (Figure 3.2).

In terms of age at diagnosis, net survival was highest in the youngest age group and declined with each successive age group. Increases in pancreatic cancer survival by age group over time appear to indicate greater improvements in the younger age groups (Table 6.3). However, there was also considerably more variability in the estimates for younger age groups due to the lower incidences in these populations.

In general, estimates of five-year age-standardized net survival for pancreatic cancer show little geographical variation (Table 6.3). One notable exception, however, is the consistently higher estimates of net survival in Ontario. At 9.7%, the predicted five-year age-standardized net survival for Ontario for the 2004 to 2008 period was almost double that of the next highest provincial estimate. This phenomenon has been previously investigated and attributed to the assumption that a meaningful proportion of deaths among pancreatic cancer cases are not captured in Ontario due to incomplete death clearance,[8] a notion supported by additional investigation performed for this publication (see *Appendix II: Data sources and methods*).

Net survival

The survival probability that would be observed in the hypothetical situation where the cancer of interest is the only possible cause of death (i.e., the survival as far as the cancer of interest is concerned). Net survival is the preferred method for comparing cancer survival in population-based cancer studies because it adjusts for the fact that different populations may have different levels of background risk of death. It can be measured over various timeframes but, as is standard in other reports, five years has been chosen as the primary duration of analysis for this publication.

Age-standardized net survival

The net survival that would have occurred if the age distribution at diagnosis of the group of people with the cancer under study had been the same as that of the standard population. For each cancer, the standard population was typically based on persons diagnosed with that cancer in Canada from 2004 to 2008.

Confidence interval (CI)

A range of values that provides an indication of the precision of an estimate. Confidence intervals are usually 95%, which means that, assuming no other sources of bias, one can be 95% confident the range contains the true value for the estimate of interest. Confidence limits (CL) report the upper and lower bound of the interval.

Median survival

The midpoint of survival time after diagnosis. Approximates the length of time after the date of diagnosis at which about half of the individuals diagnosed with cancer have died and half continue to survive.

Conditional survival

The net survival probability of surviving an additional five years provided that a given amount of time has already been survived.

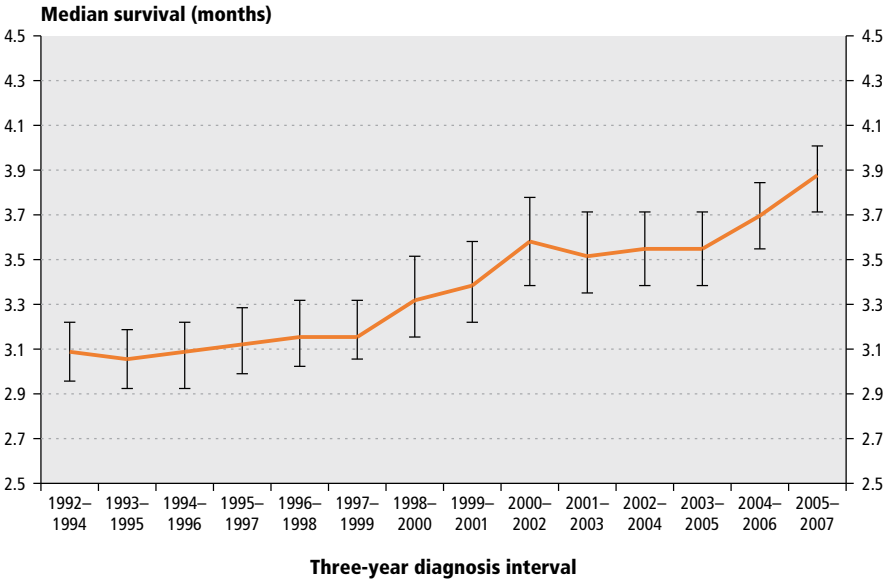
Cumulative survival

The net survival probability over a specified time interval from the date of diagnosis of cancer.

The relatively high survival in Ontario has a large effect on the national estimate (which excludes data from Quebec). Also excluding Ontario from the national data reduced the five-year age-standardized net survival estimate from 6.9% to 4.5% (4.1% males; 4.8% females) (data not shown). Corresponding age-specific estimates were also reduced. They dropped to 18.6%, 7.2%, 6.5%, 3.6% and 2.6% for those aged 15–44, 45–54, 55–64, 65–74 and 75–99 years, respectively. Other than Ontario, the largest percentage unit increase in five-year age-standardized net survival since the early- to mid-1990s was observed for Saskatchewan, which had the lowest survival in the 1992 to 1996 period (Table 6.3). New Brunswick had the next largest improvement in five-year age-standardized net survival, which increased from 2.5% in the 1992 to 1996 period to 5.1% in the 2004 to 2008 period.

Survival from pancreatic cancer is also very poor in the short term, with considerable loss of life in the first year after diagnosis. The median all-cause survival for pancreatic cancer cases diagnosed from 2005 to 2007 was 3.9 months, or just under 17 weeks (Figure 6.6), which is a three-and-a-half week increase compared with the 1992 to 1994 time period. The biggest gains appear to have arisen between the periods 1997 to 1999 and 2000 to 2002 and between the periods 2003 to 2005 and 2005 to 2007. A distinct trend of progressively shorter median survival times with advancing age has been noted elsewhere, and differences in age-specific net survival for pancreatic cancer are evident as early as one month after diagnosis.[9]

FIGURE 6.6 Pancreatic cancer median survival times*, ages 15–99, Canada (excluding Quebec†), 1992–1994 to 2005–2007



Analysis by: Health Statistics Division, Statistics Canada
Data source: Canadian Cancer Registry database at Statistics Canada

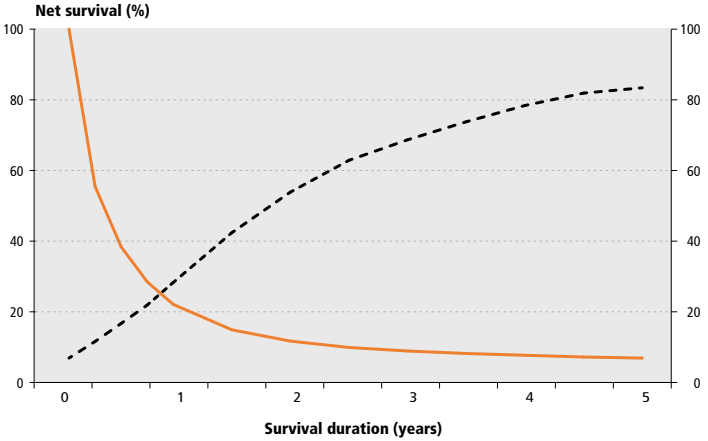
* Survival times were measured from the date of diagnosis to the date of death from any cause. Survival times were sorted by duration; the midpoint of these times is referred to as the median survival time. As such, median survival is viewed as the length of time after diagnosis at which approximately half of individuals diagnosed with pancreatic cancer have died and half continue to survive. Rolling three-year periods were used to reduce variability in individual estimates. Error bars refer to 95% confidence intervals.

† Data from Quebec were excluded, in part, because the method for ascertaining the date of cancer diagnosis differs from the method used by other provinces and territories, and because of issues in correctly ascertaining the vital status of cases.

View data

Poor short-term survival for pancreatic cancer is also evident in the steep initial decline in the cumulative net survival curve for this cancer (Figure 6.7). The predicted age-standardized net survival was 38.4% at six months, dropped to 22.1% at one year and decreased further to 8.9% at three years post diagnosis. While the initial five-year prognosis among those diagnosed with this disease is quite poor, among those who survive one or more years the outlook for surviving an additional five years greatly improves. For example, the five-year age-standardized conditional net survival improved from 6.9% at diagnosis to 28.3%, 68.7% and eventually 83.4% among those who survived the first one, three and five years, respectively.

FIGURE 6.7 Five-year age-standardized net survival for pancreatic cancer, Canada (excluding Quebec),* 2004–2008



View data

Analysis by: Health Statistics Division, Statistics Canada
Data source: Canadian Cancer Registry database and life tables at Statistics Canada

* Data from Quebec were excluded, in part, because the method for ascertaining the date of cancer diagnosis differs from the method used by other provinces and territories, and because of issues in correctly ascertaining the vital status of cases.

† Conditional survival estimates represent the net survival probability of surviving an additional five years provided that a given amount of time has already been survived.

Note: The period method of survival analysis was used. Net survival was estimated using age-standardized relative survival ratios. For further details see *Appendix II: Data sources and methods*. The age distribution of persons recorded as being diagnosed with pancreatic cancer in Canada from 2004–2008 was used as the standard.

Risk Factors

As with many cancers, age is a significant risk factor for pancreatic cancer with most cases occurring in individuals aged 60 years and older. Pancreatic cancer is also more common in males than females. Aside from age and sex, there are several known and possible risk factors for pancreatic cancer,[1] the most notable of which are described in this section. As several of these risk factors are modifiable, primary prevention efforts may help stop cases of pancreatic cancer from ever developing.

Tobacco

Smoking is one of the most well-established risk factors for pancreatic cancer.[10] This relates to cigarette smoking as well as other forms of tobacco smoking (e.g., cigars and pipe).[1, 11] It is estimated that about 17% of pancreatic cases diagnosed in Canada in 2012 are attributable to smoking (Figure 6A). This percentage ranges from 20%–25% in other jurisdictions, which may reflect differences in prior smoking exposure.[1, 11, 12] The evidence on smokeless tobacco use (e.g., chewing and snuff tobacco) as a risk factor for pancreatic cancer has been less consistent, where some studies identify an increased risk while others do not find an association.[1]

Excess body weight

Evidence consistently suggests excess body weight (as defined by body mass index [BMI] or other measures) increases the risk of pancreatic cancer.[1, 12, 13] A recent study in the United Kingdom estimates that approximately 12% of new pancreatic cancer cases could be attributed to obesity. In Canada, approximately 7% of pancreatic cancer cases are attributable to being overweight or obese (Figure 6A).

Medical and family history

A history of certain medical conditions elevates pancreatic cancer risk. For example, long-term diabetes has been consistently identified as risk factor for pancreatic cancer.[14] Pancreatitis (inflammation of the pancreas) is also associated with an increased risk for pancreatic cancer.[15] As chronic pancreatitis is often associated with excessive consumption of alcohol, some of the reported associations between pancreatitis and pancreatic cancer risk may be in part attributable to alcohol consumption.

Although not a modifiable risk factor, a family history of pancreatic cancer has been associated with an 80% increased risk of developing the disease.[16, 17] A number of inherited gene mutations, including BRCA1 and BRCA2, are believed to increase the risk for pancreatic cancer, but more research is needed in this area.[1]

Interestingly, studies show that allergies, most notably hay fever and animal allergies, reduce the risk for pancreatic cancer by 20%–30%.[18, 19] Although these risk factors are not amenable to prevention initiatives, understanding the relationship between the immune system and cancer risk may provide important insight into the etiology of this disease.

Alcohol

Alcohol is considered a possible risk factor for pancreatic cancer, particularly with heavy consumption.[20] A recent review of the evidence suggested consumption of approximately three or more alcoholic drinks per day is associated with at least a 20% increase in risk compared to consumption of one or fewer drinks per day. Despite this possible association, the data shown in Figure 6A suggests that less than 1% of pancreatic cancer cases diagnosed in 2012 were attributable to alcohol consumption. It is also possible that smoking modifies the relationship between alcohol and pancreatic cancer risk, where pancreatic cancer risk due to drinking is only elevated among smokers.[21]

Diet

The association between diet and pancreatic cancer risk is still not well understood, and studies have shown less consistency than with other risk factors. However, it is possible that higher consumption of fruits and vegetables decreases the risk, while red meat intake increases the risk.[22] The results displayed in Figure 6A provides evidence to support the association between diet and pancreatic cancer, suggesting that approximately 9% and 4% of pancreatic cancers diagnosed in 2012 were caused by inadequate vegetable and fruit intake, respectively. Although coffee was once thought to be a risk factor for pancreatic cancer, evidence currently suggests there is no association.[1]

Summary

Because of the poor prognosis for pancreatic cancer, prevention strategies have considerable appeal. For some people, smoking cessation and maintaining a healthy body weight may help reduce the risk for pancreatic cancer. However, the majority of pancreatic cancers are not directly linked to modifiable risk factors, limiting current prevention opportunities. Improved understanding of how to prevent this cancer could have a major impact on reducing its burden.

