Canadian Cancer Statistics 2013

Special topic: Liver cancer

Public Health Agency of Canada / Agence de la santé publique du Canada

Statistics Canada / Statistique Canada

Canadian Cancer Society / Société canadienne du cancer

With you in the fight for life

Avec vous dans le combat pour la vie

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

Citation:
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[May 2013]

ISSN 0835-2976

This publication is available in English and French on the Canadian Cancer Society's website at cancer.ca/statistics. The website includes 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 be notified about next year's publication or to offer ideas on how the publication can be improved, please complete the evaluation form or e-mail stats@cancer.ca.

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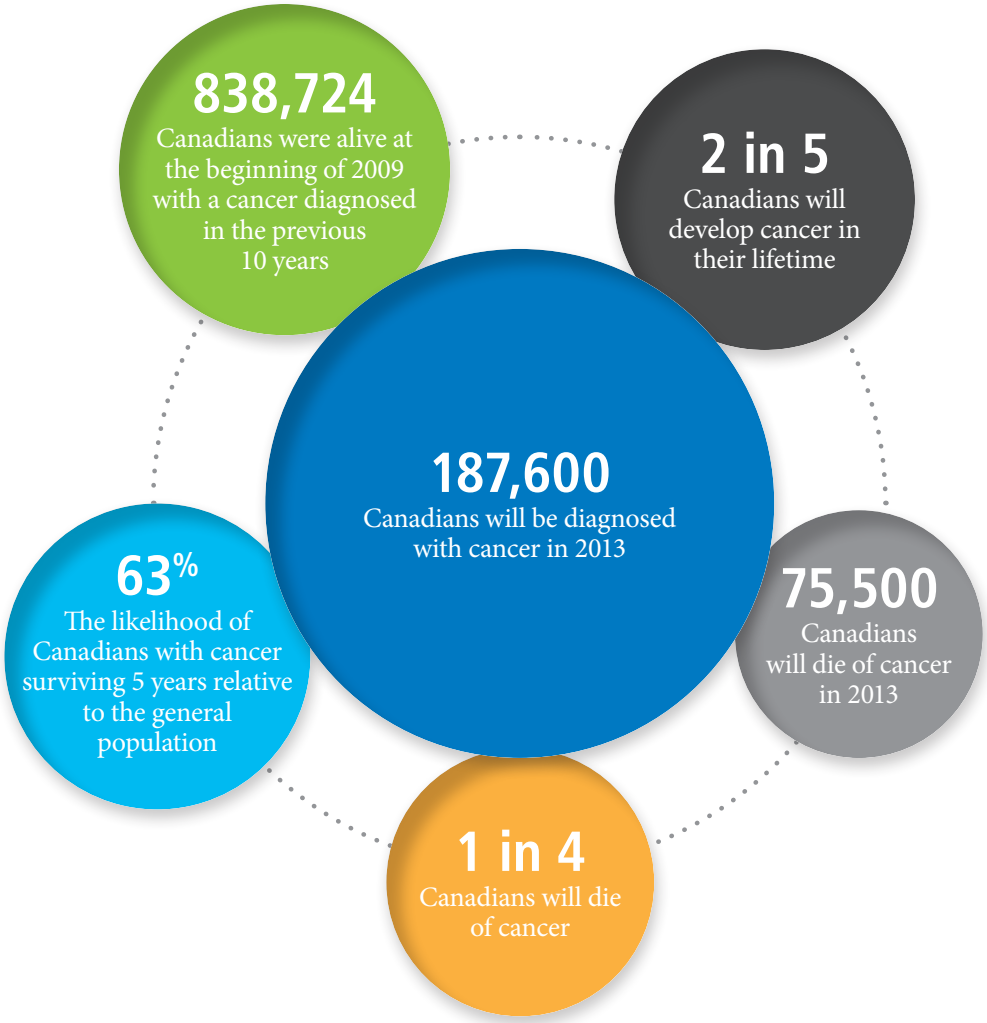
Executive summary

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

About 2 in 5 Canadians will develop cancer in their lifetime and about 1 in 4 Canadians will die of cancer. In 2013, it is estimated that 187,600 Canadians will develop cancer and 75,500 will die of cancer. More than half of new cancer cases (52%) will be lung, breast, colorectal and prostate cancer. Lung cancer is the leading cause of cancer death, causing more cancer deaths among Canadians than the other three cancer types combined. Despite this large impact, there has been a significant drop in the lung cancer death rate (especially for men) over the past 20 years, which has driven a decline in the overall cancer death rate.

Slightly more men than women get cancer in Canada, and the vast majority (88%) of Canadians who develop cancer are over the age of 50. However, cancer can occur at any age. Its impact at a younger age can be particularly devastating: according to Statistics Canada, in 2009, cancer was the leading cause of disease-related death in children under the age of 15 years.

Overall, the five-year relative survival ratio for people diagnosed with cancer is 63%, but it ranges widely by the type of cancer. Some cancers have very high five-year relative survival ratios, including thyroid cancer (98%). Other cancers have consistently low five-year relative survival ratios, such as pancreatic cancer (8%).



As of January 2009, 838,724 Canadians had been diagnosed with cancer within the previous 10 years and were still alive on that date. This means that about 2.5% of the Canadian population were living with, or beyond, a cancer diagnosis in the decade leading up to 2009.

This year's publication also features an in-depth analysis of liver cancer (*Chapter 7: Special topic: Liver cancer*). This cancer is one of the fastest growing cancer types in Canada with regard to new cases and deaths. It is increasing particularly quickly in men, with an average annual percent increase in incidence of 3.6% (1970 to 2007). An estimated 1,550 men and 490 women will be diagnosed with liver cancer this year. Major risk factors for liver cancer include viral hepatitis infection (hepatitis B and C), smoking, alcohol consumption and obesity. A higher risk of liver cancer in lower income populations and concomitant barriers to accessing healthcare, early detection and treatment need to be investigated further to reduce the impact of this cancer. More Canadian data are also needed to understand the best strategies for risk reduction, early detection and treatment of hepatitis infection, as well as approaches to community engagement in promoting healthy behaviours in hard-to-reach populations.

Measuring the cancer burden in Canada is vital for health policy and it helps decision-makers assess the type and allocation of health resources needed. The data are also essential in focusing prevention efforts, in both primary prevention of cancer and secondary prevention, allowing more effective treatment of certain cancers through earlier detection. 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 supportive care after their treatment has ended. We hope that our readers will think critically about what these numbers mean and how they can be used to improve survival, develop better overall care for those with cancer and reduce cancer incidence in Canada.

About this publication

Canadian Cancer Statistics is part of an annual series that began in 1987. It has been 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 Canadian Council of Cancer Registries, Canadian Partnership Against Cancer and the US Centers for Disease Control and Prevention, as well as researchers based in universities and provincial or territorial cancer agencies.

Purpose and intended audience

The aim of this annual publication is to provide detailed information regarding incidence, mortality, survival and other measures of cancer burden for the most common types of cancer. Data are presented by sex, age and province or territory. They also show trends over time. The publication is designed to help health professionals, policy-makers and researchers identify and make decisions about new areas for investigation. The media, educators and members of the public with an interest in cancer will also find this publication valuable.

Format

Based on a recent evaluation of this publication, the content and format of this year's edition have changed.

- 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.
- Chapters 1 and 2 describe the incidence of cancer in Canada overall, by the demographic profile and over time.
- Chapters 3 and 4 examine the mortality associated with cancer in Canada by the demographic profile and over time.
- Chapter 5 focuses on relative survival for cancer in Canada by population demographics and over time.
- Chapter 6 describes the prevalence of cancer in Canada by examining the number of cancer cases and the number of people affected by cancer who are still alive.
- Chapter 7 is a special topic for this year's publication. The chapter explores the epidemiology of liver cancer, challenges in clinical management, prevention of this disease and new developments related to the control of the disease in Canada. In future editions, this chapter will feature other emerging or prominent issues on cancer, which are selected annually based on criteria that include data availability, recent trends and feedback from our readers through evaluation forms.
- The appendices provide the actual (not projected) data for new cancer cases and deaths, as well as additional information on data sources and projection methods. They also discuss caveats to the analyses presented in this publication and provide a listing of previously covered special topics, which are available in past editions of this publication.
- The last section of this publication (*For further information*) includes contact information for partner organizations and the provincial and territorial cancer registries.

The Introduction and Chapters 1 to 7 conclude with a list of other relevant resources, including links to online databases for additional analyses.

Analysis and production

The Chronic Disease Surveillance and Monitoring Division of the Centre for Chronic Disease Prevention (CCDP) at the Public Health Agency of Canada conducted the data analyses on incidence, mortality, probability and trends presented in this publication. The Health Statistics Division of Statistics Canada conducted the analyses on survival and prevalence presented in this publication. Provincial and territorial cancer registries were consulted regarding the cancer incidence and mortality estimates for their own jurisdictions.

The Canadian Cancer Society supports the production of this publication with charitable funds. Ms Monika Dixon coordinated the production process and provided administrative support from the initial planning through to release.

A note on data

The main sources of data for this publication are the Canadian Cancer Registry (CCR), National Cancer Incidence Reporting System (NCIRS), Canadian Vital Statistics — Death database (CVS: D) and population life tables, censuses and forecasts.

- Provincial and territorial cancer registries collect clinical and demographic data on newly diagnosed cancer cases for people residing in the 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.
- Cancers in this publication include only invasive primary cancers and are defined according to ICD-O-3[1] and ICD-10[2] classifications, unless otherwise noted.
- Non-melanoma skin cancers (basal and squamous) are not included because most provincial and territorial cancer registries do not collect incidence data on this type of cancer. Canada-wide non-melanoma skin cancer estimates are based on data from three provinces only and are shown in select tables. Note that for the chapters on survival and prevalence, all non-melanoma skin cancers (in addition to basal and squamous) are excluded.

This publication examines approximately 20 cancer types, which represent the vast majority of cancers that occur in Canada. For practical considerations of space and data quality, the less common cancers are excluded from this publication. Information on cancer types not covered here may be found through reports from Statistics Canada and the Public Health Agency of Canada.

Actual and estimated data

This publication strives to provide the most up-to-date data. However, because time is required for reporting, collating, verifying, analyzing and publishing surveillance data, the most recent information available is several years behind the current year. Actual cancer incidence data reported in this publication are for the period 1984 to 2010 (except for Quebec, for which data in the CCR in time for this publication were available to 2007). Actual mortality data are for the period 1984 to 2009 for all provinces and territories. Short-term statistical projections provide an estimate of cancer incidence and mortality for recent years (see *Appendix II: Data sources and methods*). Incidence is projected for 2008 to 2013 for Quebec, and for 2011 to 2013 for the other provinces and territories. Mortality is projected for 2010 to 2013.

Because the CCR is a dynamic database, estimates may be updated as new data become available. Projected data are derived using statistical models and, therefore, they should be considered as estimates only and approached 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 estimates to those from prior editions of this publication) can be misleading and is discouraged.

Tables A1 and A2 list a larger number of cancer types than those found elsewhere in the publication. In addition, Tables A3 to A6 provide actual incidence and mortality counts and age-standardized rates for selected cancers by province and territory. Because of the small populations of the territories, only five-year averages (2006 to 2010 for incidence and 2005 to 2009 for mortality) are provided.

For information on how to access the most recent available data, refer to the additional sources of information listed at the end of each chapter or contact the respective cancer registries (see a list of Canadian Cancer Registries).

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Introduction

Cancer in Canada

Almost half of all Canadians (41% of females and 46% of males) will develop cancer in their lifetime and a quarter of all Canadians are expected to die of the disease. Cancer is the leading cause of death in Canada (Figure A), responsible for nearly 30% of all deaths, followed by cardiovascular diseases (diseases of the heart and cerebrovascular diseases) and chronic lower respiratory diseases.[1] In addition to being personally costly, cancer has major economic ramifications on society at large. In 2000, cancer was the fourth-costliest disease in Canada, accounting for $17.4 billion. These costs include $2.6 billion in direct healthcare costs, which included physician and hospital expenses, and $14.8 billion in indirect costs from lost productivity and premature death.[2] Due to our aging population, these costs are likely to increase. 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.

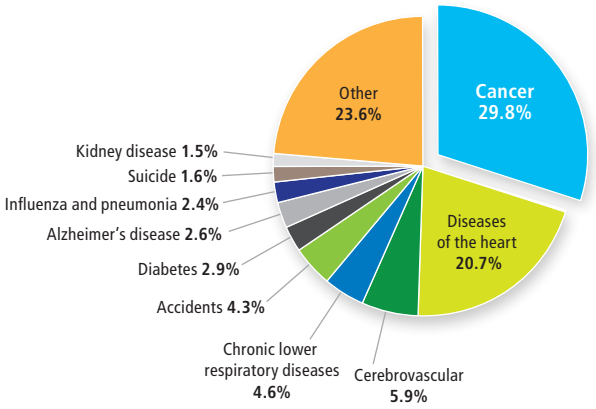
Despite these ongoing challenges, much progress has been made in our fight against cancer. Today, we know more about what causes cancer, how it develops and how best to treat it. We also know more about how we can improve the quality of life of people living with cancer and cancer survivors, as well as their families and caregivers. One example of progress is seen in the drop in the lung cancer mortality rate, especially in males, from the control of tobacco use among Canadians. It is estimated that since 1989, nearly 100,000 deaths in males and females have been avoided as a result of cancer control efforts, many of which would have been due to lung cancer (Figure B).

Other signs of progress are illustrated by the fact that Canada compares favourably to other countries on several measures, such as relative survival and mortality rates. Examples of such comparisons of cancer indicators among different countries can be found through various international resources, such as the GLOBOCAN database,[3] the Cancer Incidence in Five Continents publication,[4] the International Cancer Benchmarking Partnership[5] and CONCORD studies on cancer survival.[6]

According to the American Institute for Cancer Research and the World Cancer Research Fund,[7] about one-third of 12 major cancers can be prevented through a combination of changes in behaviour and lifestyle, such as a healthy diet, regular physical activity and maintaining a healthy body weight. The World Health Organization suggests that prevention offers the most cost-effective, long-term strategy for controlling cancer and other non-communicable diseases.[8] Cancer prevention and risk reduction can be further achieved through the following initiatives:

- Eliminating tobacco use — Tobacco is responsible for nearly one-quarter of cancer deaths worldwide, making it the single greatest avoidable risk factor for cancer.[8]
- Reducing alcohol consumption — Alcohol is a risk factor for many different cancers and the risk of cancer increases with the amount of alcohol consumed.[8]

FIGURE A Proportion of deaths due to cancer and other causes, Canada, 2009

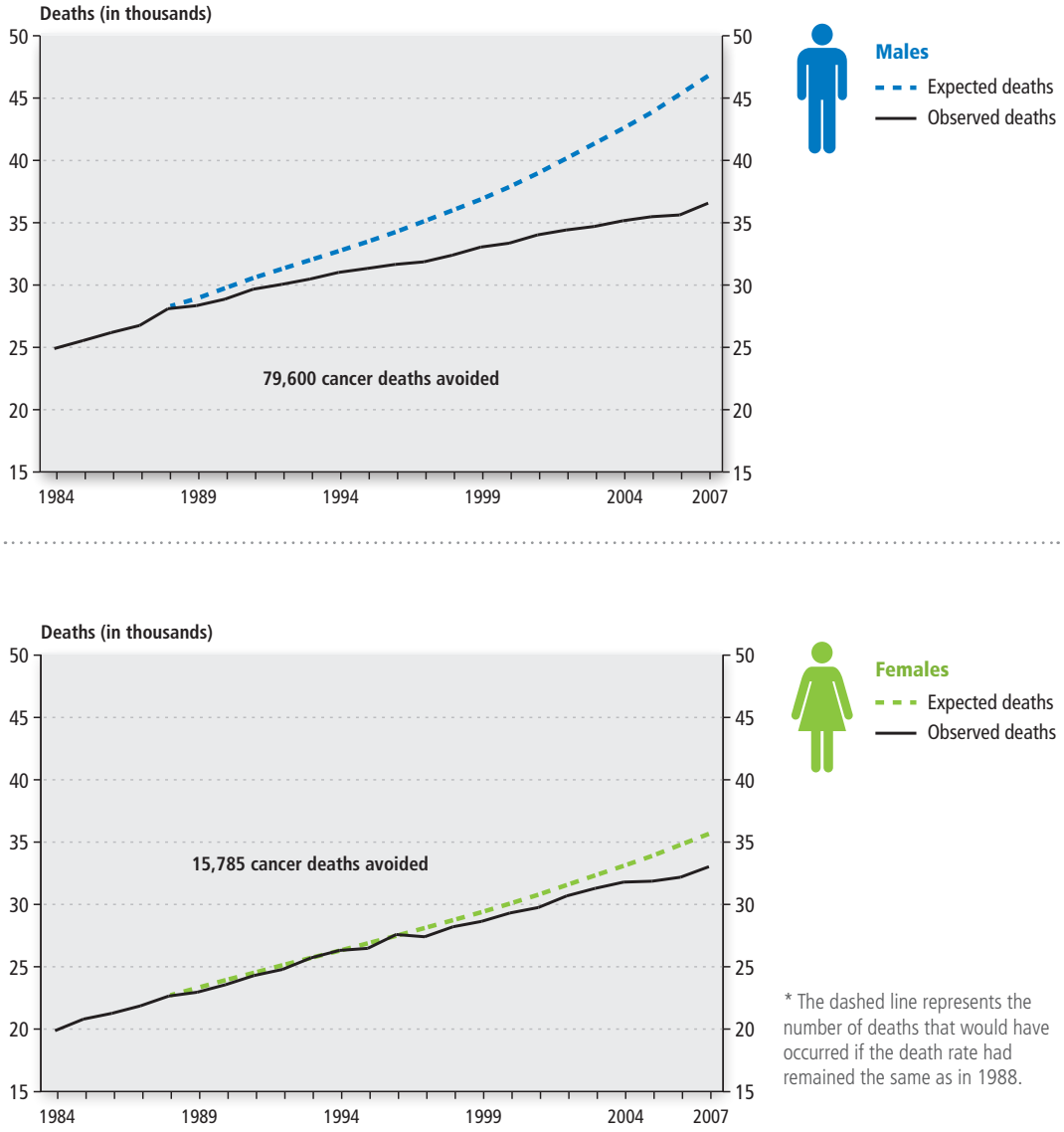


Note: The total of all deaths in 2009 in Canada was 238,418
Adapted from: Statistics Canada. Leading Causes of Death in Canada, 2009, CANSIM Table 102-0561

- Reducing prolonged exposure to sunlight and eliminating artificial tanning — Wearing protective clothing and using sunscreen can help reduce the risk of skin cancer, while still allowing people to receive the benefits of sun exposure.
- Reducing exposure to other preventable risk factors for cancer — This includes infections (responsible for about 6% of cancer deaths in industrialized countries), environmental pollution (such as second-hand smoke), occupational exposures to carcinogens (such as industrial chemicals) and radiation.[8]

According to Statistics Canada, the Canadian population will increase from 34.9 million in 2012 to as much as 47.7 million people by 2036. The number of seniors is expected to more than double (to as high as 10.9 million) during this time period.[9] Increases in the number of new cancer cases in Canada over the past 30 years can largely be attributed to the aging and growing population. In Figure C, 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 1984. Thus, this line measures the effect of changes in cancer risk and cancer control practices. There is very little increase in cancer incidence as a result of changes in cancer risk or changes in cancer control practices. The uppermost line represents the number of new cases or deaths that actually occurred once the impact of population growth and aging are taken into account. With such population factors expected to continue into the foreseeable future, the Canadian healthcare system is expected to face greater demand for cancer screening, as well as diagnostic and treatment services.

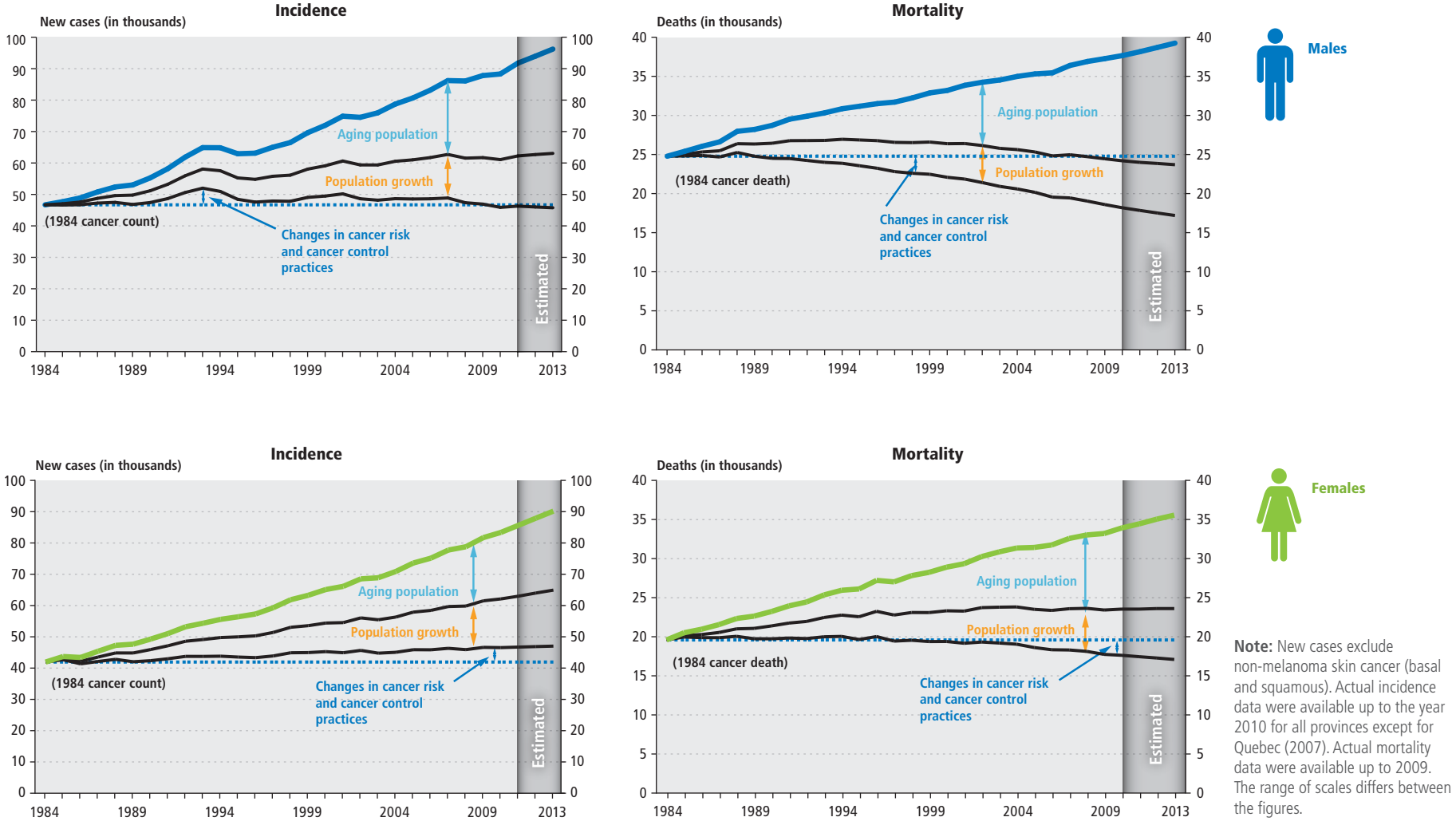
FIGURE B Number of cancer deaths avoided* (1989–2007) since the cancer mortality rate peaked in Canada in 1988



* The dashed line represents the number of deaths that would have occurred if the death rate had remained the same as in 1988.

Analysis by: Canadian Cancer Society
Data source: Canadian Vital Statistics Death database at Statistics Canada

FIGURE C Trends in new cases and deaths for all cancers and ages, attributed to cancer risk, population growth and aging population, both sexes, Canada, 1984–2013



Note: New cases exclude non-melanoma skin cancer (basal and squamous). Actual incidence data were available up to the year 2010 for all provinces except for Quebec (2007). Actual mortality data were available up to 2009. The range of scales differs between the figures.

Analysis by: Chronic Disease Surveillance and Monitoring 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

Cancer surveillance can help inform cancer prevention and control. Canada is one of the few nations in the world with a national population-based cancer registry that covers the entire population. The information gained from the national and provincial cancer registries 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 to help focus both primary prevention efforts (through reducing risk factors and promoting protective factors) and secondary prevention efforts (which have the goal of improving survival through the earlier detection of cancers and treatment of cancer precursors). To this end, the annual *Canadian Cancer Statistics* publication aims to provide the most current summary of key cancer surveillance indicators. ■

For more information

- North American Association of Central Cancer Registries. Cancer in North America: 2005–2009. Available at: www.naaccr.org/DataandPublications/CINAPubs.aspx (Accessed June 1, 2012).
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CHAPTER 1:
Incidence: How many people in Canada get cancer?

Highlights

- It is expected that 2 in 5 Canadians will develop cancer in their lifetimes. Males have a 46% lifetime probability (or a 1 in 2.2 chance) of developing cancer. Females have a 41% lifetime probability (or a 1 in 2.4 chance) of developing cancer.
- An estimated 187,600 new cases of cancer are expected to be diagnosed in Canada in 2013. More than half of these cases (52%) will be lung, breast, colorectal and prostate cancers.
- From 1998 to 2007, the incidence rate rose by 0.3% per year for females (statistically significant). Between 2003 and 2007, incidence increased by 0.1% per year for males (not statistically significant).
- Some of the overall increase in the incidence rate is related to increased detection, while decreases correspond in part to previous declines in major risk factors, such as tobacco use or alcohol consumption.
- Increases in the number of new cases over the past 30 years can largely be attributed to a growing and aging population, rather than to an increase in cancer risk. Given current population trends, increases in cancer incidence are expected to continue. Increases in incidence will have implications for screening, diagnostic and treatment services.
- Increased prevention efforts could reduce incidence rates or result in earlier diagnosis and treatment, thereby helping to improve survival rates.

Introduction

Each hour, an estimated 21 people will be diagnosed with cancer in Canada in 2013. The number of new cases of cancer each year (the incidence) is an important measure of cancer burden on the Canadian population and healthcare system. Trends in incidence rates can be used to predict the future burden of cancer. This information is essential in ensuring adequate testing, diagnostic and treatment services, as well as directing future cancer prevention, control and research programs.

Probability of developing cancer

The probability of developing a specific type of cancer depends on many factors, including the population characteristics (e.g., demographics), prevalence of risk factors (e.g., smoking, obesity), life expectancy and others. This probability reflects the average experience of people in Canada and does not take into account individual behaviours and risk factors.

The Canadian population is aging.[1] Like many other developed countries, Canada has a greater proportion of people who are seniors than in the past. 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, such as cancer.

In Canada, 1 in 2.2 males and 1 in 2.4 females (approximately 2 in 5 Canadians) are expected to develop cancer in their lifetime (Figure 1.1).

Probability

The chance a person has of developing cancer measured over a period of time. The data here are presented over a lifetime, but probability can also be calculated as the chance of developing cancer at a specific point in time, such as by age 30 or over the next 10 years. The probability of developing cancer is expressed as a percentage or as a chance (e.g., a 1 in 5 chance).

FIGURE 1.1 Lifetime probability of developing cancer, Canada, 2007

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

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

- As shown in Table 1.1, Canadian males are most likely to develop prostate cancer, with 1 in 7 males expected to be diagnosed with prostate cancer in their lifetime. After prostate cancer, males have the highest probability of developing lung cancer, with 1 in 11 males expected to be diagnosed in their lifetime, followed by colorectal cancer, with 1 in 13 males expected to develop colorectal cancer in their lifetime.

Age-standardized incidence rate (ASIR)

The number of new cases of cancer per 100,000 people, standardized to the age structure of the 1991 Canadian population to account for changes in age distribution over time.

Annual percent change (APC)

The estimated change in the rate of new cases (incidence) from one year to the next over a defined period of time, reported as a percentage. Along with the changepoint (the year in which the APC changed), the APC is useful for examining trends.

Incidence

The number of new cases of cancer in a given year.

Statistical significance

Refers to a number or a relationship that is unlikely to occur simply by chance. In other words, a statistic that is reliable.

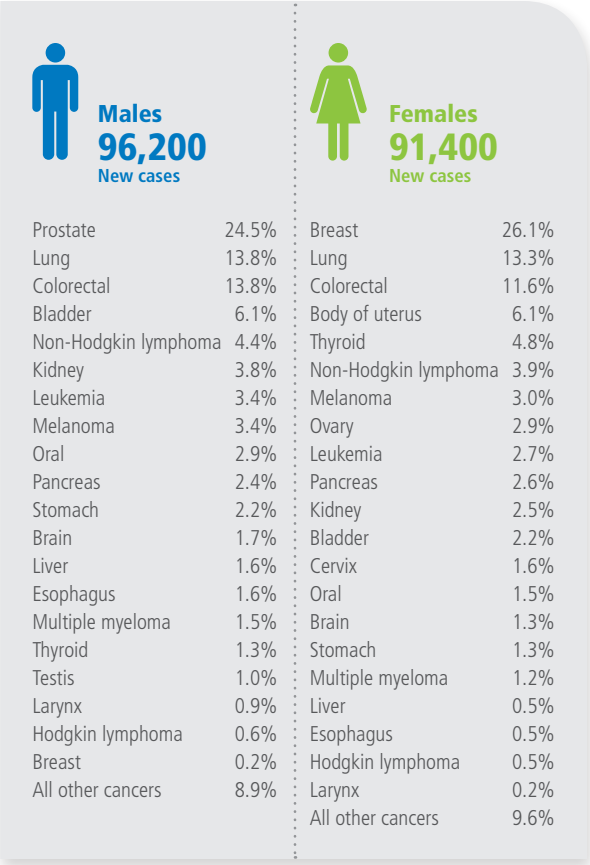
- Canadian females are most likely to develop breast cancer, with 1 in 9 females expected to develop breast cancer in their lifetime. As with men, lung and colorectal cancer are the next most likely cancers to develop. Each type of cancer is expected to be diagnosed in 1 in 15 females during their lifetime.

New cases of cancer in 2013

An estimated 187,600 new cases of cancer, as well as an estimated 81,700 new cases of non-melanoma skin cancers (basal and squamous), are expected to be diagnosed in 2013 (Table 1.2).

- As shown in Figure 1.2, four cancers — prostate, breast, lung and colorectal — together are expected to account for more than half (52%) of all cancers diagnosed in Canada in 2013.
- The leading cancers are prostate cancer for males (23,600 expected new cases, or 25% of all new male cases) and breast cancer for females (23,800 expected new cases, or 26% of all new female cases).
- In both males and females, lung cancer is the second most common cancer, representing 14% and 13% of cases, respectively. Colorectal cancer is the third most common cancer for both males and females.

FIGURE 1.2 Percent distribution of estimated new cancer cases, by sex, Canada, 2013



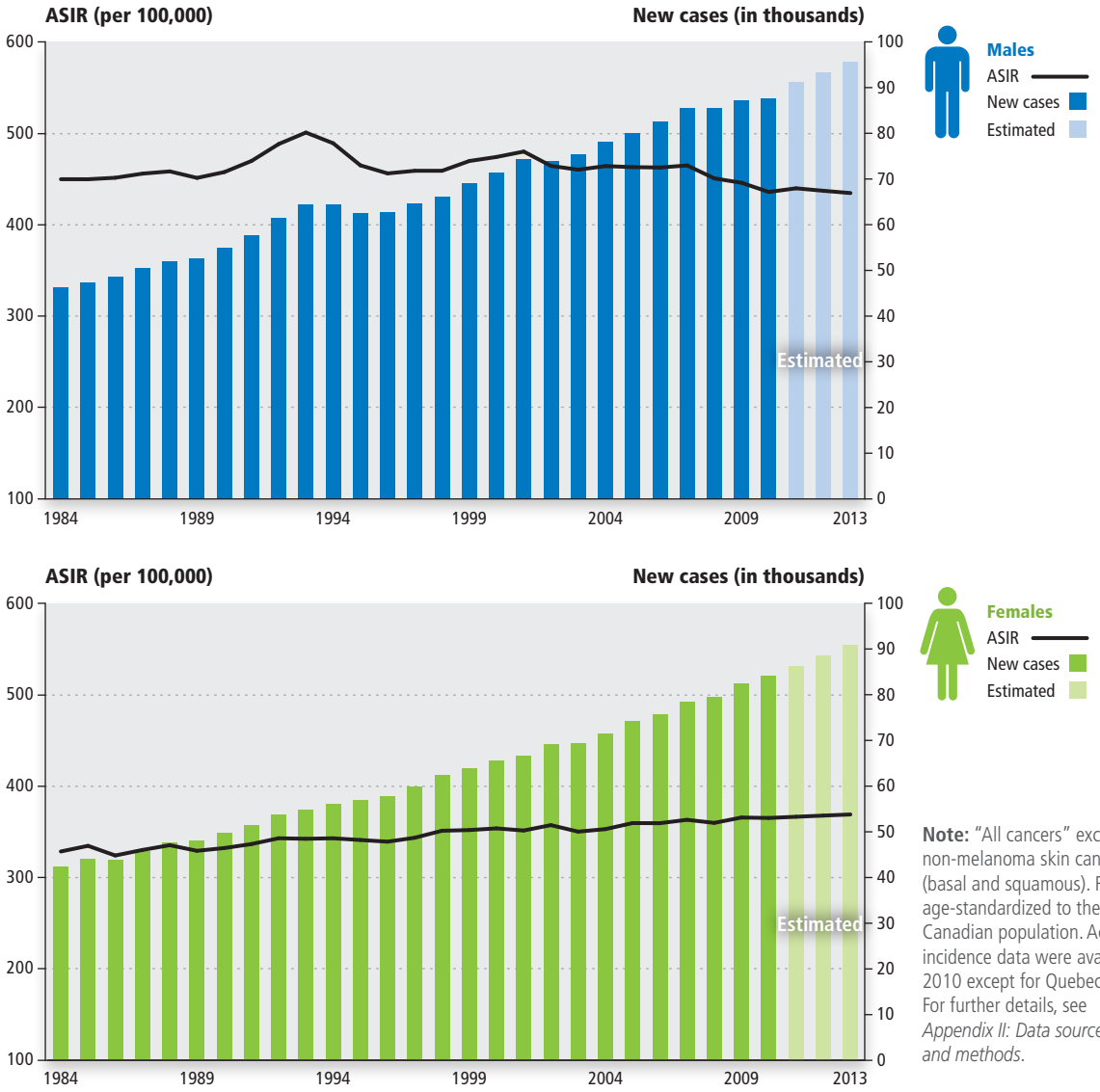
Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data source: Canadian Cancer Registry database at Statistics Canada

Trends over time

Between 1984 and 2013, the number of new cancer cases rose steadily (Figure 1.3). However, age-standardized incidence rates (ASIR) were mostly stable for males and increased slightly for females.

- In males, brief peaks in the number of new cancer cases in early 1990s and early 2000s reflect the underlying trend in the prostate cancer incidence rate, the leading type of cancer in Canadian men.
- Among females, the overall cancer incidence rate primarily reflects the steady rise in lung, thyroid and breast cancer incidence rates.

FIGURE 1.3 New cases and age-standardized incidence rates (ASIR) for all cancers, Canada, 1984–2013



Note: "All cancers" excludes non-melanoma skin cancer (basal and squamous). Rates are age-standardized to the 1991 Canadian population. Actual incidence data were available to 2010 except for Quebec (2007). For further details, see *Appendix II: Data sources and methods*.

