Cancer Care Ontario

ONTARIO CANCER STATISTICS **2016**

Ontario
Cancer Care Ontario

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ONTARIO CANCER STATISTICS **2016**

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Many of the tables and charts in this report contain information derived from the Ontario Cancer Registry. While Cancer Care Ontario makes every effort to ensure the completeness, accuracy and currency of this information at the time of writing this report, this information does change over time as does our interpretation of it.

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Foreword

"At Cancer Care Ontario, patients are at the centre of all that we do. This report will enable us and our partners to create a sustainable healthcare system for patients to continue to receive high quality care."

I AM PLEASED TO PRESENT *Ontario Cancer Statistics 2016*, the definitive source for cancer surveillance information in Ontario.

As the principal cancer advisor to the government of Ontario, Cancer Care Ontario is committed to improving the performance of the cancer system by driving quality, accountability, innovation and value. Cancer surveillance is a cornerstone of this work.

This comprehensive report uses data from the Ontario Cancer Registry to provide a clear picture of cancer in this province: who gets what type of cancer, at what age, where they live and their likelihood of surviving or dying from the disease. The collection and reporting of this data are the first critical steps in identifying opportunities to reduce the burden of cancer on people with the disease, their caregivers and the healthcare system.

At all times, we must remember that behind this data are human lives: patients diagnosed with and treated for cancer, family, friends and colleagues who are touched by their loved ones' illness, and the healthcare professionals who care for them. At Cancer Care Ontario, people are at the centre of all that we do. This report will enable us and our partners to create a sustainable healthcare system for patients to continue to receive high quality care.

Michael Sherar
President and CEO, CCO

"Cancer survivorship for nearly all cancer types is on the rise. Today, more Ontarians than ever before are living with cancer."

WITH RECENT ESTIMATES AND HISTORICAL DATA on the burden of cancer, *Ontario Cancer Statistics 2016* allows us to evaluate our progress and plan for future improvements in cancer control.

The number of new cases of cancer in Ontario is rising and is expected to continue to rise into the foreseeable future. Our aging population is a significant factor in this growth in new cancer cases as cancer is largely a disease of aging. At the same time, cancer survivorship for nearly all cancer types is on the rise and death rates are declining, particularly from breast, colorectal and lung cancer (which, along with prostate cancer, are the four most common cancers in Ontario).

Today, more Ontarians than ever before are living with cancer. An estimated 362,000 individuals—about 2.7% of our population—have been diagnosed within the past 10 years and have completed or are undergoing treatment. Because cancer care does not end at the completion of treatment, people with cancer, their families, their caregivers and the healthcare system will face new challenges as more and more people move from active treatment to survivorship.

This report provides Cancer Care Ontario and our many partners, including the Ministry of Health and Long-Term Care and our Regional Cancer Programs, with the information from which we can make informed decisions, take action and measure the impact of our initiatives.

Jason Garay
Vice-President, Analytics and Informatics, CCO

By the numbers

1 in 4 Ontarians
will die from cancer

Lifetime probabilities

1 in **2**

Ontarians will develop cancer in their lifetime

- **Most common cancers:** female breast, prostate, lung and colorectal
- **Incidence rates** (past 10 years) have risen fastest for thyroid, liver, and uterine cancers and for melanoma

Incidence

New cancer cases expected in 2016, almost triple the number of cases diagnosed in 1981