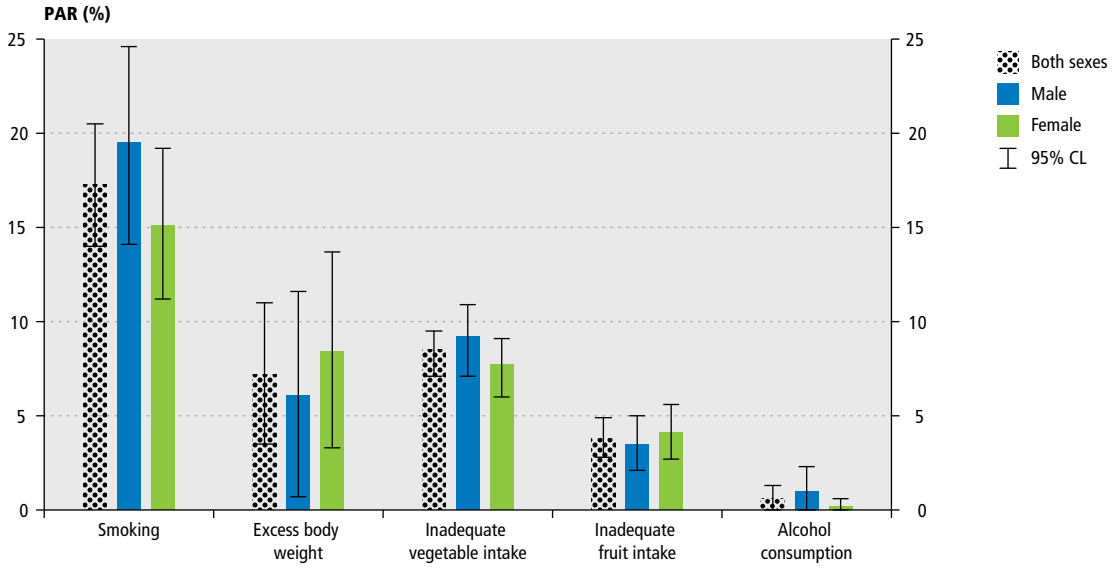
The percentage of pancreatic cancer cases caused by modifiable risk factors

The population attributable risks (PAR) presented in Figure 6A estimate the percentage of pancreatic cancer cases in Canada caused by previous exposure to smoking, alcohol consumption, excess body weight and low intake of vegetables and fruits. These findings were provided by the Canadian Population Attributable Risk of Cancer (ComPARe) project, which is aimed at estimating the percentage of cancer cases in Canada caused by preventable lifestyle and environmental exposures. The Canadian Community Health Survey (Cycles 1.1 and 2.1) was used to estimate the prevalence of the risk factors listed in Figure 6A, and cancer incidence for the 2012 diagnosis year was obtained from the Canadian Cancer Registry. Additional details on the methods used to estimate PARs are provided in *Appendix II: Data sources and methods*.

An estimated 17% of pancreatic cancer cases diagnosed in Canada in 2012 were attributable to smoking. The higher PAR for smoking in males compared to females reflects the higher smoking prevalence among males, though the difference in PARs is not statistically significant. Inadequate vegetable and fruit consumption was associated with approximately 9% and 4% of all cases, respectively, whereas an estimated 7% of all pancreatic cancer cases were associated with excess body weight. It is estimated that heavy alcohol consumption caused about 0.6% of all cases.

Because these PARs provide an estimate of the percentage of cases that could be avoided if the risk factor was eliminated, they can be used to help inform prevention initiatives and cancer control priorities for pancreatic cancer.

Figure 6A Population attributable risk of modifiable risk factors for pancreatic cancer



Detection

Unfortunately, opportunities for early detection are limited.

Cystic tumours of the pancreas, known as intraductal papillary mucinous neoplasms (IPMN), are precancerous lesions that progress to cancer in 5%–60% of cases. Current guidelines recommend surgically resecting (i.e., removing) lesions that have features associated with an increased risk for cancer.[23] However, more than 95% of pancreatic cancers do not arise from IPMN, and the vast majority of people who develop pancreatic cancer do not develop their cancer from an identifiable precursor lesion. As a result, there is currently no effective or recommended screening strategy for pancreatic cancer in the general population.

Considerable research efforts have focused on evaluating the effectiveness of screening in people with an increased risk for pancreatic cancer due to family history, certain inherited gene mutations (such as BRCA2, p16 and hereditary non-polyposis colorectal cancer gene mutations) and hereditary pancreatitis. Researchers have investigated a number of screening strategies, including blood, stool and saliva testing. They have also looked at a variety of imaging techniques, such as endoscopic ultrasound, computerized tomography (CT) scans and magnetic resonance imaging (MRI). Unfortunately, the benefits of these tests and optimal screening strategy remain unclear.[24]

As previously described, pancreatic cancer often goes undetected for months, growing silently without any symptoms. Symptoms often begin when the tumour grows big enough to affect nearby structures, including nerves (which may present as pain in the upper abdomen), the small intestine (which may lead to nausea and weight loss) or the common bile duct (which can cause jaundice). By the time symptoms present and it is diagnosed, pancreatic cancer is often at an advanced stage, limiting treatment options.

Treatment

Surgical removal of the tumour remains the backbone of potentially curative treatments for pancreatic cancer.[25] Unfortunately, pancreatic cancer is typically diagnosed at an advanced or metastatic stage because it does not cause symptoms in its early stages and it is highly aggressive.[25, 26]

In general, people with pancreatic cancer are considered eligible for surgery if the tumour is confined to one area of the pancreas, has not invaded major blood vessels and has not spread to other organs (most often the liver or lungs). The type of surgery performed depends on the location of the tumour within the pancreas. For example, the Whipple procedure (pancreaticoduodenectomy) may be considered if the tumour is in the head of the pancreas, whereas a distal pancreatectomy may be considered if the tumour is in the body or tail. Central pancreatectomy (removal of the middle of the pancreas) is generally not recommended in cases of pancreatic cancer. Regardless of the type, surgery for pancreatic cancer is complex and has traditionally been associated with a relatively high risk for complications. However, studies indicate that better outcomes are associated with surgeries done in facilities that perform more of these types of procedures ("high volume facilities").[27] For example, a study in Canada showed that every increase of 10 pancreatic resections in a particular hospital predicted a 22% reduction in the risk of in-hospital mortality resulting from those surgeries.[28]

The best outcomes for pancreatic cancer are achieved when surgery removes all microscopic evidence of cancer and is combined with chemotherapy. The use of chemotherapy in the form of 5-fluorouracil or gemcitabine or a combination of gemcitabine and capecitabine after surgery (i.e., adjuvant chemotherapy) is well established and has been shown to delay recurrence and improve survival.[29-31] In contrast, the addition of radiation to post-surgery chemotherapy has not proven beneficial. Some physicians advocate for the use of chemotherapy prior to surgery (e.g., neoadjuvant chemotherapy) as a way of selecting people who will have surgery based on their response to chemotherapy and the potential for increasing the chances of completely removing the cancer with surgery.[32] Current studies are investigating the use of radiation and combinations of chemotherapy drugs after pancreatic cancer resection and the use of chemotherapy and radiation before surgery.

Technical advances in surgical techniques and the increasing safety of pancreatic surgery has led to significant progress in expanding the number of people who may be eligible for surgery. Nevertheless, only 20% of people diagnosed with pancreatic cancer are eligible for surgery. Most others are diagnosed at a later stage and are ineligible for surgery either because the cancer has spread to other organs (metastatic disease) or there has been extensive tumour invasion (locally advanced disease). As a result, the focus is on prolonging life or palliative care, which can be competing priorities.

For example, combination chemotherapy regimen called FOLFIRINOX (folinic acid, 5-fluorouracil, irinotecan and oxaliplatin) has been shown to improve survival compared to single agent chemotherapy by about 4.3 months, but it is associated with more side effects than other regimens.[33] Chemotherapy with gemicitabine (with or without nab-paclitaxel) is also associated with some improvement in survival; the increase is less than that seen with FOLFIRINOX but it is associated with fewer complications.[34] For patients with locally advanced pancreatic cancer, treatment with chemotherapy (with or without radiation) is recommended with current studies looking to define the optimal treatment regimen. Techniques that cause local tumour destruction or ablation, such as irreversible electroporation, have been developed for patients with locally advanced pancreatic cancer, but these strategies remain experimental.[35]

Supportive care

Given the poor prognosis for the disease, palliative care is required for a large portion of people with pancreatic cancer. The primary goals of palliative care are to manage pain and symptoms, provide psychosocial, emotional and spiritual support, and enhance quality of life. Although it is often thought of as treatment given at the end of life, palliative care can be delivered progressively throughout the course of the disease. A comprehensive approach to palliative care can improve the quality of life for people with cancer and their caregiver and increase the likelihood people with cancer die in the setting of their choice. Palliative care can also reduce time spent in intensive care units and reduce hospital re-admissions.[36]

Palliative care can help alleviate the discomfort caused by the different complications of pancreatic tumours, including gastrointestinal obstructions and severe pain. For example, expandable metal stents, which can be inserted to open gastrointestinal blockages, have shown to be very effective in treating obstructions.[37] Similarly, the injection of neurolytic celiac plexus block (NCPB) into the nervous system by an anesthesiologist has proven to be a particularly effective pain management technique.[38]

Advances in the prevention, detection and clinical management of pancreatic cancer have made modest but tangible improvements. Current research is focused on exploring early detection strategies, expanding treatment options, defining the optimal treatment sequences and assessing new drugs that can be given either alone or in combination with standard treatments. Further progress will likely be propelled by an enhanced understanding of the molecular and genetic characteristics of pancreatic cancer, which will help clinicians develop personalized treatment strategies based on predictors of tumour behaviour and response to therapy.

Emerging research: Is there a light at the end of the tunnel?

Despite the significant challenges that exist in the prevention, detection and treatment of pancreatic cancer, progress is being made in understanding the disease. Research in Canada and around the world continues to lead to improvements in how pancreatic cancer is diagnosed and treated.

Unfortunately, etiologic and genetic research for pancreatic cancer has lagged behind other common cancers and limited progress has been made in these areas. However, a number of ongoing efforts aim to fill this gap in knowledge. For example, the Ontario Pancreas Cancer Study, which began in 2003, is aimed at identifying genetic, environmental and lifestyle causes of pancreatic cancer.[39] The study is expected to help elucidate pancreatic cancer risk factors and patterns of inheritance. It is also trying to uncover possible genetic and biochemical markers for the disease that may help in developing screening techniques. To that end, the Ontario Pancreas Cancer Study is one of six sites in North America contributing data, blood and tumour samples to the Pancreatic Cancer Screening Study.[40] The blood and tumour samples will be used to develop a biobank that will be linked to clinical outcomes.[41] The biobank will allow researchers to investigate, for example, if new blood markers can be used as screening tests. This type of research can play a critical role in developing new prevention, screening and treatment approaches.

Advancing the treatment of pancreatic cancer has been particularly challenging for a number of reasons, including the fact that it does not respond well to chemotherapy[42] and is relatively resistant to radiation.[43] In addition, the majority of pancreatic cancers have KRAS gene mutations, a common oncogene for which no molecularly targeted therapies exist.[44] As highlighted in the previous section, despite these challenges, research has led to improved chemotherapy options with combination chemotherapeutic regimens, including FOLFIRINOX and gemcitabine with nab-paclitaxel.[33, 34] Both of these regimens demonstrate improved efficacy compared to the previous standard of gemcitabine alone.

To date, there are no confirmed subtypes that can help in making decisions about treatment for pancreatic cancer. This has limited the advancement of pancreatic cancer therapies compared to options available for cancers such as breast and lung. For example, in breast cancer the presence of hormone expression (ER/PR) or growth factor expression (HER2) helps determine treatment, as does the presence of EGFR mutations or ALK fusions for lung cancer. There are several cutting edge pancreatic cancer molecular analyses trials ongoing in Canada to determine why some people with pancreatic cancer have better outcomes than others, such as PanGen at the BC Cancer Agency (NCT02869802). This type of work will hopefully lead to the development of clinically actionable subtypes in pancreatic cancer.

An emerging potential actionable subtype is the presence of BRCA mutations, which is most commonly known for its association with an increased risk for female breast cancer. The presence of this mutation has led to improved outcomes for people with pancreatic cancer who are treated with platinum-based chemotherapy drugs.[45, 46] More recently the presence of mismatch repair deficiency has been suggested to be a predictor of immune checkpoint inhibitors.[47] There is a great deal of work being done both nationally (such as PanGen) and other groups internationally (such as the Pancreatic Cancer Case-Control Consortium)[48] to attempt to identify additional subtypes. Furthermore, there is a great deal of research into developing new drugs to treat pancreatic cancer,[49] including a large number of clinical trials ongoing in Canada (e.g., NCT02879318, led by Canadian Cancer Trials Group) and beyond.

Despite significant challenges, therapies for this disease have improved substantively over the past five years, and local and international research is studying promising pancreatic cancer subtypes and new therapeutics. Although the advances to date have been modest, continued research will ensure we continue to make improvements that prolong the life and enhance the treatment of people with pancreatic cancer. As a result, there is a great deal of hope that outcomes for this cancer will begin to improve in the near future.