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

Trends for selected cancers

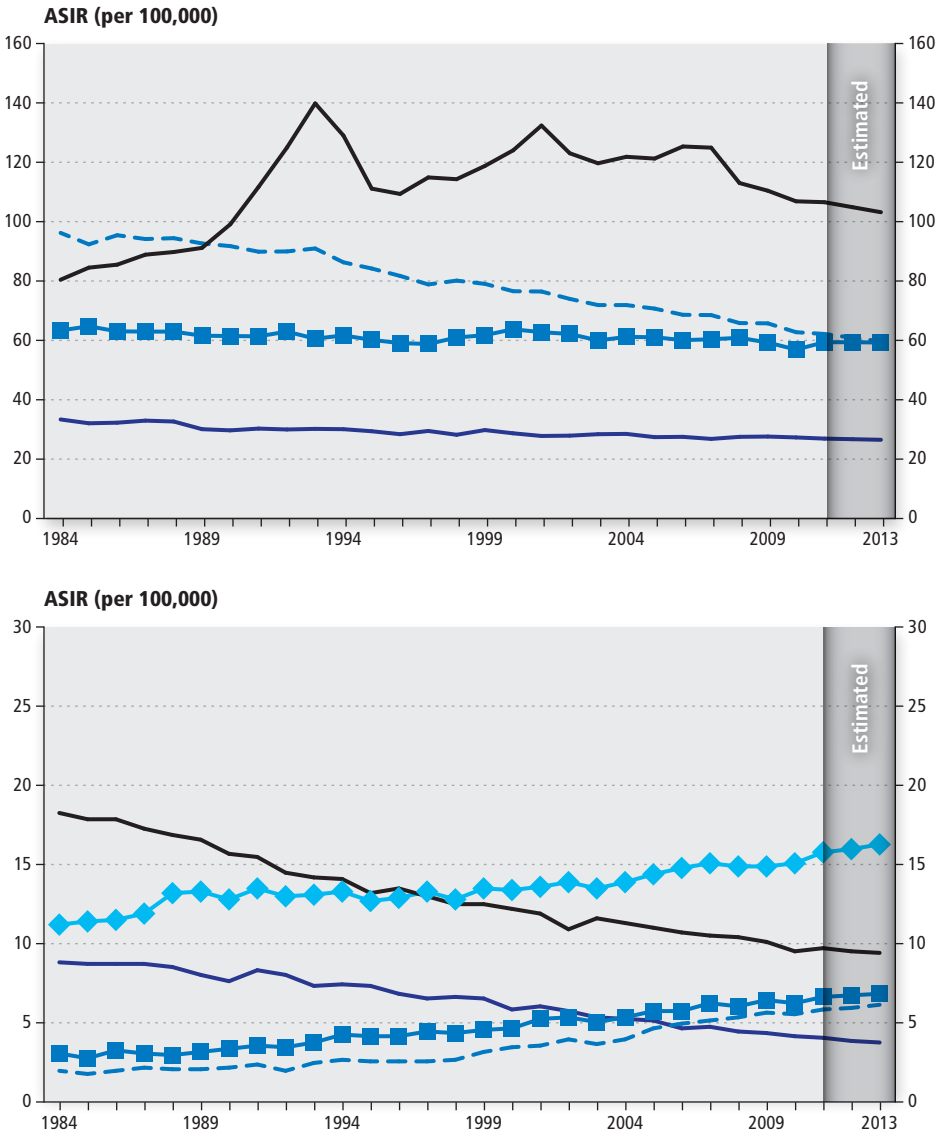
Tables 1.3 and 1. 4 show the ASIR for selected cancers in males and females over 30 years. Table 1.5 shows the annual percent change (APC).

Figures 1.4 and 1.5 show the five most common cancers (both sexes combined) and those with the largest statistically significant increases or decreases in APC (of at least 2% per year). These cancers are discussed below.

Bladder cancer

Bladder cancer predominantly affects Canadians over the age of 70 years and occurs more commonly in the Atlantic provinces. Between 1998 and 2007, incidence rates in males have fallen slightly (by 0.7% per year). Little or no change has been seen for the incidence rate in females. According to one US study,[2] tobacco smoking, particularly cigarette smoking, accounts for approximately 50% of all bladder cancers in both males and females. Occupational exposure to certain chemicals is the second most important risk factor for bladder cancer. Exposure to aromatic amines (especially beta-naphthylamine, benzidine, 4-aminobiphenyl and 4-o-toluidine), polyaromatic hydrocarbons (PAHs) and diesel engine exhaust are most commonly found to increase the risk for bladder cancer.[3]

FIGURE 1.4 Age-standardized incidence rates (ASIR) for selected* cancers, males, Canada, 1984–2013



* 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 1991 Canadian population. See Table 1.3 for data points. Actual data for incidence were available to 2010 except for Quebec (2007). The range of scales differs widely between the figures.

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

Breast cancer

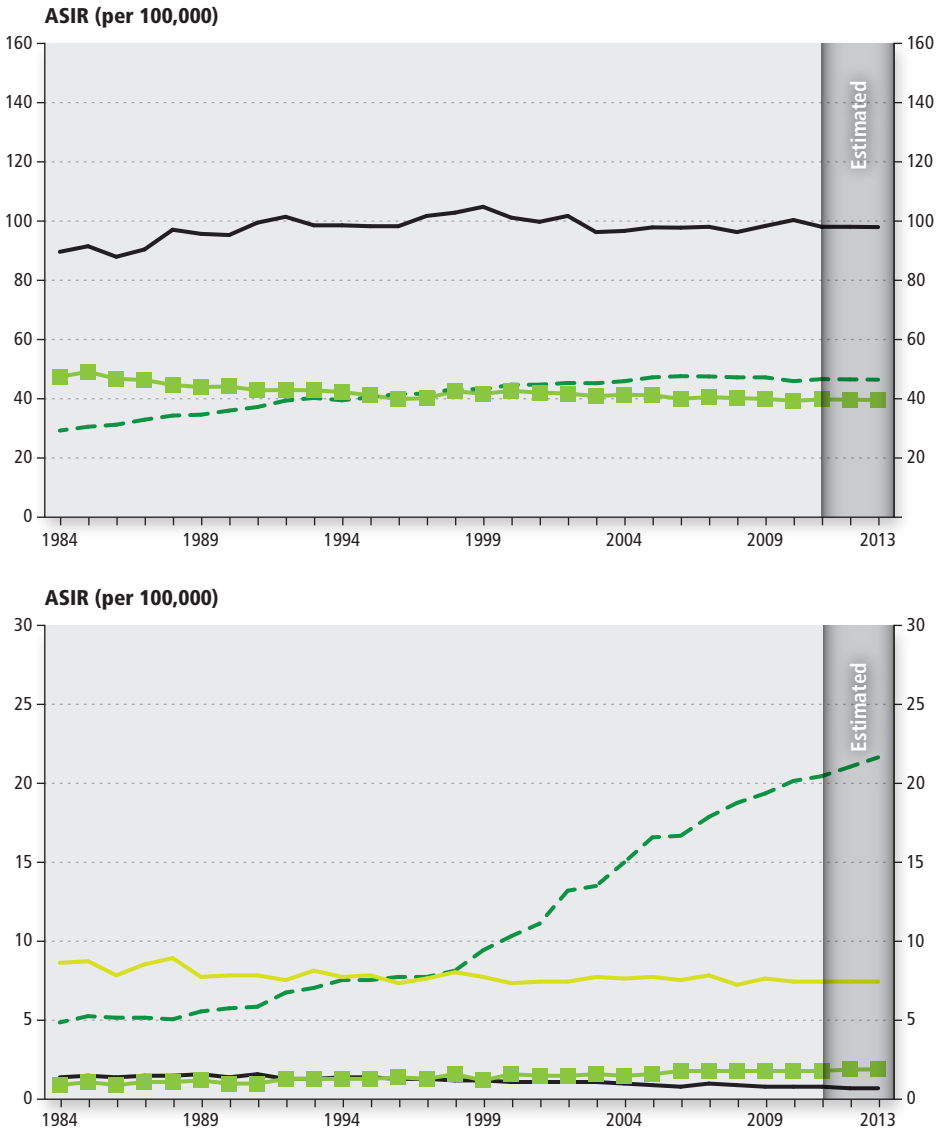
The breast cancer incidence rate rose through the early 1990s. This increase in the incidence rate is due in part to increased opportunistic mammography screening that was done before organized provincial screening programs were implemented from 1988 onward. Since 1988 the rates have fluctuated. The reasons for these fluctuations are unclear, but they likely have to do with continued participation in mammography screening and 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.[4] The decrease in incidence that occurred around 2002 may reflect the reduced use of hormone replacement therapy (HRT) among post-menopausal women.[5]

Colorectal cancer

Starting from the mid-1980s, incidence rates declined for both sexes until the mid-1990s (although this decline was more prominent for females). Incidence rates then rose through 2000, only to decline significantly thereafter.

Screening for colorectal cancer can identify and remove precancerous polyps, which can in turn reduce incidence. As of 2010, all provinces had announced or started implementing organized screening programs, although screening rates remain low.[6] Colorectal cancer is linked to several modifiable risk factors including obesity, physical inactivity, consumption of red and processed meat and smoking.[7,8]

FIGURE 1.5 Age-standardized incidence rates (ASIR) for selected* cancers, females, Canada, 1984–2013



* 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 1991 Canadian population. See Table 1.4 for data points. Actual data for incidence were available to 2010 except for Quebec (2007). The range of scales differs widely between the figures.

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

Larynx cancer

Incidence rates of larynx cancer decreased significantly from 1998 to 2007 for both males (3.8% per year) and females (3.3% per year). As cancer of the larynx is most strongly associated with smoking[9] and alcohol,[10] declines in incidence rates reflect decreasing trends in these risk factors.[11,12]

Liver cancer

The incidence rate of liver cancer increased significantly for males (3.7% per year) and females (2.4% per year). 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.[13] See *Chapter 7* for more information on liver cancer.

Lung cancer

In males, the incidence rate of lung cancer began to level off in the mid-1980s and has been declining significantly (1.8% per year) since at least 1998. Among females, the incidence rate has been increasing since 1982, with a significant upward trend of 1.1% per year between 1998 and 2007. Despite the increasing number of cases among women, the incidence rate of lung cancer is higher among males (60 per 100,000) than females (47 per 100,000).

The differences in lung cancer incidence rates among males and females reflect past differences in tobacco use. In 2011, smoking prevalence among Canadians aged 15 and over was estimated to be 17%.[11] In males, a drop in smoking began in the mid-1960s, preceding the drop in lung cancer incidence by about 20 years. In females, tobacco consumption began to drop in the mid-1980s, suggesting that lung cancer incidence rates in women should also begin to level off or decrease in the next two decades.

Prostate cancer

The prostate-specific antigen (PSA) test is not currently recommended in Canada as a population-based screening test. Despite uncertainty about the benefits and risks of prostate cancer testing, use of the PSA test is widespread.[14] In Canada, the incidence rate of prostate cancer peaked in 1993 and 2001. Each of these peaks was followed by a decline. These peaks are compatible with two waves of intensified screening activity using the PSA test.

Stomach cancer

Incidence rates of stomach cancer are declining in both males (2.0% per year) and females (1.6% per year). These rates are now about half of what they were in 1984. This decline may be due to long-term improvements in diets[15] and decreases in smoking and heavy alcohol use.[16] 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.[17]

Thyroid cancer

The incidence rate of thyroid cancer is the most rapidly increasing incidence rate among all major cancers. There was a 6.8% per year increase in males since 1998, and a 7.0% per year increase in females since 2002. The rise may be due to several reasons. More frequent use of diagnostic testing, including ultrasound, computed tomography (CT) scanning and magnetic resonance imaging (MRI), may mean that more earlier stage, asymptomatic thyroid cancers are being diagnosed.[18] Exposure to diagnostic ionizing radiation has likely increased over time and this could promote the initiation of new tumours.[19] Finally, the increase could be spurred by exposure to a yet unidentified risk factor.

What do these statistics mean?

Generally, the incidence rate for all cancers combined in males has been stable over the past two decades. In contrast, the incidence rate for all cancers combined in females has continued to increase. This increase is driven mainly by the rise in lung cancer incidence, which appears to be plateauing in recent years, and thyroid cancer incidence. While the incidence rates for individual cancer types can be better explained by changes in risk factors and prevention efforts, the overall trend reflects the cumulative impact of the changes seen for each type of cancer.

Given that so much of the increase in cancer incidence over the past 30 years is due to an aging population, this increase can be expected to continue as the population continues to age. With the rising incidence of cancer, there will be a commensurate increase in the need for diagnostic, treatment and support services in the healthcare system. It will also be important to develop early strategies to address the cancers that are now showing significant increase in incidence, such as liver and thyroid cancers.

Primary prevention efforts should be improved to reduce the impact of risk factors, such as tobacco use or obesity. A sustained focus on screening for breast, colorectal and cervical cancers will help catch and more effectively treat these cancers earlier in their course.

For more information

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Databases

- Statistics Canada. Table 103-0550 — New cases for ICD-O-3 primary sites of cancer (based on the July 2011 CCR tabulation file), by age group and sex, Canada, provinces and territories, annual, CANSIM (database).
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TABLE 1.1 Lifetime probability of developing cancer overall and by age group, Canada, 2007

	Lifetime probability of developing cancer overall		Lifetime probability (%) of developing cancer in next 10 years by age group					
	%	One in:	30–39	40–49	50–59	60–69	70–79	80–89
Males								
All cancers*	**46.4**	**2.2**	**0.7**	**1.7**	**6.3**	**15.2**	**21.9**	**21.0**
Prostate	14.3	7	—	0.2	1.9	5.7	6.3	4.6
Lung	9.0	11	—	0.1	0.8	2.4	4.3	3.9
Colorectal	7.7	13	0.1	0.2	0.9	2.1	3.4	3.4
Bladder	3.6	28	—	0.1	0.3	0.8	1.6	1.9
Non-Hodgkin lymphoma	2.4	41	0.1	0.1	0.3	0.6	0.9	0.9
Leukemia	1.9	53	—	0.1	0.2	0.4	0.7	0.9
Kidney	1.8	56	—	0.1	0.3	0.5	0.6	0.5
Melanoma	1.6	63	0.1	0.1	0.2	0.4	0.5	0.6
Oral	1.5	67	—	0.1	0.3	0.4	0.5	0.5
Pancreas	1.4	71	—	—	0.2	0.3	0.6	0.6
Stomach	1.4	73	—	—	0.1	0.3	0.5	0.7
Brain	0.9	117	—	0.1	0.1	0.2	0.3	0.2
Esophagus	0.8	125	—	—	0.1	0.2	0.4	0.3
Multiple myeloma	0.8	131	—	—	0.1	0.2	0.3	0.4
Liver	0.8	132	—	—	0.1	0.2	0.3	0.2
Larynx	0.6	170	—	—	0.1	0.2	0.2	0.2
Thyroid	0.5	217	0.1	0.1	0.1	0.1	0.1	—
Females								
All cancers*	**41.3**	**2.4**	**1.3**	**3.2**	**6.3**	**10.7**	**14.3**	**14.6**
Breast	11.5	9	0.4	1.3	2.2	3.2	3.2	2.7
Lung	6.9	15	—	0.2	0.8	1.9	2.7	2.2
Colorectal	6.6	15	0.1	0.2	0.6	1.3	2.3	2.7
Body of uterus	2.6	39	—	0.1	0.6	0.8	0.7	0.5
Non-Hodgkin lymphoma	1.9	52	—	0.1	0.2	0.4	0.7	0.7
Thyroid	1.5	66	0.3	0.3	0.3	0.3	0.2	0.1
Ovary	1.5	68	—	0.1	0.2	0.3	0.4	0.4
Pancreas	1.4	69	—	—	0.1	0.2	0.5	0.7
Leukemia	1.4	72	—	0.1	0.1	0.3	0.4	0.5
Bladder	1.3	78	—	—	0.1	0.3	0.5	0.5
Melanoma	1.3	79	0.1	0.2	0.2	0.3	0.3	0.3
Kidney	1.2	82	—	0.1	0.2	0.3	0.4	0.4
Stomach	0.8	127	—	—	0.1	0.1	0.3	0.3
Oral	0.7	137	—	0.1	0.1	0.2	0.2	0.2
Cervix	0.7	145	0.1	0.1	0.1	0.1	0.1	0.1
Brain	0.7	150	—	—	0.1	0.1	0.2	0.2
Multiple myeloma	0.6	157	—	—	0.1	0.1	0.2	0.3
Esophgus	0.3	359	—	—	—	0.1	0.1	0.1
Liver	0.3	377	—	—	—	0.1	0.1	0.1
Larynx	0.1	743	—	—	—	—	0.1	—

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

— Value less than 0.05

* "All cancers" excludes *in situ* bladder cancer and non-melanoma skin cancer (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 2007 and on life tables based on 2006–2008 all-cause mortality rates. For further details, see *Appendix II: Data sources and methods*.

TABLE 1.2 Estimated new cases and age-standardized incidence rates (ASIR) for cancers by sex, Canada, 2013

	New cases (2013 estimates)			Cases per 100,000		
	Total*	Males	Females	Total*	Males	Females
All cancers	**187,600**	**96,200**	**91,400**	**398.6**	**437.0**	**370.6**
Lung	25,500	13,300	12,200	52.6	60.1	46.8
Breast	24,000	200	23,800	51.6	0.9	98.7
Colorectal	23,900	13,200	10,600	49.1	59.7	39.9
Prostate	23,600	23,600	—	—	103.9	—
Bladder†	7,900	5,900	2,000	16.2	26.7	7.5
Non-Hodgkin lymphoma	7,800	4,300	3,600	16.9	19.7	14.4
Melanoma	6,000	3,300	2,700	13.4	15.1	12.2
Kidney	5,900	3,600	2,300	12.5	16.4	9.1
Leukemia	5,800	3,300	2,500	12.8	15.7	10.3
Thyroid	5,700	1,250	4,400	14.0	6.2	21.8
Body of uterus	5,600	—	5,600	—	—	22.4
Pancreas	4,700	2,300	2,400	9.5	10.3	8.7
Oral	4,100	2,800	1,350	8.7	12.2	5.4
Stomach	3,300	2,100	1,200	6.8	9.5	4.5
Brain	2,900	1,650	1,200	6.9	8.2	5.7
Ovary	2,600	—	2,600	—	—	10.8
Multiple myeloma	2,500	1,400	1,100	5.2	6.3	4.2
Liver	2,100	1,550	490	4.3	6.9	1.9
Esophagus	2,000	1,550	460	4.1	6.8	1.7
Cervix	1,450	—	1,450	—	—	7.4
Larynx	1,050	860	180	2.2	3.8	0.7
Hodgkin lymphoma	1,000	560	440	2.8	3.2	2.5
Testis	960	960	—	—	6.0	—
All other cancers	17,400	8,600	8,800	36.2	39.5	33.8
Non-melanoma skin	81,700	45,000	36,800	—	—	—

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

— Not applicable.

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

† Ontario does not currently report *in situ* bladder cancer.

Note: "All cancers" excludes the estimated new cases of non-melanoma skin cancer (basal and squamous).

TABLE 1.3 Age-standardized incidence rates (ASIR) for selected* cancers, males, Canada, 1984–2013

	Cases per 100,000									
Year	All cancers	Prostate	Lung	Colorectal	Bladder	Kidney	Stomach	Liver	Thyroid	Larynx
1984	452.3	81.0	96.9	63.8	33.6	11.3	18.4	3.1	2.0	8.9
1985	452.3	85.1	93.0	65.2	32.3	11.5	18.0	2.8	1.8	8.8
1986	453.9	86.1	96.1	63.5	32.5	11.6	18.0	3.3	2.0	8.8
1987	458.5	89.5	94.8	63.4	33.2	12.0	17.4	3.1	2.2	8.8
1988	460.9	90.4	95.1	63.4	32.9	13.3	17.0	3.0	2.1	8.6
1989	453.8	91.8	93.3	62.0	30.3	13.4	16.7	3.2	2.1	8.1
1990	460.2	99.8	92.4	61.9	29.9	12.9	15.8	3.4	2.2	7.7
1991	472.4	112.5	90.5	61.8	30.5	13.6	15.6	3.6	2.4	8.4
1992	491.1	125.8	90.6	63.4	30.2	13.1	14.6	3.5	2.0	8.1
1993	503.7	140.8	91.6	61.0	30.4	13.2	14.3	3.8	2.5	7.4
1994	491.9	129.9	86.9	62.1	30.3	13.4	14.2	4.3	2.7	7.5
1995	467.6	111.9	84.8	60.6	29.6	12.8	13.3	4.2	2.6	7.4
1996	458.7	110.1	82.3	59.5	28.6	13.0	13.6	4.2	2.6	6.9
1997	461.6	115.7	79.4	59.2	29.7	13.4	13.1	4.5	2.6	6.6
1998	461.6	115.1	80.7	61.4	28.4	12.9	12.6	4.4	2.7	6.7
1999	472.4	119.6	79.6	62.2	30.0	13.6	12.6	4.6	3.2	6.6
2000	476.8	124.9	77.1	64.2	28.9	13.5	12.3	4.7	3.5	5.9
2001	482.8	133.3	77.0	63.2	28.0	13.7	12.0	5.3	3.6	6.1
2002	467.0	123.9	74.5	62.6	28.1	14.0	11.0	5.4	4.0	5.8
2003	462.8	120.5	72.4	60.4	28.6	13.6	11.7	5.1	3.7	5.4
2004	466.8	122.7	72.4	61.6	28.7	14.0	11.4	5.4	4.0	5.3
2005	465.6	122.1	71.2	61.5	27.6	14.5	11.1	5.8	4.7	5.2
2006	465.2	126.2	69.1	60.5	27.7	14.9	10.8	5.8	5.0	4.7
2007	467.5	125.8	69.0	60.8	27.0	15.2	10.6	6.3	5.2	4.8
2008	453.2	113.8	66.3	61.3	27.7	15.0	10.5	6.1	5.4	4.5
2009	448.4	111.2	66.2	59.7	27.8	15.0	10.2	6.5	5.7	4.4
2010	438.3	107.6	63.2	57.3	27.5	15.2	9.6	6.3	5.6	4.2
2011†	442.3	107.3	62.6	59.8	27.1	15.9	9.8	6.7	5.9	4.1
2012†	439.6	105.6	61.3	59.8	26.9	16.1	9.6	6.8	6.0	3.9
2013†	437.0	103.9	60.1	59.7	26.7	16.4	9.5	6.9	6.2	3.8

Analysis by: Chronic Disease Surveillance and Monitoring 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).

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

Note: "All cancers" excludes non-melanoma skin cancer (basal and squamous). Rates are age-standardized to the 1991 Canadian population.

TABLE 1.4 Age-standardized incidence rates (ASIR) for selected* cancers, females, Canada, 1984–2013

	Cases per 100,000							
Year	All cancers	Breast	Lung	Colorectal	Thyroid	Bladder	Liver	Larynx
1984	329.9	90.3	29.5	47.8	4.9	8.7	0.9	1.4
1985	336.1	92.2	30.8	49.5	5.3	8.8	1.1	1.5
1986	325.4	88.6	31.5	47.1	5.2	7.9	0.9	1.4
1987	331.6	91.1	33.2	46.7	5.2	8.6	1.1	1.5
1988	336.8	97.8	34.6	45.0	5.1	9.0	1.1	1.5
1989	330.6	96.4	34.9	44.3	5.6	7.8	1.2	1.6
1990	333.6	96.0	36.3	44.5	5.8	7.9	1.0	1.4
1991	338.0	100.2	37.5	43.2	5.9	7.9	1.0	1.6
1992	344.5	102.2	39.7	43.3	6.8	7.6	1.3	1.3
1993	343.9	99.3	40.6	43.2	7.1	8.2	1.3	1.3
1994	344.4	99.3	39.8	42.6	7.6	7.8	1.3	1.4
1995	342.5	99.0	40.8	41.5	7.6	7.9	1.3	1.4
1996	340.7	99.0	42.0	40.2	7.8	7.4	1.4	1.3
1997	345.0	102.5	42.0	40.5	7.8	7.7	1.3	1.3
1998	352.7	103.6	43.7	42.9	8.2	8.1	1.6	1.2
1999	353.5	105.6	43.5	42.0	9.5	7.8	1.2	1.2
2000	355.3	101.9	45.1	43.0	10.4	7.4	1.6	1.1
2001	353.0	100.5	45.1	42.4	11.2	7.5	1.5	1.1
2002	358.9	102.5	45.7	42.1	13.3	7.5	1.5	1.1
2003	351.7	97.0	45.6	41.2	13.6	7.8	1.6	1.1
2004	354.5	97.4	46.3	41.7	15.1	7.7	1.5	1.0
2005	361.2	98.6	47.6	41.5	16.7	7.8	1.6	0.9
2006	361.0	98.5	48.0	40.3	16.8	7.6	1.8	0.8
2007	364.8	98.8	47.9	40.9	18.0	7.9	1.8	1.0
2008	361.4	97.0	47.6	40.5	18.9	7.3	1.8	0.9
2009	367.3	99.1	47.6	40.3	19.5	7.7	1.8	0.8
2010	366.8	101.1	46.3	39.6	20.3	7.5	1.8	0.8
2011†	368.1	98.8	47.0	40.1	20.6	7.5	1.8	0.8
2012†	369.4	98.8	46.9	40.0	21.2	7.5	1.9	0.7
2013†	370.6	98.7	46.8	39.9	21.8	7.5	1.9	0.7

Analysis by: Chronic Disease Surveillance and Monitoring 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).

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

Note: "All cancers" excludes non-melanoma skin cancer (basal and squamous). Rates are age-standardized to the 1991 Canadian population.

TABLE 1.5 Annual percent change (APC) in age-standardized incidence rates for selected cancers, by sex, Canada, 1998–2007

	Males		Females	
	APC†	Changepoint‡	APC†	Changepoint‡
All cancers	**0.1**	**2003**	**0.3****	
Prostate	–0.5	2001	—	
Lung	–1.8**		1.1**	
Breast	—		–0.7**	
Colorectal	–0.8**	2000	–0.8**	2000
Non-Hodgkin lymphoma	0.8**		0.4	
Bladder	–0.7*		–0.1	
Melanoma	1.4**		1.5**	
Thyroid	6.8**		7.0**	2002
Leukemia	0.5		1.1**	
Kidney	2.6*	2003	1.9**	
Body of uterus	—		0.7*	
Pancreas	–0.3		0.4	
Oral	–1.0*		0.1	
Stomach	–2.0**		–1.6**	
Brain	–0.4		–0.8	
Ovary	—		–0.2	
Multiple myeloma	0.5		0.1	
Liver	3.7**		2.4*	
Esophagus	0.6		–0.6	
Cervix	—		–1.4**	
Larynx	–3.8**		–3.3**	
Hodgkin lymphoma	0.5		0.9	
Testis	1.4*		—	

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

— Not applicable or small number of cancer cases.

* Significant increase or decrease in APC, $p<0.05$.

** Significant increase or decrease in APC, $p<0.01$.

† APC is calculated assuming a piecewise log linear model. The model was fitted to the rates in 1986–2007. "All cancers" includes cancers not found in the table but excludes non-melanoma skin cancer (basal and squamous). When there is no changepoint in the most recent 10 years, the APC was obtained by running a separate changepoint analysis on the most recent 10 years. If there is a changepoint, the APC was taken from the last segment. For further details, see *Appendix II: Data sources and methods*.

‡ Changepoint indicates the baseline year for the APC shown, if the slope of the trend changed after 1998.

CHAPTER 2:
Incidence by sex, age and geography: Who gets cancer in Canada?

Highlights

- More cases of cancer are diagnosed in males under the age of 19 and over the age of 59 than in females in the same age groups.
- Canadians over the age of 50 represent 88% of all new cancer cases; nearly half of all new cases (43%) will occur in individuals aged 70 years or older.
- A variety of factors, including cancer type and age, influence treatment needs for people with cancer. For example, treatment decisions may be different for people nearing the end of their lives. Canadians in the prime of their lives may have specific needs for supportive services to help them balance their work and family responsibilities.
- Cancer incidence decreases from east to west across the country. The highest incidence rates are generally found in the Atlantic provinces and Quebec, while the lowest incidence rates are in British Columbia. Correlating incidence data with regional risk factor information, such as tobacco use or obesity rates, could help better target regional and local prevention efforts.

Introduction

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 how cancer affects people in Canada.

Incidence by sex

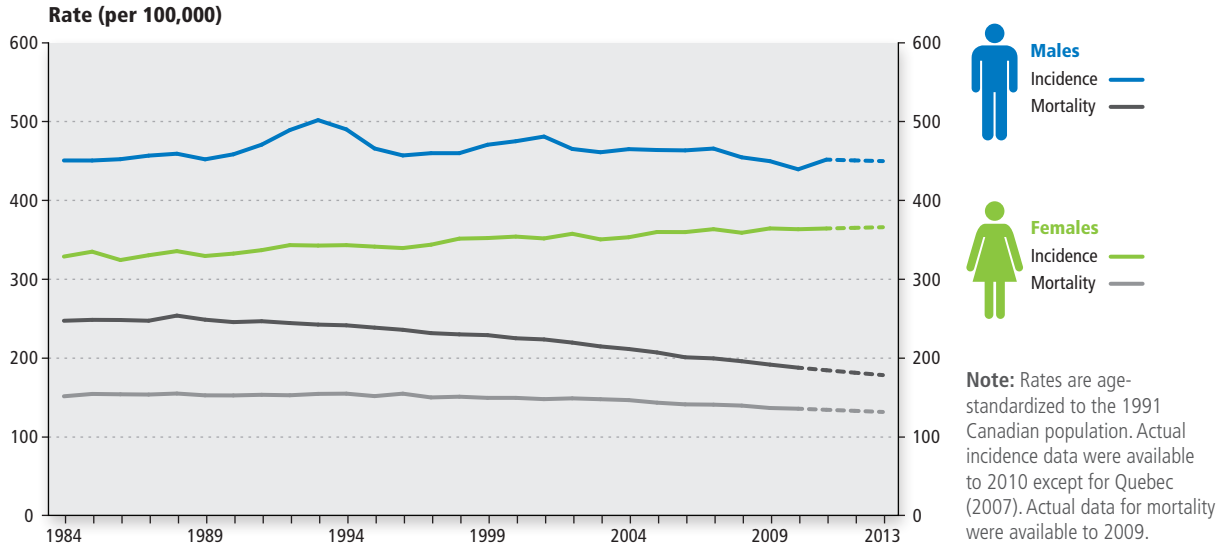
Prostate and breast cancer are the most frequently diagnosed cancers for males and females respectively, followed by lung and colorectal cancers. Overall, more males are diagnosed with cancer than females: 51% of all new cases are diagnosed in males; 49% of all new cases are diagnosed in females (Table 2.1).

Trends over time

Figure 2.1 shows that the incidence rates for both males and females changed between 1984 and 2013.

- The overall cancer incidence rate for males of all ages rose until the early 1990s. Since 1993, there has been a decline in the incidence rate in males.
- Among females, the overall cancer incidence rate has been increasing slowly since the early 1990s. This increase reflects a rise primarily of lung cancer, but it also represents an increase in thyroid and kidney cancers, as well as leukemia and melanoma, in females.

FIGURE 2.1 Age-standardized incidence and mortality rates for all cancers combined, by sex, Canada, 1984–2013



Note: Rates are age-standardized to the 1991 Canadian population. Actual incidence data were available to 2010 except for Quebec (2007). Actual data for mortality were available to 2009.

Analysis by: Chronic Disease Surveillance and Monitoring 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

Incidence by age

Cancer primarily affects Canadians over the age of 50: 88% 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. As shown in Table 2.1, it is estimated that in 2013:

- 43% 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.
- 18% of all new cases will occur in people aged 50–59 years.
- Less than 1% of all new cases will occur in children and youth aged 0–19 years. Although this represents a small percentage of new cancer cases, the diagnoses have a significant impact on these children and their families.

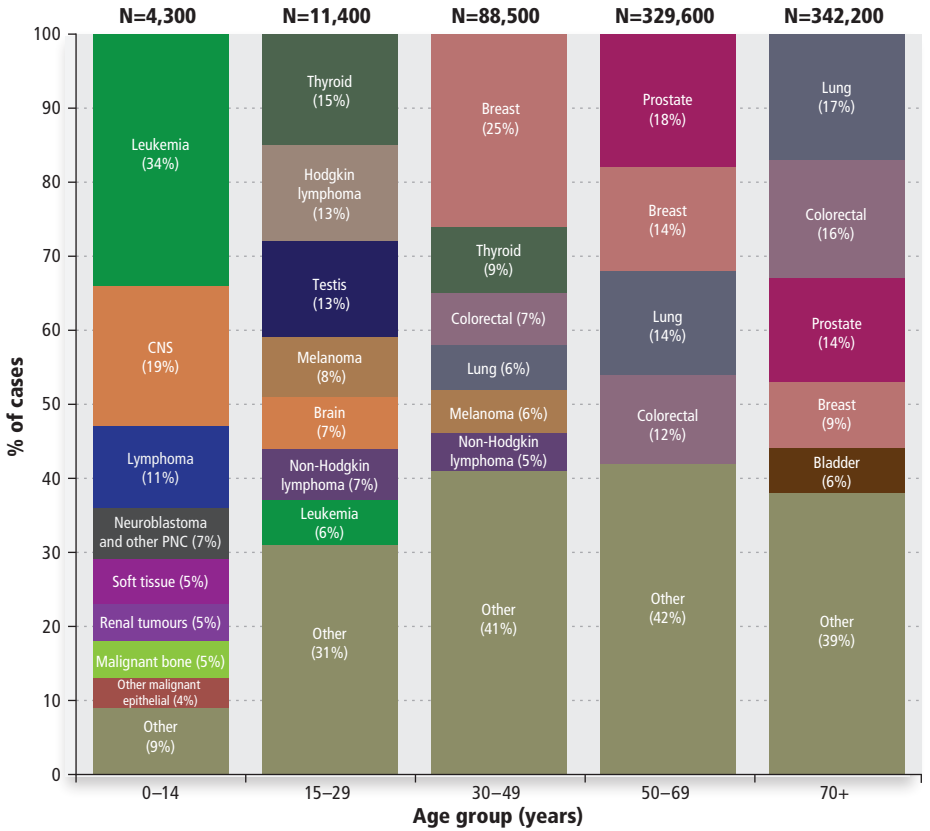
The largest proportion of diagnoses of new cases from the most common cancers occurs in older adults (Table 2.2).

- Approximately half (53%) of all newly diagnosed cases of lung and colorectal cancer will occur among people aged 70 years or older. It is important to note that the overall cancer incidence rate in males aged 70 and older has been dropping over time, primarily due to a declining rate of lung cancer from decreased tobacco use in past decades.[1]
- Breast cancer occurs primarily in females 50–69 years of age (52%). Approximately 30% of cases will be diagnosed in females over the age of 69, while 18% of cases will occur in females under age 50.
- Prostate cancer will be diagnosed most frequently in males aged 60–69 years (40%).

Figure 2.2 shows that the distribution of new cancer cases is quite different between older and younger age groups.

- Between 2003 and 2007, the most commonly diagnosed childhood cancer was leukemia, which accounted for 34% of all newly diagnosed cases, 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 accounted for 1.5% of all new cancer cases. The most commonly diagnosed cancers in this age group were testicular and non-Hodgkin lymphoma in males and thyroid and melanoma in females, as well as Hodgkin lymphoma in both sexes.