85,648

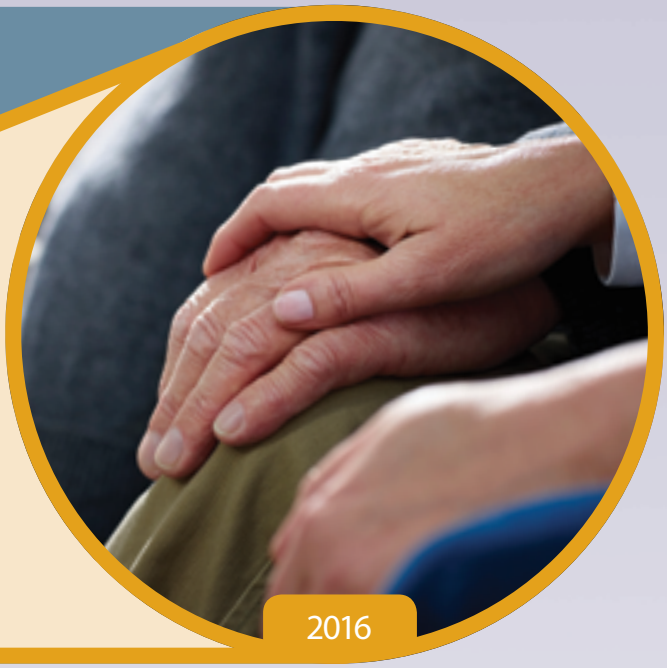
Mortality

Expected cancer deaths in 2016, nearly double the number of deaths in 1981

29,288

1981

- **Lung cancer:** approx. ¼ of all cancer deaths
- **Mortality rates** have decreased more for males than for females



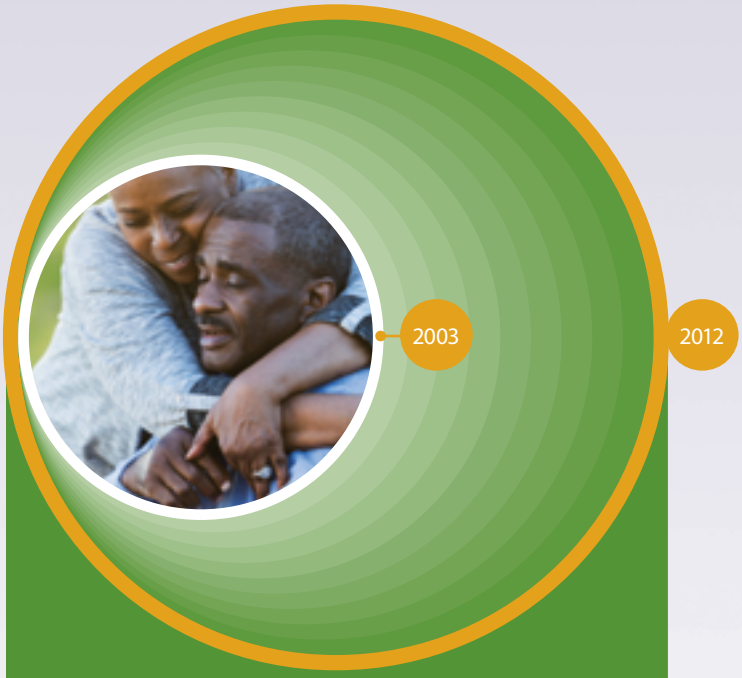
2016

- **Lowest survival:** pancreatic, esophageal, lung and liver cancers
- **Greatest increases in survival:** liver, pancreas, and stomach cancers, as well as leukemia and myeloma

Relative survival

5-year relative survival for all cancers combined

63%



2003

2012

- **Most prevalent cancers:** prostate, female breast, colorectal, thyroid, melanoma and lung

Prevalence

As of January 1, 2013, people diagnosed with cancer within the previous 10 years

362,557

About this publication

Ontario cancer surveillance

Cancer Care Ontario is the Ontario government's principal cancer advisor and plays an important role in equipping health professionals, organizations and policy-makers with the most up-to-date cancer knowledge and tools to prevent cancer and deliver high quality patient care.

Cancer Care Ontario actively engages people with cancer and their families in the design, delivery and evaluation of Ontario's cancer system and is guided by a mission of working together to improve the performance of Ontario's cancer system by driving quality, accountability, innovation and value.

This mission is achieved, in part, by conducting routine cancer surveillance through the systematic collection, analysis, interpretation and dissemination of information on cancer in Ontario. Cancer Care Ontario has been granted authority under the Cancer Act, 1990,[1] to operate the Ontario Cancer Registry (OCR), which is a population-based cancer registry that maintains data on diagnosed cases of cancer among Ontario residents.

Cancer Care Ontario's surveillance program analyzes and transforms the raw data from the OCR into information for action by the healthcare system to ultimately improve the well-being of Ontarians.