Conclusion: What do these statistics mean?

Major advancements have been made in the prevention, detection and treatment of the other leading causes of cancer deaths in Canada, but improvements in pancreatic cancer have been more limited. As a result, survival remains the lowest of the 23 cancers reported in this publication, and pancreatic cancer is expected to surpass breast cancer and become the third leading cause of cancer-related death in Canada in the coming years.

This chapter highlights the urgent need to address the challenges presented by pancreatic cancer. Although there are established modifiable risk factors for pancreatic cancer, they do not account for the majority of cases. Recent advances in treatments have shown tangible but modest improvements, but they extend life by only a few months. To improve outcomes for those diagnosed with pancreatic cancer in a meaningful way, advancements need to be made in understanding the disease to determine how to detect it earlier and to develop therapeutic strategies that can be tested in clinical trials. Continuing to monitor the burden of pancreatic cancer will help assess if progress is made.

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TABLE 6.1 Projected pancreatic cancer incidence and mortality, by sex, age and province, Canada, 2017

	Incidence		Mortality	
	Cases	ASIR	Deaths	ASMR
All pancreatic cancers	**5,500**	**13.5**	**4,800**	**11.9**
Sex				
Males	2,800	14.7	2,400	13.1
Females	2,700	12.4	2,400	10.8
Age				
0–39	55	0.3	20	0.1
40–49	180	3.9	120	2.6
50–59	730	13.4	560	10.3
60–69	1,450	32.9	1,200	26.8
70–79	1,650	63.0	1,450	55.8
80+	1,450	92.0	1,500	95.9
Province				
British Columbia (BC)	710	12.5	650	11.4
Alberta (AB)	500	13.3	410	11.1
Saskatchewan (SK)	160	13.2	140	12.1
Manitoba (MB)	180	12.9	160	11.7
Ontario (ON)	2,200	14.0	1,900	12.0
Quebec (QC)	1,400	13.8	1,200	12.1
New Brunswick (NB)	140	14.5	130	12.9
Nova Scotia (NS)	150	12.2	150	12.4
Prince Edward Island (PE)	25	12.9	25	13.3
Newfoundland and Labrador (NL)	70	10.5	75	11.4

ASIR=age-standardized incidence rate; ASMR=age-standardized mortality rate

Note: Actual incidence data were available to 2013 for all provinces and territories except Quebec, for which data were available to 2010 and projected thereafter. Actual mortality data were available to 2012. Rates are per 100,000 and are age-standardized to the 2011 Canadian population. For further details, see *Appendix II: Data sources and methods*.

Analysis by: Surveillance and Epidemiology Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry, National Cancer Incidence Reporting System and Canadian Vital Statistics Death databases at Statistics Canada

TABLE 6.2 Distribution of pancreatic cancer cases, by stage, select provinces*

	Stage I	Stage II	Stage III	Stage IV	Unknown
Alberta (AB)	7%	24%	7%	54%	7%
Saskatchewan (SK)	10%	21%	6%	57%	5%
Manitoba (MB)	12%	24%	6%	52%	6%
Nova Scotia (NS)	13%	17%	7%	55%	8%
Prince Edward Island (PE)	11%	20%	7%	59%	2%
Newfoundland and Labrador (NL)	9%	20%	9%	53%	8%
Combined†	10%	22%	7%	55%	7%

Data sources: Cancer Control Alberta, Alberta Health Services; Epidemiology and Cancer Registry, CancerCare Manitoba; Epidemiology & Cancer Registry, Saskatchewan Cancer Agency; CancerCare Nova Scotia, Nova Scotia Health Authority; PEI Cancer Registry, PEI Cancer Treatment Centre; Cancer Care Program, Eastern Health

* Data are pooled from 2011–2013 for MB, SK, NS and NL, 2012–2014 for AB and 2011–2014 for PE.

† The overall distribution is based on the sum of cases across provinces for each stage.

Note: TNM "best stage group" was assigned using the Collaborative Stage System Version 02.05, which incorporates the American Joint Committee on Cancer TNM seventh edition. For further details, see *Appendix II: Data sources and methods*.

TABLE 6.3 Estimated five-year age-standardized net survival for pancreatic cancer, by time period, sex, age group and select province, Canada,* 1992–2008

	Net survival (%) (95% confidence interval)		
	1992–1996	1998–2002	2004–2008
All pancreatic cancers	**5.0 (4.5–5.5)**	**5.7 (5.2–6.2)**	**6.9 (6.4–7.5)**
Sex			
Males	4.3 (3.7–5.0)	5.4 (4.7–6.1)	6.2 (5.6–7.0)
Females	5.6 (4.9–6.3)	6.1 (5.4–6.8)	7.6 (6.9–8.4)
Age group†			
15–44	18.6 (14.6–23.0)	23.5 (19.0–28.2)	28.3 (23.4–33.4)
45–54	9.1 (7.2–11.3)	8.9 (7.2–10.8)	12.1 (10.2–14.2)
55–64	5.2 (4.2–6.3)	7.1 (5.9–8.3)	8.2 (7.0–9.4)
65–74	4.7 (4.0–5.5)	5.2 (4.4–6.0)	6.0 (5.1–6.9)
75–99	3.4 (2.7–4.2)	3.7 (3.0–4.4)	4.6 (3.9–5.4)
Province‡			
British Columbia	2.6 (1.9–3.6)	3.9 (3.1–4.8)	4.6 (3.7–5.7)
Alberta	3.8 (2.8–5.1)	3.6 (2.6–4.8)	4.8 (3.7–6.1)
Saskatchewan	1.7 (0.8–3.1)	4.4 (2.7–6.6)	4.3 (2.7–6.4)
Manitoba	2.5 (1.3–4.3)	2.8 (1.6–4.7)	2.6 (1.5–4.4)
Ontario§	6.9 (6.1–7.7)	7.9 (7.1–8.8)	9.7 (8.9–10.6)
New Brunswick	2.5 (1.2–4.5)	4.3 (2.6–6.6)	5.1 (3.3–7.3)
Nova Scotia	4.9 (3.0–7.4)	3.4 (2.0–5.4)	3.1 (1.9–4.9)

Analysis by: Health Statistics Division, Statistics Canada
Data sources: Canadian Cancer Registry database and life tables at Statistics Canada

* Data from Quebec were excluded, in part, because the method for ascertaining the date of cancer diagnosis differs from the method used by other provinces and territories and because of issues in correctly ascertaining the vital status of cases.

† Age group-specific results were not age-standardized.

‡ Estimates for Newfoundland and Labrador are not shown as they are artefactually high. There were insufficient data to calculate estimates for Prince Edward Island.

§ It is likely that pancreatic cancer survival for this province is overestimated. For further details, see *Appendix II: Data sources and methods*.

Note: The period method was used to estimate survival for the period from 2004–2008; otherwise the cohort method was used. The 15–44 and 45–54 age groups were combined to facilitate calculation of provincial age-standardized results.

APPENDIX I: Using CANSIM to find additional cancer statistics

Previous versions of this publication included data tables with the actual (not projected) number of cancer cases and cancer deaths for the most recent year of data that was used in the preparation of the publication. Although this was meant to provide a view of the most recent data available, the tables in the publication quickly became out of date as new data are regularly provided to the public through Statistics Canada's online resources. To support readers in accessing the most up-to-date data available at any given time, this section now offers links to Statistics Canada's online resources (referred to as CANSIM tables) along with a brief description of how to use these resources.

What is CANSIM?

CANSIM is Statistics Canada's socio-economic database. It provides the public with fast and easy access to the latest statistics available in Canada relating to demography, health, trade, education and other key topics. This includes a number of tables related to cancer. CANSIM tables can be accessed from the Statistics Canada website at www.statcan.gc.ca/cansim.

Users can browse available data tables by topic or search CANSIM by keywords or a CANSIM table number. Users can generate customized statistical summaries of tables using some of CANSIM's data functions (e.g., "Add/Remove data" and "Manipulate"). Final summaries can be exported using the download function.

Table number	Title and description
103-0550	*New cases of primary cancer, by cancer type, age group and sex, Canada, provinces and territories* Provides counts of new cancer cases and crude incidence rates (and 95% confidence intervals) for Canada and provinces and territories by cancer type, age group, sex and year
103-0554	*New cases and 2011 age-standardized rate for primary cancer, by cancer type and sex, Canada, provinces and territories* Provides counts of new cancer cases and age-standardized incidence rates (and 95% confidence intervals) for Canada and provinces and territories by cancer type, sex and year
103-0406	*Cancer incidence, by selected sites of cancer and sex, three-year average, Canada, provinces, territories and health regions (2015 boundaries)*
103-0407	*Cancer incidence, by selected sites of cancer and sex, three-year average, census metropolitan areas, occasional (age-standardized rate per 100,000 population)*
102-0522	*Deaths, by cause, Chapter II: Neoplasms (C00 to D48), age group and sex, Canada* Provides the annual number of cancer deaths for Canada by cancer cause of death, age group, sex and year
102-0551	*Deaths and mortality rate, by selected grouped causes, age group and sex, Canada* Provides the annual number of deaths and crude mortality rates for Canada by cause of death, age group, sex and year
102-0553	*Deaths and mortality rate, by selected grouped causes and sex, Canada, provinces and territories* Provides the annual number of deaths and the crude and age-standardized mortality rates for Canada or provinces and territories by sex, year and cause of death
051-0001	*Estimates of population, by age group and sex for July 1, Canada, provinces and territories* Provides population counts for Canada or provinces and territories by age, year and sex
103-0555	*New cases of primary cancer, by cancer type, age group and sex, Canada excluding Quebec, provinces (excluding Quebec) and territories* Provides counts of new cancer cases and crude incidence rates (and 95% confidence intervals) for Canada and provinces (excluding Quebec) and territories by cancer type, age group, sex and year
103-0556	*New cases and 2011 age-standardized rate for primary cancer (based on the July 2016 CCR tabulation file), by cancer type and sex, Canada (excluding Quebec), provinces (excluding Quebec) and territories* Provides counts of new cancer cases and age-standardized incidence rates (and 95% confidence intervals) for Canada and provinces (excluding Quebec) and territories by cancer type, sex and year

Which CANSIM tables are relevant?

The table below contains a list of the CANSIM tables most relevant to this publication. This is not a list of all CANSIM tables. Additional tables can be found by browsing CANSIM by subject.

How do I use CANSIM tables?

A detailed description of how to access, modify and download CANSIM tables is provided online. The following offers a brief overview of how to customize and download the summary statistics.

Upon accessing a CANSIM table, the user is provided with default summary statistics. Directly below the title of the table, there is a series of tabs that allow the user to perform additional functions or obtain additional information.

To customize the statistics, open the "Add/Remove data" tab and select the items of interest (e.g., sex, age group, year, cancer or measure). The "Apply" button at the bottom of the page generates a table based on the items specified.

At any time, users can access the "Download" tab, which provides options to download the customized table into a comma-separated value (CSV) file format. The entire (unrestricted) data can also be downloaded. Downloading the summary statistics allows the user to further manipulate the data or save the information in a spreadsheet.

Why do some numbers in this publication differ from CANSIM?

Users of CANSIM tables should be aware that there are some differences between data compiled for this publication and those used in the CANSIM online tables. For additional details on CANSIM data, users should review the footnotes provided under each CANSIM table on the Statistics Canada website. The information in those footnotes can be compared to the details provided in *Appendix II* of this publication.

The following are a few notable differences between the methodology used in compiling the statistics in the CANSIM tables and this publication:

- The number of age groups used to age standardize the rates was 19 in CANSIM and 18 in this publication. The "85–89" and "90+" age groups used in CANSIM were collapsed into "85+" for this publication.
- In the data used for this publication, cases identified through death certificate only (DCO) were imputed for the provinces of Ontario (2008 onward) and Quebec (2010). This approach was not done for the CANSIM data. This could lead to differences in statistics for these provinces and for Canada as a whole.
- Cancer groupings sometimes differ between CANSIM tables and this publication. For example, leukemia is split into several leukemia subtypes in some CANSIM tables (e.g., acute lymphocytic leukemia, chronic lymphocytic leukemia). Users should carefully compare cancer group definitions across data sources.
- Data on new cancer cases for the province of Quebec are not available in the Canadian Cancer Registry for diagnosis years beyond 2010. To impute the data, CANSIM carried forward the Quebec incidence data from 2010 to the diagnosis years 2011–2013 for CANSIM Tables 103-0550 and 103-0554, but a different approach was used for this publication (see *Appendix II: Data sources and methods* for details). CANSIM Tables 103-0555 and 103-0556 exclude Quebec incidence data completely for all reported years.