FIGURE 2.2 Distribution of new cancer cases for selected cancers by age group, both sexes combined, Canada, 2003–2007



N is the total number of cases over 5 years (2003–2007) for each age group; CNS=central nervous system; PNC=peripheral nervous cell tumours.

Note: Childhood cancers (ages 0–14) are classified according to ICCC-3[2] and young adults (ages 15–29) and adult cancers according to ICD-0-3.[3]

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

Trends over time

Incidence rates differ between sexes according to age. Specifically, females in the four age groups between 20 and 59 years have consistently higher incidence rates than males over time (Figure 2.3).

Incidence by geographic region

The estimated numbers of new cases for all cancers combined by province and territory for 2013 are shown in Figure 2.4, with data in Table 2.3. The age-standardized incidence rate (ASIR) shows a declining trend moving from east to west in Canada, with the highest incidence rates in the Atlantic provinces and Quebec and the lowest rates in British Columbia.

Age-standardized incidence rate (ASIR)

The number of new cases of cancer per 100,000 people, standardized to the age structure of the 1991 Canadian population to account for changes in age distribution over time.

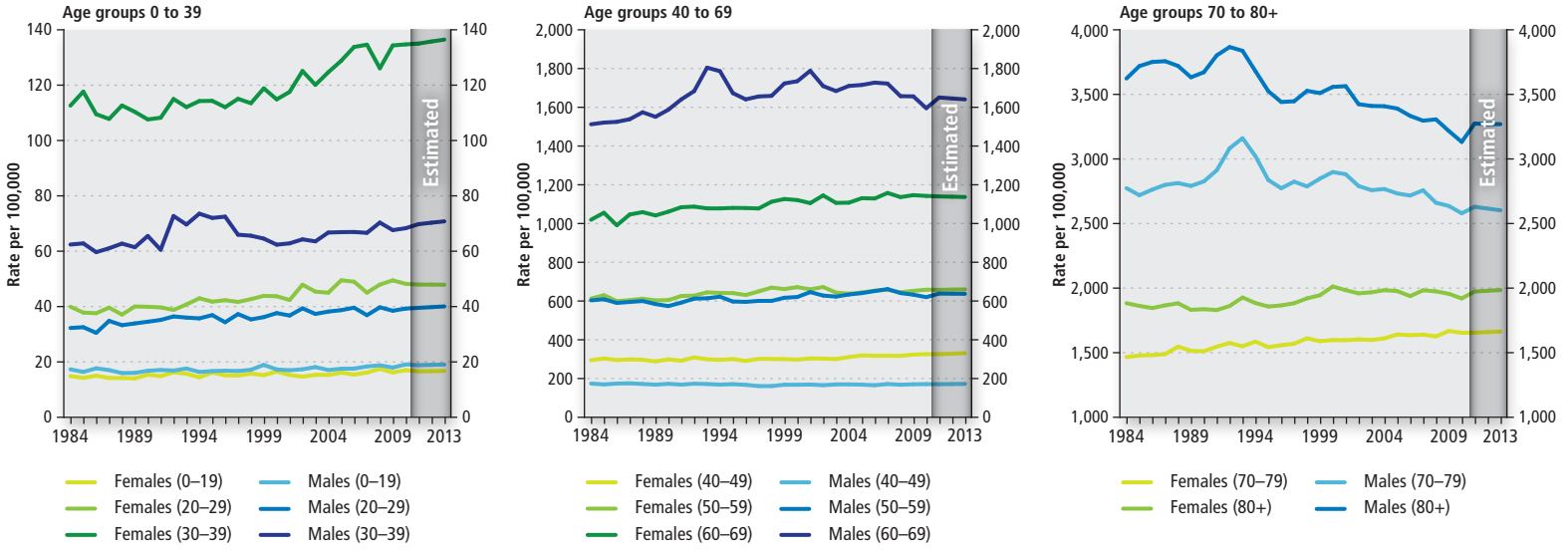
In this section, age standardization is used to adjust for differences in age distributions among the provinces and territories, which allows for more accurate comparisons.

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 for provinces and territories are available to 2010 (see Tables A3 and A4 in *Appendix I: Actual data for new cases and deaths*).

FIGURE 2.3 Age-standardized incidence rates (ASIR) for all cancers, by age group, Canada 1984–2013



Note: The range of rate scales differs widely between the age groups. Incidence rates exclude non-melanoma skin cancer (basal and squamous). Actual incidence data were available up to the year 2010 for all provinces and territories except Quebec (2007).

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

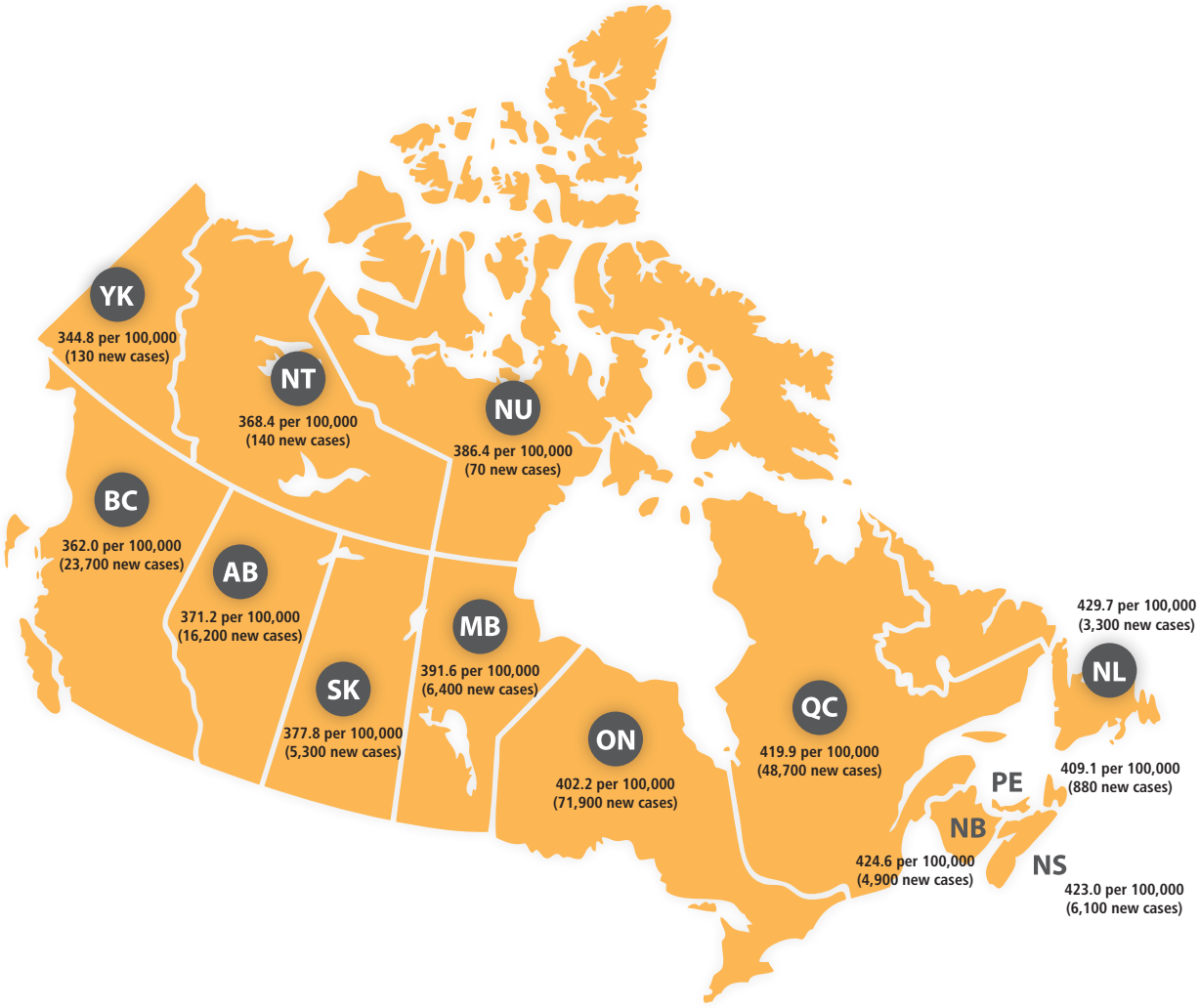
Estimated new cases (Table 2.4) and ASIR (Table 2.5) for specific cancer types show that there are geographic differences for males and females.

- Prostate cancer incidence rates vary greatly among the provinces, possibly due to variations in PSA testing across the country.
- Among males, lung cancer incidence rates are estimated to be highest in Quebec and lowest in British Columbia. This difference in incidence rates is linked in large part to the prevalence of smoking in each province.
- Colorectal cancer incidence rates for both males and females are highest in Newfoundland and Labrador. For females, high rates are also seen in Nova Scotia and Prince Edward Island. The lowest rates for both sexes are in British Columbia.
- Apart from Newfoundland and Labrador, breast cancer incidence rates appear to be fairly consistent across the country, with no discernible geographic pattern. The lower rate in Newfoundland and Labrador may be related to incomplete registration of all breast cancers.

Geographic variations in incidence rates may be due to differences in 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 approved screening programs and the availability of diagnostic services.

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

FIGURE 2.4 Geographic distribution of estimated new cancer cases and age-standardized incidence rates (ASIR) by province or territory, both sexes, Canada, 2013



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

- Cancer frequency — When a cancer is rare or the population is small, the estimated number of new cases of a cancer type may be 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 mainly linked to the unavailability and inaccuracy of death certificate data and specific diagnostic information in some provinces.
- Method of projection — The selected method of projection (Nordpred Power5 regression model or five-year average) for provincial data can vary across provinces and across cancer types (see Tables A9 and A10 in *Appendix II: Data sources and methods*).
- Availability of *in situ* cases — The large variation seen in bladder cancer incidence rates among the provinces is likely due to differences in reporting of *in situ* cases, especially in Ontario, where such cases were not collected until recently and were not available for this publication.

What do these statistics mean?

This chapter shows a distinct picture of cancer distribution in Canada by presenting incidence estimates 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 identify opportunities to target prevention and cancer control initiatives. 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. The priorities of people with cancer and their needs for services can be expected to vary at different points in the age continuum; in this case, issues may arise as females with cancer try to balance family and work responsibilities.

Finally, cancer incidence rates across the country are decidedly uneven, with 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.

For further information

Publications

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- Furlong W, Rae C, Greenberg ML, Barr RD. Surveillance and survival among adolescents and young adults with cancer in Ontario, Canada. *International Journal of Cancer*. 2012; 131(11):2660-7.
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- Ellison LF, De P, Mery LS, Grundy PE. Canadian cancer statistics at a glance: Cancer in children. *CMAJ*. 2009:180(4):422-4

Databases

- Statistics Canada. Table 103-0550 — New cases for ICD-O-3 primary sites of cancer (based on the July 2011 CCR tabulation file), by age group and sex, Canada, provinces and territories, annual, CANSIM (database).
- Statistics Canada. Table 103-0553 — New cases and age-standardized rate for ICD-O-3 primary sites of cancer (based on the July 2011 CCR tabulation file), by sex, Canada, provinces and territories, annual, CANSIM (database).

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1. Health Canada. *Canadian Tobacco Use Monitoring Survey (CTUMS)*. Otttawa; 2011.
2. Steliarova-Foucher E, Stiller CA, Lacour B, Kaatsch P. International classification of childhood cancer. 3rd ed. *Cancer*. 2005;103:1457–1467.
3. Fritz A, Jack A, Parkin DM, et al., eds. *International Classification of Diseases for Oncology*. 3rd ed. Geneva, Switzerland: World Health Organization; 2000.

TABLE 2.1 Estimated population and new cases for all cancers by age group and sex, Canada, 2013

Age	Population (in thousands)			New cases (2013 estimates)		
	Total*	Males	Females	Total*	Males	Females
All ages	**35,318**	**17,521**	**17,796**	**187,600**	**96,200**	**91,400**
0–19	7,907	4,058	3,849	1,450	790	670
20–29	4,897	2,495	2,403	2,100	990	1,150
30–39	4,796	2,401	2,395	5,000	1,700	3,300
40–49	4,994	2,515	2,479	13,100	4,600	8,500
50–59	5,248	2,613	2,635	33,800	16,300	17,600
60–69	3,839	1,871	1,968	51,600	29,100	22,500
70–79	2,183	1,016	1,166	45,100	25,500	19,600
80+	1,454	552	902	35,500	17,300	18,200

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry database 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 (basal and squamous).

TABLE 2.2 Estimated new cases for the most common cancers by age group and sex, Canada, 2013

Age	Lung			Colorectal			Prostate	Breast
	Total*	Males	Females	Total*	Males	Females	Males	Females
All ages	**25,500**	**13,300**	**12,200**	**23,900**	**13,200**	**10,600**	**23,600**	**23,800**
0–19	5	5	—	10	5	5	—	5
20–29	20	10	10	75	40	35	—	120
30–39	90	35	50	270	140	130	5	930
40–49	720	320	400	1,100	570	530	470	3,300
50–59	3,700	1,800	1,950	3,600	2,000	1,500	4,400	5,900
60–69	7,400	4,000	3,500	6,200	3,800	2,400	9,400	6,400
70–79	7,900	4,300	3,600	6,600	3,900	2,800	6,300	4,300
80+	5,600	2,900	2,700	6,000	2,700	3,300	3,000	2,900

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

— Fewer than 3 cases.

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

TABLE 2.3 Estimated population and new cases for all cancers by sex and geographic region, Canada, 2013

	Population (in thousands)			New cases (2013 estimates)		
	Total*	Males	Females	Total*	Males	Females
CANADA	**35,318**	**17,521**	**17,796**	**187,600**	**96,200**	**91,400**
British Columbia (BC)	4,744	2,352	2,391	23,700	12,600	11,200
Alberta (AB)	3,893	1,982	1,910	16,200	8,600	7,600
Saskatchewan (SK)	1,055	525	530	5,300	2,700	2,600
Manitoba (MB)	1,274	635	639	6,400	3,200	3,200
Ontario (ON)	13,775	6,795	6,981	71,900	36,400	35,500
Quebec (QC)†	8,089	4,013	4,076	48,700	24,500	24,200
New Brunswick (NB)	763	375	388	4,900	2,600	2,200
Nova Scotia (NS)	957	466	492	6, 100	3,100	2,900
Prince Edward Island (PE)	146	71	75	880	490	390
Newfoundland and Labrador (NL)†	509	249	260	3,300	1,800	1,450
Yukon (YT)	34	17	17	130	65	65
Northwest Territories (NT)	45	23	22	140	70	75
Nunavut (NU)	34	17	16	70	35	35

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data sources: Canadian Cancer Registry 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 2013 incidence estimates for this province was underestimated.

Note: New cases excludes non-melanoma skin cancer (basal and squamous).

TABLE 2.4 Estimated new cases for selected cancers by sex and province, Canada, 2013

	Canada*	BC	AB	SK	MB	ON	QC†	NB	NS	PE	NL†
Males											
All cancers	**96,200**	**12,600**	**8,600**	**2,700**	**3,200**	**36,400**	**24,500**	**2,600**	**3,100**	**490**	**1,800**
Prostate	23,600	3,500	2,200	650	720	9,600	4,800	740	720	140	500
Lung	13,300	1,500	1,050	360	420	4,400	4,300	420	470	75	260
Colorectal	13,200	1,600	1,150	410	510	4,800	3,500	350	480	60	310
Bladder§	5,900	840	570	190	210	1,600	2,000	180	220	30	95
Non-Hodgkin lymphoma	4,300	600	410	130	150	1,700	960	100	130	15	75
Kidney	3,600	330	330	110	150	1,350	950	130	140	20	90
Leukemia	3,300	450	330	110	130	1,350	740	80	75	15	30
Melanoma	3,300	520	300	75	100	1,600	360	85	140	25	50
Oral	2,800	360	240	65	110	1,150	640	65	90	15	45
Pancreas	2,300	310	200	65	80	840	630	60	65	10	25
Stomach	2,100	260	190	60	85	750	570	55	60	10	55
Brain	1,650	190	150	45	45	690	440	35	45	5	25
Liver	1,550	230	140	25	35	630	430	20	35	5	15
Esophagus	1,550	200	160	40	45	630	320	40	55	5	20
Multiple myeloma	1,400	180	130	35	40	550	370	35	45	5	15
Thyroid	1,250	110	120	20	30	610	290	35	30	5	15
Females											
All cancers	**91,400**	**11,200**	**7,600**	**2,600**	**3,200**	**35,500**	**24,200**	**2,200**	**2,900**	**390**	**1,450**
Breast	23,800	3,100	2,100	690	820	9,300	6,000	550	750	100	330
Lung	12,200	1,500	1,000	390	450	4,200	3,500	360	460	55	170
Colorectal	10,600	1,300	860	330	410	3,900	2,800	250	400	55	220
Body of uterus	5,600	720	500	160	230	2,400	1,200	130	150	25	110
Thyroid	4,400	280	350	50	100	2,300	1,050	100	90	10	40
Non-Hodgkin lymphoma	3,600	470	340	110	130	1,400	850	90	120	15	65
Melanoma	2,700	430	250	60	75	1,350	280	85	130	15	35
Ovary	2,600	300	180	80	100	1,150	660	65	65	10	30
Leukemia	2,500	310	240	80	75	1,100	550	50	60	10	20
Pancreas	2,400	290	200	70	80	810	740	70	75	10	20
Kidney	2,300	190	200	75	75	870	620	75	95	10	45
Bladder§	2,000	270	170	70	70	500	760	60	75	10	35
Cervix	1,450	170	160	45	50	610	280	30	45	10	30
Oral	1,350	170	100	35	55	570	320	30	40	10	15
Brain	1,200	140	100	35	35	470	340	30	40	5	20
Stomach	1,200	130	85	35	40	480	310	35	35	5	30
Multiple myeloma	1,100	130	100	35	35	450	290	25	30	5	15

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

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

† The number of cases for some cancers used to calculate the overall 2013 estimates for this province was underestimated.

§ Ontario does not currently report *in situ* bladder cancers; this should be considered when making comparisons across provinces.

Note: "All cancers" excludes non-melanoma skin cancer (basal and squamous).

TABLE 2.5 Estimated age-standardized incidence rates (ASIR) for selected cancers by sex and province, Canada, 2013

	Cases per 100,000										
	Canada*	BC	AB	SK	MB	ON	QC†	NB	NS	PE	NL†
Males											
All cancers	**437**	**402**	**415**	**406**	**428**	**435**	**462**	**491**	**472**	**490**	**500**
Prostate	104	110	102	97	94	112	86	130	102	131	129
Lung	60	47	52	53	56	53	80	77	69	74	70
Colorectal	60	51	57	62	66	57	66	65	71	60	85
Bladder§	27	27	29	28	28	19	37	33	32	30	27
Non-Hodgkin lymphoma	20	20	20	20	20	20	18	20	20	16	21
Kidney	16	11	16	17	19	16	18	23	22	20	24
Leukemia	16	15	16	18	17	17	15	16	12	14	10
Melanoma	15	17	14	12	13	20	7	17	23	24	14
Oral	12	11	11	10	14	13	12	11	13	14	12
Pancreas	10	10	10	10	10	10	12	11	10	12	7
Stomach	9	8	9	9	11	9	11	10	9	8	15
Brain	8	7	7	7	7	9	9	7	8	7	8
Liver	7	7	6	4	5	7	8	3	5	4	3
Esophagus	7	6	8	6	6	7	6	8	8	8	5
Multiple myeloma	6	6	6	6	6	7	7	6	6	7	5
Thyroid	6	4	6	4	5	8	6	7	5	6	5
Females											
All cancers	**371**	**329**	**337**	**357**	**366**	**379**	**394**	**370**	**385**	**344**	**370**
Breast	99	95	92	97	99	101	102	93	101	93	82
Lung	47	42	44	51	50	42	55	56	57	47	41
Colorectal	40	35	37	42	43	39	42	39	49	44	54
Body of uterus	22	21	22	22	28	25	19	21	20	19	26
Thyroid	22	10	17	9	14	29	23	22	15	10	13
Non-Hodgkin lymphoma	14	14	15	15	15	15	14	15	15	13	16
Melanoma	12	14	11	9	9	16	5	16	19	15	9
Ovary	11	9	8	11	12	12	11	11	8	10	8
Leukemia	10	9	11	11	9	12	9	9	8	8	6
Kidney	9	5	9	10	9	9	10	12	12	11	12
Pancreas	9	8	9	9	8	8	11	10	9	8	5
Bladder§	8	7	7	9	7	5	12	9	9	7	8
Cervix	7	6	8	9	7	8	6	7	8	10	10
Brain	6	5	5	5	5	6	7	6	6	5	5
Oral	5	5	4	5	6	6	5	5	5	7	4
Stomach	5	4	4	4	4	5	5	5	5	4	8
Multiple myeloma	4	4	4	5	3	4	4	4	4	4	3

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

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

† The number of cases for some cancers that were used to calculate the overall 2013 estimates for this province was underestimated.

§ Ontario does not currently report *in situ* bladder cancers; this should be considered when making comparisons across provinces.

Note: "All cancers" excludes non-melanoma skin cancer (basal and squamous). Rates are age-standardized to the 1991 Canadian population.

CHAPTER 3:
Mortality: How many people in Canada die of cancer?

Highlights

- An estimated 75,500 Canadians are expected to die of cancer in 2013.
- It is expected that 1 in 4 Canadians will die of cancer in their lifetime. Males have a 28% lifetime probability (approximately a 1 in 3.6 chance) of dying from cancer. Females have a 24% lifetime probability (approximately a 1 in 4.2 chance) of dying from cancer.
- Between 2001 and 2009, overall mortality rates declined by 1.9% per year for males. A similar decline of 1.2% per year for females was seen between 2002 and 2009. On average, mortality rates declined by at least 2% per year for the following cancers: colorectal, lung and prostate cancers in males; breast, ovary and cervical cancers in females; and larynx, non-Hodgkin lymphoma and stomach cancers in both sexes.
- Between 2000 and 2009, liver cancer mortality rates increased in both males and females.
- The mortality rate continues to increase for lung cancer in females, although the rate of increase is slowing.

Introduction

Each hour, an estimated nine people will die of cancer in Canada, in 2013. Monitoring cancer deaths over time allows us to measure progress in reducing cancer deaths and contemplate the implications of changing patterns on the Canadian healthcare system.

Probability of dying from cancer

The chance of dying from cancer differs slightly by sex (see Figure 3.1). As shown in Table 3.1, males have a 28% chance (or 1 in 3.6 chance) of dying from cancer. Lung cancer is the most likely cause of cancer death, with a 1 in 13 chance. Prostate cancer is the next most likely cause of cancer death, with a 1 in 28 chance. Colorectal cancer is the third most likely cause of cancer death, with a 1 in 29 chance.

Table 3.1 also shows that females in Canada have a 24% chance (or a 1 in 4.2 chance) of dying from cancer. Lung cancer is the most likely cause of cancer death in females, with a 1 in 18 chance. Similar to the probability of prostate cancer death in males, females have a 1 in 29 chance of dying from breast cancer. This was followed by a 1 in 31 chance of dying from colorectal cancer.

FIGURE 3.1 Lifetime probability of dying from cancer, Canada, 2007

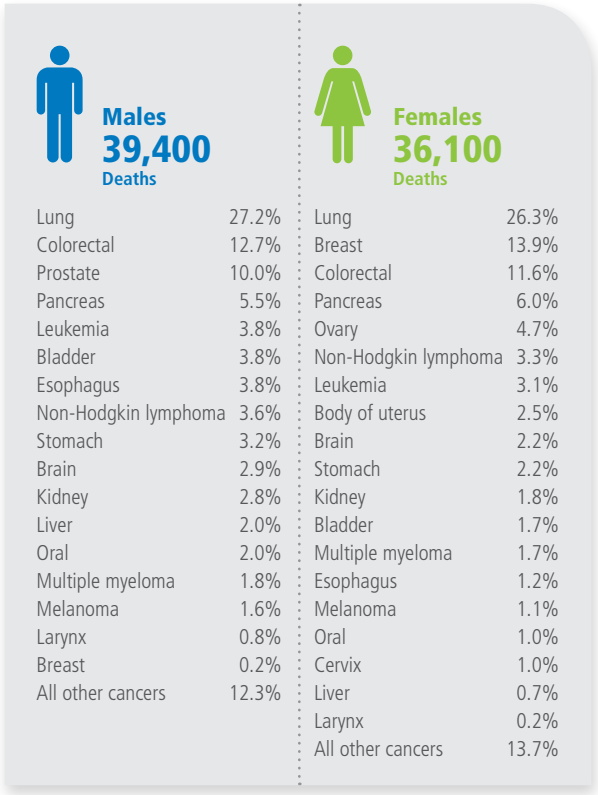
Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

Deaths from cancer in 2013

An estimated 75,500 Canadians are expected to die from cancer in 2013 (Table 3.2).

- Lung, colorectal, breast and prostate cancers each account for 10% or more of all cancer deaths in each sex (Figure 3.2).
- Lung cancer is the leading cause of cancer death for both sexes. It is responsible for approximately equal proportions of all cancer deaths in both males and females.
- Colorectal cancer is the second most common cause of cancer death for males and the third most common cause of cancer death for females.
- Breast cancer is the second most common cause of cancer death in females.
- Prostate cancer is the third most common cause of cancer death in males.
- Although it is much less commonly diagnosed than many other cancers, pancreatic cancer is the fourth leading cause of cancer death in both sexes because of its low survival rate.

FIGURE 3.2 Percent distribution of estimated cancer deaths, by sex, Canada, 2013



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

Age-standardized mortality rate (ASMR)

The number of cancer deaths per 100,000 people, standardized to the age structure of the 1991 Canadian population to account for changes in age distribution over time.

Annual percent change (APC)

The estimated change in the rate of cancer deaths (mortality) from one year to the next over a defined period of time, reported as a percentage. Along with the changepoint (the year in which the APC changed), the APC is useful for examining trends.

Mortality

The number of deaths due to cancer in a given year.

Probability

The chance a person has of dying from cancer measured over a period of time. The probability of dying from cancer is expressed as a percentage or as a chance (e.g., a 1 in 5 chance).

Statistical significance

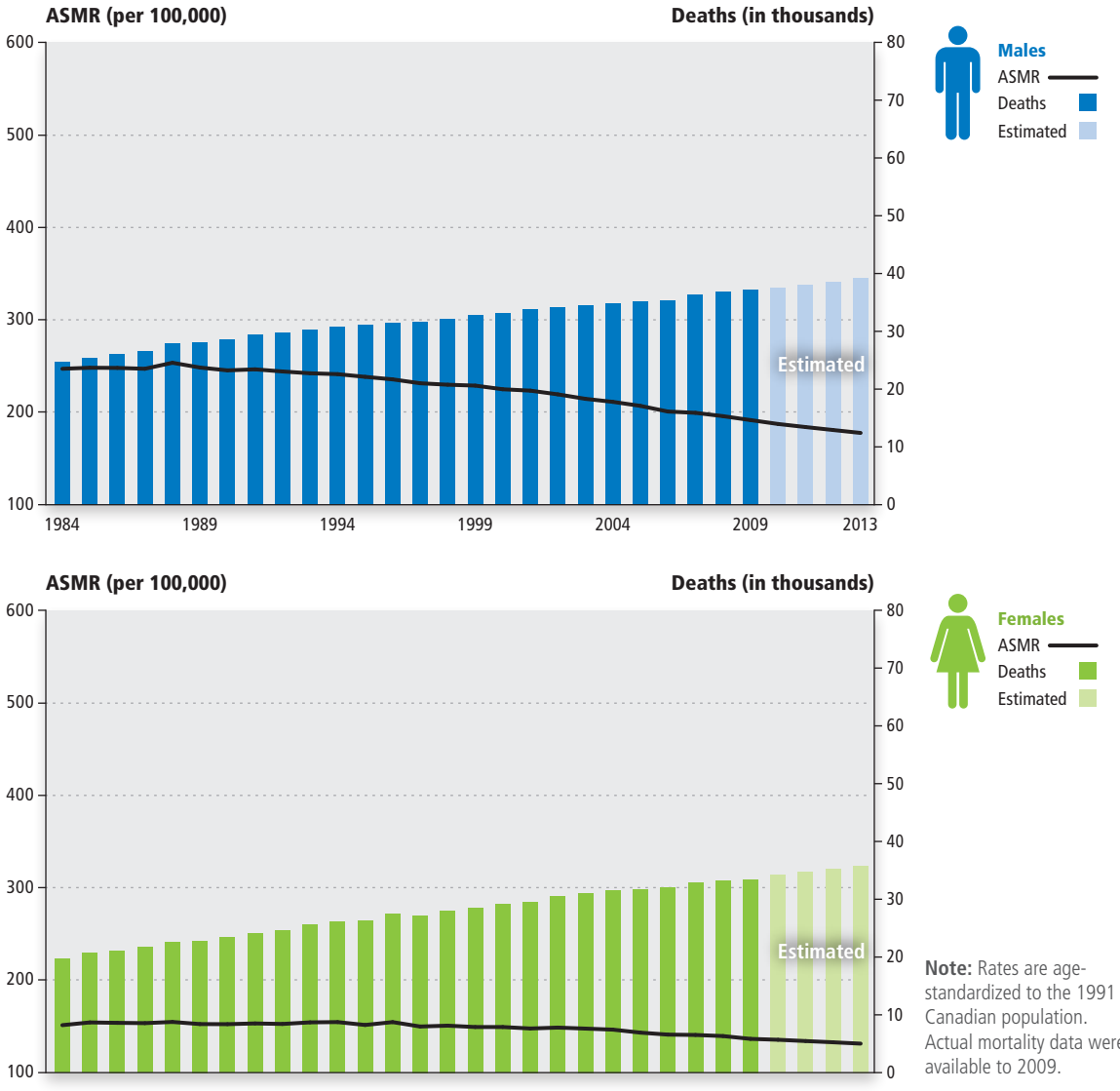
Refers to a number or a relationship that is unlikely to occur simply by chance. In other words, a statistic that is reliable.

Trends over time

Since 1984, the number of cancer deaths per year has increased in both sexes. During this period, age-standardized mortality rates (ASMR) for some cancers have varied between the sexes (Figures 3.3–3.5).

- For males, the mortality rate for all cancers has been decreasing after it reached a peak in 1988. 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 had dropped since 1988 as a result of declines in the mortality rates for breast and colorectal cancers.
- Since the early 2000s, the mortality rate for non-Hodgkin lymphoma has declined for both sexes.
- Cancer mortality rates continue to increase for liver cancer in both sexes, and for lung cancer in females (although the rate of increase for lung cancer is slowing).

FIGURE 3.3 Deaths and age-standardized mortality rates (ASMR) for all cancers, Canada, 1984–2013



Note: Rates are age-standardized to the 1991 Canadian population. Actual mortality data were available to 2009.

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

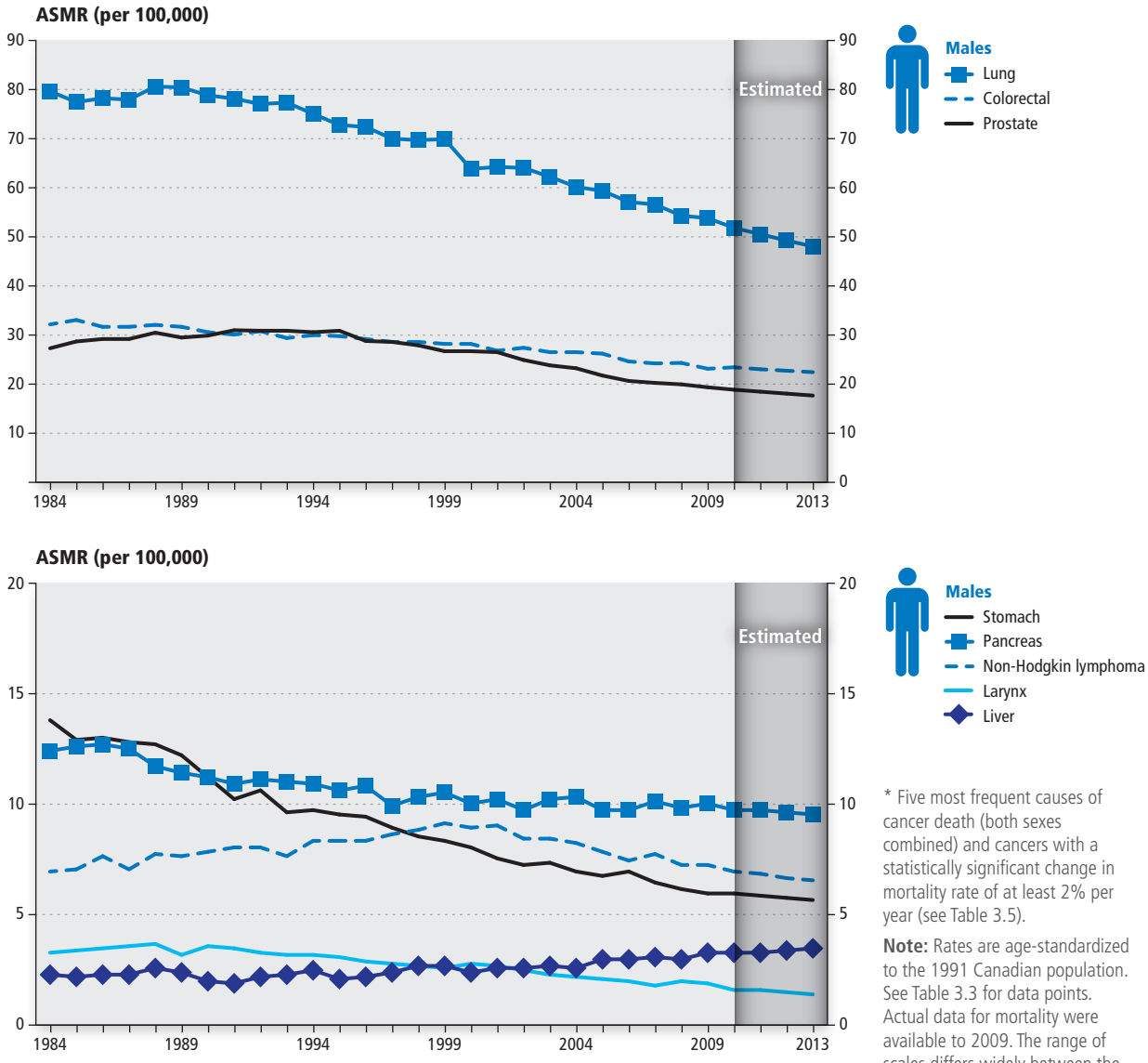
Trends for selected cancers

Tables 3.3 and 3.4 show the ASMR from 1984 to 2013 for selected cancers in males and females. Table 3.5 shows the annual percentage change (APC). Figures 3.4 and 3.5 show the five most common cancers (both sexes combined) and those with the largest statistically significant decreases or increases in APC (of at least 2% per year). These cancers are discussed below.

Breast cancer

The female breast cancer death rate has been declining since the mid-1980s. After its peak in 1986, the age-standardized mortality rate has fallen 42%, from 32.0 deaths per 100,000 in 1986 to a projected rate of 18.7 deaths per 100,000 in 2013. The downward trend has accelerated to 2.4% per year since 2000, which is likely due to a combination of increased mammography screening[1] and the use of more effective therapies following breast cancer surgery.[2,3] The breast cancer mortality rate in Canada is the lowest it has been since 1950, with similar declines observed in the United States, United Kingdom and Australia.[4]

FIGURE 3.4 Age-standardized mortality rates (ASMR) for selected* cancers, males, Canada, 1984–2013



* 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 3.5).