Established in 1964, Ontario's cancer registry is one of the oldest and most comprehensive population-based cancer registries in North America.

Cancer Care Ontario's surveillance program analyzes and transforms the raw data from the OCR into information for action by the healthcare system

Milestones in cancer surveillance in Ontario

THE ONTARIO CANCER REGISTRY

Established in 1964, Ontario's cancer registry is one of the oldest and most comprehensive population-based cancer registries in North America. In the fall of 2014, Cancer Care Ontario launched the new OCR and decommissioned its predecessor, the Ontario Cancer Registry Information System (OCRIS). See the timeline below, "Milestones in cancer surveillance in Ontario."

The OCR covers a population of approximately 13.8 million people. Mortality from cancer is determined by linking cause of death data obtained from the Office of the Registrar General for Ontario to incidence data within the OCR (see the *Technical appendix* for more information on the OCR).

1943

Ontario Cancer Treatment and Research Foundation (OCTRF) created to manage 3 regional cancer centres

1964

Ontario Cancer Registry created and managed by what was then the provincial Department of Health

1970s

First population based cancer statistics are published in scientific journals using Ontario Cancer Registry data

1970

OCTRF takes over the OCR

1980s

An automated system, called the Ontario Cancer Registry Information System (OCRIS), is built to replace the manually curated approach to cancer registration in Ontario

1997

Cancer Care Ontario is created and replaces the former OCTRF with an expanded mandate

2004

A standardized template for collecting pathology information (synoptic reports) is introduced in Ontario hospitals, improving the quality of pathology data collected by the OCR

2006

First cancer statistics monograph on adolescents and young adults is published in Ontario

2008

Cancer Care Ontario joins the National Staging Initiative to improve collection of information about cancer stage at diagnosis

2009

Cancer Care Ontario's surveillance program leads the first in-depth examination of colorectal cancer—from risk factors to survival—in Canada and the provinces

2014

OCRIS is decommissioned and replaced by the new OCR

2015

Over 500 peer-reviewed scientific studies using OCR data have been published since 1970

Purpose of this report

This report provides comprehensive information about cancer incidence, mortality, survival and prevalence in Ontario. To develop a clear understanding of the burden of cancer on the population, it is important to consider the number of people affected, their age and sex, and the region where they live. This information is intended to support decision-makers, the public health community, healthcare providers, researchers and others in planning, investigating, measuring and monitoring population-based cancer control efforts, including those related to cancer screening, prevention and treatment. This report may also be useful for the media and general public with an interest in cancer.

DATA SOURCES

Cancer data were obtained from the OCR, which relies on the following data sources:

- provincial pathology reports from Ontario's public hospital laboratories and private laboratories;
- activity level reporting (ALR) from the 14 Regional Cancer Centres, and their associated hospitals, for selected systemic therapy and all radiation treatment;
- admission and discharge information from the Canadian Institute of Health Information's hospital abstracting databases (Discharge Abstract Database [DAD], National Ambulatory Care and Reporting System [NACRS]);
- hospital electronic medical records, used for deriving stage at cancer diagnosis; and
- cause of death data from the Office of the Registrar General for Ontario.

As of 2015, all 14 Regional Cancer Centres, as well as 31 other sites, reported through ALR, many of which transmitted data for other institutions in addition to their own.

Case records in the OCR are also supplemented using information exchanged with other provincial and territorial cancer registries about Ontario residents who were diagnosed and/or treated in other jurisdictions.

DATA NOTES

There are several points that readers of this report should be aware of:

- Statistics reported here generally refer to malignant (i.e., invasive) cancers. The exception is bladder cancer. Similar to other jurisdictions, *in situ* bladder cases are reported jointly with invasive cases for the purpose of incidence surveillance. Because the OCR only began registering *in situ* bladder cancer cases in 2010, *in situ* cases are excluded in analyses of incidence trends for periods prior to 2010 and from all mortality, survival and prevalence analyses. Where non-invasive cancers (other than bladder) are presented in this report, they are indicated as such.
- Shortened forms of the names of cancer types are used throughout this report. See **Table TA.1** in the *Technical appendix* for the corresponding full names.
- Because non-melanoma skin cancer records are not routinely reported to the OCR, statistics for these cases are excluded from this report, including from statistics for all cancers combined.
- Both actual and estimated data are reported here, and distinctions between them are made where applicable. Given that the OCR is a dynamic database, new case information and updates to existing records occur on an ongoing basis. As a result, statistics in this report should only be considered accurate at the time of publication for the years being reported. More up to date incidence and mortality statistics may be found at cancercare.on.ca/ocs/csurv/stats/.