APPENDIX II: Data sources and methods

Data sources

Incidence data: The Canadian Cancer Registry (CCR)

Actual cancer incidence data used in this publication cover the period of 1988 to 2013 (except Quebec, for which data from 1986 to 2010 were used). Data for 1992 to 2013 were obtained from the CCR[1] August 2015 CCR Tabulation Master File, released March 15, 2016. Data for years that precede the CCR (before 1992) were retrieved from its predecessor, the National Cancer Incidence Reporting System (NCIRS). The NCIRS is a fixed, tumour-oriented database containing cases diagnosed as far back as 1969.

- Incidence data originate with the provincial and territorial cancer registries (PCTR), which provide data annually to Statistics Canada for inclusion in the CCR.
- The CCR is a person-oriented database that includes clinical and demographic information about residents of Canada diagnosed with new cases of cancer.
- The Health Statistics Division at Statistics Canada maintains the CCR. CCR data has been linked to the end of the 2013 diagnosis year to identify duplicate person and tumour records. Records from Quebec and Yukon have traditionally been excluded from this process, though a similar provincial record linkage for Quebec records was completed for cases diagnosed to December 31, 2008. Cancer data has also been linked with mortality data (described below) to ensure the completeness and correctness of vital status information. This linkage was last performed in 2011 and involved records dated to the end of 2008. Both linking procedures help optimize the accuracy of incidence, prevalence and survival statistics.
- Cancer diagnoses are classified according to the *International Classification of Diseases for Oncology, 3rd Edition,* (ICD-O-3) from 1992 onward.[2] Cancer diagnoses in the NCIRS (i.e., prior to 1992) were classified according to the *International Statistical Classification of Diseases and Related Health Problems, Ninth Revision* (ICD-9).[3]
- International Agency for Research on Cancer (IARC) rules[4] for multiple primaries were used for cases from the CCR (see *Data and methods issues*), but during the period covered by the NCIRS, registries other than Quebec and Ontario used multiple primary rules that allowed a small percentage of additional cases.

Mortality data: The Canadian Vital Statistics — Death database (CVS: D)

The actual cancer mortality data cover the period of 1988 to 2012 and were obtained from the Canadian Vital Statistics – Death Database (CVS: D).[5]

- Death records originate with the provincial and territorial registrars of vital statistics and are provided regularly to Statistics Canada for inclusion in the CVS: D.
- The CVS: D includes information on demographics and causes of death for all Canadian residents and non-residents who died in Canada between 1950 and 2012. Information on non-residents is not used for this publication.
- Data are also included for Canadian residents who died in a small number of states within the United States from which abstracted death data were received. Starting with the 2010 data year, this information is no longer available.
- The Health Statistics Division at Statistics Canada maintains the CVS: D.
- Cause of death is classified according to the ninth and tenth revisions of the *International Statistical Classification of Diseases and Related Health Problems* (ICD): ICD-9 from 1979 to 1999 and ICD-10 from 2000 onward.[6]
- Cancer deaths are those for which some form of cancer, as certified by a physician, is the primary underlying cause of death.

Population data: Census of the population

- Population estimates for 1986 to 2016 were obtained from Statistics Canada.[7, 8]
- Projected population estimates are used for 2017, as prepared by Statistics Canada under assumptions of medium growth (scenario M1).[9] Scenario M1 incorporates medium-growth and historical trends (1991/1992 to 2010/2011) of interprovincial migration.
- All population estimates include non-permanent residents and are adjusted for net census undercoverage and Canadians returning from abroad.

Life tables

- Life tables are required to estimate expected survival, which is used in the calculation of relative (net) survival.
- Expected survival data for the years 2006, 2007 and 2008 were derived from complete life tables for 2005 to 2007,[10] 2006 to 2008[11] and 2007 to 2009,[12] respectively. The methodology used to produce these life tables[13] was retroactively used to produce annual life tables from 1991–1993 to 2004–2006.[14]
- As complete life tables were not available for Prince Edward Island or the territories, expected survival proportions for these areas were derived, up to the age of 99 years, from abridged life tables for Canada[14] and the affected jurisdictions[10-12, 14] and complete Canadian life tables[10-12, 14] using a method suggested by Dickman et al.[15] Where this was not possible (i.e., ages 100–109 years), complete Canadian life table values were used.

Cancer definitions

- Cancer cases are defined according to ICD-9 prior to 1992 and ICD-O-3[2] thereafter. Cancer deaths are defined according to ICD-9 prior to 2000 and ICD-10[6] thereafter. Table A2 outlines the ICD-O-3 and ICD-10 codes used to identify cancer cases and deaths by cancer type.
- Some definitions have changed slightly over time. Changes occurring since the 2004 edition of this publication are outlined in Tables A3-1 and A3-2.
- For children aged 0–14 years, new cancers were classified and reported according to the Surveillance, Epidemiology and End Results Program (SEER) update[16] of the International Classification of Childhood Cancer, Third Edition (ICCC-3).[17] The update was in response to new morphology codes introduced by the World Health Organization.[18] The classification system is more appropriate for reporting childhood cancers because it acknowledges the major differences between cancers that develop during childhood and those that occur later in life. The category "intracranial and intraspinal" excludes non-malignant tumours.

Methods

Incidence and mortality rates

- Records from each province or territory were extracted from the relevant incidence or mortality files and then classified by year of diagnosis or death and by sex, five-year age group (e.g., 0–4, 5–9,…, 85–89 and 90+ years) and cancer type.
- Rates for each category were calculated by dividing the number of cases or deaths in each category (i.e., sex, age group, year, cancer type and province or territory) by the corresponding population figure. These formed the basis for calculations of age-standardized rates and for projections beyond the most recent year of actual data.
- Age-standardized rates were calculated using the direct method, which involves weighting the age-specific rates for each five-year age group according to the age distribution of the 2011 Canadian population. In order to use the CANPROJ projection package, all age-standardized rates were based on 18 age groups instead of 19, whereby the last two age categories were combined into a new 85+ age group and assigned a weight of 0.018725 (see *Projection of incidence and mortality for 2017* below).
- Age-standardized rates computed for age categories (e.g. 0–19, 20–29,…, 70–79 and 80+ years) used adjusted weights. Specifically, the weight assigned to each age group in the category was divided by the sum of the weights in the age category.

2011 Canadian standard population

Age group	Population	Standard weight
0–4	1,899,064	0.055297
5–9	1,810,433	0.052717
10–14	1,918,164	0.055853
15–19	2,238,952	0.065194
20–24	2,354,354	0.068555
25–29	2,369,841	0.069006
30–34	2,327,955	0.067786
35–39	2,273,087	0.066188
40–44	2,385,918	0.069474
45–49	2,719,909	0.079199
50–54	2,691,260	0.078365
55–59	2,353,090	0.068518
60–64	2,050,443	0.059705
65–69	1,532,940	0.044636
70–74	1,153,822	0.033597
75–79	919,338	0.026769
80–84	701,140	0.020416
85–89*	426,739	0.012426
90+*	216,331	0.006299
Total	**34,342,780**	**1.000000**

Note: The Canadian population distribution is based on the final postcensal estimates of the July 1, 2011, Canadian population, adjusted for census undercoverage.

*Age-standardized incidence and mortality rates were based on 18 age groups, whereby the last two categories were collapsed to 85+, with a population size of 643,070 and a standard weight of 0.018725.

Data source: Census and Demographics Branch, Statistics Canada

Figure D (*Introduction*) shows the number of deaths avoided since the mortality rate for all cancers combined peaked in 1988.

- The year 1988 was chosen as the baseline year when the overall cancer mortality rate was at its highest for Canadian men and women.

- The age-specific cancer mortality rates from 1988 (the baseline year) for males and females in each five-year age group were applied to the age-specific populations for each of the subsequent calendar years (1989 to 2012) to obtain the expected number of deaths for each of those years if their mortality rates were the same as the 1988 mortality rates.
- To obtain the excess number of deaths that would have occurred, the age-specific expected deaths for each year that were calculated using the 1988 mortality rates were summed, and then the observed number of deaths for each year was subtracted from this total.
- Similar analyses were done for lung cancer for 1989 to 2012 (with 1988 as the baseline year) and female breast cancer for 1987 to 2012 (with 1986 as the baseline year).

Figure E (*Introduction*) shows the relative number of new cases and deaths that can be attributed to changes in cancer risk and cancer control practices, population size and aging of the population.

The series shown in Figure E were calculated as follows:

- Uppermost series — The annual number of Canadian cancer cases or deaths, for males or females
- Next-to-uppermost series — Annual total population multiplied by the annual age-standardized rate, using the 1988 population distribution for males or females as the standard weights
- Next-to-baseline series — The 1988 total population multiplied by the annual age-standardized rate, using the 1988 population distribution for males or females as the standard weights
- Baseline (dotted line) — The observed number of Canadian cancer cases or deaths during 1988 for males or females

Projection of incidence (new cases) and mortality (deaths) for 2017

Using the CANPROJ projection package, two methods were used to project incidence and mortality data: the Nordpred Power5 regression model and five-year averaging.

Nordpred Power5 modelling

The Nordpred Power5 regression model was the primary method for estimating the number of new cases and deaths in 2017 for each cancer type by sex (except new cases of prostate cancer; see *Prostate cancer incidence* below) reported in Tables 1.2 and 2.2. Nordpred is based on an age-period-cohort Poisson regression model but has enhancements that overcome difficulties in the standard Poisson model and improve projection accuracy.[19] The Nordpred method has been developed into software packages[20, 21] and is now one of the most frequently used methods for cancer projections worldwide.[22-26] The Nordpred Power5 regression model was used when the average annual number of cases or deaths for a type of cancer for the most recent five years was greater than 50. The assumption underlying the Nordpred Power5 regression model is that the annual number of new cases and deaths are independent Poisson random variables with mean values equal to the product of the population size for a particular year and the (true) annual rate. For this publication, a slight modification of the original Nordpred method was implemented using the CANPROJ subpackage Adpcproj. Specifically, the Poisson distribution was replaced with the negative-binomial distribution when overdispersion occurred.

- A separate Nordpred Power5 regression model was fit for each province, sex and type of cancer for the period of 1989 to 2013 for incidence (1986 to 2010 for Quebec) and 1988 to 2012 for mortality.
- The Nordpred Power5 regression model is $R_{ap} = (A_a + D \cdot p + P_p + C_c)^5$ where a, p and c represent age, period and cohort, respectively, in five-year groups. Input data were aggregated into five-year calendar periods and 18 five-year age groups. Cohorts were created synthetically by subtracting age from period. R_{ap} is the incidence/mortality rate in age group a in calendar period p, A_a is the age component for age group a, and D is the common linear drift parameter of period and cohort.[27] P_p is the nonlinear period component of period p, and C_c is the nonlinear cohort component of cohort c.
- The 18 age groups used were as described above for the standard population with the 85–89 and 90+ age groups collapsed to form an 85+ category. The last two age groups were collapsed to enable the use of the CANPROJ projection package.
- CANPROJ uses a goodness-of-fit test to choose the number of five-year periods to be included in the dataset used for calculating future values (projection base).
- The software determines whether the average trend across all observed values, or the slope for the last 10 years of observed values, is used for projection, based on a significance test for departure from linear trend. This approach serves as an approximate way of looking for significant changes in the observed trend. The software also allows the user to make this selection.
- For each age group, a minimum of five cases in each five-year period was required. For age groups below this minimum, the average number of cases in the last two periods was used to calculate future rates.

To allow for a damping of the impact of current trends in the future time periods, a "cut-trend" option was used, which is a vector of proportions indicating how much to cut the trend estimate for each five-year projection period. A gradual reduction in the drift parameter of 25% and 50% in the second and third five-year period, respectively, was used as the default in this publication.

- Age was included in all models as a factor. Age-specific incidence and mortality rate trends were then extrapolated to 2017. The predicted numbers of cancer cases and deaths in 2017 were calculated by multiplying these extrapolated rates by the sex-, age- and province-specific population projections for the same year.
- Provincial cancer registries could request modifications of "recent" and "cut-trend" options to produce estimates that were more consistent with the most recent data available to the provincial cancer registries.

Five-year averaging

New cases and deaths in 2017 for each type of cancer were also projected based on the average of the five most recent years of data. This method may be more realistic for cancers for which there are recent changes in trend (the Nordpred Power5 regression model results in poor projections for these cancers because it is based on a medium- or longer-term trend) or when frequencies are low and result in unstable projections using the Nordpred model. The average of rates for the most recent five years was calculated for each sex, five-year age group, cancer type and province or territory. The predicted numbers were then obtained by multiplying these rates by the corresponding projected population sizes.