Note: Rates are age-standardized to the 1991 Canadian population. See Table 3.3 for data points. Actual data for mortality were available to 2009. The range of scales differs widely between the figures.

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

Cervical cancer

The mortality rate for cervical cancer decreased by 2.7% per year between 2000 and 2009. The decrease in mortality rate has followed the reduction in the cervical cancer incidence rate over the same period of time. The latter is largely the result of Pap test screening,[5] which has helped detect precancerous and malignant lesions at an earlier stage when treatment is more effective.

Colorectal cancer

The death rate from colorectal cancer continues to decline for both males (2.7% per year since 2004) and females (1.8% per year since 2000). This is likely due to improvements in treatments (particularly chemotherapy).

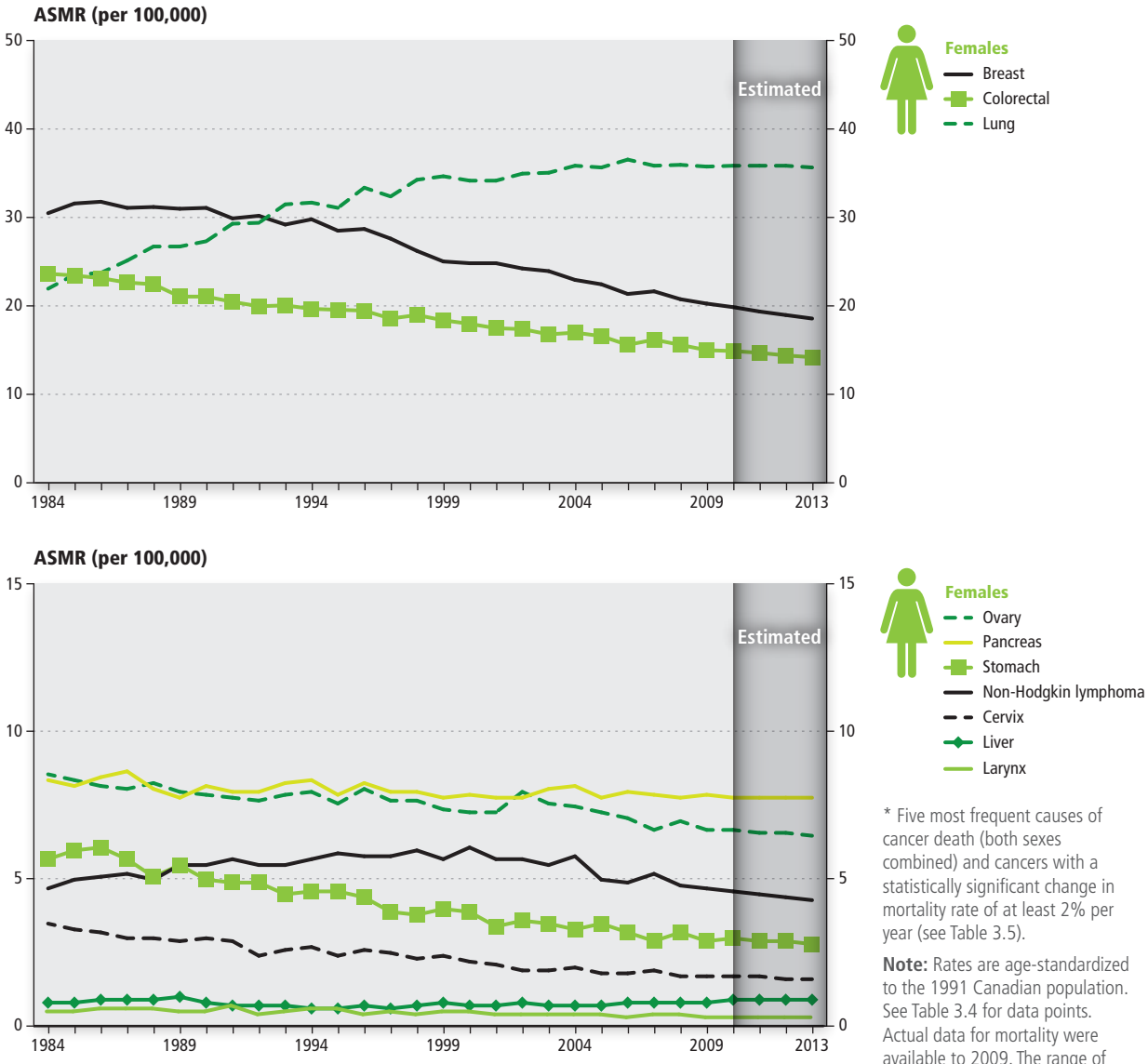
Larynx cancer

Deaths due to larynx cancer have been declining in both males (4.7% per year) and females (4.0% per year) since 2000. The trend in mortality rates has followed the reduction in the larynx cancer incidence rate during the same time period.

Liver cancer

Between 2000 and 2009, the mortality rate of liver cancer has increased significantly for both males (3.2% per year) and females (2.0% per year). The upward trend in mortality rates has followed the increase in liver cancer incidence rate. See *Chapter 7* for more information about liver cancer.

FIGURE 3.5 Age-standardized mortality rates (ASMR) for selected* cancers, females, Canada, 1984–2013



Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDP, Public Health of 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 3.5).

Note: Rates are age-standardized to the 1991 Canadian population. See Table 3.4 for data points. Actual data for mortality were available to 2009. The range of scales differs widely between the figures.

Lung cancer

In males, the mortality rate of lung cancer began to level off in the late 1980s and has been declining ever since. The mortality rate for females shows a slight but statistically significant increase (0.6% per year since 2000). The rate of increase is slowing. The death rate in females is expected to begin to decline in the future, similar to the trend in female lung cancer death rate seen in the US.[6] Despite the diverging trends, males are projected to continue to have a higher mortality rate of lung cancer (48.4 per 100,000) than females (35.9 per 100,000) in 2013.

Non-Hodgkin lymphoma (NHL)

Mortality rates for NHL have declined for both males (2.5% per year) and females (2.7% per year) since 2000. 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[7] for HIV infection has resulted in a decline of aggressive forms of non-Hodgkin lymphoma attributable to HIV infection.

Pancreatic cancer

Mortality rates for pancreatic cancer have been stable in males and females. The mortality rates for pancreatic cancer closely reflect the incidence rates for this cancer due to the low survival. In other countries, trends in pancreatic cancer mortality rates have shown wide variation in the past decade. For example, the UK experienced decreases,[8] while the US showed increases of pancreatic cancer mortality rates.[9]

Prostate cancer

The mortality rate for prostate cancer rose slowly from 1984 to the mid-1990s, when it began to decline. Between 2001 and 2009, the mortality rate declined significantly (by 3.9% per year). This decline likely reflects improved treatment following the introduction of hormonal therapy for early and advanced-stage disease[10,11] and advances in radiation therapy.[12] 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 US and Europe that studied the use of PSA testing in males over the age of 55 reported conflicting results.[13,14] The ongoing follow-up of the men in these studies may help clarify the role of PSA testing in reducing deaths from prostate cancer.

Stomach cancer

Between 2000 and 2009, mortality rates for stomach cancer have declined for both males (3.0% per year) and females (2.7% per year). Mortality rates for both males and females are now one half or less than what they were in 1984. The trend in mortality rates has followed the reduction in the stomach cancer incidence rate during the same time period.

What do these statistics mean?

While the overall incidence rate of cancer has been slightly increasing in Canada, the cancer death rate has been decreasing. The relatively large reduction in mortality rates from lung, oral and larynx cancers reflect the reduction in smoking rates, particularly among males. The decrease in the overall mortality rate also reflects the availability of better treatment options, particularly for cancers that are detected at an early stage of disease when they are most amenable to treatments. Although the ASMR for cancer continues to decline, the actual number of cancer deaths continues to increase. This has implications for health policy and resource planning.

For further information

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Databases

- Statistics Canada. Table 102-0522 — Deaths, by cause, Chapter II: Neoplasms (C00 to D48), age group and sex, Canada, annual (number), CANSIM (database).
- Statistics Canada. Table 102-4309 — 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, occasional (number unless otherwise noted), CANSIM (database).
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TABLE 3.1 Lifetime probability of dying from cancer, Canada, 2007

	Probability (%)	One in:
Males		
All cancers	**28.1**	**3.6**
Lung	7.7	13
Prostate	3.6	28
Colorectal	3.5	29
Pancreas	1.4	72
Bladder	1.1	89
Non-Hodgkin lymphoma	1.0	95
Leukemia	1.0	96
Stomach	0.9	111
Esophagus	0.8	119
Kidney	0.7	149
Brain	0.6	165
Oral	0.5	200
Multiple myeloma	0.5	205
Liver	0.4	269
Melanoma	0.3	287
Larynx	0.2	407
Females		
All cancers	**23.7**	**4.2**
Lung	5.5	18
Breast	3.5	29
Colorectal	3.2	31
Pancreas	1.4	71
Ovary	1.0	95
Non-Hodgkin lymphoma	0.9	110
Leukemia	0.7	134
Body of uterus	0.6	173
Stomach	0.5	195
Bladder	0.5	213
Brain	0.5	220
Multiple myeloma	0.4	247
Kidney	0.4	252
Esophagus	0.3	339
Melanoma	0.2	420
Oral	0.2	406
Cervix	0.2	443
Liver	0.1	769

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

Note: The probability of dying from cancer represents the proportion of Canadians who die of cancer in a cohort subjected to the mortality conditions prevailing in the population at large in 2007. For further details, see *Appendix II: Data sources and methods.*

TABLE 3.2 Estimated deaths and age-standardized mortality rates (ASMR) for cancers by sex, Canada, 2013

	Deaths (2013 estimates)			Deaths per 100,000		
	Total*	Males	Females	Total*	Males	Females
All cancers	**75,500**	**39,400**	**36,100**	**151.6**	**178.2**	**131.7**
Lung	20,200	10,700	9,500	41.3	48.4	35.9
Colorectal	9,200	5,000	4,200	18.1	22.6	14.3
Breast	5,100	60	5,000	10.2	0.3	18.7
Pancreas	4,300	2,200	2,200	8.7	9.6	7.8
Prostate	3,900	3,900	—	—	17.8	—
Non-Hodgkin lymphoma	2,600	1,450	1,200	5.3	6.6	4.3
Leukemia	2,600	1,500	1,100	5.3	7.0	4.0
Bladder	2,100	1,500	630	4.1	6.8	2.0
Stomach	2,000	1,250	780	4.1	5.7	2.8
Brain	1,950	1,150	790	4.3	5.3	3.3
Esophagus	1,900	1,500	420	3.9	6.7	1.5
Kidney	1,750	1,100	640	3.5	4.9	2.3
Ovary	1,700	—	1,700	—	—	6.5
Multiple myeloma	1,350	730	620	2.7	3.3	2.2
Oral	1,150	770	380	2.3	3.4	1.4
Melanoma	1,050	640	390	2.2	2.9	1.5
Liver	1,000	780	240	2.1	3.5	0.9
Body of uterus	890	—	890	—	—	3.3
Larynx	390	310	75	0.8	1.4	0.3
Cervix	380	—	380	—	—	1.6
All other cancers	9,800	4,900	5,000	19.2	22.1	17.1

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

— Not applicable.

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

Note: "All other cancers" includes 420 deaths from non-melanoma skin cancer (basal and squamous).

TABLE 3.3 Age-standardized mortality rates (ASMR) for selected* cancers, males, Canada, 1984–2013

Year	Deaths per 100,000								
	All cancers	Lung	Colorectal	Prostate	Pancreas	Non-Hodgkin lymphoma	Stomach	Liver	Larynx
1984	248.1	80.2	32.4	27.5	12.5	7.0	13.9	2.3	3.3
1985	249.2	78.0	33.3	28.9	12.7	7.1	13.0	2.2	3.4
1986	249.0	78.8	31.9	29.4	12.8	7.7	13.1	2.3	3.5
1987	248.1	78.5	31.9	29.4	12.6	7.1	12.9	2.3	3.6
1988	254.6	81.2	32.3	30.7	11.8	7.8	12.8	2.6	3.7
1989	249.4	81.0	31.9	29.7	11.5	7.7	12.3	2.4	3.2
1990	246.4	79.4	30.8	30.1	11.3	7.9	11.3	2.0	3.6
1991	247.5	78.7	30.3	31.2	11.0	8.1	10.3	1.9	3.5
1992	245.2	77.6	31.0	31.1	11.2	8.1	10.7	2.2	3.3
1993	243.2	77.9	29.6	31.1	11.1	7.7	9.7	2.3	3.2
1994	242.3	75.6	30.2	30.8	11.0	8.4	9.8	2.5	3.2
1995	239.3	73.3	30.0	31.1	10.7	8.4	9.6	2.1	3.1
1996	236.6	72.9	29.4	29.0	10.9	8.4	9.5	2.2	2.9
1997	232.3	70.5	28.8	28.8	10.0	8.7	9.0	2.4	2.8
1998	230.7	70.2	28.8	28.1	10.4	8.9	8.6	2.7	2.7
1999	229.8	70.4	28.4	26.9	10.6	9.2	8.4	2.7	2.6
2000	225.8	64.3	28.4	26.9	10.1	9.0	8.1	2.4	2.8
2001	224.3	64.7	27.0	26.7	10.3	9.1	7.6	2.6	2.7
2002	220.3	64.5	27.6	25.1	9.8	8.5	7.3	2.6	2.5
2003	215.4	62.7	26.7	24.0	10.3	8.5	7.4	2.7	2.3
2004	212.1	60.6	26.7	23.4	10.4	8.3	7.0	2.6	2.2
2005	207.7	59.8	26.4	21.9	9.8	7.9	6.8	3.0	2.1
2006	201.5	57.5	24.8	20.8	9.8	7.5	7.0	3.0	2.0
2007	200.1	57.0	24.4	20.4	10.2	7.8	6.5	3.1	1.8
2008	196.5	54.7	24.5	20.1	9.9	7.3	6.2	3.0	2.0
2009	192.2	54.2	23.3	19.5	10.1	7.3	6.0	3.3	1.9
2010†	188.0	52.2	23.6	19.0	9.8	7.0	6.0	3.3	1.6
2011†	184.6	50.9	23.2	18.6	9.8	6.9	5.9	3.3	1.6
2012†	181.4	49.6	22.9	18.2	9.7	6.7	5.8	3.4	1.5
2013†	178.2	48.4	22.6	17.8	9.6	6.6	5.7	3.5	1.4

Analysis by: Chronic Disease Surveillance and Monitoring 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 3.5).

† Rates for these years are estimated based on all provinces and territories. Actual mortality data were available to 2009. These estimates are based on long-term trends and may not reflect recent changes in trends.

Note: Rates are age-standardized to the 1991 Canadian population.

TABLE 3.4 Age-standardized mortality rates (ASMR) for selected* cancers, females, Canada, 1984–2013

	Deaths per 100,000										
Year	All cancers	Lung	Breast	Colorectal	Pancreas	Ovary	Non-Hodgkin lymphoma	Stomach	Cervix	Liver	Larynx
1984	151.8	22.1	30.7	23.8	8.4	8.6	4.7	5.7	3.5	0.8	0.5
1985	154.8	23.7	31.8	23.6	8.2	8.4	5.0	6.0	3.3	0.8	0.5
1986	154.4	23.9	32.0	23.3	8.5	8.2	5.1	6.1	3.2	0.9	0.6
1987	154.0	25.3	31.3	22.8	8.7	8.1	5.2	5.7	3.0	0.9	0.6
1988	155.3	26.9	31.4	22.6	8.1	8.3	5.0	5.1	3.0	0.9	0.6
1989	153.0	26.9	31.2	21.2	7.8	8.0	5.5	5.5	2.9	1.0	0.5
1990	152.9	27.5	31.3	21.2	8.2	7.9	5.5	5.0	3.0	0.8	0.5
1991	153.7	29.5	30.1	20.6	8.0	7.8	5.7	4.9	2.9	0.7	0.7
1992	153.1	29.6	30.4	20.1	8.0	7.7	5.5	4.9	2.4	0.7	0.4
1993	154.9	31.7	29.4	20.2	8.3	7.9	5.5	4.5	2.6	0.7	0.5
1994	155.2	31.9	30.0	19.8	8.4	8.0	5.7	4.6	2.7	0.6	0.6
1995	152.0	31.3	28.7	19.7	7.9	7.6	5.9	4.6	2.4	0.6	0.6
1996	155.2	33.6	28.9	19.6	8.3	8.1	5.8	4.4	2.6	0.7	0.4
1997	150.4	32.6	27.8	18.7	8.0	7.7	5.8	3.9	2.5	0.6	0.5
1998	151.3	34.5	26.4	19.1	8.0	7.7	6.0	3.8	2.3	0.7	0.4
1999	149.8	34.9	25.2	18.5	7.8	7.4	5.7	4.0	2.4	0.8	0.5
2000	149.8	34.4	25.0	18.1	7.9	7.3	6.1	3.9	2.2	0.7	0.5
2001	148.2	34.4	25.0	17.6	7.8	7.3	5.7	3.4	2.1	0.7	0.4
2002	149.2	35.2	24.4	17.5	7.8	8.0	5.7	3.6	1.9	0.8	0.4
2003	148.1	35.3	24.1	16.9	8.1	7.6	5.5	3.5	1.9	0.7	0.4
2004	147.0	36.1	23.1	17.1	8.2	7.5	5.8	3.3	2.0	0.7	0.4
2005	143.7	35.9	22.6	16.7	7.8	7.3	5.0	3.5	1.8	0.7	0.4
2006	141.5	36.8	21.5	15.7	8.0	7.1	4.9	3.2	1.8	0.8	0.3
2007	141.2	36.1	21.8	16.3	7.9	6.7	5.2	2.9	1.9	0.8	0.4
2008	140.0	36.2	20.9	15.7	7.8	7.0	4.8	3.2	1.7	0.8	0.4
2009	136.9	36.0	20.4	15.1	7.9	6.7	4.7	2.9	1.7	0.8	0.3
2010†	135.9	36.1	20.0	15.0	7.8	6.7	4.6	3.0	1.7	0.9	0.3
2011†	134.5	36.1	19.5	14.8	7.8	6.6	4.5	2.9	1.7	0.9	0.3
2012†	133.2	36.1	19.1	14.5	7.8	6.6	4.4	2.9	1.6	0.9	0.3
2013†	131.7	35.9	18.7	14.3	7.8	6.5	4.3	2.8	1.6	0.9	0.3

Analysis by: Chronic Disease Surveillance and Monitoring 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 3.5).

† Rates for these years are estimated based on all provinces and territories. Actual data were available to 2009. These estimates are based on long-term trends and may not reflect recent changes in trends.

Note: Rates are age-standardized to the 1991 Canadian population.

TABLE 3.5 Annual percent change (APC) in age-standardized mortality rates (ASMR) for selected cancers, by sex, Canada, 2000–2009

	Males		Females	
	APC†	Changepoint‡	APC†	Changepoint‡
All cancers	**–1.9****	**2001**	**–1.2****	**2002**
Prostate	–3.9**	2001	—	
Lung	–2.2**		0.6**	
Breast	—		–2.4**	
Colorectal	–2.7**	2004	–1.8**	
Non-Hodgkin lymphoma	–2.5**		–2.7**	
Bladder	–0.7*		0.6	
Melanoma	1.2		0.9	
Thyroid	2.0		0.4	
Leukemia	–1.3**		–0.2	
Kidney	–0.3		–0.6	
Body of uterus	—		2.7	2005
Pancreas	–0.2		0.0	
Oral	–1.7*		–1.3	
Stomach	–3.0**		–2.7**	
Brain	1.6	2005	–0.1	
Ovary	—		–2.2*	2004
Multiple myeloma	–1.4		–1.5*	
Liver	3.2**		2.0*	
Esophagus	–0.1		–1.1	
Cervix	—		–2.7**	
Larynx	–4.7**		–4.0**	
Hodgkin lymphoma	–2.0		–1.3	
Testis	–1.4		—	

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

— Not applicable or small number of deaths.

* Significant increase or decrease in APC, $p<0.05$

** Significant increase or decrease in APC, $p<0.01$

† APC is calculated assuming a piecewise log linear model. The model was fitted to the rates in 1986–2009. When there is no changepoint in the most recent 10 years, the APC was obtained by running a separate changepoint analysis on the most recent 10 years. If there is a changepoint, the APC was taken from the last segment. For further details, see *Appendix II: Data sources and methods*.

‡ Changepoint indicates the baseline year for the APC shown, if the slope of the trend changed after 2000.

CHAPTER 4:
Mortality by sex, age and geography: Who dies of cancer in Canada?

Highlights

- Among people under the age of 55 years, females account for a greater proportion of cancer deaths. Around age 55, the mortality rate for males surpasses that for females.
- In 2013, almost all cancer deaths in Canada (95%) will occur in people over the age of 50 years. Most of these cancer deaths (61%) will occur in people aged 70 years and over.
- The mortality rate has been decreasing to varying degrees for all age groups in males and for the under 70 age groups in females.
- Mortality rates are highest in the Atlantic provinces and Quebec. They decline moving west across Canada.
- Variations in mortality rates across different regions may reflect a number of factors, such as differences in access to and outcomes of cancer control activities (e.g., screening, diagnosis, treatment and follow-up). These differences may apply at regional and demographic (age and sex) levels.

Introduction

As with new diagnoses of cancer, cancer deaths are not distributed equally across sexes, ages and provinces or territories. Examining deaths of cancer by sex, age or geographic region provides a better sense of who is dying from cancer and can help direct cancer control services to address the needs of specific populations.

Mortality by sex

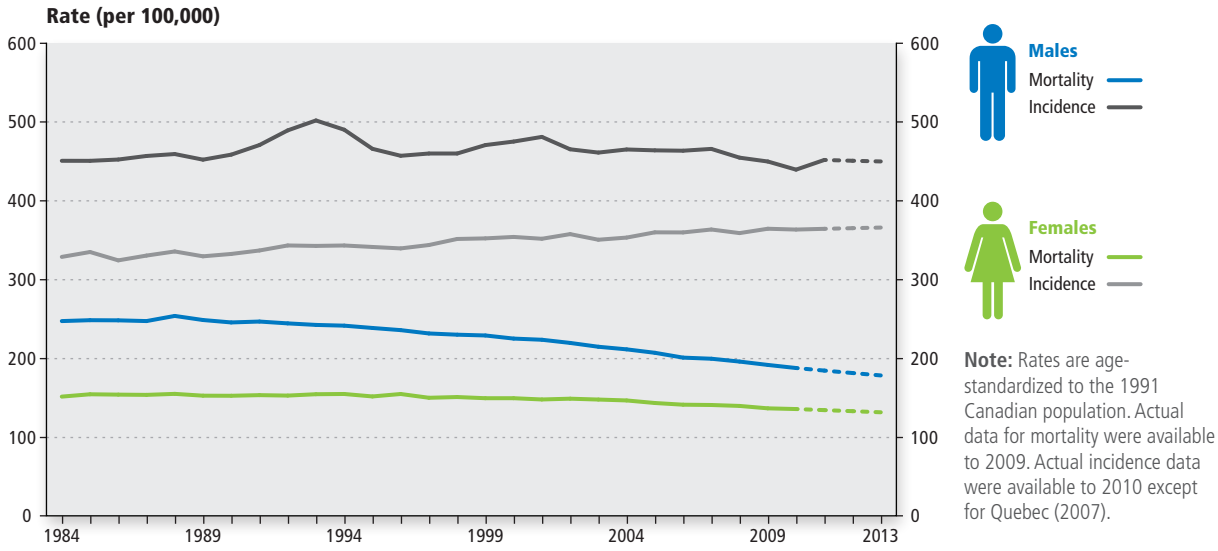
In 2013, it is estimated that 52% of all cancer deaths will occur among males and 48% among females. However, the distribution of cancer deaths between the sexes differs according to age. Among people aged 30–49 years and over 80 years, females represent a larger proportion of total cancer deaths than males (Table 4.1). This is mainly due to the varying age distributions of deaths from breast versus lung and colorectal cancer (Table 4.2).

Trends over time

Figure 4.1 shows the long-term trend in mortality rates by sex. The mortality rate for all cancers combined has been decreasing for males and females since 1988.

The decrease in mortality rate in males is largely due to reductions in lung cancer deaths (closely linked to decreases in smoking). The decrease in cancer deaths in females is attributed to declines in breast cancer mortality (most likely due to improvements in early detection and screening as well as improvements in treatment outcomes).

FIGURE 4.1 Age-standardized incidence and mortality rates for all cancers combined, by sex, Canada, 1984–2013



Note: Rates are age-standardized to the 1991 Canadian population. Actual data for mortality were available to 2009. Actual incidence data were available to 2010 except for Quebec (2007).

Analysis by: Chronic Disease Surveillance and Monitoring 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

Mortality by age

In 2013, almost all (95%) cancer deaths in Canada will occur in people over the age of 50 years, with the median age range for cancer deaths estimated to be 70–74 years for both sexes (see Table 4.1).

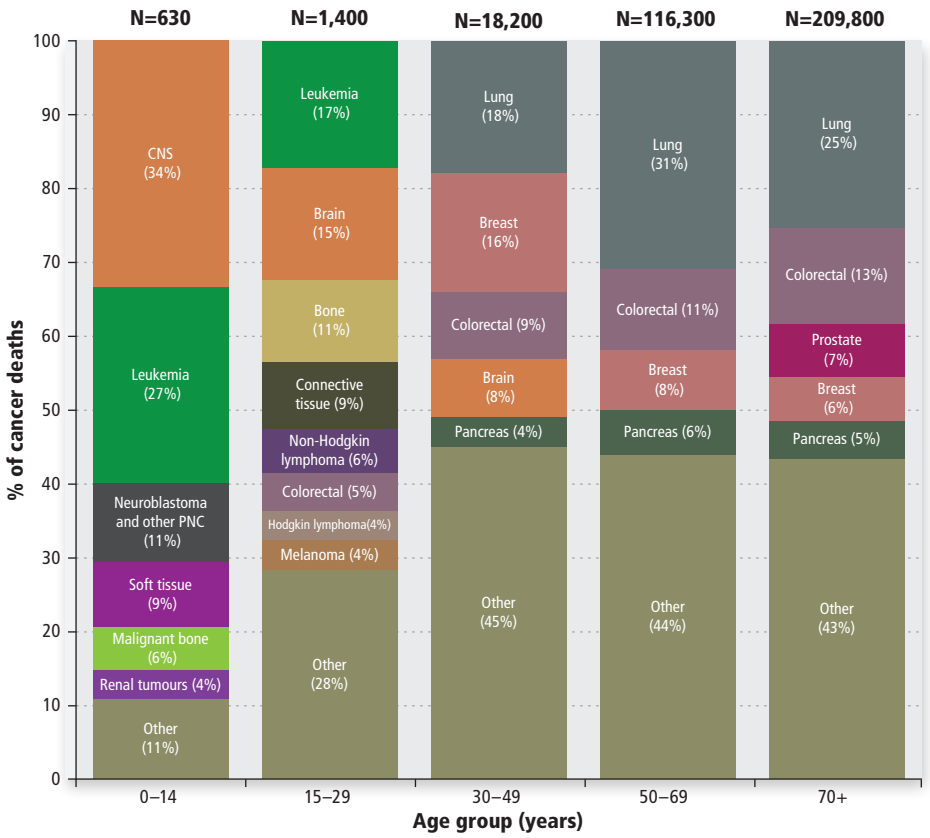
In 2013, it is estimated that:

- Canadians aged 70 years or older will account for about 46,200 cancer deaths (61% of all cancer deaths).
- Canadians aged 60–69 years will account for an additional 16,900 deaths (22% of all cancer deaths).
- Canadians aged 50–59 years will account for 8,900 deaths (12% of all cancer deaths).

Older adults account for the largest proportion of deaths from the most common cancers (see Table 4.2):

- While the majority of female cancer cases occur in females under the age of 70, breast cancer deaths are proportionately lower in that age group than in females aged 70 years and older. This potentially reflects the benefits that screening and treatment have in prolonging life in middle-aged women. A large number of females will also die of breast cancer between the ages of 50 and 69 years.
- Similarly, prostate cancer will be diagnosed most frequently in males aged 60–69 years, but most prostate cancer deaths will occur in males aged 80 years and older. These mortality rates likely reflect the benefits of early detection of prostate cancer and the slow progression of the disease. A large number of males will also die of prostate cancer between the ages of 70 and 79 years.
- Unlike other cancers, where the number of deaths increases with age, deaths for lung cancer peak in people aged 70–79 years for both males and females. This peak occurs because the largest proportion of new cases is in the same age group (see *Chapter 2*) and survival is poor, so that deaths typically occur within a short period after diagnosis (see *Chapter 5*).

FIGURE 4.2 Distribution of cancer deaths for selected cancers by age group, both sexes combined, Canada, 2005–2009



N is the total number of deaths over 5 years (2005–2009) for each age group; CNS=Central nervous system; PNC=Peripheral nervous cell tumours.

Note: Childhood cancers (ages 0–14) are classified according to ICCC-3[2] and young adults (ages 15–29) and adult cancers according to ICD-10.[3]

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

Figure 4.2 shows that the distribution of cancer deaths is quite different in the older age groups than in younger age groups.

- Between 2005 and 2009, the leading causes of childhood cancer deaths were cancers of the central nervous system (CNS) (34%), followed by leukemia (27%).
- Cancer deaths among older adolescents and young adults (aged 15–29 years) accounted for less than 1% of all cancer deaths in Canada. The most common causes of cancer deaths in this age group were leukemia (17%), followed by brain cancer (15%).

Trends over time

Cancer mortality rates have decreased to varying degrees over time for all age groups in males and for the under-70 age groups in females (Figure 4.3).

Age-standardized mortality rate (ASMR)

The number of cancer deaths per 100,000 people, standardized to the age structure of the 1991 Canadian population to account for changes in age distribution over time.

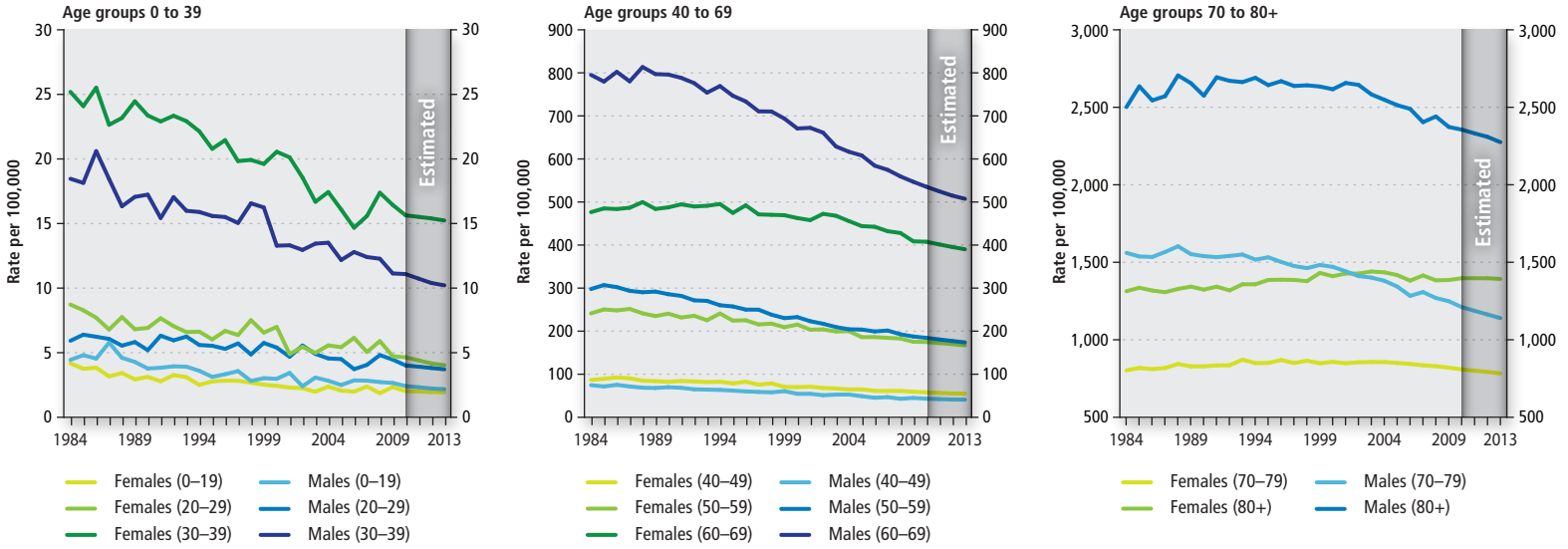
In this section, age standardization is used to adjust for differences in age distributions among the provinces and territories, which allows for more accurate comparisons.

Province or territory

Refers to the province or territory of a person's usual place of residence at the time of his/her death.

The most recent actual data for provinces and territories are available to 2009 (see Tables A5 and A6 in *Appendix I: Actual data for new cases and deaths*).

FIGURE 4.3 Age-standardized mortality rates (ASMR) for all cancers, by age group, Canada, 1984–2013



Note: The range of rate scales differs widely between the age groups. Actual mortality data were available up to 2009 for all provinces and territories.

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

Mortality by geographic region

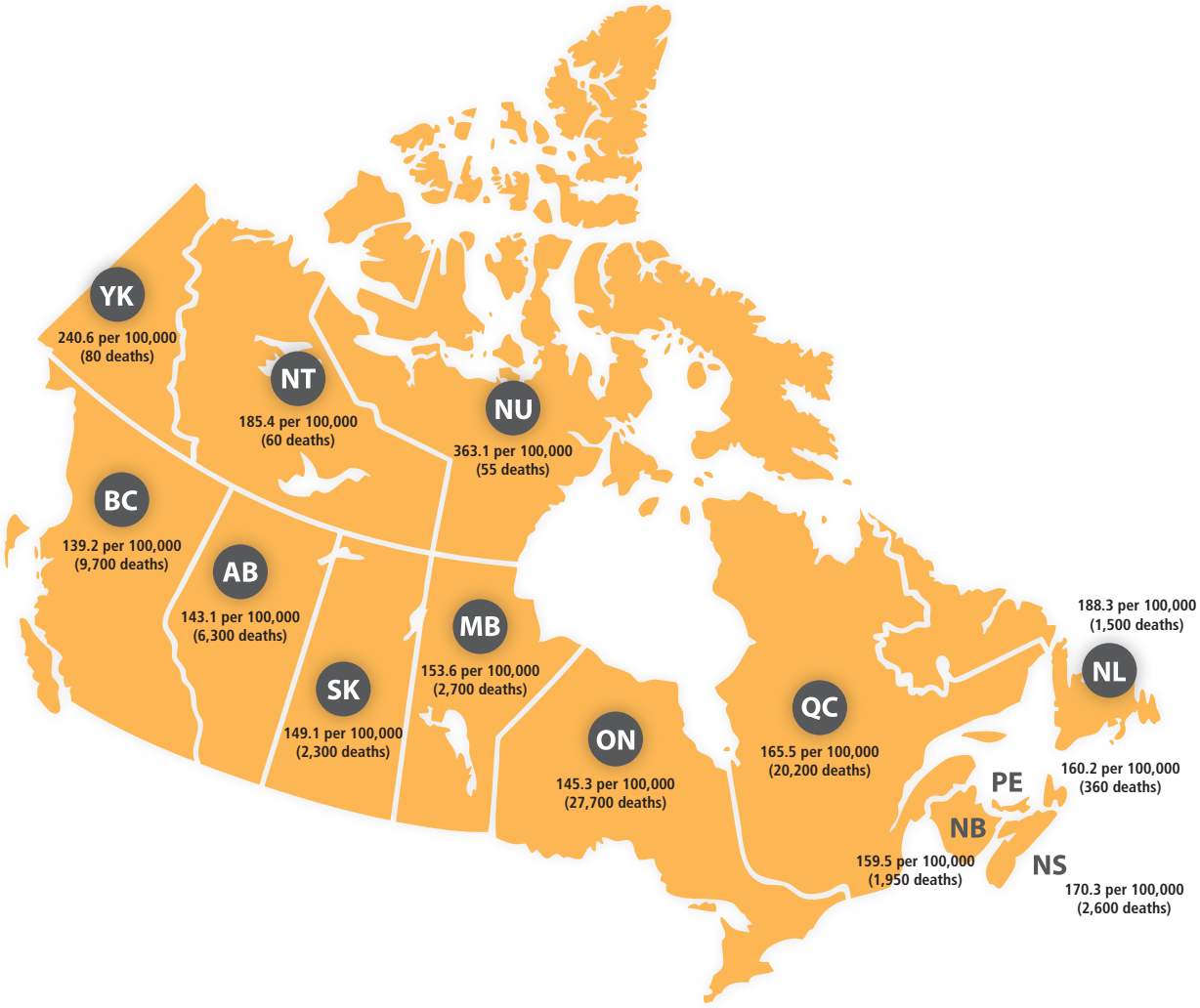
The estimated number of cancer deaths for all cancers and both sexes combined by province and territory are shown in Table 4.3, with age-standardized mortality rates (ASMR) shown in Figure 4.4. Similar to the pattern for incidence rates, the mortality rate for all cancers combined is highest in the Atlantic provinces and Quebec and lowest in western Canada.