To develop a clear understanding of the burden of cancer on the population, it is important to consider the number of people affected, their age and sex, and where they live.

- Starting with the diagnosis year 2010, the OCR adopted the Surveillance, Epidemiology and End Results (SEER) Program's multiple primary and histology coding rules.[2] These coding rules have resulted in an increase in the reported incidence of certain cancer types because they use more liberal counting methods than the previously used International Agency for Research on Cancer/International Association of Cancer Registries (IARC/IACR) multiple primary rules[3] (see the *Technical appendix* for details). This change in counts means that more cases are being included in the analysis and does not mean that more people in Ontario are being diagnosed with cancer. Therefore, caution should be taken when comparing this report to previously reported statistics. Where relevant, statistics using both IARC/IACR and SEER rules are presented in this report.
- To align with the same reference population increasingly being used by other Canadian organizations, age-adjusted rates in this report use the 2011 Canadian population as its reference population (which replaces the previously used 1991 Canadian population). As a result of this change, readers will notice a general increase in rates for most cancer types compared to previous Cancer Care Ontario reports or other publications of Ontario data using the 1991 reference population for age-standardization (see the *Technical appendix* for further details).
- The use of the word *significant* throughout this report refers to statistical significance at an alpha level of 0.05 (see the *Technical appendix* for details).

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Cancer in Ontario

1 in 2 Ontarians will develop cancer in their lifetime

1 in 4 Ontarians will die from cancer

1

Cancer in Ontario — An overview

Cancer is a group of more than 200 different diseases that are characterized by abnormal cells in the body that divide and spread without control. In 2012 alone, 77,941 new cases of cancer were diagnosed in Ontario and 27,442 people died from the disease.

Cancer as a leading cause of death

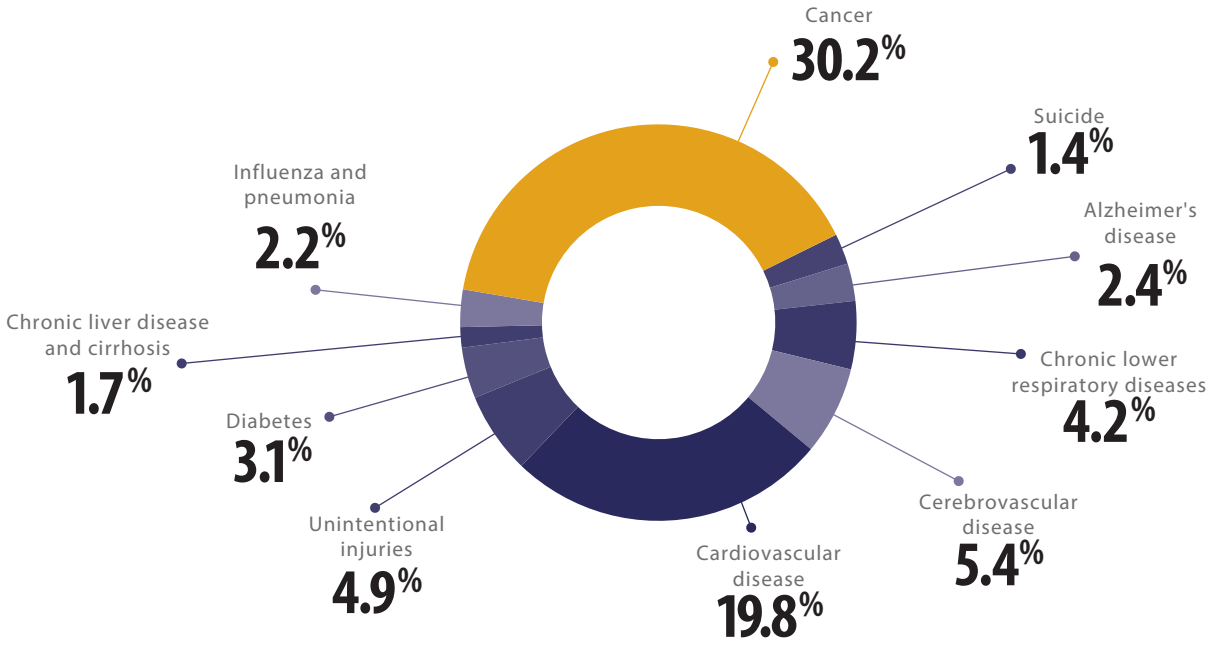
In 2012, 30.2% of all deaths in Ontario were attributable to cancer, making it the leading cause of death in this province (**Figure 1.1**). Cancer caused the same number of deaths as the next three leading causes of death combined—cardiovascular disease, cerebrovascular disease and unintentional injuries.[1]