To address a known issue of temporary underreporting of cancer cases from Ontario to the CCR for the 2010 to 2012 data years (see Data and Methods Issues later in this chapter), a correction factor was applied to the five-year average rate of some cancers for this province (Table A4). Additionally, to address provincial registry concerns not otherwise dealt with by the other options provided to them, correction factors were applied to the five-year average rates of liver and breast cancer in females in Newfoundland and Labrador and several cancer types in Manitoba. The correction factor was calculated as the ratio of the provincial estimate to the uncorrected projected estimate and was applied to each sex- and age-specific rate contributing to the average method projection. Projected rates based on correction factors can appear substantially different than actual rates in the years directly preceding them (as seen, for example, with female cancer incidence in Figure 1.3) because the underlying data for the latter have not been altered.

Selection of "best" projections

Projections from the two methods were compared for each sex, cancer type and geographic region for all ages combined. The "best" projection for each category was selected in consultation with individual provincial or territorial cancer registries, according to the following guidelines:

- The Nordpred model was generally preferred except when frequencies were low.
- Five-year average projections were used when the average annual number of cases during the most recent five years was less than or equal to 50.
- Five-year average projections were used for the territories and are reported only for "all cancers" because of small counts.
- The absolute value of the difference between the age-standardized rates projected by the two methods was calculated and expressed relative to the five-year average estimate. For example, if the Nordpred Power5 regression model projected a rate of 4.0 and the five-year average projected a rate of 4.5, the relative difference would be $|4.0 - 4.5| \div 4.5$, or 11.1%.
- Provinces closely examined projections for cancers where the absolute value of the relative difference exceeded 15%. Such differences occur because projections based on the average method do not reflect the medium- to long-term trends used in the model-based method.
- Provinces provided feedback based on the availability of in-house projections, knowledge of local trends or access to more current data, which permitted an assessment of the estimates produced by the two different projection methods.

- For each province or territory, the "all cancers" projection was calculated as the sum of the cancer-specific projections. Projections for Canada as a whole were computed as sums of the projections for the individual provinces and territories.

Tables A4 and A5 indicate the cancer types that were reported according to the five-year average method for 2017. In these situations, the age-standardized rates for 2017 reported in this publication were calculated using the most recent five years of actual data.

Prostate cancer incidence

Currently, the results of the Nordpred Power5 regression model are not realistic for prostate cancer incidence because models developed using as many as 25 years of historical data are not adequately responsive to the recent substantial declines arising from changes in prostate specific antigen (PSA) screening practices. Rather, annual age-specific Power5 models, which included common trend or age-specific trend parameters, were fit to a minimum of six years and a maximum of nine years of data using the CANPROJ subpackage Hybdproj. The most detailed age-specific trend model is $R_{ap} = (A_a + D_a \cdot p)^5$, where a is age, p is period, A_a is the age effect of age group a and D_a is the slope parameter at the a^{th} age group. Similar to the Nordpred method, a cut-trend option is available for damping the impact of current trends on future time periods. Hybdproj cut-trend defaults were used (0% for the first five years and 5% per year thereafter), but provincial cancer registries could request adjustments during the projection review process.

New cases of prostate cancer in 2017 were also projected based on the most recent year of data available. This method may be more realistic when there are recent changes in trend not captured by the model. The rate for the most recent year of data was calculated for each five-year age group and province or territory. The predicted numbers were then obtained by multiplying these rates by the corresponding projected population sizes.

Rounding for reporting

- Predicted estimates of incidence and mortality presented in this publication have been rounded as follows:
  - Numbers between 0 and 99 were rounded to the nearest 5.
  - Numbers between 100 and 999 were rounded to the nearest 10.
  - Numbers between 1,000 and 1,999 were rounded to the nearest 50.
  - Numbers greater than or equal to 2,000 were rounded to the nearest 100.
- Age-specific and sex-specific numbers or rates were combined before rounding, so it is possible that totals in the tables do not add up. However, any such discrepancies are within the precision of the rounding units described above.

Throughout the publication, actual incidence and mortality frequencies are randomly rounded up or down to a multiple of 5.[28]

Precision of 2017 projections

The precision of a projection depends primarily on the number of observed cases and the population size for each combination of cancer type, age, sex and province or territory. Estimates of precision (standard errors, coefficients of variation and confidence intervals) for 2017 counts and rates are not currently available because the methodology is being refined. Therefore, caution must be taken when interpreting differences in counts or rates, particularly for the smaller provinces and territories, as these differences may not be statistically significant.

Annual percent change (APC) and average annual percent change (AAPC) in cancer incidence and mortality rates

Using Joinpoint,[29] the APC was calculated for each cancer type by fitting a piecewise linear regression model, assuming a constant rate of change in the logarithm of the annual age-standardized rates in each segment. The models incorporated estimated standard errors of the age-standardized rates. The tests of significance used a Monte Carlo Permutation method. The estimated slope from this model was then transformed back to represent an annual percentage change in the rate.

- Joinpoint analysis was applied to annual age-standardized rates (1992 to 2013 for incidence and 1992 to 2012 for mortality) to determine years in which the APC changed significantly. Such years are referred to as changepoints.
- Projected cancer incidence data for Quebec (2011 to 2013) were included in the Joinpoint analysis to incorporate more recent actual data from the remaining provinces and territories.
- The minimum time span on which to report a trend was set at five years. Thus, the most recent possible trend period in this study was 2009 to 2013 for incidence and 2008 to 2012 for mortality.
- The most recent changepoint detected and the APC for the years beyond the changepoint are reported in Tables 1.5 and 2.5. In the absence of a changepoint, the reference year is 1992.
- Cancers that demonstrate a statistically significant APC of at least 2% since the reference year (1992 or, where applicable, the most recent changepoint) are highlighted in the text. The trends are depicted in Figures 1.4 and 1.5 for incidence and 2.4 and 2.5 for mortality.

- To summarize the trend over specified periods, the average annual percent change (AAPC) was calculated for 1992 to 2013 for incidence and 1992 to 2012 for mortality. AAPC is computed as a weighted average of the APCs in effect during the specified period with the weights equal to the proportion of the period accounted for by each APC.

Probability of developing or dying from cancer

Probabilities of developing or dying from cancer were calculated using the software application DevCan.[30] Using cross-sectional data on first cancer diagnoses, cancer deaths, all deaths and population estimates, DevCan employs statistical modelling to compute the probability of developing or dying from cancer.[31, 32] DevCan's methodology differs from that used in past publications [33, 34] in that estimates of cancer risk are based on the first diagnosis of a type of cancer and are corrected for prevalent cases in the population. The correction for prevalent cases in the population produces higher probabilities of developing cancer in older age groups, especially for cancers with a high incidence rate and long survival.

Estimating the probability of developing or dying from cancer assumes the current incidence and mortality rates at each age stay constant throughout the lifetime of the hypothetical cohort of 10,000,000 live births. Since this assumption may not be true, the probabilities should be regarded only as approximations. Further, the estimated probabilities are for the general Canadian population and should not be interpreted as an individual's risk.

Probability of developing cancer

Age-, sex- and cancer-specific case and death counts, age- and sex-specific all-cause death counts and population estimates for Canada in 2010 were calculated using 20 age groups (0 to <1, 1–4, 5–9, 10–14,…, 85–89 and 90+ years) and analyzed in DevCan using the default all ages with five-year intervals.

- For any defined age period (e.g., age 0–90+ or 30–39), the probability of developing cancer is the number of new cancers occurring over the time period divided by the number of persons never diagnosed with cancer at the start of the time period. For example, the probability of developing cancer between the age of 30 and 39 is calculated as the total number of cancers diagnosed between the two ages divided by the number of persons alive at age 30 who have never been diagnosed with cancer. Thus, the lifetime probability of developing cancer is the total number of cancers occurring over the complete lifetable (age 0–90+) divided by the hypothetical cohort of 10,000,000 live births. This calculation does not assume that an individual lives to any particular age.
- Probabilities can be calculated for all cancers combined or by cancer type.

Probability of dying from cancer

Age-, sex- and cancer-specific death counts, age- and sex-specific all-cause death counts and population estimates for Canada in 2012 were calculated using 20 age groups (0 to <1, 1–4, 5–9, 10–14,…, 85–89 and 90+ years) and analyzed in DevCan using the default all ages with five-year intervals.

- For any defined age period (e.g., age 0–90+ or 30–39), the probability of dying from cancer is the number of cancer deaths occurring over the time period divided by the number of persons alive at the start of the time period. For example, the probability of dying of cancer between the ages of 30 and 39 is calculated as the total number of cancer deaths occurring between the two ages divided by the total number of persons alive at age 30. Thus, the lifetime probability of dying from cancer is the total number of cancer deaths occurring over the complete lifetable (age 0–90+) divided by the hypothetical cohort of 10,000,000 live births. This calculation does not assume that an individual lives to any particular age.
- Probabilities can be calculated for all cancers combined or by cancer type.

Potential Years of Life Lost (PYLL)

The indicator was calculated by taking the exact age of each person dying before the age of 75 years and subtracting that from 75 to calculate individual years lost. The sum of all these values represents the total PYLL. Figure B presents the total PYLL for people aged 0–74 in 2010 to 2012, inclusively. The following ICD-10 codes were used to create the categories presented in Figure B.

Category	ICD-10 cause of death terminology	ICD -10 Codes
Cancer	All malignant neoplasms	C00-C97
Accidents	Unintentional injuries	V01-X59, Y85-Y86
Heart disease	Ischemic heart disease	I20-I25
Suicide	Suicides and self-inflicted injuries	X60-X84, Y87.0
Respiratory disease	Respiratory diseases (excluding infectious and parasitic diseases)	J00-J99
Cerebrovascular diseases	Cerebrovascular diseases	I60-I69
HIV	Human immunodeficiency virus (HIV) disease	B20-B24

Survival

No new data were available to produce more recent survival estimates for this year's publication. In the 2016 publication, several updates to the methodology were incorporated, and conceptual changes to the interpretation of the results were made. The following are of particular note:

- Whereas editions prior to 2016 reported relative survival, estimates are now explicitly referred to as net survival[35] and are interpreted as such.
- Traditional methods of estimating relative survival have recently been shown to produce biased estimates of net survival under certain circumstances.[36] In particular, estimates of net survival for "all ages" combined are prone to a potential bias that can arise because people diagnosed at older ages are more likely to die from causes other than the cancer of interest than those diagnosed at younger ages. Age-standardization has been shown to be a useful tool to mitigate this potential bias.[37, 38] Where appropriate, survival estimates in this report were age-standardized.
- Estimating net survival in a relative survival framework requires that the non-cancer mortality rate in a group of people diagnosed with cancer is the same as that in the population-based life table.[37] Prior to the 2016 edition, this publication made the common assumption that the bias introduced by the use of population-based life tables, which include people previously diagnosed with cancer, was negligible. This has been shown to be true for most, but not all, individual cancers and to not be true for all cancers combined.[39-41] To account for this bias, expected survival data were adjusted for cancer-specific mortality rates in the general population, where appropriate.[39]

The following is a complete description of the survival methodology used:

- Analyses were based on individuals aged 15–99 years at diagnosis, excluding adolescent (15–19 years) bone cancers, which are dissimilar to bone cancers diagnosed in older adults. A second exception related to the analysis of childhood cancers, which was based on children under the age of 15 years at diagnosis.
- Observed survival proportions were reported for the analysis of childhood cancers.
- Age-specific net survival was estimated directly from age-specific relative survival ratios (RSRs).
- Net survival for ages 15–99 combined was estimated using age-standardized (RSRs).[42] As previously mentioned, age-standardization was used here to mitigate the bias that can arise because people diagnosed at older ages are more likely to die from causes other than the cancer of interest than those diagnosed at younger ages.
- Age-standardization was performed using the direct method, which involved weighting age-specific estimates for a given cancer to the age distribution of persons recorded as being diagnosed with that cancer in Canada from 2004 to 2008.
- RSRs were estimated by comparing the actual survival experience of persons diagnosed with cancer to that expected in the general population of people in Canada of the same age, sex, province or territory of residence and time period. As previously mentioned, earlier editions of this publication made the assumption that the bias introduced by the use of population-based life tables, which include people previously diagnosed with cancer, was negligible. This has been shown to be true for most, but not all, individual cancers and to not be true for all cancers combined.[39-41]