Estimated deaths (Table 4.4) and ASMR (Table 4.5) for specific cancer types show that there are several geographic differences:

- Lung cancer mortality rates for both males and females are highest in Quebec and the Atlantic provinces and lowest in British Columbia.
- Colorectal cancer mortality rates are highest in Newfoundland and Labrador, particularly for males.
- The prostate cancer mortality rate is highest in Prince Edward Island (although this may be due to statistical variability associated with small populations), Saskatchewan and Manitoba. The mortality rate for prostate cancer is lowest in Quebec.

Mortality rates reflect the incidence and survival rates in a given region, which could reflect variation across regions in risk factors, availability and use of screening programs and diagnostic services, as well as differences in treatment practices.

FIGURE 4.4 Geographic distribution of estimated cancer deaths and age-standardized mortality rates (ASMR) by province or territory, both sexes, Canada, 2013



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

What do these statistics mean?

Differences in cancer mortality rates by age, sex and geography 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 they tend to occur in populations of males versus females (e.g., prostate cancer deaths typically occur in older males compared to breast cancer deaths in females). Other factors, however, may be differences in access to cancer control interventions (such as screening and early detection) as well as variations in practice patterns between provinces as well as within age and sex groupings across provinces. There are likely also age and sex differences in response rate to cancer treatment,[1] which may contribute to variations in the mortality rate.

For further information

Publications

- Navaneelan T, Janz T. Cancer in Canada: Focus on lung, colorectal, breast and prostate. *Health at a Glance, Statistics Canada* (Catalogue no. 82-624-X); 2011.
- Statistics Canada. *Mortality, Summary List of Causes, 2009*. (Catalogue no. 84F0209X); 2012.

Databases

- Statistics Canada. Table 102-0552 — Deaths and mortality rate, by selected grouped causes and sex, Canada, provinces and territories, annual, CANSIM (database).
- Statistics Canada. Table 102-4309 — 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, occasional (number unless otherwise noted), CANSIM (database).

References

1. Schmetzer O, Flörcken A. Sex differences in the drug therapy for oncologic diseases. *Handbook of Experimental Pharmacology*. 2012;(214):411–42.
2. Steliarova-Foucher E, Stiller CA, Lacour B, Kaatsch P. International classification of childhood cancer. 3rd ed. *Cancer*. 2005;103:1457–1467.
3. World Health Organization. *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision*. Volumes 1 to 3. Geneva, Switzerland: World Health Organization; 1992.

TABLE 4.1 Estimated population and deaths for all cancers by age group and sex, Canada, 2013

Age	Population (in thousands)			Deaths (2013 estimates)		
	Total*	Males	Females	Total*	Males	Females
All ages	**35,318**	**17,521**	**17,796**	**75,500**	**39,400**	**36,100**
0–19	7,907	4,058	3,849	160	90	75
20–29	4,897	2,495	2,403	190	100	85
30–39	4,796	2,401	2,395	610	250	370
40–49	4,994	2,515	2,479	2,500	1,100	1,400
50–59	5,248	2,613	2,635	8,900	4,500	4,400
60–69	3,839	1,871	1,968	16,900	9,300	7,600
70–79	2,183	1,016	1,166	20,700	11,500	9,200
80+	1,454	552	902	25,500	12,600	13,000

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

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

TABLE 4.2 Estimated deaths for the most common cancers by age group and sex, Canada, 2013

Age	Lung			Colorectal			Prostate	Breast
	Total*	Males	Females	Total*	Males	Females	Males	Females
All ages	**20,200**	**10,700**	**9,500**	**9,200**	**5,000**	**4,200**	**3,900**	**5,000**
0–19	—	—	—	—	—	—	—	—
20–29	5	5	5	15	10	5	—	5
30–39	40	15	25	60	30	30	—	95
40–49	450	200	250	260	140	120	10	390
50–59	2,600	1,300	1,300	940	570	370	130	870
60–69	5,400	2,900	2,500	1,900	1,200	700	510	1,100
70–79	6,400	3,500	2,900	2,400	1,450	970	1,050	1,000
80+	5,400	2,800	2,600	3,600	1,650	1,950	2,200	1,550

— Fewer than 3 cases or deaths.
* Column totals may not sum to row totals due to rounding.

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

TABLE 4.3 Estimated population and deaths for all cancers by sex and geographic region, Canada, 2013

	Population (in thousands)			Deaths (2013 estimates)		
	Total*	Males	Females	Total*	Males	Females
CANADA	**35,318**	**17,521**	**17,796**	**75,500**	**39,400**	**36,100**
British Columbia (BC)	4,744	2,352	2,391	9,700	5,200	4,500
Alberta (AB)	3,893	1,982	1,910	6,300	3,400	2,900
Saskatchewan (SK)	1,055	525	530	2,300	1,200	1,100
Manitoba (MB)	1,274	635	639	2,700	1,400	1,300
Ontario (ON)	13,775	6,795	6,981	27,700	14,300	13,400
Quebec (QC)	8,089	4,013	4,076	20,200	10,300	9,900
New Brunswick (NB)	763	375	388	1,950	1,000	930
Nova Scotia (NS)	957	466	492	2,600	1,400	1,150
Prince Edward Island (PE)	146	71	75	360	180	180
Newfoundland and Labrador (NL)	509	249	260	1,500	830	660
Yukon (YT)	34	17	17	80	45	35
Northwest Territories (NT)	45	23	22	60	30	30
Nunavut (NU)	34	17	16	55	30	25

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

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

TABLE 4.4 Estimated deaths for selected cancers by sex and province, Canada, 2013

	Canada*	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL
Males											
All cancers	**39,400**	**5,200**	**3,400**	**1,200**	**1,400**	**14,300**	**10,300**	**1,000**	**1,400**	**180**	**830**
Lung	10,700	1,250	810	300	360	3,600	3,400	340	370	55	230
Colorectal	5,000	650	400	150	180	1,850	1,300	110	200	25	140
Prostate	3,900	570	360	160	180	1,500	860	100	130	20	65
Pancreas	2,200	310	180	65	70	800	540	60	75	10	35
Leukemia	1,500	190	130	50	60	600	350	35	55	10	20
Bladder	1,500	250	120	50	55	550	360	35	55	10	25
Esophagus	1,500	240	150	40	60	580	300	40	55	10	25
Non-Hodgkin lymphoma	1,450	200	130	55	50	540	340	45	55	5	20
Stomach	1,250	130	110	30	50	470	340	35	45	5	45
Brain	1,150	150	110	30	35	430	300	30	40	5	20
Kidney	1,100	130	95	35	50	390	260	35	45	5	25
Liver	780	140	65	5	20	320	190	10	15	—	10
Oral	770	110	75	20	30	300	170	20	25	5	15
Multiple myeloma	730	90	65	25	25	280	180	15	25	5	10
Melanoma	640	85	55	15	15	290	120	15	25	5	15
Females											
All cancers	**36,100**	**4,500**	**2,900**	**1,100**	**1,300**	**13,400**	**9,900**	**930**	**1,150**	**180**	**660**
Lung	9,500	1,150	730	280	320	3,300	2,900	260	340	50	160
Breast	5,000	600	400	160	190	1,950	1,350	110	130	30	95
Colorectal	4,200	530	300	120	160	1,500	1,150	100	160	25	100
Pancreas	2,200	280	200	75	70	760	600	65	75	10	30
Ovary	1,700	240	150	55	70	670	400	50	50	5	30
Non-Hodgkin lymphoma	1,200	140	95	40	55	430	320	30	50	10	20
Leukemia	1,100	140	90	40	45	430	260	30	40	5	15
Body of uterus	890	90	80	20	30	390	210	20	30	5	15
Brain	790	100	60	25	25	280	230	20	30	5	15
Stomach	780	85	60	20	30	270	240	25	25	5	25
Kidney	640	70	55	25	25	240	160	20	25	5	15
Bladder	630	85	45	15	20	250	160	10	20	5	10
Multiple myeloma	620	70	60	20	25	240	160	15	20	—	10
Esophagus	420	75	40	15	15	160	80	15	20	—	5
Melanoma	390	55	35	10	10	170	80	10	10	—	5
Oral	380	50	35	10	15	150	95	5	10	—	5
Cervix	380	40	45	15	20	150	70	10	20	—	10

— 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 separately due to small numbers.

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

TABLE 4.5 Estimated age-standardized mortality rates (ASMR) for selected cancers by sex and province, Canada, 2013

	Deaths per 100,000										
	Canada*	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL
Males											
All cancers	**178**	**163**	**172**	**173**	**180**	**169**	**194**	**189**	**213**	**180**	**235**
Lung	48	39	41	44	47	43	63	62	55	57	64
Colorectal	23	20	20	22	23	22	24	21	30	23	39
Prostate	18	17	19	22	22	17	16	19	20	23	20
Pancreas	10	10	9	10	9	9	10	12	11	10	10
Leukemia	7	6	7	8	8	7	7	7	9	9	6
Bladder	7	8	6	7	7	6	7	6	8	8	8
Esophagus	7	8	7	6	8	7	5	8	8	8	7
Non-Hodgkin lymphoma	7	6	7	8	7	6	6	9	8	7	6
Stomach	6	4	5	5	7	6	6	7	7	4	13
Brain	5	5	5	5	5	5	6	6	6	5	5
Kidney	5	4	5	5	6	5	5	7	7	7	7
Liver	3	4	3	1	3	4	4	2	2	—	2
Oral	3	4	3	3	4	3	3	4	4	5	4
Multiple myeloma	3	3	3	3	4	3	3	3	4	4	3
Melanoma	3	3	3	3	2	4	2	3	4	3	4
Females											
All cancers	**132**	**120**	**121**	**132**	**135**	**127**	**146**	**138**	**138**	**146**	**153**
Lung	36	32	32	34	34	32	44	40	41	40	39
Breast	19	16	17	20	20	19	21	17	15	23	22
Colorectal	14	13	12	13	16	13	16	14	18	18	22
Pancreas	8	7	8	9	7	7	9	9	9	7	7
Ovary	6	6	6	7	8	7	6	7	6	5	7
Non-Hodgkin lymphoma	4	4	4	5	5	4	5	5	6	6	4
Leukemia	4	4	4	5	5	4	4	5	4	5	4
Body of uterus	3	2	3	3	3	4	3	3	3	3	3
Brain	3	3	3	3	3	3	4	4	4	3	4
Stomach	3	2	2	2	3	3	3	3	3	3	6
Kidney	2	2	2	3	3	2	2	3	3	5	4
Multiple myeloma	2	2	3	2	2	2	2	2	2	—	2
Bladder	2	2	2	2	2	2	2	1	2	3	2
Cervix	2	1	2	2	2	2	1	1	2	—	2
Melanoma	2	1	2	1	1	2	1	1	2	—	1
Esophagus	1	2	2	2	2	1	1	2	2	—	1
Oral	1	1	1	1	1	1	1	1	1	—	1

— Fewer than 3 deaths.

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

Note: Rates are age-standardized to the 1991 Canadian population.

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

CHAPTER 5:
Relative survival: What is the likelihood of surviving cancer?

Highlights

- For 2006 to 2008, the five-year relative survival ratio (RSR) for people diagnosed with cancer was 63%.
- Five-year RSRs are highest for thyroid (98%), testicular (97%) and prostate (96%) cancers. They are lowest for pancreatic (8%), esophageal (14%) and lung (17%) cancers.
- Five-year relative survival generally decreases with age.
- People diagnosed with cancer today have a better five-year relative survival than they did just over a decade ago. Between 1992 to 1994 and 2006 to 2008, the five-year relative survival for all cancers combined increased by seven percentage points from 56% to 63%.
- Five-year conditional RSRs demonstrate that survival of people diagnosed with cancer generally improves with time since diagnosis. Between 2006 and 2008, the five-year RSR for all cancers combined increased from 63% when measured from the date of diagnosis to 81% when measured among those who survived the first year after a cancer diagnosis.
- Differences in age-standardized five-year RSRs across geographic regions and types of cancer help point to areas where greater effort is required to detect, diagnose and effectively treat cancer earlier.

Introduction

Five-year relative survival ratios (RSRs) provide a measure of disease severity and prognosis. A person diagnosed with a cancer that has a poor five-year relative survival has a small probability of living until the fifth anniversary of his or her diagnosis. Relative survival estimates, when examined across cancer types and geographic regions, can be used to establish priorities for improving prognosis. Examining these estimates 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 likelihood 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.

The RSR is a useful "average" indicator of survival[2] and does not reflect any individual's prognosis. It is 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 ratios 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 RSRs are different from five-year observed survival, which refers 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 56% (Table 5.1).

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 one can be 95% confident the range contains the true value for the estimate of interest.

Five-year relative survival ratio (RSR)

A measure of the impact of cancer on life expectancy that compares the survival of people diagnosed with cancer to the survival of a comparable group of people in the general population. For example, a five-year RSR of 63% means that the cancer reduces the likelihood of surviving five years after a cancer diagnosis by 37%. Five-year RSR is the preferred measure for assessing population-based cancer survival.

RSRs can be measured over various timeframes, such as 1, 3, 5 or 10 years. As is standard in other reports, five years has been chosen as the primary duration of analysis for this report.

Observed survival

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

Five-year relative survival

Table 5.1 shows the five-year RSRs for people diagnosed with selected cancers in Canada between 2006 and 2008.

- For all cancers combined, the five-year RSR is 63%.
- The five-year RSRs are highest for thyroid (98%), testicular (97%) and prostate (96%) cancers.
- The five-year RSRs are lowest for pancreatic (8%), esophageal (14%) and lung (17%) cancers.
- For most of the cancers examined, the five-year RSRs tend to be higher among females.

Other time periods commonly used to measure relative survival include 1, 3 and 10 years. For colorectal and lung cancers, RSRs demonstrate a general pattern of substantial decline in the first year after diagnosis (one-year RSR), a more gradual fall over the next two years (three-year RSR) and then smaller declines over the intervals from 3 to 5 years and to 10 years (Figure 5.1).

Survival by sex

Table 5.1 shows that the five-year RSR differed by more than five percentage points for four of the cancers examined. In all four cancer types, relative survival was better for females than for males: melanoma (92% vs. 85%), breast (88% vs. 80%), oral (68% vs. 61%) and lung (20% vs. 14%).

Survival by province

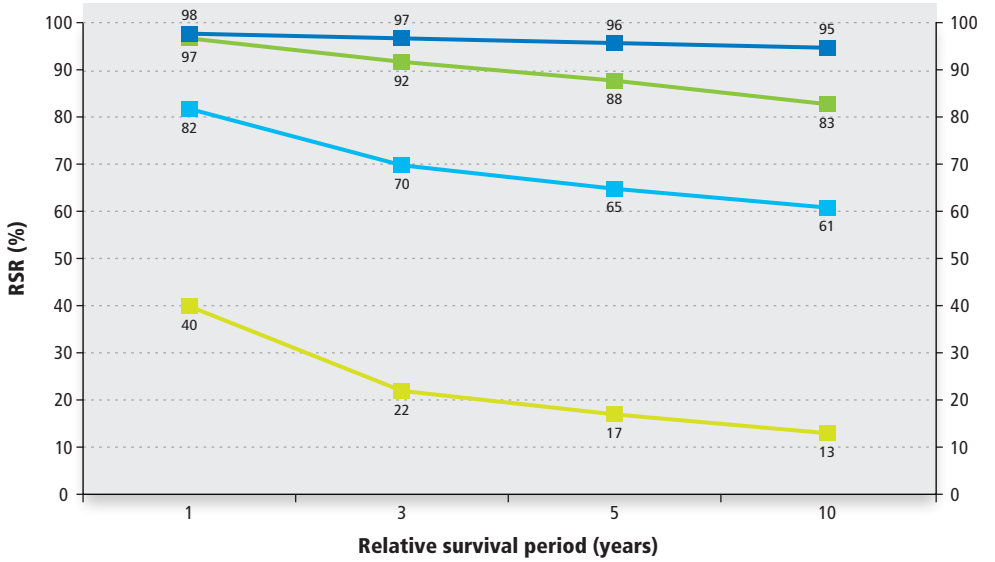
Five-year RSRs are age-standardized to allow comparisons across provinces. Table 5.2 shows age-standardized five-year RSRs for the four most common cancer types (prostate, breast, colorectal and lung cancers). The following exceptions and caveats should be considered when examining these data:

- Cancer cases in Newfoundland and Labrador may be under-reported due to incomplete linkage of cancer incidence data with death data. Such under-reporting 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 new cancer cases to calculate reliable estimates. Territorial cases are, however, included in the estimates for all of Canada.
- RSRs for Prince Edward Island are imprecise because of the relatively small number of cancer cases.

Despite these constraints, several patterns are worth mentioning:

- The highest RSRs for prostate cancer are in Ontario (97%), New Brunswick (95%) and Nova Scotia (95%). The lowest RSRs for prostate cancer are in Manitoba (90%), Saskatchewan (91%) and Alberta (92%).
- There is little provincial variation in RSRs for breast cancer.
- The RSRs for colorectal cancer range from 61% in several provinces to 67% in Ontario.

FIGURE 5.1 One, three, five and ten-year relative survival ratios (RSR) for the most common cancers, Canada (excluding Quebec*), 2006–2008



*Data from Quebec were excluded, in part, because its 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: These data are based on people aged 15–99 years at diagnosis.

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

- The RSRs for lung cancer range from a low of 15% in Alberta and Nova Scotia to a high of 21% 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.

Age-standardized relative survival ratio (RSR)

The RSR that would have occurred if the age distribution of the group of people with cancer under study had been the same as that of the standard population (i.e., all people diagnosed with that cancer in Canada between 1992 and 2001).

Survival by age at diagnosis

Relative 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.[3]

Table 5.3 shows the five-year RSRs for the four most common cancers by age group.

- RSRs for prostate cancer are consistently high (>95%) among males diagnosed between the ages of 40 and 79 years, but the RSR is lower in males aged 80–99 years.
- The highest RSRs for breast cancer (88%–90%) are among people diagnosed between the ages of 40 and 79 years. Lower RSRs are seen for people at both younger (85%) and older (80%) ages.
- RSRs for colorectal cancer are consistent at 68% among people diagnosed between the ages of 15 and 69 years, but the RSR is lower in people aged 70–99 years.
- For lung cancer, the RSR decreases with advancing age. People aged 15–39 years at diagnosis have the highest RSR at 45%, while people aged 80–99 years have the lowest RSR at 10%.

Trends over time

Age-standardized RSRs are used to examine changes in relative survival over time. Figure 5.2 shows that there has been substantial improvement in the age-standardized five-year RSRs for selected cancers diagnosed between 1992 to 1994 and 2006 to 2008.

- The RSR for all cancers combined has risen by seven percentage points to 63% in 2006 to 2008 from 56% in 1992 to 1994.
- The largest increases between the two time periods are seen for non-Hodgkin lymphoma (16 percentage points) and leukemia (14 percentage points).
- A few factors have contributed to the increased relative 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.[4]
- The improvement in age-standardized RSR for leukemia can be explained by multiple incremental improvements in care. These improvements include better and more specific diagnosis, advances in and extension of the use of stem cell transplantation and high-dose therapy, as well as improved supportive care.[5] In 1960, the overall five-year relative survival ratio for all leukemias was about 14%, while in 2006 to 2008 it was 58%.[5]

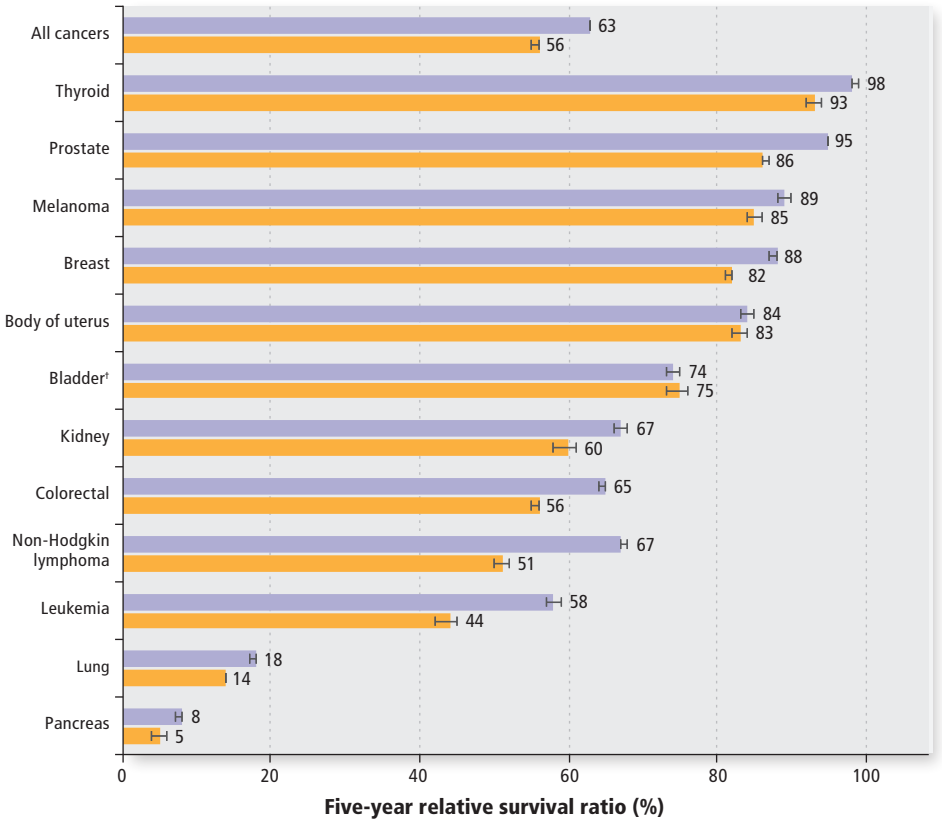
- Age-standardized RSRs for prostate and colorectal cancers each increased by nine percentage points. Survival improvements in prostate and colorectal cancers are due to increased use of screening and early detection that have helped identify cancers at a treatable stage.
- There has been little change (about one percentage point) for cancers of the bladder and body of uterus between 1992 to 1994 and 2006 to 2008.

Five-year conditional relative survival

Conditional relative survival is a useful measure for predicting survival based on past survival. The five-year conditional RSR for people with cancer who have already survived 1–3 years after their diagnosis is often more meaningful for clinical management and prognosis than the five-year RSR 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. Thus, the five-year RSR measured at diagnosis no longer applies.[6,7]

Table 5.4 presents five-year RSRs estimated from the date of cancer diagnosis and five-year conditional RSRs calculated using people who have survived the first, second, third, fourth and fifth year after a cancer diagnosis. Five-year conditional RSRs demonstrate that the survival experience of people diagnosed with cancer generally improves with time since diagnosis.

FIGURE 5.2 Age-standardized five-year relative survival ratio (RSR) for selected cancers, both sexes combined, Canada (excluding Quebec*), 2006–2008 versus 1992–1994



* Data from Quebec were excluded, in part, because its 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 does not report *in situ* bladder cancers.

Note: These data are based on people aged 15–99 years at diagnosis and exclude non-melanoma skin cancers and adolescent (aged 15–19 years) bone cancers, which are dissimilar to those diagnosed in older adults. Since estimates are rounded to the nearest whole percent, confidence limits may be the same as the five-year relative survival ratio. Error bars refer to 95% confidence interval.

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

Conditional relative survival

The likelihood a person will survive an additional number of years (i.e., 5 years) once he or she has already survived a fixed number of years since diagnosis, compared to the expected survival of people with similar characteristics (age, sex and area of residence) in the general population.

- The five-year RSR for all cancers combined increased from 63% when measured from the date of diagnosis to 81% 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 RSR.
- The impact of time survived on the five-year conditional RSR varied by type of cancer. Cancers with low initial five-year RSRs (such as stomach, brain, liver, lung, esophagus and pancreas cancers) showed the most dramatic increases in five-year conditional RSRs.

- Conversely, since the potential for improvement is limited for cancers that have an excellent prognosis at diagnosis, cancers with high initial five-year RSRs (such as thyroid, testicular, prostate, melanoma and breast cancers) showed little improvement in five-year conditional RSRs.

What do these statistics mean?

People diagnosed with cancer today have a better chance of surviving the next five years after their diagnosis than they did just over a decade ago. Despite this improvement in survival, some cancers continue to have lower RSRs than others because of the aggressiveness of the disease, the late stage at which they tend to be diagnosed or because of the lack of effective treatment options.

Among the most common cancers, there is variation in age-standardized five-year RSRs across provinces for prostate, lung and colorectal cancers, while there is little provincial variation for breast cancer. These differences in five-year RSRs 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. It is anticipated that cancer stage at diagnosis and its impact on survival will be reported in this publication in future years.

For more information

Publications

- Ellison LF. Measuring the effect of including multiple cancers in survival analyses using data from the Canadian Cancer Registry. *Cancer Epidemiology*. 2010;34(5):550–5.
- Ellison LF, Gibbons L. Survival from cancer — Up-to-date predictions using period analysis. *Health Reports*. 2006;17:19–30.
- Ellison LF, Pogany L, Mery LS. Childhood and adolescent cancer survival: A period analysis of data from the Canadian Cancer Registry. *European Journal of Cancer*. 2007;43(13):1967–75.
- Ellison LF, Wilkins K. An update on cancer survival. *Health Reports*. 2010;21(3):55–60.
- Statistics Canada. *Cancer Survival Statistics* (Catalogue 82-226-x). Ottawa: Minister of Industry; 2012.

Databases

- Statistics Canada. Table 103-1559 — 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, 1 year of cases, Canada (excluding Quebec), annual (percent), 1992 to 2003, CANSIM (database).
- 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).
- Statistics Canada. Table 103-1574 — Five-year survival estimates for primary sites of cancer, ICD-O-3 (October 2011 CCR file), by sex, population aged 15 to 99, 3 years of cases, selected provinces, annual (percent), 1992/1994 to 2001/2003, CANSIM (database).
- 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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7. Ellison LF, Bryant H, Lockwood G, Shack L. Conditional survival analyses across cancer sites. *Health Reports*. 2011; 22(2):1–5.

TABLE 5.1 Five-year relative survival ratios (RSRs) and observed survival for selected cancers by sex, Canada (excluding Quebec*), 2006–2008

	Relative survival ratio (%) (95% CI)			Observed survival (%) (95% CI)		
	Both sexes	Males	Females	Both sexes	Males	Females
All cancers	**63 (63–64)**	**63 (62–63)**	**64 (64–64)**	**56 (55–56)**	**54 (53–54)**	**58 (58–58)**
Thyroid	98 (98–99)	96 (94–97)	99 (99–100)	95 (95–96)	90 (89–92)	96 (96–97)
Testis	—	97 (96–98)	—	—	95 (94–96)	—
Prostate	—	96 (96–96)	—	—	81 (81–82)	—
Melanoma	89 (88–89)	85 (84–86)	92 (91–93)	80 (79–80)	75 (74–76)	85 (84–86)
Breast	88 (88–88)	80 (74–86)	88 (88–88)	80 (80–81)	66 (62–71)	80 (80–81)
Hodgkin lymphoma	85 (83–87)	83 (81–85)	87 (85–90)	83 (81–84)	80 (78–83)	85 (83–87)
Body of uterus	—	—	85 (84–86)	—	—	78 (77–79)
Bladder†	74 (72–75)	74 (73–76)	72 (69–74)	60 (59–61)	60 (58–61)	61 (59–63)
Cervix	—	—	74 (72–75)	—	—	71 (70–73)
Kidney	68 (67–69)	67 (65–68)	69 (67–71)	60 (59–61)	59 (58–60)	62 (61–64)
Non-Hodgkin lymphoma	67 (66–67)	65 (64–66)	69 (67–70)	59 (58–60)	57 (56–58)	62 (60–63)
Colorectal	65 (64–65)	64 (63–65)	65 (64–66)	54 (54–55)	53 (53–54)	55 (54–56)
Larynx	63 (61–66)	63 (61–66)	64 (58–69)	55 (53–57)	54 (52–57)	57 (52–61)
Oral	63 (62–64)	61 (60–63)	68 (66–70)	57 (55–58)	55 (53–56)	60 (59–62)
Leukemia	59 (58–60)	59 (58–61)	59 (57–61)	51 (50–52)	51 (50–52)	52 (50–53)
Ovary	—	—	45 (44–46)	—	—	42 (41–43)
Multiple myeloma	43 (41–44)	44 (42–47)	41 (38–43)	37 (35–38)	38 (36–40)	36 (33–38)
Stomach	25 (24–26)	23 (22–24)	28 (27–30)	21 (20–22)	19 (18–20)	25 (23–26)
Brain	25 (24–27)	23 (22–25)	28 (26–30)	24 (23–26)	22 (21–24)	27 (25–29)
Liver	20 (18–22)	20 (18–22)	19 (16–22)	18 (17–19)	18 (17–20)	17 (15–20)
Lung	17 (17–17)	14 (14–15)	20 (19–21)	15 (15–15)	12 (12–13)	18 (17–18)
Esophagus	14 (13–15)	13 (12–15)	15 (13–18)	12 (11–13)	12 (10–13)	13 (11–15)
Pancreas	8 (7–8)	8 (7–9)	8 (7–9)	7 (6–7)	7 (6–8)	7 (6–8)

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

CI=confidence interval

— 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 does not currently report *in situ* bladder cancers.

Note: These data are based on people aged 15–99 years at diagnosis and exclude non-melanoma skin cancers and adolescent (aged 15–19 years) bone cancers, which are dissimilar to those diagnosed in older adults.

TABLE 5.2 Age-standardized five-year relative survival ratios (RSRs) for the most common cancers by province, Canada (excluding Quebec*), 2006–2008

Province	Relative survival ratio (%) (95% CI)			
	Prostate	Breast	Colorectal	Lung
Canada*	**95 (95–95)**	**88 (87–88)**	**65 (64–65)**	**18 (17–18)**
British Columbia (BC)	93 (92–94)	88 (87–89)	62 (60–63)	16 (15–17)
Alberta (AB)	92 (90–93)	86 (85–87)	62 (60–64)	15 (14–16)
Saskatchewan (SK)	91 (89–92)	86 (85–88)	61 (59–64)	16 (14–18)
Manitoba (MB)	90 (88–92)	85 (83–87)	61 (58–63)	21 (19–23)
Ontario (ON)	97 (97–98)	89 (88–89)	67 (67–68)	19 (19-20)
New Brunswick (NB)	95 (92–97)	89 (87–91)	62 (59–65)	17 (15–18)
Nova Scotia (NS)	95 (93–97)	88 (86–89)	61 (59–63)	15 (13–16)
Prince Edward Island (PE)	93 (88–97)	86 (81–90)	61 (55–67)	—

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

CI=confidence interval

— Estimate not shown due to small number of cases.

* 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: These data are based on people aged 15–99 years at diagnosis. Survival ratios for Newfoundland and Labrador are not shown as they are artefactually high.

TABLE 5.3 Five-year relative survival ratios (RSRs) for the most common cancers by age group, Canada (excluding Quebec*), 2006–2008

	Relative survival ratio (%) (95% CI)					
	15–39	40–49	50–59	60–69	70–79	80–99
Prostate	—	96 (94–97)	98 (97–98)	99 (98–99)	96 (96–97)	82 (80–84)
Breast	85 (84–87)	90 (89–90)	89 (88–90)	90 (90–91)	88 (87–89)	80 (78–82)
Colorectal	68 (64–71)	68 (67–70)	68 (67–69)	68 (67–69)	65 (64–66)	57 (56–59)
Lung	45 (39–51)	23 (21–25)	21 (20–22)	19 (18–20)	16 (15–17)	10 (10–11)

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

CI=confidence interval

— Estimate not shown due to small number of cases.

* 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.

TABLE 5.4 Five-year relative survival ratios (RSRs), conditional on having survived the specified number of years, for selected cancers, Canada (excluding Quebec*), 2006–2008

	Conditional RSR (%) (95%CI)					
	0	1	2	3	4	5
All cancers	**63 (63–64)**	**81 (81–81)**	**87 (87–87)**	**90 (90–90)**	**92 (92–93)**	**94 (94–94)**
Thyroid	98 (98–99)	100 (100–100)	100 (100–101)	100 (99–100)	100 (99–100)	99 (99–100)
Testis	97 (96–98)	98 (97–99)	99 (99–100)	100 (99–100)	100 (99–100)	100 (99–101)
Prostate	96 (96–96)	97 (97–98)	98 (98–99)	99 (98–99)	99 (98–99)	99 (98–99)
Melanoma	89 (88–89)	91 (91–92)	93 (92–94)	95 (94–96)	96 (95–97)	98 (97–99)
Breast	88 (88–88)	89 (89–90)	91 (90–91)	92 (91–92)	93 (93–93)	94 (94–94)
Hodgkin lymphoma	85 (83–87)	93 (91–94)	95 (93–96)	95 (93–96)	96 (94–97)	96 (95–97)
Body of uterus	85 (84–86)	91 (90–91)	94 (94–95)	96 (96–97)	99 (98–99)	100 (99–100)
Bladder†	74 (72–75)	82 (81–83)	86 (84–87)	88 (87–90)	90 (88–91)	90 (89–92)
Cervix	74 (72–75)	82 (81–83)	88 (87–90)	92 (91–93)	94 (93–95)	97 (96–98)
Kidney	68 (67–69)	82 (81–83)	87 (86–88)	89 (88–91)	91 (90–93)	93 (92–94)
Non-Hodgkin lymphoma	67 (66–67)	82 (81–83)	85(84–86)	87 (86–88)	88 (87–89)	89 (88–90)
Colorectal	65 (64–65)	77 (76–77)	83 (82–84)	88 (88–89)	92 (91–93)	95 (94–96)
Larynx	63 (61–66)	71 (69–74)	77 (75–80)	81 (78–83)	83 (80–85)	84 (81–87)
Oral	63 (62–64)	75 (74–76)	83 (81–84)	86 (85–87)	88 (86–89)	89 (88–91)
Leukemia	59 (58–60)	80 (78–81)	83 (82–85)	85 (83–86)	86 (84–87)	85 (83–87)
Ovary	45 (44–46)	57 (55–58)	65 (63–67)	72 (70–74)	80 (78–82)	86 (84–88)
Multiple myeloma	43 (41–44)	52 (50–54)	54 (52–56)	56 (53–58)	59 (56–62)	62 (58–65)
Stomach	25 (24–26)	51 (49–53)	72 (69–74)	84 (81–86)	92 (89–94)	95 (92–98)
Brain	25 (24–27)	49 (47–51)	65 (63–67)	73 (70–75)	76 (74–79)	80 (77–82)
Liver	20 (18–22)	42 (39–45)	55 (51–59)	67 (62–71)	77 (72–82)	83 (78–88)
Lung	17 (17–17)	39 (38–40)	56 (55–57)	65 (64–67)	71 (69–72)	75 (74–76)
Esophagus	14 (13–15)	34 (31–36)	55 (50–59)	69 (64–74)	75 (70–81)	81 (75–86)
Pancreas	8 (7–8)	30 (28–33)	53 (49–57)	68 (63–72)	78 (73–83)	83 (77–88)

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

CI=confidence interval

* 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 does not currently report *in situ* bladder cancers.