The number of deaths caused by cancer increased by nearly 18% between 2000 and 2012. In comparison, the number of deaths caused by cardiovascular disease and cerebrovascular disease, the next two leading causes of death, decreased by 14.4% and 20.0% respectively, over the same time period.[1]

Cancer contributed an identical proportion of deaths in 2012 at the national level (30.2%) as it did in Ontario. The proportion of deaths from cancer varied between 23.6% and 33.5% in the other provinces and territories.[1]

In 2012, 30.2% of all deaths in Ontario were attributable to cancer, making it the leading cause of death in this province.

Figure 1.1 **Leading causes of death, Ontario, 2012**



Analysis by: Surveillance, Analytics and Informatics, CCO
Source: Statistics Canada, Canadian Vital Statistics, Death Database and population estimates, Table 102-0563

Cancer across the lifespan

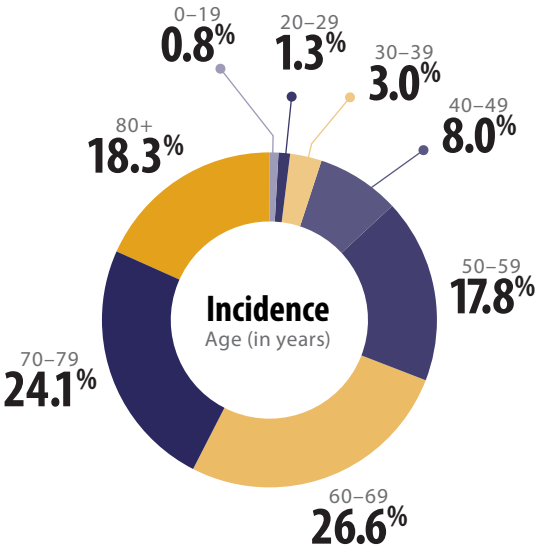
The majority of new cancer cases were diagnosed in people 50 years of age and older in 2012 (**Figure 1.2**). The greatest proportion of cases were diagnosed in people between the ages of 60 and 69 (26.6% of new cases) and 70 and 79 (24.1%).

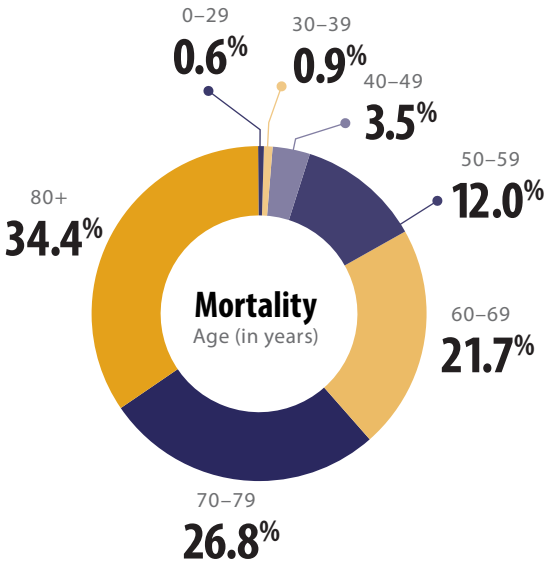
Cancer was rare among children and adolescents, with less than 1% of all new cases diagnosed in people under the age of 20. In fact, almost 95% of all new cases were in people over the age of 40.