- To account for the aforementioned bias, expected survival data used in the calculation of RSRs for prostate, female breast and colorectal cancer, as well as for all cancers combined, were adjusted for cancer specific mortality rates in the general population.[39-41] In each case, the proportion of deaths among Canadian residents due to cancer, by sex, five-year age group and year of death, was used for the adjustment.
- Analyses were based on a publicly available algorithm,[43] with some minor adaptations to increase precision. Expected survival proportions were derived using the Ederer II approach,[44] from sex-specific provincial life tables produced by Statistics Canada.
- Analyses were based on all primary cancers. The effect of including multiple cancers in survival analyses has been studied both internationally[45, 46] and in Canada.[47]
- Deaths of people diagnosed with cancer were identified through record linkage of the CCR and the CVS: D, as well as from information reported by provincial or territorial cancer registries. For deaths reported by a registry but not confirmed by record linkage, it was assumed that the individual died on the date submitted by the reporting province or territory. At the time of the analysis, registration of new cases and follow-up for vital status were complete through December 31, 2008.
- Persons whose diagnosis was established through death certificate only or autopsy only were excluded.
- Survival time was measured in days. Cases with the same date of diagnosis and death (not including those previously excluded because they were diagnosed through autopsy only or death certificate only) were assigned one day of survival because the program automatically excludes cases with zero days survival. Exclusion of these cases would have biased the RSRs upward.
- For five-year survival, three-month subintervals were used for the first year of follow-up, then six-month subintervals for the remaining four years, for a total of 12 subintervals. Where the analysis was extended to 10 years, one-year subintervals were used for the sixth through 10th years.
- In practice, estimates of RSRs may exceed 100%. However, as these estimates were used to estimate net survival probability, a maximum of 100% was permitted for interval-specific RSRs.
- Survival analyses were conducted using both period and cohort analysis methods.[48] The period approach to survival analysis provides up-to-date predictions of cancer survival.[49] With this method, follow-up data do not relate to a fixed cohort of people with cancer. Rather, estimates of period survival are based on the assumption that persons diagnosed in the period of interest will experience the most recently observed conditional probabilities of survival.
- When survival is generally improving, a period estimate tends to be a conservative prediction of the survival that is eventually observed.
- Conditional five-year relative survival was calculated as per five-year RSRs using only the data of people who have already survived specified amounts of time since diagnosis.[50, 51]
- Confidence intervals are provided as an indication of the level of statistical uncertainty in the survival estimates. For age-standardized RSRs, standard errors were estimated by taking the square root of the sum of the squared weighted age-specific RSR standard errors. Standard errors of RSRs were estimated by dividing the standard error of the observed survival (determined by Greenwood's method[52]) by expected survival.[53]
- Net survival probabilities were expressed as percentages.
- Survival estimates associated with standard errors greater than 0.10 were omitted. Estimates associated with standard errors greater than 0.05 but less than or equal to 0.10 were italicized.

Prevalence

This section of the publication has been reproduced, as is, from the corresponding section in the 2014 publication. As such, the analytical techniques used reflect the state of knowledge at the time of the production of that publication.

The primary type of prevalence reported in this publication is tumour-based. Two-, five- and 10-year limited duration prevalence estimates are based on the number of cancers diagnosed in the previous two, five and 10 years among people who are alive.

Estimating prevalence requires current, accurate information about both the incidence and vital status of cases. Because of issues in correctly ascertaining the vital status of persons diagnosed while residing in Quebec, the following approach was used:

- Cancer site-, sex- and age-specific limited duration, tumour-based, prevalence estimates for all of Canada, excluding Quebec, were determined directly using the counting method.[54, 55] Specifically, all primary invasive cancers (including in situ bladder cancers) diagnosed among persons residing outside of Quebec in the relevant time period and alive on January 1, 2009, were counted, regardless of whether they were first or subsequent primaries.
- Sex- and age-specific population estimates for January 1, 2009, were derived by averaging the 2008 and 2009 mid-year population estimates for all of Canada, excluding Quebec.
- Cancer site-, sex- and age-specific limited duration prevalence proportions for all of Canada, excluding Quebec, were then estimated by dividing counts by the appropriate population estimates.
- Cancer site-, sex- and age-specific counts for all of Canada, including Quebec, were then obtained by applying the prevalence proportions to Canadian sex- and age-specific population estimates, which included Quebec, and then summing across the strata.
- Person-based limited duration prevalence counts are estimated as the number of individuals represented in the tumour-based limited duration prevalence counts. For example, a person diagnosed with two primary cases of cancer A and one of cancer B in the 10 years preceding the index date would be counted once under cancer A, once under cancer B and once under all cancers combined for 10-year person-based prevalence. In terms of 10-year tumour-based prevalence, the same person would contribute twice to cancer A, once to cancer B and three times to all cancers combined.
- Age-specific prevalence estimates were obtained using the age attained as of January 1, 2009.
- The indirect approach for estimating cancer prevalence in Quebec is different from that used in previous versions of this publication. The current approach's primary assumption is that sex- and age-specific limited duration cancer prevalence proportions, calculated using cancer cases and population estimates from all of Canada excluding Quebec, are an accurate estimate of cancer prevalence proportions within Quebec.

Chapter 6: Pancreatic cancer

The methods used to estimate incidence, mortality and survival in Chapter 6 mirror those previously described. One exception is the estimation of median survival, which is described in a footnote with Figure 6.6. This chapter also includes estimates of endocrine pancreatic cancers, pancreatic cancer stage at diagnosis and population attributable risks. Details on these calculations are provided in the following sections, along with additional discussion on the high estimates of pancreatic cancer survival in Ontario.

Endocrine pancreatic cancers

Consistent with the World Health Organization definition,[56] the following morphological codes were used to identify endocrine pancreatic cancers:

	ICD-O-3 Morphology
Neuroendocrine tumour (NET)	
NET G1	8240/3
NET G2	8249/3
Non-functional pancreatic NET G1, G2	8150/3
Neuroendocrine carcinoma (NEC)	8246/3
Large cell NEC	8013/3
Small cell NEC	8041/3
EC cell, serotonin-producing NET (carcinoid)	8241/3
Gastrinoma	8153/3
Glucagonoma	8152/3
Insulinoma	8151/3
Somatostatinoma	8156/3
VIPoma	8155/3

Note: ICD-O-3 refers to the *International Statistical Classification of Diseases for Oncology, Third Edition*.

The percentage of endocrine pancreatic cancers was calculated based on all invasive pancreatic cancer cases diagnosed in 2013, excluding those with unspecified histology (histology codes 8000–8009). Since data from Quebec were not available to 2013, the estimate excludes Quebec.

Pancreatic cancer stage

As no national data on pancreatic cancer stage at diagnosis were available, these data were obtained in aggregate form from provincial registries that collect the information requested. The data excluded non-residents but were not restricted based on age, sex or method of diagnostic confirmation (e.g., death certificate only, clinical/radiological cases). Cancers were registered based on the Surveillance, Epidemiology and End Results (SEER) Program rules for multiple primaries.

TNM is a staging system used to classify cancers based on the extent of the tumour (T), the extent of spread to the lymph nodes (N) and the presence of metastasis (M). To identify pancreatic cancer stage in this publication, TNM "best stage group" was assigned using the Collaborative Stage System Version 02.05, which incorporates the American Joint Committee on Cancer TNM seventh edition.

Data were requested to 2013 because it is the latest diagnosis year used in this report, and three years of pooled data (2011 to 2013) were requested to improve the precision of the estimates. Due to data availability, data from Alberta are from 2012 to 2014, and because of low counts, data from Prince Edward Island are from 2011 to 2014.

Population attributable risks

A population attributable risk (PAR) provides an estimate of the percentage of incident cancer cases that can be attributed to exposure to a specific risk factor. The PARs for pancreatic cancer presented in this publication were contributed by the Canadian Population Attributable Risk (ComPARe) project, which is led by Dr Christine Friedenreich and Dr Darren Brenner of Alberta Health Services and the University of Calgary. ComPARe is an ongoing project aimed at estimating the percentage of new cases of cancer in Canada, now and projected to 2040, caused by preventable lifestyle and environmental exposures.

PARs reported in this publication were estimated using the formula by Levin,[57] which required age- and sex-specific prevalence data for the exposures of interest among Canadian adults and effect estimates (odds ratios or relative risks) associated with exposure and pancreatic cancer risks.

The effect of risk factors on pancreatic cancer incidence is assumed to be the product of previous exposures. Biologically plausible latency periods (i.e., the time between exposure measurement and cancer diagnosis) were quantified using the average time between exposure measurement and cancer diagnosis obtained from large prospective cohort studies. This information was then compared with the time for which high-quality data on exposure prevalence were available. Prevalence estimates corresponding to the midpoint of potential latency periods from cohort studies were identified and used in the PAR analysis.

Prevalence estimates for current and former smoking, alcohol consumption and daily fruit and vegetable intake were obtained from the Canadian Community Health Survey (CCHS) cycle 1.1 (2000–01). Estimates of the prevalence of being overweight or obese were obtained from the CCHS Cycle 2.1 (2003). These survey years were chosen to align with latency periods of 12 years for smoking, alcohol and diet, and nine years for obesity. Relative risks of pancreatic cancer for smoking, alcohol, overweight/obesity and insufficient fruit and vegetable intake were obtained from recent meta-analyses.[58-61] In the CCHS, current smokers are defined as those who smoked cigarettes daily or occasionally at the time of the interview, and former smokers are those who did not smoke at the time of the interview but had smoked more than 100 cigarettes in their lifetime. Relative risks for current smoking and former smoking are 1.70 (95% confidence interval [CI] = 1.51–1.91) and 1.18 (95% CI 1.04–1.33), respectively, for both sexes combined. Overweight was defined as a body mass index (BMI) ≥25.0 kg/m^2 and <30.0 kg/m^2 and obese was defined as a BMI ≥30 kg/m^2. Relative risks of being overweight and being obese are 1.11 (95% CI 0.99–1.25) and 1.11 (95% CI 0.95–1.30) for men and 1.15 (95% CI 0.99–1.34) and 1.34 (95% CI 1.11–1.64) for women, respectively. The relative risk for alcohol consumption is 1.04 (95% CI 1.02–1.05) per drink/day for both sexes combined. Relative risks for insufficient fruit intake (less than five servings per day) are 1.04 (95% CI 1.01–1.08) for men and 1.05 (95% CI 1.02–1.09) for women. The relative risk for vegetable intake (for each 80 grams per day below 320 grams per day) is 1.06 (95% CI 1.04–1.08) for both sexes combined.

To estimate the overall PAR for all age groups and sexes combined, the PARs for all age and sex subgroups were summed and divided by the total number of incident pancreatic cancer cases in 2012. The confidence intervals for the PARs were estimated using Monte-Carlo simulation. In brief, the distribution of the PAR was simulated by randomly drawing from the distribution of relative risk and prevalence estimates to generate 10,000 PAR estimates. The 2.5% and 97.5% percentile values were taken as the lower and upper limits of the confidence interval.

Survival in Ontario

Ontario's high pancreatic cancer survival has been previously investigated by Cancer Care Ontario.[62] The conclusion was that the bias in five-year survival appears to be caused by the assumption that all cases lost to follow up are alive at the cut-off date, whereas in reality some are not. This bias has a much greater impact on cancers with low survival, such as pancreatic, where the likelihood that the case is still alive is low.

Based on the data presented here, an additional investigation was undertaken. These analyses revealed that pancreatic cancer cases diagnosed from 1992 to 1996 in Canada were almost four times more likely to be considered alive at the end of 2008 if they had been diagnosed in Ontario rather than elsewhere in Canada (data not shown). This ratio ranged from 1.7 among those aged 15–44 years at diagnosis to 18.2 among those aged 75–99 years. This provides additional evidence that disproportional number of deaths among pancreatic cancer cases, particularly in older age groups, were not identified in Ontario.

The reason for the possible higher under-identification of deaths among pancreatic cancer cases in Ontario relative to other provinces is not clear, but there are several possible contributors. For instance, death clearance in Canada has not traditionally included deaths from Quebec, which neighbours Ontario and is Canada's second most populous province. As interprovincial migration is higher out of Ontario than other provinces[63], incomplete national death clearance is an important factor to consider. Another possible contributor is that, unlike other provinces, which have a more active registration process, the Ontario Cancer Registry used only passive case registration methods during the time period under consideration. This can lead to artificially earlier diagnosis dates[64] and misidentification of records as cancer cases, both of which likely bias survival estimates higher.

Previous research has shown that even a small percentage of missed deaths can result in large overestimation of five-year survival.[65] The impact of these missed deaths increased with follow-up duration and was more pronounced for older age groups and for cancers with poorer prognoses (such as pancreatic cancer).

It is also important to note that more recent advances in pancreatic cancer care in Ontario, such as the formation of high-volume pancreatic cancer facilities, would not influence these survival results, as they are based on data from 2004 to 2008.

Overall, the evidence suggests pancreatic cancer survival rates in Ontario should be interpreted with caution, as should the national survival estimate, as it is heavily influenced by Ontario, Canada's most populous province.