Note: These data are based on people aged 15–99 years at diagnosis and exclude non-melanoma skin cancers and adolescent (aged 15–19 years) bone cancers, which are dissimilar to those diagnosed in older adults.

CHAPTER 6:
Prevalence: How many people diagnosed with cancer are alive today?

Highlights

- A substantial number of Canadians have been diagnosed with cancer within the 10 years prior to 2009. There were 838,724 people diagnosed with cancer alive at the beginning of 2009 (10-year person-based prevalence). Among these people, 839,291 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, which means that the individuals affected 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.

Population-based cancer prevalence can be measured by the total number of tumours or by the number of individuals with cancer.

- 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.

Prevalence

The number of people with a new or previous cancer diagnosis in a given population who are alive on a specific date (known as the index date).

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.

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. This publication uses these periods for limited-duration prevalence.

Tumour-based prevalence

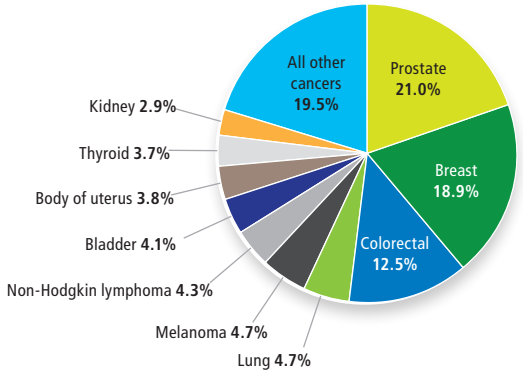
Among Canadians alive on January 1, 2009, close to 840,000 cancers had been diagnosed in the previous 10 years (Table 6.1). These cases can be analyzed according to the type of cancer, the sex and age of the person and the amount of time since diagnosis.

Prevalence by type of cancer

Figure 6.1 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, despite having an average incidence rate compared to other cancer types, melanoma represents 5% of all 10-year prevalent cancer cases because of its high survival.

FIGURE 6.1 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 may be lower than in previous editions of this publication because of the different method used to estimate Quebec's prevalence. For further details, see *Appendix II: Data sources and methods*.

Note: "All other cancers" excludes non-melanoma skin cancers.

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

Prevalence by sex

Table 6.1 shows that several types of cancer account for similar proportions of 10-year tumour-based prevalence in both sexes, 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 relative survival.

Prevalence by age

While the 10-year prevalence for all cancers peaked in people aged 70–79 years for both sexes combined, it peaked at a lower age group (60–69 years) for females alone (Table 6.2). This difference is primarily due to female breast cancer prevalence peaking in females aged 60–69 years rather than in females aged 70–79 years. The other exception to this pattern is the prevalence of colorectal cancer, which peaks in females aged 80 years or older.

Prevalence by duration

Of the 839,291 10-year prevalent cancer cases at the beginning of 2009, 246,874 (29%) had been diagnosed within the previous two years (2007 to 2008) and 272,183 (32%) had been diagnosed within the previous two to five years. An additional 320,234 (38%) had been diagnosed in the previous five to 10 years (Table 6.1). These data have implications for planning healthcare and supportive services.

- Prevalent cases diagnosed in the past two years (2007 to 2008) include individuals likely to be currently receiving or recovering from treatment for their cancer.
- Prevalent cases diagnosed between two and five years ago (2004 to 2006) include individuals in the third to fifth year after their diagnosis, a period that typically requires close clinical follow-up for recurrence and supportive care.
- Prevalent cases diagnosed between five and 10 years ago (1999 to 2003) include individuals likely to have completed their treatment, some of whom may require clinical monitoring.

Figure 6.2 shows that the prevalence of certain types of cancer depends on the length of the period considered. For example:

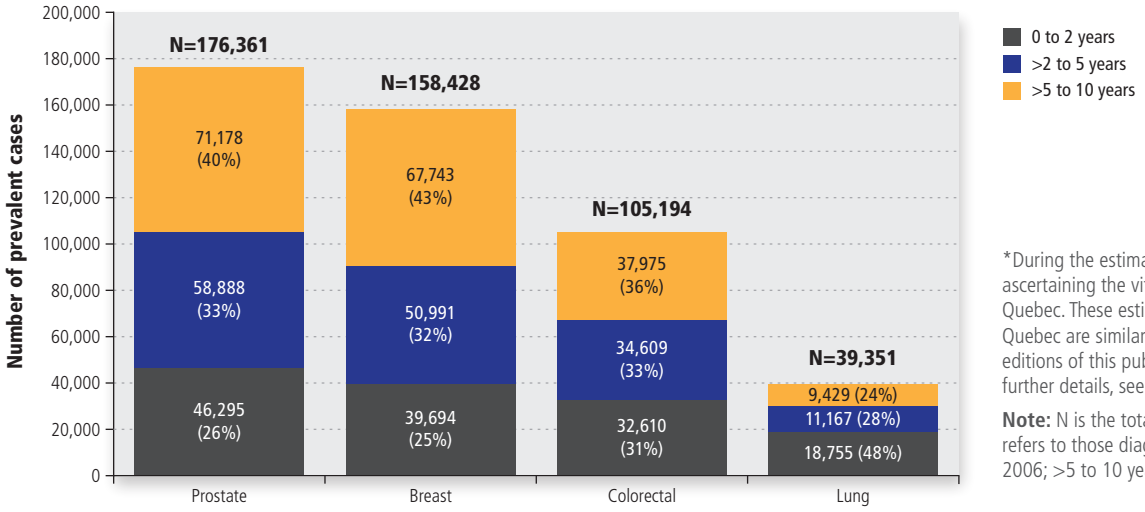
- The prevalence of breast cancer and prostate cancer rises with longer duration compared to other common cancers, such as colorectal and lung cancers.
- The poor prognosis for lung cancer cases means that fewer individuals with this cancer are alive beyond two years after diagnosis.

Person-based prevalence

Among Canadians alive on January 1, 2009, 838,724 had been diagnosed with cancer in the previous 10 years (Table 6.3). This number represents approximately 1 in 40 Canadians or 2.5% of the Canadian population (Table 6.4). 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 294 males and 1 in 348 females had been diagnosed with colorectal cancer.
- 1 in 907 males and 1 in 813 females had been diagnosed with lung cancer.

FIGURE 6.2 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. 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.

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

Publications

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- Ellison LF, Wilkins K. Canadian trends in cancer prevalence. *Health Reports*. 2012;23(1):7–16.

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3. Statistics Canada.Table 103-0550 – New cases for ICD-O-3 primary sites of cancer (based on the July 2011 CCR tabulation file), by age group and sex, Canada, provinces and territories. CANSIM (database). Retrieved December 17, 2012, from http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=1030550&paSer=&pattern=&stByVal=1&p1=1&p2=-1&tabMode=dataTable&csid=.
4. Ellison LF, Wilkins K. An update on cancer survival. *Health Rep.* 2010;21(3):55–60.
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TABLE 6.1 Tumour-based prevalence for selected cancers by duration and sex, Canada*, January 1, 2009

	2-year (diagnosed since 2007)			5-year (diagnosed since 2004)			10-year (diagnosed since 1999)		
	Total	Males	Females	Total	Males	Females	Total	Males	Females
All cancers	**246,874**	**127,539**	**119,335**	**519,057**	**265,665**	**253,392**	**839,291**	**422,914**	**416,377**
Prostate	46,295	46,295	—	105,183	105,183	—	176,361	176,361	—
Lung†	18,755	9,103	9,652	29,922	14,169	15,753	39,351	18,433	20,918
Breast	39,694	285	39,409	90,685	636	90,049	158,428	1,048	157,380
Colorectal	32,610	18,129	14,481	67,219	36,860	30,359	105,194	56,648	48,546
Non-Hodgkin lymphoma	10,760	5,896	4,864	23,144	12,440	10,704	36,222	19,140	17,082
Bladder†	9,941	7,534	2,407	21,127	15,947	5,180	34,259	25,651	8,608
Melanoma	10,639	5,530	5,109	23,362	11,984	11,378	39,494	19,895	19,599
Thyroid	8,626	1,934	6,692	19,243	4,122	15,121	30,926	6,517	24,409
Leukemia	7,153	4,182	2,971	14,620	8,502	6,118	22,514	13,044	9,470
Kidney	7,481	4,498	2,983	15,198	9,203	5,995	24,176	14,434	9,742
Body of uterus	8,451	—	8,451	18,541	—	18,541	31,611	—	31,611
Pancreas	2,321	1,167	1,154	3,138	1,561	1,577	3,754	1,846	1,908
Oral	5,957	4,005	1,952	12,148	8,068	4,080	19,511	12,836	6,675
Stomach	3,048	1,955	1,093	5,170	3,247	1,923	7,419	4,626	2,793
Brain	2,737	1,580	1,157	4,788	2,679	2,109	7,382	4,013	3,369
Ovary	3,537	—	3,537	7,028	—	7,028	10,695	—	10,695
Multiple myeloma	2,886	1,562	1,324	5,617	3,111	2,506	7,461	4,103	3,358
Liver	1,451	1,079	372	2,298	1,723	575	2,985	2,242	743
Esophagus	1,489	1,131	358	2,166	1,612	554	2,742	2,034	708
Cervix	2,480	—	2,480	5,501	—	5,501	10,201	—	10,201
Larynx†	1,647	1,371	276	3,415	2,829	586	5,577	4,623	954
Hodgkin lymphoma	1,683	900	783	3,904	2,099	1,805	7,161	3,890	3,271
Testis	1,758	1,758	—	4,212	4,212	—	7,936	7,936	—

Analysis by: Health Statistics Division, Statistics Canada
Data sources: Canadian Cancer Registry and Canadian Vital Statistics Death databases 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 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. For further details, see *Appendix II: Data sources and methods*.

TABLE 6.2 Age distribution for 10-year tumour-based prevalence for the most common cancers by sex, Canada*, January 1, 2009

	All cancers			Lung†			Colorectal			Prostate	Breast
	Total N=839,291	Males N=422,914	Females N=416,377	Total N=39,351	Males N=18,433	Females N=20,918	Total N=105,194	Males N=56,648	Females N=48,546	Males N=176,361	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	27.8	24.0	29.7	30.1	29.4	24.4	27.0	21.4	31.8	26.1
70–79	26.3	31.4	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 sources: Canadian Cancer Registry and Canadian Vital Statistics Death databases 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. For further details, see *Appendix II: Data sources and methods*.

Note: Due to rounding, columns may not total 100%.

TABLE 6.3 Person-based prevalence for selected cancers by duration and sex, Canada*, January 1, 2009

	2-year (diagnosed since 2007)			5-year (diagnosed since 2004)			10-year (diagnosed since 1999)		
	Total	Males	Females	Total	Males	Females	Total	Males	Females
All cancers	**246,700**	**127,448**	**119,252**	**518,705**	**265,500**	**253,205**	**838,724**	**422,670**	**416,054**
Prostate	46,293	46,293	—	105,179	105,179	—	176,353	176,353	—
Lung†	18,681	9,067	9,614	29,780	14,108	15,672	39,114	18,335	20,779
Breast	39,693	285	39,408	90,677	636	90,041	158,407	1,048	157,359
Colorectal	32,592	18,119	14,473	67,173	36,829	30,344	105,117	56,600	48,517
Non-Hodgkin lymphoma	10,722	5,873	4,849	23,097	12,412	10,685	36,173	19,111	17,062
Bladder	9,938	7,531	2,407	21,118	15,939	5,179	34,245	25,639	8,606
Melanoma	10,639	5,530	5,109	23,362	11,984	11,378	39,494	19,895	19,599
Thyroid	8,608	1,928	6,680	19,186	4,104	15,082	30,845	6,498	24,347
Leukemia	7,152	4,181	2,971	14,618	8,500	6,118	22,512	13,042	9,470
Kidney	7,478	4,495	2,983	15,193	9,199	5,994	24,164	14,423	9,741
Body of uterus	8,449	—	8,449	18,537	—	18,537	31,603	—	31,603
Pancreas	2,321	1,167	1,154	3,138	1,561	1,577	3,754	1,846	1,908
Oral	5,953	4,002	1,951	12,140	8,065	4,075	19,490	12,829	6,661
Stomach	3,045	1,954	1,091	5,166	3,244	1,922	7,415	4,623	2,792
Brain	2,737	1,580	1,157	4,788	2,679	2,109	7,382	4,013	3,369
Ovary	3,534	—	3,534	7,025	—	7,025	10,690	—	10,690
Multiple myeloma	2,883	1,561	1,322	5,614	3,109	2,505	7,458	4,101	3,357
Liver	1,451	1,079	372	2,298	1,723	575	2,985	2,242	743
Esophagus	1,489	1,131	358	2,166	1,612	554	2,742	2,034	708
Cervix	2,480	—	2,480	5,495	—	5,495	10,190	—	10,190
Larynx	1,647	1,371	276	3,415	2,829	586	5,577	4,623	954
Hodgkin lymphoma	1,683	900	783	3,904	2,099	1,805	7,161	3,890	3,271
Testis	1,758	1,758	—	4,212	4,212	—	7,936	7,936	—

Analysis by: Health Statistics Division, Statistics Canada
Data sources: Canadian Cancer Registry and Canadian Vital Statistics Death databases 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.

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

TABLE 6.4 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	**2.5**	**2.5**	**2.5**	**40**	**39**	**41**
Prostate	—	1.1	—	—	94	—
Lung†	0.1	0.1	0.1	857	907	813
Female breast	—	—	0.9	—	—	107
Colorectal	0.3	0.3	0.3	319	294	348

Analysis by: Health Statistics Division, Statistics Canada
Data sources: Canadian Cancer Registry and Canadian Vital Statistics Death databases and Population and Demography Branch 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. For further details, see *Appendix II: Data sources and methods*.

CHAPTER 7:
Special topic: Liver cancer

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Statistics at a glance

Incidence (estimates for 2013)	Males	Females
Number of new cases	1,550	490
Age-standardized rates (per 100,000)	6.9	1.9
% of all cancers	1.6	0.5
Mortality (estimates for 2013)		
Number of deaths	780	240
Age-standardized rates (per 100,000)	3.5	0.9
% of all cancers	2.0	0.7
Survival (2006–2008)		
Five-year relative survival (%)	20	19
Prevalence		
10-year person-based prevalence (as of Jan 1, 2009)	2,242	743
Potential years of life lost (2009)		
Number of years of life lost	11,200	3,500

Note: Rates are age-standardized to the 1991 Canadian population.

Highlights

- Liver cancer is one of the fastest rising cancers in Canada. In 2013, over 2,000 Canadians are expected to develop primary liver cancer and about 1,000 will die of this disease.
- Between 1970 and 2007, the incidence rate of liver cancer in Canadian males increased by an average of 3.6% per year. In Canadian females, the rate increased by 2.6% per year between 1986 and 2007.
- The main subtype of liver cancer is hepatocellular carcinoma (HCC).
- The predominant risk factor for liver cancer in Canada is chronic viral hepatitis infection with hepatitis B virus (HBV) or hepatitis C virus (HCV). Alcohol abuse, obesity, diabetes and smoking are also associated with a higher risk and may play an increasingly important role in the growing incidence of liver cancer in Canada.
- The five-year relative survival ratio (RSR) for primary liver cancer is 20%.
- As of January 1, 2009, it is estimated that there were 2,985 Canadians (2,242 males and 743 females) who had been diagnosed with primary liver cancer in the previous 10 years and were still alive on that date.
- Liver cancer is associated with high costs for treatment and managing the disease presents both clinical and financial challenges.
- Several measures can be taken to reduce liver cancer risk, including:
  - preventing infection with HBV and HCV, reducing alcohol intake, and avoiding obesity and smoking
  - identifying and treating cirrhosis and chronic infection with HBV or HCV
  - implementing public education about risk reduction and who should be screened, as well as removing stigma from screening
  - educating healthcare providers about who to screen, screening protocols and how to test and treat the disease

Epidemiology of liver cancer

In 2013, over 2,000 Canadians are expected to develop primary liver cancer and about 1,000 will die of this disease. While it remains relatively uncommon (accounting for an estimated 1% of all new cancer diagnoses and deaths in 2013), the morbidity and mortality associated with liver cancer have been rising in Canada. In 2009, premature death from liver cancer caused 14,700 potential years of life lost (PYLL), which represented 1.3% (2.1% in males and 0.6% in females) of all PYLL due to cancer in Canada.

Potential years of life lost (PYLL)

An estimate of the number of years of life lost due to premature death. It provides an alternative measure to death rates by taking into account average life expectancy and giving more weight to deaths that occur among younger people.

The liver performs many functions. It produces bile, processes nutrients and drugs, and filters blood from the stomach and intestines. Other liver functions include removing and excreting body waste, synthesizing plasma proteins and helping the body fight infection.

Primary liver cancer originates in cells of the liver (hepatocytes), bile ducts or blood vessels or connective tissue of the liver. However, the liver is also a frequent site for metastatic cancer. Metastatic cancer in the liver occurs when cancer cells from tumours in other parts of the body, such as the lung, breast, pancreas, gastrointestinal tract or lymphatic system, travel to the liver through the blood or lymph fluid. These cancer cells can establish tumours in the liver. Histopathology and the radiologic characteristics of a tumour can help determine whether cancer in the liver is primary or metastatic. This chapter focuses on primary (i.e., non-metastatic) liver cancer.

Hepatocellular carcinoma (HCC) and cholangiocarcinoma are the two main morphologic types of liver cancer in adults. As shown in Table 7.1:

- HCC develops from hepatocytes and accounts for the majority (71.9%) of liver cancers in males and females in Canada.
- Cholangiocarcinoma develops from the epithelial lining of the intrahepatic bile ducts. It is less common than HCC, accounting for 4.1% of liver cancers in Canada.
- In children, hepatoblastoma is the most common hepatic tumour, accounting for 1.1% of all new liver cancer cases.
- A large proportion of liver cancer diagnoses are classified as "unspecified" and some of these are likely to be HCC.

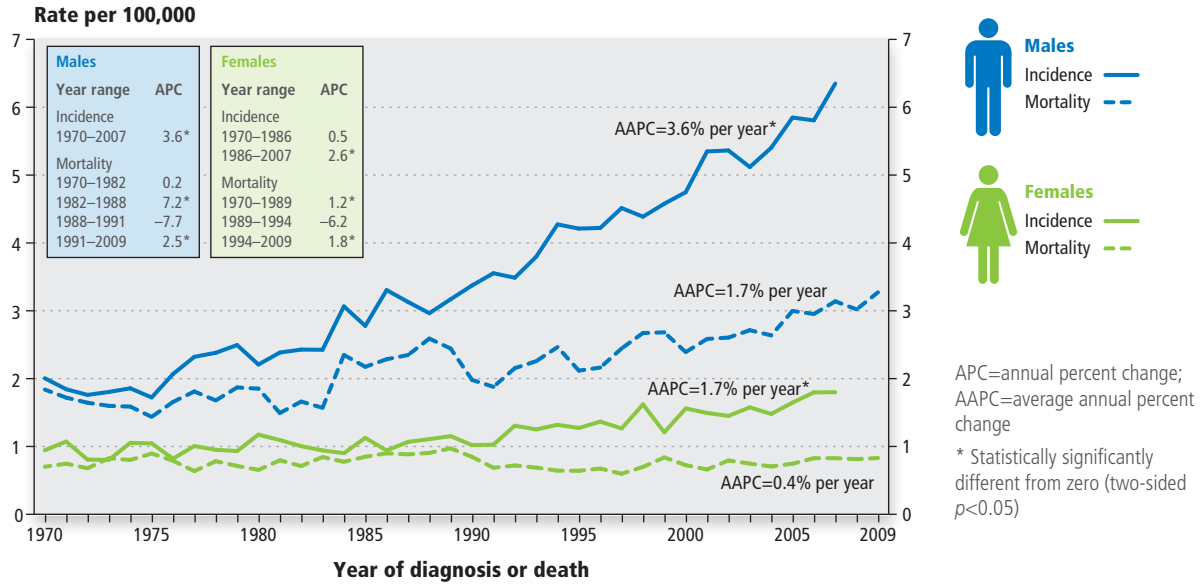
Because most adult liver cancer cases are HCC, the majority of this chapter focuses on this morphologic type.

Age and sex differences in incidence and mortality rates

Age-standardized incidence rates (ASIR) for primary liver cancer for both males and females in Canada have increased in the past four decades (Figure 7.1).

- The incidence rate is higher in males. Between 1970 and 2007, this rate tripled from 2.0 to 6.3 per 100,000. This represents an average annual percent change (AAPC) of 3.6% per year.
- Between 1970 and 2007, the incidence rate in females doubled from 0.9 to 1.8 per 100,000. The fastest increase occurred between 1986 and 2007, where the incidence rate increased by an annual percent change (APC) of 2.6% per year.
- Between 1970 and 2009, age-standardized mortality rates (ASMR) for liver cancer also increased from 1.8 to 3.3 per 100,000 in males and 0.7 to 0.8 per 100,000 in females. APCs in the most recent period were 2.5% per year in males since 1991 and 1.8% per year in females since 1994. The increase in incidence and mortality rates have occurred for all groups aged 40 years and older.[1]
- Among Canadian provinces, age-standardized incidence and mortality rates for liver cancer are highest in British Columbia, Alberta, Ontario and Quebec (see *Chapters 2* and *4*).

FIGURE 7.1 Age-standardized incidence rates (1970–2007) and mortality rates (1970–2009) for primary liver cancer, Canada



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

International differences in incidence and mortality rates

- Much of the information on the global distribution of cancer comes from the GLOBOCAN 2008 database.[2] This database is a repository of data from cancer registries and other sources and is maintained by the International Agency for Research on Cancer. Worldwide, liver cancer was the sixth most common cancer and accounted for 5.9% of all new cancers in 2008.
- Because HCC is the predominant type of liver cancer in most countries, the global variations in the disease generally reflect trends in HCC incidence and the prevalence of risk factors for HCC. The incidence of HCC is high in Asia, southern Europe and sub-Saharan Africa. The incidence of HCC is lower, but increasing, in North America and parts of Europe.
- As in Canada, the worldwide incidence rate of liver cancer is higher in males than in females. Liver cancer has a very poor prognosis and ranks third in cancer mortality worldwide, accounting for about 700,000 or 9.2% of all cancer-related deaths annually.[2]

Risk factors

HCC is often preceded by cirrhosis (scarring) of the liver. Cirrhosis can be caused by chronic hepatitis infection, excessive and prolonged use of alcohol, aflatoxin exposure, diabetes, obesity and metabolic disorders that cause liver damage (such as alpha-1 antitrypsin deficiency or hereditary tyrosinemia). Some people with liver cancer have no known risk factors. Trends in liver cancer in Canada strongly reflect the historical and ongoing trends in hepatitis B virus (HBV) and hepatitis C virus (HCV) infections, which are the major risk factors for the disease in this country.

Age-standardized incidence rate (ASIR)

The number of new cases of cancer per 100,000 people, standardized to the age structure of the 1991 Canadian population to account for changes in age distribution over time.

Age-standardized mortality rate (ASMR)

The number of cancer deaths per 100,000 people, standardized to the age structure of the 1991 Canadian population to account for changes in age distribution over time.

Annual percent change (APC)

The estimated change in the rate of new cases or deaths from one year to the next over a defined period of time, reported as a percentage. Along with the changepoint (the year in which the APC changed), the APC is useful for examining trends.

Average annual percent change (AAPC)

The average rate of change in a rate over the full period of time being examined. It is a weighted average of the APCs for the full period.

Hepatitis B

HBV infection accounts for approximately 23% of all HCC cases in developed countries. The percentage of HCC cases related to HBV infection is much higher in the developing world, including in Asia and sub-Saharan Africa.[3] The Public Health Agency of Canada has estimated that chronic carriers of HBV, represent 0.7% to 0.9% of the Canadian population.[4] HBV infection in Canada is linked to increasing immigration from areas of the world where HBV infection is endemic,[5] which is in part reflected by the higher rates of HCC in provinces where most immigrants settle. Most infections in the developing world are transmitted from mother to child at birth. Worldwide, the virus is also commonly passed through exposure to contaminated blood or body fluids between sexual partners and injecting drug users or through other contact with infected individuals.[6] As an oncogenic virus, HBV can lead to HCC without the development of cirrhosis.

Hepatitis C

Chronic HCV infection accounts for approximately 30% to 50% of HCC cases in North America.[7] Based on statistical models,[8] the prevalence of HCV in Canada is estimated to be 0.7%, but it could be even higher. HCV infection is believed to be associated with exposure to contaminated blood. Individuals at high risk for HCV infection include former or current drug users, immigrants from HCV-endemic regions (e.g., Egypt, Japan, Italy, Pakistan, Bangladesh and Somalia),[9] people occupationally exposed to contaminated blood, Aboriginal people and recipients of transfused blood products prior to the implementation of enhanced blood screening for HCV in Canada in the early 1990s.[10] The majority of immigrants likely acquire HCV infection through unsafe injections or medical procedures in their countries of origin.[11] In the US, baby boomers born in North America between 1945 and 1965 have also been identified as a group at higher than average risk for HCV infection because of the potential for past exposures to HCV.[12]

Alcohol, obesity, smoking, diabetes and other factors

In the US and northern Europe, more than half of HCC cases are not linked to HBV or HCV,[13] implying that other risk factors may play a role. These risk factors include alcohol-related cirrhosis of the liver,[14] fatty liver disease (steatohepatitis) associated with obesity,[15] smoking[16] and diabetes.[17] Some of these risk factors appear to work as cofactors with liver disease to increase the risk of cancer. For example, in the presence of liver disease, the attributable risk of smoking ranges up to 47%.[18] Alcoholic cirrhosis is thought to be a major risk factor for HCC in areas where prevalence of HBV and HCV is low.[19]

Less common risks include metabolic diseases that cause abnormal liver deposits (e.g., hereditary hemochromatosis, alpha-1 antitrypsin deficiency), primary biliary cirrhosis and autoimmune hepatitis.[20] Oral contraceptive use was previously linked to a higher risk of liver cancer, but the risk associated with newer, low-dose formulations is unclear. In occupational settings, exposure to polychlorinated biphenyls (PCBs)[21] or vinyl chloride[22] has been linked to a higher risk of liver cancer, but exposure to these chemicals is now strictly regulated.

Diagnosis, treatment, survival and prevalence

Diagnosis

In most cases, HCC does not cause any symptoms until very late in the course of disease. Although HCC causes bleeding in some cases, it does not cause bleeding into a hollow organ, like colorectal or cervical cancer. Furthermore, it does not present with a palpable mass, such as breast cancer. Diagnosing and caring for people with HCC may also be complicated by the presence of an underlying cirrhosis. Thus, people with liver cancer frequently present with large, late-stage tumours that are often beyond the reach of curative therapy. People with liver cancer may present with acute liver failure, jaundice, ascites, variceal bleeding or hepatic encephalopathy. They may also present with constitutional symptoms of cancer, such as weight loss, night sweats and fatigue. Alternatively, the presentation may be abdominal pain.

Routine screening with ultrasound in people with chronic viral hepatitis, cirrhosis or both may identify asymptomatic, early-stage liver cancer that is amenable to treatment. Early treatment can lead to improved survival.

Treatment

Several treatment modalities have proven effective against HCC. Many other treatments for which proof of efficacy is lacking are nonetheless used. Resection, radiofrequency ablation (RFA) and liver transplantation are considered potentially curative treatments. All other forms of treatment are considered palliative. HCC is a very uncommon tumour in children and there are no specific strategies for treatment in this age group. Most approaches applied to adults are also applicable to younger people with liver cancer.

The Canadian Association for Study of the Liver,[23] the American Association for Study of Liver Disease[24] and the European Association for Study of the Liver[25] all have similar practice guidelines for managing HCC. As shown in Table 7.2, treatment of HCC depends on the stage of the disease and the health of the liver.[26] In addition to stage and liver status, the selection of treatment is based on the availability of healthcare resources and the level of practitioner expertise.[27]

Observed survival

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

Very early stage HCC is currently difficult to diagnose because it is a single, asymptomatic lesion measuring less than 2 cm in diameter, with no vascular or distant metastases.[27] Surgical resection is considered for very early stage HCC because it is associated with an overall observed survival rate of 90%.[28] RFA is also offered — typically to people whose liver disease or general health precludes surgery — but it has a lower five-year observed survival than surgical resection.

The most appropriate treatment for people with early stage HCC may include either liver resection or liver transplantation, depending on individual and tumour factors, as well as on the status of the underlying liver disease. People with solitary early HCC and well-preserved liver function (Child-Pugh class A) may be treated with liver resection or liver transplantation, although liver resection is favoured in many centres due to the scarcity of donor organs. Liver transplantation is the favoured treatment modality for people with solitary HCC and poor liver function or

multifocal HCC. Liver transplantation is a recognized treatment for people with HCC, but many factors are associated with an increased risk of post-transplant recurrence, including large or multiple lesions, vascular invasion, poorly differentiated histology and an elevated alpha-fetoprotein (over 400 ng/mL). People with early stage HCC who are not candidates for or decline transplant may be offered resection or RFA, depending on the number and size of tumours and liver function status.

For intermediate stage HCC, transarterial chemoembolization (TACE) improves two-year observed survival rate by 20% to 25% compared to more conservative therapy.[28]

For advanced stage HCC with well-preserved liver function (Child-Pugh class A), the primary treatment option is chemotherapy with sorafenib, an oral molecular targeted agent.[28] Unfortunately, many people with advanced HCC and poor liver function are not suitable candidates for any active treatment.

Five-year relative survival ratio (RSR)

A measure of the impact of cancer on life expectancy that compares the survival of people diagnosed with cancer to the survival of a comparable group of people in the general population. For example, a five-year RSR of 20% means that the cancer reduces the likelihood of surviving five years after a cancer diagnosis by 80%. Five-year RSR is the preferred measure for assessing population-based cancer survival.

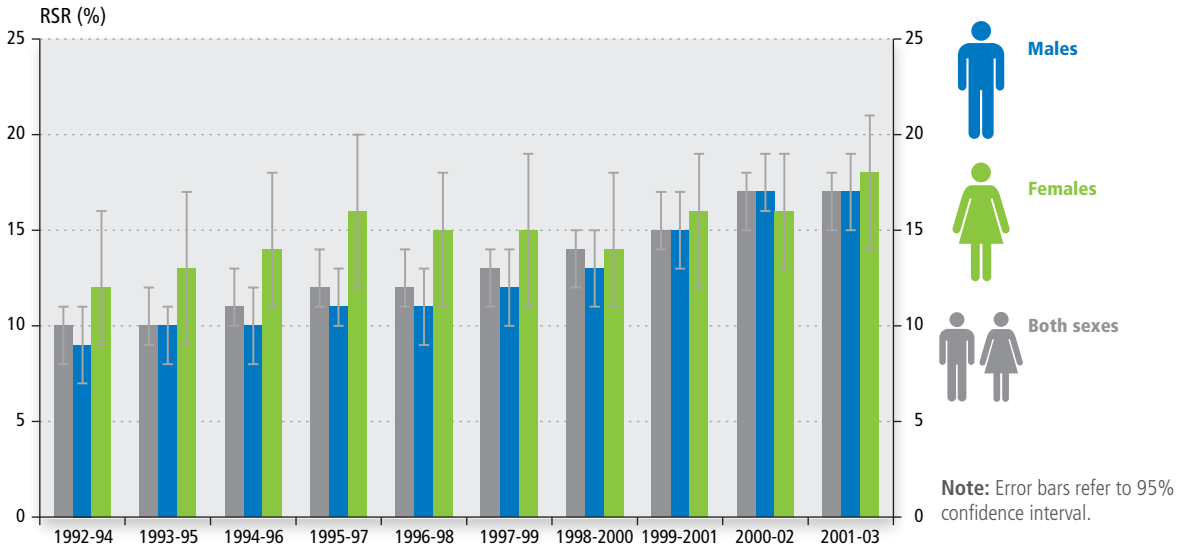
Survival

Table 7.3 shows that the five-year relative survival ratio (RSR) for liver cancer is 20%, but it differs according to age and stage at diagnosis. As with most other cancer types, survival decreases with advancing age at diagnosis. The greatest difference in survival between the sexes is in people aged 15 to 59 years, where females had better five-year RSRs. Survival data for liver cancer by stage are not currently available for all of Canada. However, data from the US Surveillance Epidemiology and End Results program from 2002 to 2008 indicate that the five-year RSR for liver and intrahepatic bile duct cancer improves dramatically when it is diagnosed at an earlier stage. This program reported the following RSRs by stage: localized stage was 27.7%; regional stage was 10.1%; distant stage was 2.7%; and unknown stage was 6.0%.[29]

In spite of the low RSR compared to other cancer types, the age-standardized five-year RSR for both sexes combined increased from 10% between 1992 and 1994 to 17% between 2001 and 2003 (Figure 7.2). A similar trend occurred in the US, where the increasing RSR is thought to be due to more people being diagnosed at earlier stages as a result of increasing awareness and screening in people at risk for liver cancer.[30] Improvements in diagnosis may also be attributed to the widespread use of ultrasound and measurement of alpha-fetoprotein since the 1980s.[31]

Despite advances in liver cancer treatment,[32] improvements in survival worldwide have not been equally distributed among all social classes. Studies in Korea,[33] the United States[34] and Canada[35] have shown that people with a higher socio-economic status (SES) have better survival outcomes compared to those

FIGURE 7.2 Age-standardized five-year relative survival ratios (RSRs) by sex, Canada, 1992–2003



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

with the lowest SES. This association is most likely due to lower income groups being less likely to receive potentially curative treatment.[35] People in lower income groups may also be more likely to present with more advanced disease, which precludes curative therapy. This explanation would be more in keeping with data on other cancers for which effective treatment relies on early diagnosis.