Data and methods issues

Incidence

Although the Canadian Council of Cancer Registries and its standing Data Quality and Management Committee make every effort to achieve uniformity in defining and classifying new cancer cases, reporting procedures and completeness still vary across the country. The standardization of case-finding procedures, including linkage to provincial or territorial mortality files, has improved the registration of cancer cases and comparability of data across the country. Some specific issues remain:

- Benign and borderline tumours, and carcinomas in situ are not routinely captured or reported except for *in situ* carcinomas of the bladder. For the period included in this report, all provinces and territories except Ontario reported *in situ* bladder cancers to the CCR. At the time of analysis, data on in situ carcinomas of the bladder were limited to 2013 for Ontario. Consequently, Ontario's in situ carcinomas of the bladder are excluded from all analyses in this publication.
- In previous editions of this publication, it was noted that data from Newfoundland and Labrador (NL) were potentially affected by under-reporting of cases due to incomplete linkage of cancer and vital statistics information. The NL Cancer Registry has implemented death clearance processes to improve case ascertainment and have also improved the reporting of cases from sub-provincial regions that previously under-reported cases. As a result of the enhancements to the NL Cancer Registry, case ascertainment is improved in the 2006 data onward. However, underreporting persists in this province in years prior to 2006. For example, the total number of cases reported to the CCR by NL for 2005 is 21% lower than the corresponding count for 2006.

- Because the Quebec registry relied primarily on hospital data for the period included in the present report, the numbers of cases of some cancers are underestimated, particularly for those where pathology reports represent the main source of diagnostic information. Prostate cancer, melanoma and bladder cancer are affected in particular.[66] The 2017 projections for these sites may be an underestimate because an increase in cases in the registry is expected with the inclusion of pathology reports starting with 2011 data.
- No death certificate only (DCO) cases were reported to the CCR from Quebec for 2010 and from Ontario for 2008 onward. DCO cases for 2010 in Quebec were created by randomly assigning DCO cases diagnosed in 2007 to 2009 to the time period 2010 to 2012 and retaining the 2010 DCO cases. DCO cases for 2008 to 2013 in Ontario were created by doubling the DCO cases diagnosed in 2005 to 2007 and randomly assigning them to the time period 2008 to 2013. These DCO cases were all assumed to be first cancer diagnoses when calculating the probability of developing cancer.
- In October 2014, Ontario implemented a new cancer reporting system. The new system has several enhancements that permit the identification of cancer cases that previously went unrecorded. These include the use of more liberal rules for counting multiple primary sites, the use of additional source records and the inclusion of records that were previously not included. While the new system has applied these changes retrospectively to the 2010 diagnosis year onward, the first year reported to the CCR using this new system was the 2013 diagnosis year. The relative number of cases of certain types of cancer—including bladder, non-Hodgkin lymphoma, leukemia, multiple myeloma, melanoma and stomach—reported to the CCR from Ontario increased considerably from 2012 to 2013, while for many other cancers studied in this publication there was little change. Statistics Canada and Cancer Care Ontario are currently working together to synchronize case ascertainment back to 2010.
- Bladder cancer included *in situ* carcinomas, which are considered invasive for the purpose of incidence reporting for all provinces and territories except Ontario. At the time of analysis, data on *in situ* carcinomas of the bladder were limited to 2013 for Ontario. Consequently, Ontario's *in situ* carcinomas of the bladder are excluded from all analyses in this publication.
- For the 2013 diagnosis year there was a case reporting delay of just under 8% for all cancers combined in British Columbia.
- Non-melanoma skin cancers (neoplasms, NOS; epithelial neoplasms, NOS; basal and squamous) are not included since most provincial and territorial cancer registries (PTCRs) do not collect incidence data on this type of cancer. These cancers are difficult to register because they may be diagnosed and/or treated in a variety of settings that do not report to the PTCRs, including dermatologist offices.

Multiple primaries

- There are two common systems of rules used to determine when a second or subsequent cancer should be considered a new primary cancer, as opposed to a relapse or duplicate of a previously registered cancer: one from the International Agency for Cancer Research (referred to as the "IARC rules") and one from the Surveillance, Epidemiology, and End Results Program (referred to as "SEER rules"). IARC rules tend to yield lower total case counts than the SEER rules because IARC rules generally do not permit multiple cancers to be diagnosed at the same site within a single individual.
- Although all provinces and territories now register cancers according to the SEER rules for multiple primaries, historically, some did not. Since this report uses historical data, data were collapsed into the IARC rules for all regions. Consequently, cancer counts for some provinces may appear lower in this publication than cancer counts in provincial cancer reports. The magnitude of difference between the two systems varies by province, cancer, sex and diagnosis year. For example, unpublished analyses performed by the Public Health Agency of Canada on the CCR file showed British Columbia would report approximately 6% more female breast cancer cases under the SEER rules compared with the IARC rules for diagnosis year 2010. For male melanoma in British Columbia, the number of new cases in 2010

under the SEER rules would be about 8% higher than under the IARC rules. A recent paper from the United States based on data from the SEER program reported similar differences between statistics based on SEER and IARC rules[67] and also examined the impact of the rules on reported trends.

Mortality

Although procedures for registering and allocating cause of death have been standardized both nationally and internationally, some lack of specificity and uniformity is inevitable. The description of cancer type provided on the death certificate is usually less accurate than that obtained by the cancer registries from hospital and pathology records. Although there have been numerous small changes in definitions over the years (see Tables A3-1 and A3-2), there are a few of note:

- In the versions of this publication published before 2003, mortality due to colorectal cancer was based on the International Classification of Diseases, Ninth Revision (ICD-9)[3] codes 153–154, which was consistent with other publications. However, this definition underestimates colorectal cancer mortality by about 10% because most deaths registered as ICD-9 code 159.0 (intestine, not otherwise specified) are cases of colorectal cancer. Starting in the 2003 edition of this publication, these deaths were included in the definition of colorectal cancer. As a consequence, mortality figures for colorectal cancer appearing in this publication cannot be directly compared with those appearing in publications prior to 2003.
- The liver cancer mortality definition currently used differs from that used by some other North American publications (http://www.naaccr.org/dataandpublications/ cinapubs.aspx; http://seer.cancer.gov/csr/1975_2012/). SEER Cancer Statistics Review presents estimates for liver and intrahepatic bile duct (C22.0 to C22.9), while Cancer in North America (CINA) presents estimates for liver (C22.0, C22.2 to C22.9). Consistent with CINA, estimates of liver cancer mortality in this publication exclude cancers of the intrahepatic bile duct (C22.1). However, unlike SEER and CINA, this publication also excludes liver, unspecified (C22.9). This decision was based on unpublished analyses performed by the Public Health Agency of Canada indicating a consequential number of CCR decedents without a registered primary liver cancer had C22.9 as their underlying cause of death. In other words, C22.9 likely includes a substantial number of deaths from cancers that metastasized to the liver. Nevertheless, given C22.9 also contains primary liver cancer deaths, its exclusion from the liver cancer mortality definition used in this publication results in underestimated liver cancer deaths. The impact of adding liver, unspecified (C22.9) to the current liver cancer mortality definition would be substantial, increasing the number of liver cancer deaths in Canada in 2012 by about 45.9% (from 1,059 to 1,545 deaths). Therefore, the method of defining liver cancer mortality should be acknowledged when comparing estimates across sources. The Canadian Cancer Statistics Advisory Committee will continue to examine this issue when deciding the definition to use for future publications.

Finally, due to data sharing agreements, detailed information regarding deaths occurring in Quebec was not available for 2001 onward. Information regarding the year, sex, age and cause of deaths occurring in Quebec was obtained by differencing a national file, which includes all deaths occurring among residents of Canada (including Quebec), and a file excluding deaths in Quebec. This approach slightly overestimates cancer deaths among residents of Quebec (e.g., by 13 cancer deaths in 2012) and correspondingly slightly underestimates cancer deaths among people residing outside of Quebec.

Survival

Cases diagnosed in the province of Quebec were excluded from survival analyses, in part because the method of ascertaining the date of diagnosis of cancer cases in this province clearly differed from that of the other provincial cancer registries[68] and because of issues in correctly ascertaining the vital status of cases.

Prevalence

Because of issues in correctly ascertaining the vital status of persons diagnosed while residing in Quebec, prevalence data for this province were determined indirectly (see *Methods* section above). Prevalence estimates were derived using the corresponding observed prevalence proportion calculated for the rest of Canada, stratified by age group, sex and cancer type.

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TABLE A1 New cases and average annual age-standardized incidence rates (ASIR) by diagnostic group, in children (0–14 years), Canada, 2006–2010

Diagnostic group	New cases* (both sexes)	ASIR 1,000,000 per year
Total (5 years)†	**4,540**	**163.3**
Average per year	**910**	
I. Leukemia	**1,460**	**53.0**
a. Lymphoid	1,140	41.6
b. Acute myeloid	200	7.2
III. Central nervous system	**875**	**31.3**
a. Ependymoma	100	3.6
b. Astrocytoma	375	13.4
c. Intracranial & intraspinal embryonal	195	7.1
II. Lymphoma	**505**	**17.6**
a. Hodgkin lymphoma	190	6.4
b. Non-Hodgkin lymphoma	160	5.6
c. Burkitt lymphoma	45	1.6
IV. Neuroblastoma & other PNC	**355**	**13.1**
a. Neuroblastoma	350	13.0
IX. Soft tissue	**295**	**10.6**
a. Rhabdomyosarcoma	140	5.1
VI. Renal tumours	**235**	**8.7**
a. Nephroblastoma	225	8.3
XI. Other malignant epithelial	**205**	**7.1**
b. Thyroid	90	3.1
d. Malignant melanoma	50	1.7
VIII. Malignant bone	**195**	**6.8**
a. Osteosarcoma	100	3.5
c. Ewing sarcoma	75	2.7
X. Germ cell and other gonadal	**145**	**5.0**
c. Gonadal germ cell tumours	55	2.0
V. Retinoblastoma	**120**	**4.5**
XII. Other and unspecified cancers	**70**	**2.5**
VII. Hepatic tumours	**75**	**2.7**

Analysis by: Health Statistics Division, Statistics Canada
Data source: Canadian Cancer Registry database at Statistics Canada

PNC= peripheral nervous cell tumours

* International classification of childhood cancer (ICCC) Recode ICD-O-3/WHO 2008. Surveillance, Epidemiology, and End Results Program (SEER). Diagnostic groups are listed in descending order of disease incidence.

† Total included 10 malignant cases that were unclassifiable.

Note: Rates are age-standardized to the under age 15 years component of the 2011 Canadian population using the following age groups: < 1, 1–4, 5–9 and 10–14. Rates are expressed per million due to disease rarity.

TABLE A2 Cancer definitions

Cancer	ICD-O-3 Site/Type (incidence)	ICD-10 (mortality)
Oral	C00–C14	C00–C14
Esophagus	C15	C15
Stomach	C16	C16
Colorectal	C18–C20, C26.0	C18–C20, C26.0
Liver	C22.0	C22.0, C22.2–C22.7
Pancreas	C25	C25
Larynx	C32	C32
Lung and bronchus	C34	C34
Melanoma	C44 (Type 8720–8790)	C43
Breast	C50	C50
Cervix	C53	C53
Body of uterus and uterus NOS	C54–C55	C54–C55
Ovary	C56.9	C56
Prostate	C61.9	C61
Testis	C62	C62
Bladder (including *in situ* for incidence)	C67	C67
Kidney and renal pelvis	C64.9, C65.9	C64–C65
Brain/CNS	C70–C72	C70–C72
Thyroid	C73.9	C73
Hodgkin lymphoma*	Type 9650–9667	C81
Non-Hodgkin lymphoma*	Type 9590–9597, 9670–9719, 9724–9729, 9735, 9737, 9738	C82–C85, C96.3
	Type 9811-9818, 9823, 9827, 9837 all sites except C42.0,.1,.4	
Multiple myeloma*	Type 9731, 9732, 9734	C90.0, C90.2
Leukemia*	Type 9733, 9742, 9800–9801, 9805-9809, 9820, 9826, 9831–9836, 9840, 9860–9861, 9863, 9865–9867, 9869–9876, 9891, 9895–9898, 9910, 9911, 9920, 9930–9931, 9940, 9945–9946, 9948, 9963–9964	C91–C95, C90.1
	Type 9811-9818, 9823, 9827, 9837 sites C42.0,.1,.4	
All other cancers	All sites C00–C80, not listed above	All sites C00–C80, C97 not listed above
All other and unspecified cancers (grouping used only in Tables A1 and A2)	Type 9140, 9740, 9741, 9750–9759, 9760–9769, 9950–9962, 9966, 9970–9989, 9991, 9992 C76.0–C76.8 (type 8000–9592) C80.9 (type 8000–9592) C42.0–C42.4 (type 8000–9592) C77.0–C77.9 (type 8000–9592) C44.0–C44.9 excluding type 8050–8084, 8090–8110, 8720–8790, 9590–9992	C26.1, C44, C46, C76–C80, C88, C96.0–.2, C96.7–.9, C97
All cancers	All invasive sites	All invasive sites

CNS=central nervous system; NOS=not otherwise specified

* For incidence, histology types 9590–9992 (leukemia, lymphoma and multiple myeloma), 9050–9055 (mesothelioma) and 9140 (Kaposi sarcoma) are excluded from other specific organ sites.

Note: ICD-O-3 refers to the *International Classification of Diseases for Oncology, Third Edition*.[2] ICD-10 refers to the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision*.[4]

TABLE A3-1 Recent cancer definition changes in incidence

	New definition	Year changed	Old definition
Bladder	ICD-O-3 C67 (including *in situ* cancers, except for Ontario since this province does not report *in situ* bladder cancer)	2006	ICD-O-3, C67 (not including *in situ* cancers)
Colorectal	ICD-O-3 C18–C20, C26.0	2011	ICD-O-3 C18–C21, C26.0
Kidney and renal pelvis	ICD-O-3 C64–C65	2008	ICD-O-3 C64–C66, C68
Lung and bronchus	ICD-O-3 C34	2008	ICD-O-3 C33-C34 (before 2006) ICD-O-3 C34 (in 2006) ICD-O-3 C33–C34 (in 2007)
Ovary	ICD-O-3 C56	2006	ICD-O-3 C56, C57.0–C57.4

Note: Bladder, colorectal, kidney, lung and ovary cancers exclude histology types 9590–9992 (leukemia, lymphoma and multiple myeloma), 9050–9055 (mesothelioma) and 9140 (Kaposi sarcoma). ICD-O-3 refers to the *International Classification of Diseases for Oncology, Third Edition*.[2]

TABLE A3-2 Recent cancer definition changes in mortality

	New definition	Year changed	Old definitions
Colorectal	ICD-10 C18–C20, C26.0	2012	ICD-10 C18–C21, C26.0
Kidney and renal pelvis	ICD-10 C64–C65	2008	ICD-10 C64–C66, C68
Leukemia	ICD-10 C91–C95, C90.1	2008	ICD-10 C91–C95
Liver	ICD-10 C22.0, C22.2–C22.7	2007	ICD-10 C22 (before 2006) ICD-10 C22.0, C22.2–C22.9 (in 2006)
Lung and bronchus	ICD-10 C34	2008	ICD-10 C33–C34 (before 2006) ICD-10 C34 (in 2006) ICD-10 C33–C34 (in 2007)
Multiple myeloma	ICD-10 C90.0, C90.2	2008	ICD-10 C88, C90 (before 2007) ICD-10 C90 (in 2007)
Ovary	ICD-10 C56	2006	ICD-10 C56, C57.0–C57.4
All other and unspecified cancers	ICD-10 C44, C46, C76–C80, C88,C96.0–C96.2, C96.7–C96.9, C97	2007	ICD-10 C44, C46, C76–C80,C96.0–C96.2, C96.7–C96.9, C97

Note: ICD-10 refers to the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision*.[4]

TABLE A4 Use of five-year average method* for incidence projection by cancer type, sex and province, 2017

	BC		AB		SK		MB		ON		QC		NB		NS		PE		NL	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Oral			■			●	■							●		●	■	●		●
Esophagus				●	■	●	■	●					■	●	■	●	■	●	■	●
Stomach						●		●						●		●	■	●		●
Colorectal							■	●	■	●							■	●		
Liver				●	■	●	■	●					■	●	■	●	■	●	■	●
Pancreas							■		■	●							■	●	■	●
Larynx	■	●	■	●	■	●	■	●					■	●	■	●	■	●	■	●
Lung and bronchus									■	●								●		
Melanoma									■	●						●	■	●	■	●
Breast	■		■		■		■	●			■		■		■		■	●	■	●
Cervix				●		●		●		●				●		●		●		●
Uterus (body, NOS)										●								●		
Ovary																		●		●
Prostate†							■		■										■	
Testis					■		■						■		■		■		■	
Bladder							■	●	■	●							■	●		●
Kidney and renal pelvis					■		■		■	●							■	●	■	●
Brain/CNS					■	●	■	●					■	●	■	●	■	●	■	●
Thyroid				●	■		■	●	■	●			■	●	■		■	●	■	
Hodgkin lymphoma		●		●	■	●	■	●					■	●	■	●	■	●	■	●
Non-Hodgkin lymphoma																	■	●		
Multiple myeloma					■	●	■	●					■	●	■	●	■	●	■	●
Leukemia							■	●									■	●	■	●
All other cancers																	■	●		

M=males; F=females. BC=British Columbia; AB=Alberta; SK=Saskatchewan; MB=Manitoba; ON=Ontario; QC=Quebec; NB=New Brunswick; NS=Nova Scotia; PE=Prince Edward Island; NL=Newfoundland & Labrador.

■ ● correction factor was applied to projection analysis

CNS=central nervous system; NOS=not otherwise specified

* Nordpred Power5 regression model is the default method, except when the average annual deaths for the most recent five years is less than or equal to 50, in which case the five-year average method is the default.

† An annual age-specific Power5 model that includes common trend or age-specific trend parameters is the default for prostate cancer. In place of the five-year average as an alternative, the last available year of data was used for prostate cancer to better capture recent changes observed for this cancer.

Note: For territories (not shown), five-year average method was used for all cancers because of small numbers.

TABLE A5 Use of five-year average method* for mortality projection, by cancer type, sex and province, 2017

	BC		AB		SK		MB		ON		QC		NB		NS		PE		NL	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Oral		●		●	■	●	■	●					■	●	■	●	■	●	■	●
Esophagus				●	■	●		●					■	●		●	■	●	■	●
Stomach			■		■	●	■	●					■	●	■	●	■	●	■	●
Colorectal																	■	●		
Liver		●		●	■	●	■	●					■	●	■	●	■	●	■	●
Pancreas																	■	●	■	●
Larynx	■	●	■	●	■	●	■	●		●		●	■	●	■	●	■	●	■	●
Lung and bronchus																		●		
Melanoma		●		●	■	●	■	●					■	●	■	●	■	●	■	●
Breast	■		■		■		■		■		■		■		■		■	●	■	
Cervix		●		●		●		●						●		●		●		●
Uterus (body, NOS)						●		●						●		●		●		●
Ovary						●								●				●		●
Prostate																	■			
Testis	■		■		■		■		■		■		■		■		■		■	
Bladder				●	■	●	■	●					■	●	■	●	■	●	■	●
Kidney and renal pelvis				●	■	●	■	●					■	●	■	●	■	●	■	●
Brain/CNS					■	●	■	●					■	●	■	●	■	●	■	●
Thyroid	■	●	■	●	■	●	■	●	■	●	■	●	■	●	■	●	■	●	■	●
Hodgkin lymphoma	■	●	■	●	■	●	■	●	■	●	■	●	■	●	■	●	■	●	■	●
Non-Hodgkin lymphoma					■	●	■	●					■	●	■	●	■	●	■	●
Multiple myeloma				●	■	●	■	●					■	●	■	●	■	●	■	●
Leukemia					■	●		●					■	●	■	●	■	●	■	●
All other cancers																	■	●		

M=males; F=females. BC=British Columbia; AB=Alberta; SK=Saskatchewan; MB=Manitoba; ON=Ontario; QC=Quebec; NB=New Brunswick; NS=Nova Scotia; PE=Prince Edward Island; NL=Newfoundland & Labrador.

CNS=central nervous system; NOS=not otherwise specified

* Nordpred Power5 regression model is the default method, except when the average annual deaths for the most recent five years is less than or equal to 50, in which case the five-year average method is the default.

Note: For territories (not shown), five-year average method was used for all cancers because of small numbers.

APPENDIX III: Previous special topics, abbreviations and index

Previous special topics

Special topics are related to current or ongoing issues in cancer surveillance or cancer control. In particular, they aim to provide an in-depth look at the Canadian context. The following previous special topics are available at cancer.ca/statistics:

2016	HPV-associated cancers
2015	Predictions of the future burden of cancer in Canada
2014	Skin cancers
2013	Liver cancer
2011	Colorectal cancer
2010	End-of-life care Cancer in depth: esophagus cancer Cancer in depth: kidney cancer
2009	Cancer in adolescents and young adults (15–29 years)
2008	Childhood cancer (ages 0–14)
2007	Breast cancer
2006	Progress in cancer control: screening
2005	Progress in cancer prevention: modifiable risk factors
2004	International variation in cancer incidence, 1993–1997 Economic burden of cancer in Canada, 1998
2003	Non-Hodgkin's lymphoma
2002	Cancer incidence in young adults Five-year relative cancer survival in Canada, 1992
2001	Colorectal cancer
2000	Progress in cancer control
1999	Factors contributing to the population burden of cancer incidence and mortality A new national cancer surveillance system for Canada
1998	International comparisons
1997	Ten years of Canadian cancer statistics
1996	Prostate cancer Direct costs of cancer in Canada, 1993 Evaluation of cancer estimates: 1987–1991
1995	Prevalence of cancer Colorectal cancer
1993	Female breast cancer
1991	Smoking and lung cancer Cancer among the Inuit and Indians
1990	Cancer of the female breast and genital organs – recent trends Hodgkin's disease and cancer of the testis Cancer mortality by income quintile Economic cost of illness in Canada Cancer control
1989	Cancer incidence and mortality: an international comparison
1988	Tobacco consumption from smoking and mortality from lung cancer Cancer mortality: an international comparison

Abbreviations

AAPC	Average annual percent change
APC	Annual percent change
ASIR	Age-standardized incidence rate
ASMR	Age-standardized mortality rate
CCHS	Canadian Community Health Survey
CCR	Canadian Cancer Registry
CI	Confidence interval
CL	Confidence limits
CNS	Central nervous system
CTFPH	Canadian Task Force on Preventive Health Care
CVS: D	Canadian Vital Statistics – Death database
DCO	Death certificate only
HAART	Highly active antiretroviral therapy
HIV	Human immunodeficiency virus
HPV	Human papillomavirus
HRT	Hormone replacement therapy
IARC	International Agency for Research on Cancer
ICCC-3	International Classification of Childhood Cancer, Third Edition
ICD-9	International Statistical Classification of Diseases and Related Health Problems, Ninth Revision
ICD-10	International Statistical Classification of Diseases and Related Health Problems, Tenth Revision
ICD-O-3	International Classification of Diseases for Oncology, Third Edition
IPMN	Intraductal papillary mucinous neoplasm
NCIRS	National Cancer Incidence Reporting System
NOS	Not otherwise specified
OSP	Observed survival proportion
PSA	Prostate-specific antigen
PTCR	Provincial and territorial cancer registries
PAR	Population attributable risk
PYLL	Potential years of life lost
RSR	Relative survival ratio
SEER	Surveillance, Epidemiology, and End Results Program

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Tables

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Figures

For further information

Partner organizations

Canadian Council of Cancer Registries

Cancer incidence data are supplied to Statistics Canada by provincial and territorial cancer registries. Detailed information regarding the statistics for each province or territory is available from the relevant registry.

Public Health Agency of Canada

phac-aspc.gc.ca (select "surveillance")

More detailed information on the methodology used in this publication is available from the Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada, 785 Carling Avenue, Ottawa, Ontario, K1A 0K9. Email: ccs-ssc@phac-aspc.gc.ca

Chronic Disease Infobase Cubes (infobase.phac-aspc.gc.ca) is an interactive online tool for easy access to cancer surveillance data. It allows you to generate tables, charts and maps according to a choice of parameters, such as cancer type, geographic area and time period.

Statistics Canada

statcan.gc.ca (search "cancer")

More detailed information on the survival and/or prevalence methodology used in this publication is available from the Health Statistics Division, Statistics Canada, National Enquiries Line (1-800-263-1136) or through Client Services in the Health Statistics Division (613-951-1746).

Custom tabulations are available on a cost-recovery basis upon request. Analytical articles appear regularly in *Health Reports*, Statistics Canada, Catalogue no. 82-003. Detailed standard tables are available on the Statistics Canada website (statcan.gc.ca).

Canadian Cancer Society

cancer.ca

For general information about cancer (such as cancer prevention, screening, diagnosis, treatment or care), contact the Canadian Cancer Society's Cancer Information Service at 1-888-939-3333 or the Canadian Cancer Society, National Office or divisional offices.

For information about research funded by the Canadian Cancer Society, visit cancer.ca/research or contact us at research@cancer.ca.

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Questions about cancer?

When you want to know more about cancer, call the Canadian Cancer Society's Cancer Information Service.

1-888-939-3333 Monday to Friday
cancer.ca

Canadian Cancer Society
Société canadienne du cancer