In Ontario between 1990 and 2009, for example, people from the lowest income quintile were less likely to receive curative treatment (25.3% for the lowest income quintile vs. 30.5% to 32.6% for higher income quintiles).[35] As shown in Table 7.4, the median survival durations among those receiving potentially curative therapy, non-curative therapy, palliative therapy and no treatment were 44.4, 21.4, 8.8 and 4.2 months, respectively. The median survival durations for income quintiles 1 to 5 were 8.5, 8.9, 10.5, 10.4 and 8.8 months, respectively.

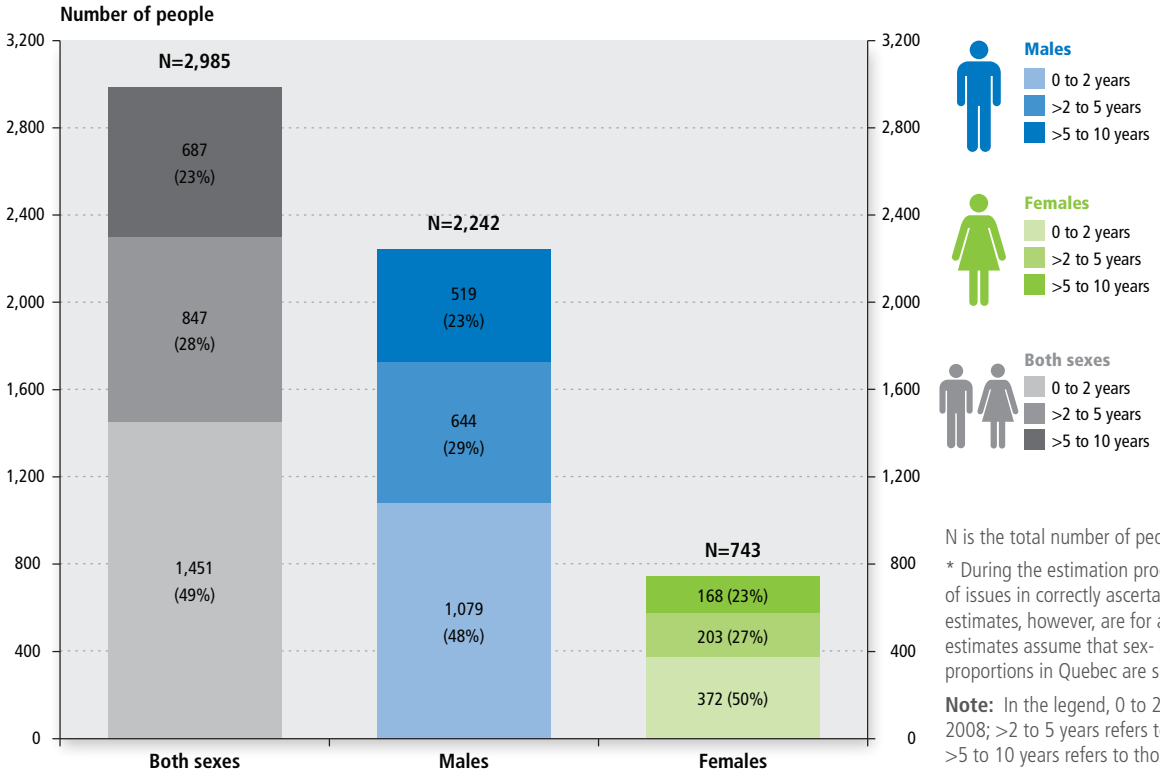
Adjusted hazard ratios suggested that a 10% HCC survival advantage exists for the higher SES groups. This association between SES and HCC survival most likely reflects a lack of access to care for low SES groups, revealing inequities in the Canadian healthcare system.

Prevalence

As of January 1, 2009, it is estimated that 2,985 Canadians (2,242 males and 743 females) had been diagnosed with primary liver cancer in the previous 10 years and were still alive on that date. Figure 7.3 shows the recency of their diagnosis (i.e., within the past 2 years, between 2 and 5 years ago and between 5 and 10 years ago). The relatively small percentage of people diagnosed between 5 and 10 years ago reflects the poor survival associated with this cancer.

One study estimated that the prevalence proportion of liver cancer cases among Canadian males was highest among those aged 70–79 years, followed by males aged 60–69 years and 80 years and older.[36] These patterns in prevalence reflect the late age at diagnosis of most cases. The prevalence proportion of liver cancer cases has been increasing in Canada. Between 2002 and 2008, the APC was 8.5%, more than double that of any other cancer type examined except thyroid.[37]

FIGURE 7.3 Person-based prevalence of primary liver cancer by duration and sex, Canada*, January 1, 2009



N is the total number of people with the cancer.

* 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.

Note: 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.

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

Prevalence

The number of people with a new or previous cancer diagnosis in a given population who are alive on a specific date (known as the index date).

Prevention and control

Important risk factors for HCC are smoking, alcohol-related cirrhosis and fatty liver disease, which means that ongoing efforts should be made to address tobacco use, alcohol abuse and excess body weight. However, large strides in the control of liver cancer will also be achieved by addressing viral hepatitis infection. Currently neither HBV nor HCV infections are well recognized by the public as threats to health, even though they pose the greatest risk for liver cancer.[38] According to the Public Health Agency of Canada, approximately 600,000 Canadians are infected with HBV or HCV.

There is strong evidence that implementing universal vaccination against hepatitis B results in a decrease in HCC.[39] All provinces in Canada now offer universal vaccination against hepatitis B, although the strategies vary from province to province. Some offer universal vaccination to newborns and others to adolescents.[40] All medical bodies that have opinions on hepatitis B vaccination recommend neonatal vaccination. This is because infection in infancy often leads to life-long chronic infection with the virus, whereas infection in adults results in chronic infection in less than 1% of cases. The incidence of childhood hepatitis B is either stable or rising in provinces where adolescent vaccination is offered, but it is falling in British Columbia where neonatal vaccination is offered.[41] In Canada, most cases of HBV infection are in adult immigrants from countries where universal vaccination is either not offered or was introduced only recently.

In the absence of randomized trials, the role that treatment for hepatitis B plays in reducing the incidence of HCC is unclear. Recent studies suggest that treatment with lamivudine can reduce HCC incidence in the presence and absence of cirrhosis.[42–44] Currently, however, only a very small proportion of people with chronic hepatitis B are receiving treatment. This is in part because of the poor recognition of the severity of hepatitis B consequences by infected people and family practitioners and because of the restricted access to hepatitis B antiviral agents through provincial drug reimbursement plans.

One randomized controlled trial showed that screening of people with hepatitis B can reduce HCC-related mortality by 37%.[45] Other studies also strongly suggest that screening reduces HCC-related mortality,[46–49] which supports the recommendation by all major international hepatology associations for the regular screening of HBV-infected people at risk for HCC. Modelling studies also suggest that screening immigrants for hepatitis B is cost effective and will reduce the incidence of complications of hepatitis B.[50]

As with hepatitis B, there is some evidence that treating HCV reduces HCC incidence,[46–49, 51] although the evidence is not strong. Despite low cure rates in the past, HCV treatment today is thought to cure the infection in 65% to 70% of people. However, less than 3% of chronically infected people receive treatment each year. It is estimated that only about 80,000 HCV-positive people in Canada have been treated over the last 15 to 20 years.[52, 53] As with HBV, the limited number of people treated for HCV is due to the lack of awareness among primary care physicians and because of restrictive drug reimbursement policies.

Population-level initiatives

Governments in many other Western countries (including the US, Australia, France, Germany and New Zealand) have developed concerted strategies to identify and offer treatment to individuals infected with HBV or HCV. For example, in 2008 the US Centers for Disease Control and Prevention (CDC) published updated guidelines for HBV screening, which broadened screening to all individuals in the US who lived in or were born in world regions with intermediate or high HBV prevalence (>2%).[54] Recommendations by the US Institute of Medicine were also updated to reflect expanded community-based programs for HBV screening, testing and vaccination services for immigrants.[55]

More recently, the CDC recommended at least a one-time blood test for HCV for all individuals born in North America between 1945 and 1965.[12] This recommendation is supported by statistical modelling of sequelae and studying the cost-effectiveness of treatment. There is no similar recommendation in Canada, but the Public Health Agency of Canada is examining the issue. In Canada, other options (such as a catch-up immunization program) could be considered for children and young adults from at-risk regions who have not been vaccinated against HBV. Other approaches could include screening and treatment for HBV and HCV in immigrants from high prevalence world regions,[11] public education among at-risk populations to reduce stigma and raise awareness of the prevalence of and testing for hepatitis infection, and greater implementation of safe injection sites and needle exchange programs for drug users.[56]

Healthcare professional initiatives

Healthcare professionals must also recognize people who would benefit from increased monitoring or screening for risk factors and to whom they should offer treatment. Barriers to effective care may be related to low rates of community surveillance for people with cirrhosis or those at high risk of HCC.[57, 58] These low rates of surveillance may be due to the difficulty in implementing regular surveillance, complicated diagnostic evaluation, limited access to specialized multidisciplinary care and the high cost of potentially curative therapy.[28, 59] Surveillance with liver ultrasound and measurement of serum alpha-fetoprotein levels every 6 to 12 months in people with cirrhosis or advanced hepatic fibrosis, irrespective of the cause, improves diagnosis of HCC at early stages when the tumour might be curable by surgical resection, liver transplantation or RFA. Using these measures to diagnose liver cancer at an early stage also means that a five-year survival higher than 50% can be achieved.[28, 60]

Offering testing and counselling to HIV-positive people would also be beneficial as these individuals are at greater risk of HBV or HCV co-infection due to common risk factors.[61]

Individual-level initiatives

People may be unaware that they are infected with hepatitis B or C, which can be an impediment to the control of liver cancer.[5] Initiatives to raise awareness about viral hepatitis should consider the heterogeneous nature of the demographic profile, language, cultural perceptions of disease, health literacy and frequency of contact with medical care of the targeted at-risk communities.

Testing for HBV or HCV can mean that treatment is started sooner, which can help clear the virus, lessen the damage to the liver and prevent further spread of the infection to others. Risk reduction involves practising safe sex, not sharing needles or other drug-related equipment, effective sterilizing of tattooing and body piercing equipment and not sharing personal hygiene materials that can come into contact with blood (such as razors and toothbrushes).

Costs associated with liver cancer care

The increase in HCC incidence creates a greater demand for screening, diagnosis, care and treatment. Representative cost data are needed to create policy decision models. They are designed to explicitly include resource consequences and health outcomes in a health economic evaluation framework to evaluate whether particular healthcare technologies should be provided within the context of an organized healthcare system.

Net costs of care represent the difference between the mean costs for people with HCC compared to people with similar characteristics without HCC.[62] Net costs can be calculated by phase of disease where the initial phase of HCC is defined as the first 12 months after diagnosis and includes diagnostic services and curative treatments.[65] The terminal phase is the final 12 months of life and involves care received at the end of life.[65] The continuing care phase is all months between the initial and terminal phases of care. This care phase includes surveillance activities for detecting recurrences, medications to prevent cancer recurrence and treatment of complications from the initial therapy. For people who survive less than 24 months after diagnosis, the final 12 months of observation and costs of care were allocated first to the terminal phase, consistent with other studies.[63, 64]

Between 1990 and 2009, the estimated average net cost of HCC care per 30 patient-days in Ontario was $7,134 (in 2010 Canadian dollars) in the initial phase of the disease. This cost represents 92% of the total costs of care in this phase (Table 7.5). In the continuing care phase, the cost is $1,159, which represents 58% of the total costs of care in this phase. In the terminal phase, the cost is $10,265, which represents 72% of the total costs of care in this phase.

Estimates of five-year net costs of HCC care

The mean five-year net costs of HCC care were estimated using an incidence approach that applied phase-specific net costs of care due to HCC to survival probabilities (from the date of diagnosis to death) and by aggregating the costs of the three phases.[63, 66, 67] When undiscounted, the five-year net costs of HCC are estimated to be $126,406 (95% CI, $94,646–$158,166). With a 3% discount, the estimate was $79,516 ($59,934–$99,098), and it was $70,170 ($53,062–$87,278) with a 5% discount.

Discounting

The process of converting future values (e.g., costs or health effects) to their present values to reflect the fact that individuals and society generally prefer to receive benefits sooner rather than later and pay costs later rather than sooner.

Aggregate five-year net costs of HCC care in the Canadian population

When the mean five-year net costs were applied to the newly diagnosed cases of HCC in the Canadian population in 2009, the five-year aggregate net costs of care were approximately $174 million (95% CI, $130 million–$217 million) when undiscounted. With a 3% discount the five-year aggregate net costs of care were $109 million ($82 million–$136 million) and they were $96 million ($73 million–$120 million) with a 5% discount.

New developments in liver cancer management and research

Treatments

Based on available evidence[42,43,49,68,69], eradicating hepatitis C and controlling hepatitis B replication appear to be associated with a lower risk for and less disease progression of HCC. However, there are currently no randomized controlled trials that convincingly show how treating viral hepatitis affects liver cancer mortality. The biggest limitation to treating HCC is the function of the underlying liver. Unless liver function is normal (or near normal), none of the usual treatments are possible. People with Child-Pugh class B cirrhosis are not candidates for any form of therapy.[26] These limitations extend to all the newer therapies currently being developed. The most recent development in the management of HCC is the introduction of sorafenib,[70] the first agent to be licensed for the treatment of HCC. The introduction of this drug has led to investigations into other agents, including brivanib, sunitinib, tivantinib and regorafenib. Tivantinib and regorafenib are still under investigation, while brivanib and sunitinib have failed phase III trials and are no longer being developed for HCC. The success of sorafenib in treating advanced disease also prompted investigation of its utility in earlier stage disease. While these studies are not yet complete, it is thought that sorafenib does not enhance the effect of chemoembolization.

Standard chemotherapy has not been shown to be effective in treating HCC, in part due to the severity of the underlying liver disease. People with advanced liver disease do not tolerate chemotherapy well. The experimental approaches include different methods to deliver therapeutic agents to the tumour. The most advanced of these approaches is radio-embolization, which has shown impressive tumour necrosis.[71, 72] To date there are no direct comparisons between radio-embolization and other treatments applied to the same person with HCC. However, studies comparing survival of people treated with radio-embolization to people not treated by this method suggest an improvement in survival.[73]

Another experimental approach to delivering local chemotherapy involves the use of biodegradable microspheres loaded with a chemotherapeutic agent.[74] Compared to standard chemoembolization, this approach appears to be safer, but it does not appear to improve survival. Other researchers have combined RFA with local chemotherapy. This technique is still under investigation.

Traditionally, radiation therapy has not been used for HCC because of concerns that the liver was radiosensitive. However, researchers are currently studying a number of techniques using external beam radiation therapy, such as intensity-modulated radiation therapy (IMRT), image-guided radiation therapy, 3-dimensional conformal radiation, 4-dimensional conformal radiation and charged particle therapy.[75–77]

Genetic studies

As with other cancers, researchers have attempted to identify pathways that lead to the development of HCC, but so far they have not identified a "driver" genetic alteration. However, researchers have identified different sets of genes that are over- or under-expressed in HCC. Although there has been some attempt to classify these diverse results into four main genotypes,[78] many HCCs do not fit into this classification method.

Researchers have identified gene signatures that predict better or worse prognosis for HCC,[79–81] but to date they have not identified gene expression that can be used as a target for drug intervention. Most notable is the finding that a gene signature in the healthy portion of liver that is removed with the tumour during surgery predicts recurrence two years or more after surgery.[82] This finding suggests that the whole liver or large parts of it consist of a clonal population of cells, which means that it may be possible to biopsy a liver without cancer in a person at risk for HCC and predict whether it will or will not develop HCC.

What do these statistics mean?

The burden of liver cancer in Canada is expected to grow as a result of an aging population and the ongoing trend in immigration from countries where HBV and HCV infections are endemic. The control of HCV infection continues to pose a challenge in Canada, particularly in marginalized populations.

Researchers have shown that screening for HCC can increase the chance of being successfully treated for this cancer. Yet most people with HCC have not undergone proper screening and it appears that the vast majority of at-risk people are not undergoing screening. All people at risk for HCC should be made aware of their need for screening and healthcare providers need to be educated about who to screen and which tests to use.

Greater efforts are needed to prevent liver cancer. These efforts should include public and healthcare provider education, early identification of individuals at risk of the disease, increasing the use of hepatitis screening among at-risk individuals and policies to facilitate treatment of people with liver cancer. Control of more widespread risk factors, such as smoking, alcohol abuse and excess weight, can help reduce incidence of liver and other cancers.
Recommendations to improve the control of liver cancer in Canada include:

- Healthcare providers should identify, offer testing to and counsel people at risk for liver cancer based on their hepatitis, alcohol, weight and diabetes profiles. Healthcare providers should aim to identify people early in the course of chronic HBV or HCV infection. They should also offer testing and counselling for HIV-positive people because they are at greater risk of HBV or HCV co-infection due to common risk factors.
- Canadians need easier access to HBV and HCV treatments to reduce the chance of progression to liver cancer.
- Public health messages should aim to raise the profile of this rapidly rising disease and emphasize the ways to prevent it. Public health efforts should not be limited to clinic visits; outreach should be done to increase risk-reduction education, provide support for people with HCC and offer catch-up HBV vaccination. Education on risk reduction for HCC should encompass not only testing for and treating viral hepatitis, but also the impact of alcohol abuse, obesity and smoking.
- More Canadian data are needed to understand the best strategies for HBV and HCV screening and treatment, as well as the best ways to improve community engagement in promoting screening for populations that are hard to reach.
- The approaches to HBV and HCV testing strategies undertaken in other countries should be considered for the Canadian context.
- The higher risk of the disease in lower income populations and barriers to access to healthcare, early detection and treatment need to be investigated further to reduce the impact on this population.

As liver cancer incidence increases, access to potentially curative therapies and the costs associated with them will present new challenges to the healthcare system. Further research is needed to find the most effective means of educating the public about the disease, screening for people at risk for HBV and HCV infection and understanding the needs of people with and survivors of liver cancer. In addition, current and future interventions can benefit from an understanding of their cost-effectiveness, barriers to implementation and impact on future rates of the disease.

For further information

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Databases

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- Statistics Canada. Table 102-0552 — Deaths and mortality rate, by selected grouped causes and sex, Canada, provinces and territories, annual, CANSIM (database).
- Statistics Canada. Table 102-4309 — 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, occasional (number unless otherwise noted), CANSIM (database).
- Statistics Canada. Table 103-1574 — Five-year survival estimates for primary sites of cancer, ICD-O-3 (October 2011 CCR file), by sex, population aged 15 to 99, 3 years of cases, selected provinces, annual (percent), 1992/1994 to 2001/2003, CANSIM (database).
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TABLE 7.1 New cases and percent distribution for liver cancer by morphology, Canada*, 1992–2010

	Total		Males		Females	
	New cases	%	New cases	%	New cases	%
All liver cancers	**20,368**	**100**	**15,063**	**100**	**5,305**	**100**
Morphology						
Carcinoma	16,354	80.3	12,358	82.0	3,996	75.3
Hepatocellular carcinoma (HCC)	14,650	71.9	11,328	75.2	3,322	62.6
Cholangiocarcinoma	833	4.1	479	3.2	354	6.7
Other specific carcinoma	347	1.7	221	1.5	126	2.4
Unspecified, carcinoma	524	2.6	330	2.2	194	3.7
Hepatoblastoma	220	1.1	132	0.9	88	1.7
Sarcoma	136	0.7	84	0.6	52	1.0
Other specific types	31	0.2	17	0.1	14	0.3
Unspecified	3,627	17.8	2,472	16.4	1,155	21.8

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

* Actual incidence data were available up to 2010 for all provinces and territories except for Quebec (2007).

TABLE 7.2 HCC treatment strategies by stage* of disease

Stage	Definition	Option
Very early	Single, asymptomatic lesion measuring less than 2 cm in diameter, with no vascular or distant metastases	• Local ablation with radiofrequency ablation (RFA) or resection[27, 83] • Resection can only be offered to people with no or minimal evidence of liver failure or of portal hypertension. • RFA can be offered to people with more advanced liver disease, but those with the most advanced liver disease can only benefit from liver transplantation,[84] but then only if the cancer is at an early stage.
Early	Single lesion or fewer than 3 lesions (each smaller than 3 cm)	• Resection, liver function allowing • People with early stage disease are also candidates for liver transplantation.[85] • Chemoembolization has also been offered to people with early stage disease, but the benefit of chemoembolization in these people has not yet been demonstrated.
Intermediate	Multinodular disease (either >3 nodules or 2–3 nodules with at least 1 nodule >5 cm)	• Chemoembolization[86, 87]
Advanced	Spread beyond the liver to local nodes or distant sites, or invasion of portal vein or hepatic vein by tumour	• Sorafenib, an oral multikinase inhibitor[70, 88] • The role of transarterial chemoembolization (TACE) remains to be defined.

HCC=hepatocellular carcinoma

* Based on the Barcelona Clinic Liver Cancer (BCLC) staging system.[26]

TABLE 7.3 Five-year relative survival ratios (RSRs) for primary liver cancer by sex and age group, Canada (excluding Quebec*), 2006–2008

	Both sexes		Males		Females	
	RSR (%)	(95% CI)	RSR (%)	(95% CI)	RSR (%)	(95% CI)
All ages (15–99 years)	20	(18–22)	20	(18–22)	19	(16–22)
15–49	38	(32–43)	34	(27–40)	46	(32–58)
50–59	23	(20–26)	22	(19–25)	28	(20–36)
60–69	22	(18–25)	22	(18–26)	21	(15–28)
70–79	15	(12–18)	16	(12–19)	12	(7–18)
80–99	7	(4–11)	6	(3–11)	7	(3–13)

CI=confidence interval

* 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.

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

TABLE 7.4 Observed survival of people diagnosed with HCC, by income quintile and treatment, Ontario, 1990–2009

	Cases	Events	Survival (months)	1-year survival	2-year survival	5-year survival
Characteristics	N (%)	N	Median (95 % CI)	(%) (95% CI)	(%) (95% CI)	(%) (95% CI)
Overall	5,481 (100)	4,181	9.2 (8.7–10.0)	45.2 (43.9–46.6)	29.8 (28.5–31.2)	13.2 (12.0–14.3)
Income quintile						
1 (lowest)	1,323 (24.1)	1,024	8.5 (7.3–9.9)	43.5 (40.7–46.3)	29.0 (26.3–31.7)	11.9 (9.7–14.1)
2	1,196 (21.8)	905	8.9 (7.9–11.1)	44.9 (42.0–47.9)	29.4 (26.5–32.2)	12.6 (10.2–14.9)
3	1,030 (18.8)	776	10.5 (8.8–12.2)	47.2 (44.0–50.4)	31.1 (28.0–34.2)	13.8 (11.2–16.5)
4	915 (16.7)	692	10.4 (9.1–12.2)	46.7 (43.3–50.1)	30.6 (27.3–33.9)	12.9 (10.1–15.7)
5 (highest)	893 (16.3)	667	8.8 (7.8–10.6)	45.4 (42.0–48.8)	30.9 (27.6–34.2)	15.3 (12.3–18.2)
HCC treatment*						
Curative	1,637 (29.9)	766	44.4 (40.4–46.9)	82.1 (80.1–84.1)	68.1 (65.5–70.7)	40.4 (37.2–43.6)
Non-curative	890 (16.2)	627	21.4 (19.1–23.0)	65.6 (62.4–68.9)	45.1 (41.5–48.6)	19.9 (16.8–23.2)
Palliative	1,906 (34.8)	1,755	8.8 (8.1–9.7)	42.7 (40.4–45.0)	24.3 (22.3–26.3)	7.8 (6.5–9.1)
No treatment	2,034 (37.1)	1,765	4.2 (3.7–4.6)	27.6 (25.6–29.6)	15.4 (13.7–17.1)	3.7 (2.7–4.7)

HCC=hepatocellular carcinoma; CI=confidence interval

* Included multiple treatments for some people.

Adapted from: Jembere N, et al.[35]

TABLE 7.5 Mean net costs* of care for HCC (per 30 patient-days) by cost category and disease phase, Ontario, 1990–2009

Cost category	Disease phase					
	Initial		Continuing care		Terminal	
	Mean	(95% CI)	Mean	(95% CI)	Mean	(95% CI)
Total net costs	7,134	(5,644, 8,623)	1,159	(942, 1,376)	10,265	(7,990, 12,540)
Outpatient visits	3,815	(2,960, 4,670)	422	(306, 538)	2,927	(1,687, 4,167)
Emergency room visits	150	(96, 203)	43	(15, 71)	430	(269, 590)
Same-day surgery	59	(19, 99)	4	(–2, 10)	36	(17, 54)
Acute inpatient care	2,734	(1,990, 3,478)	332	(245, 419)	6,725	(5,597, 7,853)
Medications	232	(125, 339)	294	(240, 349)	67	(37, 97)
Home care	139	(93, 184)	93	(17, 169)	294	(215, 374)
Continuing care	19	(–26 ,63)	3	(–32, 39)	208	(–197, 613)
Long-term care	–24	(–40, –7)	–42	(–67, –17)	–420	(–486, –355)

HCC=hepatocellular carcinoma; CI=confidence interval

*2010 Canadian dollars

Note: Categories are assigned as initial phase (12 months after the diagnosis), continuing care phase (intermediate observation time) and terminal phase (12 months prior to death). Negative costs refer to no increase in the net costs of long-term care due to HCC. Columns may not add to total.

Analysis based on: Thein HH, et al.[89]

APPENDIX I: Actual data for new cases and deaths

TABLE A1 Actual data for new cases of cancer, Canada, 2007 (based on September 2012 CCR file; see Statistics Canada CANSIM Table 103-0553 for availability of later data releases)

Cancer	ICD-O-3 Site/Type*	Total	Males	Females
All cancers	**All invasive sites**	**164,999**	**86,198**	**78,801**
Oral (buccal cavity and pharynx)	**C00–C14**	**3,675**	**2,497**	**1,178**
Lip	C00	338	254	84
Tongue	C01–C02	936	648	288
Salivary gland	C07–C08	419	230	189
Mouth	C03–C06	712	402	310
Nasopharynx	C11	259	183	76
Oropharynx	C10	165	116	49
Other and unspecified	C09,C12–C14	846	664	182
Digestive organs	**C15–C26,C48**	**34,144**	**19,121**	**15,023**
Esophagus	C15	1,585	1,194	391
Stomach	C16	3,076	1,960	1,116
Small intestine	C17	614	341	273
Large intestine	C18,C26.0	13,865	7,112	6,753
Rectum	C19–C20	6,763	4,147	2,616
Anus	C21	558	231	327
Liver	C22.0	1,610	1,217	393
Gallbladder	C23	463	152	311
Pancreas	C25	3,979	1,989	1,990
Other and unspecified	C22.1,C24,C26.8–.9,C48	1,631	778	853
Respiratory system	**C30–C34,C38.1–.9,C39**	**24,714**	**13,792**	**10,922**
Larynx	C32	1,116	906	210
Lung	C34	23,246	12,677	10,569
Other and unspecified	C30–31,C33,C38.1–.9,C39	352	209	143
Bone	**C40–C41**	**349**	**195**	**154**
Soft tissue (including heart)	**C38.0,C47,C49**	**1,118**	**619**	**499**
Skin (melanoma)	**C44 Type 8720–8790**	**4,843**	**2,565**	**2,278**
Breast	**C50**	**21,311**	**165**	**21,146**
Genital organs	**C51–C63**	**33,567**	**24,382**	**9,185**
Cervix	C53	1,405	—	1,405
Body of uterus	C54	4,369	—	4,369
Uterus, part unspecified	C55	150	—	150
Ovary	C56	2,463	—	2,463
Prostate	C61	23,364	23,364	—
Testis	C62	828	828	—
Other and unspecified	C51–52,C57,C58,C60,C63	988	190	798
Urinary organs	**C64–C68**	**12,055**	**8,152**	**3,903**
Bladder	C67	6,744	4,939	1,805
Kidney	C64–C65	4,837	2,883	1,954
Other urinary	C66,C68	474	330	144
Eye	**C69**	**290**	**161**	**129**
Brain and central nervous system	**C70–C72**	**2,591**	**1,468**	**1,123**
Endocrine glands	**C37,C73–C75**	**4,462**	**1,069**	**3,393**
Thyroid	C73	4,181	944	3,237
Other endocrine	C37,C74–C75	281	125	156
Hodgkin lymphoma†	**Type 9650–9667**	**922**	**505**	**417**
Non-Hodgkin lymphoma†	**See Table A7**	**6,789**	**3,770**	**3,019**
Multiple myeloma†	**Type 9731,9732,9734**	**2,011**	**1,081**	**930**
Leukemia†	**See Table A7**	**4,848**	**2,784**	**2,064**
Mesothelioma†	**Type 9050–9055**	**515**	**420**	**95**
All other and unspecified cancers	**See Table A7**	**6,795**	**3,452**	**3,343**

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

— Not applicable.

* Fritz A, Percy C, Jack A, Shanmugaratnam K, Sobin L, Parkin D, et al. Editors. *International Classification of Diseases for Oncology, Third Edition*. Geneva: World Health Organization; 2000.

† ICD-O-3 histology types 9590–9992 (leukemia, lymphoma and multiple myeloma), 9050–9055 (mesothelioma) and 9140 (Kaposi sarcoma) are excluded from other specific organ sites.

Note: Numbers are for invasive cancers and *in situ* bladder cancers (except for Ontario) but exclude non-melanoma skin cancer (basal and squamous).

TABLE A2 Actual data for cancer deaths, Canada, 2009 (see Statistics Canada CANSIM Table 102-0552 for availability of later data releases)

	ICD-10*	Total	Males	Females
All cancers	**C00–C97**	**71,125**	**37,452**	**33,673**
Oral (buccal cavity and pharynx)	**C00–C14**	**1,065**	**721**	**344**
Lip	C00	17	9	8
Tongue	C01–C02	259	169	90
Salivary gland	C07–C08	107	68	39
Mouth	C03–C06	173	97	76
Nasopharynx	C11	92	58	34
Oropharynx	C10	104	80	24
Other and unspecified	C09,C12–C14	313	240	73
Digestive organs	**C15–C25,C26.0,C26.8–.9,C48**	**19,115**	**10,704**	**8,411**
Esophagus	C15	1,685	1,264	421
Stomach	C16	1,911	1,177	734
Small intestine	C17	175	92	83
Large intestine	C18,C26.0	6,599	3,422	3,177
Rectum	C19–C20	2,008	1,175	833
Anus	C21	89	38	51
Liver	C22.0,C22.2–.7	841	647	194
Gallbladder	C23	238	75	163
Pancreas	C25	3,981	1,985	1,996
Other and unspecified	C22.1,C22.9,C24,C26.8–.9,C48	1,677	867	810
Respiratory system	**C30–C34,C38.1–.9,C39**	**19,670**	**11,016**	**8,654**
Larynx	C32	439	368	71
Lung	C34	19,106	10,567	8,539
Other and unspecified	C30–31,C33,C38.1–.9,C39	125	81	44
Bone	**C40–C41**	**147**	**80**	**67**
Soft tissue (including heart)	**C38.0,C47,C49**	**471**	**228**	**243**
Skin (melanoma)	**C43**	**1,019**	**634**	**385**
Breast	**C50**	**4,990**	**46**	**4,944**
Genital organs	**C51–C63**	**6,873**	**3,803**	**3,070**
Cervix	C53	370	—	370
Body of uterus	C54	504	—	504
Uterus, part unspecified	C55	358	—	358
Ovary	C56	1,597	—	1,597
Prostate	C61	3,745	3,745	—
Testis	C62	29	29	—
Other and unspecified	C51–52,C57,C58,C60,C63	270	29	241
Urinary organs	**C64–C68**	**3,633**	**2,409**	**1,224**
Bladder	C67	1,910	1,330	580
Kidney	C64–C65	1,547	974	573
Other urinary	C66,C68	176	105	71
Eye	**C69**	**30**	**14**	**16**
Brain and central nervous system	**C70–C72**	**1,867**	**1,102**	**765**
Endocrine glands	**C37,C73–C75**	**306**	**146**	**160**
Thyroid	C73	182	86	96
Other endocrine	C37,C74–C75	124	60	64
Hodgkin lymphoma	**C81**	**126**	**71**	**55**
Non-Hodgkin lymphoma	**C82–C85,C96.3**	**2,597**	**1,419**	**1,178**
Multiple myeloma	**C90.0, C90.2**	**1,289**	**699**	**590**
Leukemia	**C91–C95, C90.1**	**2,473**	**1,394**	**1,079**
Mesothelioma	**C45**	**421**	**355**	**66**
All other and unspecified cancers	**See Table A7**	**5,033**	**2,611**	**2,422**

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

— Not applicable.

*World Health Organization. *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision*. Volumes 1 to 3. Geneva, Switzerland: World Health Organization; 1992.

TABLE A3 Actual data for new cases for the most common cancers by sex and geographic region, Canada, most recent year* (based on September 2012 CCR file; see Statistics Canada CANSIM Table 103-0553 for availability of later data releases)

	New cases													
	Canada†	BC	AB	SK	MB	ON	QC‡	NB	NS	PE	NL‡	YT	NT	NU
Males														
All cancers	**86,200**	**11,000**	**7,700**	**2,500**	**3,000**	**33,700**	**21,400**	**2,400**	**2,900**	**420**	**1,650**	**50**	**60**	**25**
Prostate	23,400	2,900	2,100	610	730	9,300	4,300	670	720	130	480	15	15	—
Lung	12,700	1,350	910	350	390	4,400	4,100	370	430	75	220	5	10	10
Colorectal	11,300	1,400	1,000	360	450	4,000	2,900	300	440	55	280	10	10	5
Bladder§	4,900	760	500	190	190	1,550	1,650	180	210	15	100	5	—	—
Non-Hodgkin lymphoma	3,800	550	330	130	130	1,500	860	95	140	15	60	—	—	—
Kidney	2,900	280	260	95	150	1,150	730	120	110	20	75	—	—	—
Leukemia	2,800	350	300	100	120	1,200	630	90	55	10	35	—	—	—
Melanoma	2,600	430	270	60	90	1,400	350	65	130	25	45	—	—	—
Oral	2,500	370	250	80	110	1,050	610	50	75	10	35	5	5	—
Pancreas	2,000	240	180	50	90	680	540	40	60	10	20	—	—	—
Stomach	1,950	220	160	60	70	710	480	50	55	10	65	—	—	—
Brain	1,450	190	120	35	40	570	390	30	55	5	30	—	—	—
Liver	1,200	200	110	20	30	510	330	15	30	—	15	—	—	—
Esophagus	1,200	180	120	40	45	560	280	40	55	5	15	—	—	—
Multiple myeloma	1,100	180	110	40	40	520	280	30	35	5	20	—	—	—
Thyroid	940	100	100	20	30	490	200	30	30	5	20	—	—	—
Females														
All cancers	**78,800**	**10,200**	**7,000**	**2,400**	**3,000**	**33,000**	**20,500**	**1,950**	**2,700**	**380**	**1,300**	**55**	**55**	**25**
Breast	21,100	3,000	2,100	650	790	8,900	5,400	530	720	120	340	15	20	5
Lung	10,600	1,300	870	350	420	3,900	3,100	270	420	50	150	10	5	10
Colorectal	9,400	1,150	770	340	400	3,600	2,500	250	380	40	210	5	10	5
Body of uterus	4,500	670	440	150	220	2,100	1,100	130	160	15	100	5	—	—
Thyroid	3,200	240	320	60	90	2,000	740	95	85	10	45	—	—	—
Non-Hodgkin lymphoma	3,000	430	290	100	130	1,300	720	75	95	15	60	—	—	—
Ovary	2,500	280	170	65	90	1,050	650	55	70	15	35	—	—	—
Melanoma	2,300	390	230	70	75	1,150	270	55	120	10	25	—	—	—
Leukemia	2,100	250	190	70	75	960	450	55	45	5	10	—	—	—
Pancreas	2,000	220	150	65	80	760	560	55	60	10	25	—	—	—
Kidney	1,950	140	160	65	70	700	490	55	85	10	40	—	—	—
Bladder§	1,800	210	150	65	60	510	630	60	75	10	35	—	—	—
Cervix	1,400	180	150	45	40	580	300	25	35	5	40	—	—	—
Oral	1,200	150	100	30	60	490	270	25	45	5	15	—	—	—
Brain	1,100	120	80	25	35	480	310	15	30	5	20	—	—	—
Stomach	1,100	130	85	30	40	460	300	20	25	—	20	—	—	—
Multiple myeloma	930	140	75	35	35	420	220	25	30	5	20	—	—	—

— Fewer than 3 cases per year.

* 2007 for Canada, Quebec; 2010 for British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland and Labrador; 2006–2010 average for Yukon, Northwest Territories, Nunavut. The numbers of cases from death certificate only for Ontario and Newfoundland and Labrador in 2008–2010 are estimated.

† Row totals may not equal the total for Canada due to rounding and difference in the most recent year of data presented. Canada totals include provincial and territorial estimates.

‡ The number of cases for some cancers used to calculate the overall 2013 estimates for this province was underestimated.

§ Ontario does not report *in situ* bladder cases. If Ontario *in situ* cases were included, it is estimated that the total number of Ontario bladder cancers would be 2,400 among men and 830 among women.

Note: "All cancers" excludes the estimated new cases of non-melanoma skin cancer (basal and squamous).

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

TABLE A4 Actual age-standardized incidence rates (ASIR) for the most common cancers by sex and geographic region, Canada, most recent year*
(based on September 2012 CCR file; see Statistics Canada CANSIM Table 103-0553 for availability of later data releases)

	Cases per 100,000													
	Canada†	BC	AB	SK	MB	ON	QC‡	NB	NS	PE	NL‡	YT	NT	NU
Males														
All cancers	**467**	**386**	**417**	**406**	**435**	**441**	**479**	**477**	**471**	**455**	**493**	**330**	**403**	**382**
Prostate	126	102	112	97	105	121	95	130	113	131	135	92	97	—
Lung	69	47	52	56	57	57	92	74	69	82	65	46	67	170
Colorectal	61	49	56	58	63	52	65	59	71	56	83	46	80	60
Bladder§	27	26	28	30	27	21	37	36	34	17	30	25	—	—
Non-Hodgkin lymphoma	20	19	18	22	19	20	19	20	22	17	19	—	—	—
Leukemia	16	13	17	17	17	16	15	19	9	8	12	—	—	—
Kidney	15	10	13	16	20	15	16	24	18	21	21	—	—	—
Melanoma	14	15	14	10	12	18	8	13	22	29	13	—	—	—
Oral	13	12	12	12	15	13	13	10	11	9	11	11	23	—
Pancreas	11	8	10	8	12	9	12	7	9	9	6	—	—	—
Stomach	11	8	9	10	9	9	11	10	9	13	21	—	—	—
Brain	8	7	6	7	6	8	9	6	10	5	10	—	—	—
Esophagus	6	6	6	7	6	7	6	7	9	5	4	—	—	—
Liver	6	7	6	4	4	7	7	3	5	—	4	—	—	—
Multiple myeloma	6	6	6	6	6	7	6	6	6	3	5	—	—	—
Thyroid	5	4	5	4	5	7	4	7	5	7	6	—	—	—
Females														
All cancers	**365**	**324**	**342**	**348**	**369**	**376**	**377**	**351**	**386**	**364**	**360**	**335**	**386**	**375**
Breast	99	98	100	95	100	103	102	96	103	115	90	91	96	53
Lung	48	40	44	48	50	43	56	45	56	45	38	65	60	152
Colorectal	41	33	37	45	45	38	43	42	50	38	55	45	89	76
Body of uterus	21	21	21	22	27	24	20	22	22	15	29	22	—	—
Thyroid	18	9	16	11	14	27	17	20	15	11	17	—	—	—
Non-Hodgkin lymphoma	14	14	14	15	16	15	13	13	13	15	16	—	—	—
Ovary	11	9	8	10	12	12	12	10	9	13	9	—	—	—
Melanoma	11	14	11	11	10	14	6	10	19	13	7	—	—	—
Leukemia	10	8	9	10	9	11	9	12	6	8	3	—	—	—
Kidney	9	5	8	9	8	8	9	9	11	8	11	—	—	—
Pancreas	8	7	7	8	9	8	10	9	8	9	6	—	—	—
Bladder§	8	6	7	9	7	5	11	10	10	6	8	—	—	—
Cervix	8	7	8	8	6	8	7	7	6	9	15	—	—	—
Brain	6	4	4	3	5	6	6	3	4	4	6	—	—	—
Oral	5	5	5	4	7	6	5	5	6	7	3	—	—	—
Stomach	5	4	4	4	4	5	5	3	3	—	5	—	—	—
Multiple myeloma	4	4	4	5	4	5	4	4	4	4	6	—	—	—

— Fewer than 3 cases per year.

* 2007 for Canada, Quebec; 2010 for British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland and Labrador; 2006–2010 average for Yukon, Northwest Territories, Nunavut. The numbers of cases from death certificate only for Ontario and Newfoundland and Labrador in 2008–2010 are estimated.

† Canada totals include provincial and territorial estimates.

‡ The number of cases for some cancers used to calculate the overall 2013 estimates for this province was underestimated.

§ Ontario does not currently report *in situ* bladder cancers.

Note: Rates for "All cancers" excludes non-melanoma skin cancer (basal and squamous). Rates are age-standardized to the 1991 Canadian population.

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

TABLE A5 Actual data for cancer deaths for the most common cancers by sex and geographic region, Canada, 2009*
(see Statistics Canada CANSIM Table 102-0522 and CANSIM Table 102-0552 for availability of later data releases)

	Deaths													
	Canada†	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	YT	NT	NU
Males														
All cancers	**37,500**	**4,800**	**3,100**	**1,200**	**1,350**	**13,700**	**10,000**	**1,000**	**1,300**	**180**	**770**	**35**	**25**	**20**
Lung	10,600	1,200	790	300	390	3,500	3,400	340	350	40	230	10	5	10
Colorectal	4,600	570	380	140	160	1,650	1,150	110	190	20	130	5	5	5
Prostate	3,700	550	370	180	170	1,400	780	90	120	25	65	5	—	—
Pancreas	2,000	310	170	65	60	720	500	55	65	10	25	—	—	—
Non-Hodgkin lymphoma	1,400	210	100	50	40	550	350	40	55	5	20	—	—	—
Leukemia	1,400	160	130	50	60	540	370	25	45	5	10	—	—	—
Bladder	1,350	200	100	50	50	500	330	30	35	10	20	—	—	—
Esophagus	1,250	190	120	40	55	520	230	35	50	10	20	—	—	—
Stomach	1,200	120	90	30	35	480	310	30	25	5	45	—	—	—
Brain	1,100	140	95	35	25	440	270	25	45	5	15	—	—	—
Kidney	970	130	95	35	50	330	240	30	25	5	25	—	—	—
Oral	720	110	60	15	25	280	170	20	20	5	10	—	—	—
Multiple myeloma	700	80	70	25	25	260	180	15	25	5	15	—	—	—
Liver	650	110	55	10	15	260	160	10	20	5	5	—	—	—
Melanoma	630	75	55	15	15	290	130	15	30	—	15	—	—	—
Females														
All cancers	**33,700**	**4,200**	**2,700**	**1,000**	**1,300**	**12,400**	**9,100**	**920**	**1,200**	**180**	**610**	**30**	**20**	**20**
Lung	8,500	1,050	650	270	310	2,900	2,500	240	310	50	140	5	5	5
Breast	4,900	590	400	140	190	1,900	1,350	130	150	25	75	5	5	—
Colorectal	4,000	490	280	110	180	1,450	1,050	120	160	20	90	5	5	5
Pancreas	2,000	240	170	65	70	750	540	60	70	10	30	—	—	—
Ovary	1,600	230	140	45	60	610	390	45	45	5	25	—	—	—
Non-Hodgkin lymphoma	1,200	160	95	40	45	450	300	25	40	5	15	—	—	—
Leukemia	1,100	120	95	30	35	430	270	35	35	5	15	—	—	—
Body of uterus	860	85	60	20	40	370	220	10	40	5	10	—	—	—
Brain	770	85	65	20	20	290	210	20	30	5	15	—	—	—
Stomach	730	80	55	25	25	270	220	25	20	0	15	—	—	—
Multiple myeloma	590	65	55	25	15	240	160	15	5	5	10	—	—	—
Bladder	580	85	35	15	25	230	150	10	20	5	10	—	—	—
Kidney	570	65	50	20	30	200	150	15	20	10	15	—	—	—
Esophagus	420	65	40	15	15	160	80	10	25	—	10	—	—	—
Melanoma	390	55	30	10	10	170	80	10	10	5	10	—	—	—
Cervix	370	30	40	25	20	140	80	10	10	5	10	—	—	—
Oral	340	50	35	10	20	130	90	5	10	—	—	—	—	—

— Fewer than 3 deaths per year.

* 2005–2009 average for Yukon, Northwest Territories, Nunavut.

† Row totals may not equal the total for Canada due to rounding. Canada totals include provincial and territorial estimates.

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

TABLE A6 Actual age-standardized mortality rates (ASMR) for the most common cancers by sex and geographic region, Canada, 2009*
(see Statistics Canada CANSIM Table 102-0522 and CANSIM Table 102-0552 for availability of later data releases)

	Deaths per 100,000													
	Canada†	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	YT	NT	NU
Males														
All cancers	**192**	**170**	**182**	**188**	**192**	**185**	**213**	**213**	**214**	**210**	**244**	**268**	**203**	**391**
Lung	54	42	47	49	55	48	71	71	58	45	74	64	50	185
Colorectal	23	20	23	21	23	22	25	23	32	25	42	38	38	81
Prostate	19	19	22	26	23	19	17	20	21	26	22	29	—	—
Pancreas	10	11	10	10	8	10	11	11	11	13	8	—	—	—
Non-Hodgkin lymphoma	7	8	6	8	6	7	7	9	10	5	6	—	—	—
Leukemia	7	6	8	8	8	8	8	6	7	4	4	—	—	—
Bladder	7	7	6	8	7	7	7	6	6	10	6	—	—	—
Esophagus	6	7	6	7	8	7	5	7	8	12	7	—	—	—
Stomach	6	4	5	5	5	6	6	6	5	7	15	—	—	—
Brain	6	5	5	5	4	6	6	5	7	6	5	—	—	—
Kidney	5	4	6	6	7	4	5	6	4	5	8	—	—	—
Oral	4	4	3	2	3	4	4	4	4	7	3	—	—	—
Multiple myeloma	4	3	4	4	3	4	4	3	4	4	4	—	—	—
Liver	3	4	3	2	2	3	3	2	3	5	1	—	—	—
Melanoma	3	3	3	2	2	4	3	3	5	—	5	—	—	—
Females														
All cancers	**137**	**123**	**130**	**131**	**150**	**132**	**148**	**151**	**151**	**164**	**161**	**214**	**174**	**330**
Lung	36	33	33	37	37	32	43	42	41	48	38	54	49	156
Breast	20	18	19	18	22	20	22	22	20	24	19	19	20	—
Colorectal	15	14	13	12	19	14	16	17	19	18	23	28	30	52
Pancreas	8	7	8	8	7	8	9	9	9	6	8	—	—	—
Ovary	7	7	7	6	7	7	6	8	5	5	7	—	—	—
Non-Hodgkin lymphoma	5	5	4	5	5	5	5	4	5	5	3	—	—	—
Leukemia	4	3	5	4	4	4	4	6	4	4	5	—	—	—
Body of uterus	4	3	3	3	4	4	4	2	5	4	3	—	—	—
Brain	3	3	3	3	3	3	4	4	4	4	4	—	—	—
Stomach	3	2	3	3	3	3	3	4	2	1	3	—	—	—
Multiple myeloma	2	2	3	3	1	2	3	2	1	6	3	—	—	—
Kidney	2	2	2	3	3	2	2	2	2	8	4	—	—	—
Bladder	2	2	1	1	2	2	2	2	2	4	3	—	—	—
Cervix	2	1	2	4	3	2	1	2	1	5	2	—	—	—
Esophagus	2	2	2	2	2	2	1	2	3	—	2	—	—	—
Melanoma	2	2	1	1	1	2	1	2	2	3	2	—	—	—
Oral	1	1	2	1	2	1	1	1	1	—	—	—	—	—

— Fewer than 3 deaths per year.

* 2005–2009 average for Yukon, Northwest Territories, Nunavut.

† Canada totals include provincial and territorial estimates.

Note: Rates are age-standardized to the 1991 Canadian population.

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

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 1984 to 2010 (except for Quebec, for which data from the CCR were available for 1983 to 2007 in time for this publication). Data for 1992 to 2010 were obtained from the CCR[1] (September 2012 CCR Tabulation Master File), while data for earlier years 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, 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 newly diagnosed with cancer.
- The Health Statistics Division at Statistics Canada maintains the CCR. It links data internally to identify duplicate person and tumour records. The Health Statistics Division also links cancer data with mortality data (described below) to ensure the completeness and correctness of vital status information and capture missed cancer cases. Both linking procedures optimize the accuracy of incidence, prevalence and survival statistics.
- Cancer diagnoses are classified according to the *International Classification of Diseases for Oncology, Third Edition* (ICD-O-3).[2]
- *Chapter 7: Special topic: Liver cancer* uses incidence data from 1970 onwards.

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

- The actual cancer mortality data cover the period of 1984 to 2009 and were obtained from the CVS: D.[3]
- 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 demographic and cause of death information for all residents who died in Canada between 1950 and 2009.
- Data are also included for Canadian residents who died in some states of the United States, as Canada currently receives abstracted death data from approximately 10 states.
- The Health Statistics Division at Statistics Canada maintains the CVS: D.
- Cause of death is classified according to the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision* (ICD-10).[4]
- Cancer deaths are those for which some form of cancer, as certified by a physician, is the underlying cause of death.
- *Chapter 7: Special topic: Liver cancer* uses mortality data from 1970 onwards.

Population data: The Census of Canada

- Population estimates for Canada and the provinces and territories are based on censuses conducted every five years from 1981 through to 2006.
- Intercensal estimates prepared by Statistics Canada are used for the years between these censuses, and postcensal estimates are used for 2006 to 2011.[5]
- Projected population estimates are used for 2012 and 2013, as prepared by Statistics Canada under assumptions of medium growth (scenario M1).[6] The scenario M1 incorporates medium-growth and historical trends (1981 to 2008) of interprovincial migration.
- All population estimates include non-permanent residents and are adjusted for net census under-coverage and Canadians returning from abroad.

Life tables

- Life tables are required to estimate relative survival. Sex-specific provincial life tables are produced by Statistics Canada.
- Data from the 1990 to 1992 life tables[7] were used for follow-up in 1992 and 1993. Data from 1995 to 1997 life tables[8] were used for follow-up from 1994 to 1998. Data from the 2000 to 2002 life tables[9] were used for follow-up from 1999 to 2003. Data from the 2005 to 2007 life tables were used for follow-up from 2004 to 2008.[10]

- Complete life tables were not available for Prince Edward Island or the territories, so expected survival proportions for these areas were derived from abridged life tables for Canada, Prince Edward Island and the territories using a method suggested by Dickman et al.[11] Where this was not possible (i.e., for the territories from 1990 to 1992), complete Canadian life table values were used.
- The method of Dickman et al. was also used to extend, by single year of age, the 1990 to 1992 set of provincial life tables for people aged 85–99 years.

Cancer definitions

- Cancers are generally defined according to the groupings of ICD-O-3[2] for incidence and ICD-10[4] for mortality (Table A7).
- Some definitions have changed slightly over time; changes occurring since the 2004 edition of this publication are outlined in Tables A8-1 and A8-2.
- For children and youth aged 0–14 years, cancers were classified and reported according to the *International Classification of Childhood Cancer, Third Edition* (ICCC-3).[12] This system is most 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.
- Bladder cancer includes bladder *in situ* carcinomas, which are considered invasive for the purpose of incidence reporting and are included for provinces and territories except Ontario.

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 (0–4, 5–9,…, 80–84 and 85+ years) and cancer type.

- Rates for each category were calculated by dividing the number of cases or deaths in each category (i.e., province or territory, year, sex, age group, cancer type) by the corresponding provincial or territorial population figure. These formed the basis for calculations of age-standardized rates and for estimates beyond the most recent year of actual data.
- For the section *Incidence and mortality by age and sex*, age-specific rates were computed for broader age groups (0–19, 20–29, …, 70–79 and 80+ years) in the same way.
- Age-standardized incidence rates (ASIR) and mortality rates (ASMR) 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 1991 Canadian population:

1991 Canadian standard population

Age group	Population (per 100,000)
0–4	6,946.4
5–9	6,945.4
10–14	6,803.4
15–19	6,849.5
20–24	7,501.6
25–29	8,994.4
30–34	9,240.0
35–39	8,338.8
40–44	7,606.3
45–49	5,953.6
50–54	4,764.9
55–59	4,404.1
60–64	4,232.6
65–69	3,857.0
70–74	2,965.9
75–79	2,212.7
80–84	1,359.5
85+	1,023.7
Total	**100,000**

Figure B (*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 for males and females in each five-year age group were applied to the age-specific populations for each of the subsequent years up to 2007 to obtain the expected number of deaths for each of those years if the 1988 death rates prevailed.
- To obtain the excess deaths that would have occurred, the expected deaths for each year were summed and then the observed number of deaths for each year was subtracted from this total.

Figure C (*Introduction*) shows the relative contributions to the changes in the total 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 lowest solid line represents the total number of new cancer cases (or deaths) that would have occurred each year if the population size and age structure had remained the same as they were in 1984. This line reflects the impact of changes in cancer risk and cancer control practices.
- The middle line represents the number of new cases (or deaths) that would have occurred if the age structure of the population had remained the same as it was in 1984. This line reflects the impact of changes in cancer risk and population growth.
- The top line represents the number of new cases (or deaths) that actually occurred and thus reflects the combined impact of changes in risk, population growth and aging of the population.

The series shown in Figure C 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 1984 population distribution for males or females as the standard weights
- Next-to-baseline series: the 1984 total population multiplied by the annual age-standardized rate, using the 1984 population distribution for males or females as the standard weights
- Baseline (dotted line): the observed number of Canadian cancer cases or deaths during 1984, for males or females.

Estimation of incidence (new cases) and mortality (deaths) for 2013

Two methods were used to estimate 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 2013 for each cancer type by sex (except new cases of prostate cancer and non-melanoma skin cancer; see *Prostate cancer incidence* and *Non-melanoma skin cancer incidence* below) reported in Tables 1.2 and 3.2. 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.[13] Nordpred was developed into a software package[14] and is now one of the most frequently used methods for cancer projections worldwide.[15–19]

The Nordpred Power5 regression model was used when the average annual number of cases 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.

- A separate Nordpred Power5 regression model was fit for each province, sex and type of cancer for the period of 1986 to 2010 (1983 to 2007 for Quebec) for incidence and 1985 to 2009 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 (described above); 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*, *D* is the common linear drift parameter of period and cohort.[20] P_p is the nonlinear period component of period *p*, and C_c is the nonlinear cohort component of cohort *c*.
- Nordpred 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 limit, the average number of cases in the last two periods is 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 is 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 rate trends were then extrapolated to 2013. The predicted numbers of cancer cases in 2013 were calculated by multiplying these extrapolated incidence rates by the sex-, age- and province-specific population projections for the same year.
- The Nordpred "recent" and "cut-trend" options were modified from the default values for selected types of cancer, including thyroid cancer incidence and prostate cancer mortality, since recent trends are not expected to continue with as large an annual percent change. The values were chosen so that estimates were consistent with the most recent data available to the provincial cancer registries.

Five-year averaging

New cases and deaths in 2013 for each type of cancer were also estimated 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 estimates for these cancers because it is based on a medium or longer term trend) or when frequencies are low and result in unstable estimates 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. The predicted numbers were then obtained by multiplying these rates by the corresponding projected population sizes.

Selection of "best" estimates

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

- The Nordpred model was preferred except when frequencies were low.
- Five-year average estimates 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 estimates were used for the territories and are reported only for "all cancers" because of small sample sizes.
- The absolute value of the difference between the age-standardized rates estimated by the two methods was calculated and expressed relative to the five-year average estimate. For example, if the Nordpred Power5 regression model estimated a rate of 4.0 and the five-year average estimated a rate of 4.5, the relative difference would be $|4.0 - 4.5| \div 4.5$, or 11.1%.
- Provinces closely examined estimates for cancers where the absolute value of the relative difference exceeded 15%. Such situations may be indicative of important deviations from the long-term trend.
- 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 estimation methods.
- Estimates for Canada as a whole were computed as sums of the estimates for the individual provinces and territories.

Tables A9 and A10 indicate the cancer types that were reported according to the five-year average method for 2013. In these situations, the age-standardized rates for 2013 reported in this publication were calculated using the most recent five years of actual data.

All cancers combined

Provincial estimates of incidence counts for "all cancers" for males were computed as the sum of the "best" estimates for prostate cancer and all cancers excluding prostate, as estimated by the Nordpred modelling.

Prostate cancer incidence

The results of the Nordpred Power5 regression model are not satisfactory for prostate cancer. An annual age-specific trend Power5 projection model was fitted to a minimum of seven and a maximum of nine years of data, as selected by a goodness of fit test. The 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, D_a is the slope parameter at the ath age group, which takes the differentiation in trend from different 10-year age groups into consideration.

New cases of prostate cancer in 2013 were also estimated based on the most recent year of data available. This method may be more realistic when there are recent changes in trend (the age-specific trend model results in poor estimates for prostate cancers because it is based on a medium-term trend). The predicted numbers were then obtained by multiplying these rates by the corresponding projected population sizes.

Non-melanoma skin cancer incidence

Only a few provinces routinely collect data on the incidence of basal cell and squamous cell carcinoma of the skin (generally referred to as non-melanoma skin cancer, or NMSC). The numbers of NMSC in all of Canada, by sex, were estimated using these data.

- Pathology laboratories in British Columbia send all diagnostic reports of NMSC to the provincial registry. The age- and sex-specific incidence rates in British Columbia for 1992 to 1994 and 2003 were projected to 2013 by the British Columbia Cancer Registry and applied to the projected Canadian population estimates to generate an estimate of the number of cases for Canada as a whole.
- Counts of NMSC for 1992 to 2010 by year, sex and age group were provided by the Manitoba Cancer Registry and by the New Brunswick Cancer Registry. Linear regressions using a logarithmic transformation of the annual rates for each province and age group (0–39, 40–59, 60–79 and 80+ years) were conducted and projected to 2013. The predicted numbers of NMSC cases for all of Canada were calculated by multiplying the projected incidence rates for each of Manitoba and New Brunswick by the sex- and age-specific Canadian population projections for 2013.
- Reported new cases of NMSC for all of Canada are the average of 2013 estimates from British Columbia, Manitoba and New Brunswick registries.

Rounding for reporting

- 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 or equal to 2,000 were rounded to the nearest 100.
- Percentages, age-standardized rates and age-specific rates were rounded to the nearest 10th, except in Tables 2.5, 4.5, A4 and A6, where space restrictions forced rounding to the nearest whole number.
- Age-specific and sex-specific numbers or rates were combined before rounding, so it is possible that the totals in the tables do not add up. However, any such discrepancies are within the precision of the rounding units described above.

Precision of 2013 estimates

Estimates of precision (standard errors, coefficients of variation and confidence limits) for 2013 counts and rates are available on request from the Chronic Disease Surveillance and Monitoring Division (Centre for Chronic Disease Prevention, Public Health Agency of Canada). The precision of an estimate depends primarily on the number of observed cases and the population size for each combination of cancer type, age, sex and province or territory.

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

The estimated 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 ASIR or ASMR in each segment. The models incorporated estimated standard errors of the ASIR or ASMR. 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 increase or decrease in the rate.

- Joinpoint analysis was applied to annual age-standardized rates over the period of 1986 to 2007 (for incidence) and 1986 to 2009 (for mortality) to determine years in which the APC changed significantly; such years are referred to as *changepoints*.
- A minimum of five years of data before and after a changepoint was required for a new trend to be identified. Thus, the most recent possible changepoint is 2003 for incidence and 2005 for mortality.
- If no changepoint was detected within the periods of 1998 to 2007 (for incidence) or 2000 to 2009 (for mortality), then the APC was estimated by fitting a model within these time periods, in the same way as described above.
- If a changepoint was detected within these decades, then the APC was estimated from the trend in the last segment. Both the changepoint year and the APC for the years beyond the changepoint are indicated in Tables 1.5 and 3.5.
- Changepoints in incidence rates for 1970 to 2007 and mortality rates for 1970 to 2009 for liver cancer are reported in *Chapter 7: Special topic: Liver cancer*.

Probability of developing or dying from cancer

Probabilities of developing or dying from cancer were calculated according to the age- and sex-specific cancer incidence and mortality rates for Canada in 2007 and life tables based on all-cause mortality rates from 2006 to 2008. The methodology used was that of Zdeb[21] and Seidman et al.[22]

- The method used for the probability of developing cancer assumes that current age-specific incidence rates will prevail throughout the future lifetime of a person as he or she advances in age. Since this assumption may not be true, the probabilities should be regarded only as approximations.
- The probability of dying from cancer represents the proportion of people who die of cancer in a cohort subjected to the mortality conditions prevailing in the population at large in 2007. It was estimated by determining the proportion of deaths attributed to specific types of cancer for each sex and age group, multiplying this proportion by the corresponding number of deaths in the life table and summing the life table deaths over all sex and age groups to obtain the probability of dying from each cause.

Relative survival

Five-year relative survival ratios (RSRs) were estimated by comparing the actual survival experience of persons diagnosed with cancer to that expected in the general population of Canadians of the same age, sex, province of residence and time period. It is computed as a ratio and expressed as a percentage.

- Deaths of people diagnosed with cancer are identified through record linkage of the CCR to the CVS: D, and 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.
- Analyses were based on all primary cancers. The effect of including multiple cancers in survival analyses has been studied both internationally[23,24] and in Canada.[25]
- Analyses were based on those individuals aged 15–99 years at diagnosis.
- Persons whose diagnosis was established through death certificate only or autopsy only were excluded.
- Analyses were based on a publicly available algorithm,[26] with some minor adaptations. Expected survival proportions were derived, using the Ederer II approach,[27] from sex-specific provincial life tables produced by Statistics Canada.
- Survival analyses were conducted using both period (2006 to 2008) and cohort (1992 to 1994) analysis methods.[28] The period approach to survival analysis provides up-to-date predictions of cancer survival.[29] 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 expresses the probability of surviving five years into the future at various points since the time of diagnosis, relative to the expected survival of a comparable group in the general population.[30,31] It is calculated as per five-year RSRs, except conditional RSRs are estimated using people who have survived certain amounts of time after the date of cancer diagnosis.
- As an indication of the level of statistical uncertainty in the survival estimates, confidence intervals formed from standard errors estimated using Greenwood's method[32] are provided. To avoid implausible lower limits less than zero or upper limits greater than one for observed survival estimates, asymmetric confidence intervals based on the log (–log) transformation were constructed. RSR confidence limits were derived by dividing the observed survival limits by the corresponding expected survival proportion.
- Age-standardized estimates were calculated using the direct method by weighting age-specific estimates for a given cancer to the age distribution of persons diagnosed with that cancer from 1992 to 2001. Confidence intervals for age-standardized RSRs were formed by multiplying the corresponding age-standardized observed upper and lower limits by the ratio of the age-standardized relative survival point estimate to the age-standardized observed survival point estimate.

Prevalence

The primary type of prevalence reported in this publication is tumour based. Two-, five- and 10-year limited duration prevalences are estimated by the numbers of cancers diagnosed in the previous two, five and 10 years among people with cancer 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 prevalences for all of Canada, excluding Quebec, were determined directly using the counting method.[33,34] 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 prevalences are estimated as the number of individuals represented in the tumour-based limited duration prevalences.
- Age-specific prevalence estimates were obtained using the age attained as of January 1, 2009.

The above approach for estimating cancer prevalence in Canada is different from that employed 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.

Data and methods issues

Incidence

Although the Canadian Council of Cancer Registries and its Standing Committee on Data Quality 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 tumours and carcinomas *in situ* are not routinely captured or reported except for *in situ* carcinomas of the bladder; all cancer registries except Ontario report *in situ* bladder cancers to the CCR.
- There may be under-reporting of cancer cases in Newfoundland and Labrador due to incomplete linkage of cancer data with death data. This under-reporting could result in death counts or rates exceeding those for incidence in a specific year; this especially affects highly fatal cancers. The number of "death certificate only" (DCO) cases for 2008 to 2010 in Newfoundland and Labrador was estimated from 2007 data.
- In Quebec, cases diagnosed through DCO are incompletely captured prior to 2000. In addition, because of the registry's dependence 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.[35] The 2013 estimates 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.
- The number of DCO cases for 2008, 2009 and 2010 in Ontario was estimated from the average of 2003 to 2007 data.
- The number of DCO cases is less than 2% of total cases.
- Non-melanoma skin cancers are excluded since most provincial and territorial cancer registries do not collect information on these cases. These cancers are difficult to register completely because they may be diagnosed and treated in a variety of settings and are very numerous. Estimates based on the three registries that include these cancers (see *Non-melanoma skin cancer incidence* above) are therefore likely to be underestimates.

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 A8-1 and A8-2), there is one major earlier change 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),[36] codes 153–154, to be consistent with other publications. However, this 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.
- Commencing with the 2003 edition, 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.

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,[37] 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 the *Methods* section above). Prevalence estimates were derived using the corresponding observed prevalence proportion calculated for the rest of Canada, stratified on age group, sex and cancer type.

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TABLE A7 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	C34	C34
Melanoma	C44 (Type 8720–8790)	C43
Breast	C50	C50
Cervix	C53	C53
Body of uterus	C54–C55	C54–C55
Ovary	C56.9	C56
Prostate	C61.9	C61
Testis	C62	C62
Bladder (including *in situ*)	C67	C67
Kidney	C64.9, C65.9	C64–C65
Brain	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 Type 9811–9818, 9823, 9827, 9837 all sites except C42.0,.1,.4	C82–C85, C96.3
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 Type 9811–9818, 9823, 9827, 9837 sites C42.0,.1,.4	C91–C95, C90.1
All other cancers	All sites C00–C80, C97 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

* 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 A8-1 Recent cancer definition changes in incidence

	New definition	Year changed	Old definitions
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	ICD-O-3 C64–C65	2008	ICD-O-3 C64–C66, C68
Lung	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: According to ICD-O-3, incidence for bladder, colorectal, kidney, lung and ovary cancers excludes 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 A8-2 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	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	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 A9 Use of five-year average method* for incidence projection by cancer type, sex and province, 2013

	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
All cancers																●				
Lung																				
Breast																				
Colorectal																		●		
Prostate†					■						■		■						■	
Bladder																	■	●		●
Non-Hodgkin lymphoma							■								■		■	●		
Melanoma																	■	●	■	●
Kidney								●									■	●		●
Leukemia														●			■	●	■	●
Thyroid					■	●	■						■		■		■	●	■	●
Body of uterus																		●		
Pancreas																	■	●	■	●
Oral						●		●						●		●	■	●	■	●
Stomach						●		●						●		●	■	●		●
Brain					■	●	■	●					■	●	■	●	■	●	■	●
Ovary																		●		●
Multiple myeloma					■	●	■	●					■	●	■	●	■	●	■	●
Liver				●	■	●	■	●					■	●	■	●	■	●	■	●
Esophagus				●	■	●	■	●					■	●	■	●	■	●	■	●
Cervix						●		●						●		●		●		●
Larynx		●		●	■	●	■	●					■	●	■	●	■	●	■	●
Hodgkin lymphoma		●	■	●	■	●	■	●					■	●	■	●	■	●	■	●
Testis					■		■						■		■		■		■	

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 and Labrador.

* Nordpred Power5 regression model is the default for all provinces except when the average annual cases for the most recent five years is less than or equal to 50, when the five-year average estimate is the default.

† An annual age-specific trend Power5 projection model 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 A10 Use of five-year average method* for mortality projection by cancer type, sex and province, 2013

	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
All cancers																				
Lung																	■	●		
Colorectal																	■	●		
Breast																		●		
Pancreas																	■	●	■	●
Prostate																	■			
Non-Hodgkin lymphoma					■	●							■	●	■	●	■	●	■	●
Leukemia						●		●					■	●	■	●	■	●	■	●
Bladder				●	■	●	■	●					■	●	■	●	■	●	■	●
Stomach				●	■	●	■	●					■	●	■	●	■	●	■	●
Brain					■	●	■	●					■	●	■	●	■	●	■	●
Esophagus				●	■	●		●					■	●	■	●	■	●	■	●
Kidney				●	■	●	■	●					■	●	■	●	■	●	■	●
Ovary														●				●		●
Multiple myeloma					■	●	■	●					■	●	■	●	■	●	■	●
Oral				●	■	●	■	●					■	●	■	●	■	●	■	●
Melanoma		●	■	●	■	●	■	●					■	●	■	●	■	●	■	●
Liver				●	■	●	■	●					■	●	■	●	■	●	■	●
Body of uterus						●		●						●		●		●		●
Larynx		●	■	●	■	●	■	●		●		●	■	●	■	●	■	●	■	●
Cervix				●		●		●						●		●		●		●

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 and Labrador.

* Nordpred Power5 regression model is the default for all provinces except when the average annual deaths for the most recent five years is less than or equal to 50, when the five-year average estimate 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 indices

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 www.cancer.ca/statistics:

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
CCR	Canadian Cancer Registry
CCS	Canadian Cancer Society
CI	Confidence interval
CVS: D	Canadian Vital Statistics – Death database
DCO	Death certificate only
HBV	Hepatitis B virus
HCC	Hepatocellular carcinoma
HCV	Hepatitis C virus
ICCC-3	International Classification of Childhood Cancer, Third Edition
ICD-10	International Statistical Classification of Diseases and Related Health Problems, Tenth Revision
ICD-O-3	International Classification of Diseases for Oncology, Third Edition
NCIRS	National Cancer Incidence Reporting System
NMSC	Non-melanoma skin cancer
PHAC	Public Health Agency of Canada
PSA	Prostate-specific antigen
PYLL	Potential years of life lost
RSR	Relative survival ratio

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Tables

Appendix tables

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

www.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. Tel: (613) 952-5176, Fax: (613) 941-2057.

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

Statistics Canada

www.statcan.gc.ca (search "cancer")

More detailed information on the methodology used in this publication regarding survival and prevalence is available from the Health Statistics Division, Statistics Canada, National Enquiries Line (1-800-263-1136) or the Health Statistics Division: (613) 952-5176. 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 (www.statcan.gc.ca).

Canadian Cancer Society

www.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 www.cancer.ca/research or contact the Canadian Cancer Society Research Institute, National Office, at research@cancer.ca.

Canadian Council of Cancer Registries

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the Canadian Cancer Society's Cancer Information Service

1-888-939-3333 Monday to Friday, 9 a.m. – 6 p.m.
cancer.ca

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