The majority of cancer deaths occurred in people 50 years of age and older (**Figure 1.2**). Cancer deaths increased with age, with the greatest proportion of mortality occurring in people 80 years of age and older (34.4% of deaths) followed by people between the ages of 70 and 79 (26.8%). Cancer deaths were rare in children, adolescents and young adults, with only 1.5% of deaths occurring in people under the age of 40.

The greatest proportion of new cases were diagnosed in people between the ages of 60 and 69.

Figure 1.2 **Distribution of cancer incidence and mortality, by age group, Ontario, 2012**





Analysis by: Surveillance, Analytics and Informatics, CCO
Source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Probability of developing or dying from cancer

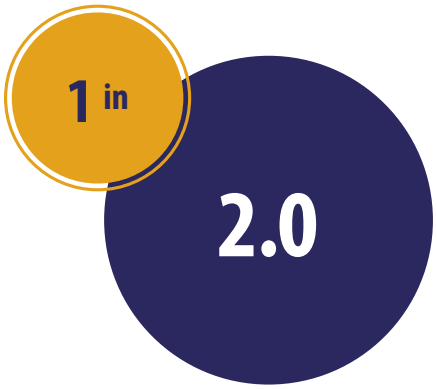
The probability of developing or dying from cancer refers to the average chance of either being diagnosed with or dying from cancer over the course of one's lifetime. This probability can be expressed both as a percentage and as odds.

The probability of developing a specific type of cancer depends on many factors, including the population's characteristics (e.g., demographics), the prevalence of risk factors (e.g., smoking, obesity) and current life expectancy. Furthermore, these probabilities reflect the average risks for the overall population and do not take into account personal risk factors. In other words, an individual's risk may be higher or lower than the numbers reported here.

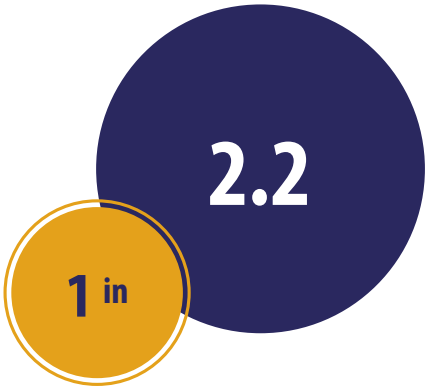
PROBABILITY OF DEVELOPING CANCER

In Ontario, 1 in 2.1 people will develop cancer in their lifetime (**Table 1.1**). Males have a greater chance of developing cancer at 49.9% (1 in 2.0) compared to females at 45.6% (1 in 2.2).

Probability of developing cancer among males



Probability of developing cancer among females



THE PROBABILITY OF DEVELOPING CANCER VARIES BY THE TYPE OF CANCER

Among **males**, the probability is highest for developing:	Among **females**, the probability is highest for developing:
Prostate **1 in 6.5**	Breast **1 in 7.8**
Lung **1 in 11.4**	Lung **1 in 13.7**
Colorectal **1 in 12.8**	Colorectal **1 in 15.1**

The probability of developing a specific type of cancer depends on many factors, including the population's characteristics, the prevalence of risk factors and current life expectancy.

The probability of developing cancer generally increases with advancing age (see **Table DA.1** in the *Data appendix*):

- Among males, the probability of developing cancer between the ages of 15 and 29 is less than 1%, but it increases to 13.3% (1 in 7.5) for those 80 years of age and older.
- The probability of developing cancer increases from less than 1% for females between the ages of 15 and 29 to 13.0% (1 in 7.7) for females 80 years of age and older.

Probability of developing cancer among males increases with age

Probability of developing cancer among females increases with age

In Ontario, males have a greater chance of dying from cancer at 28.5% (1 in 3.5) compared to females at 24.0% (1 in 4.2).

PROBABILITY OF DYING FROM CANCER

In Ontario, 1 in 3.8 people will die from cancer (**Table 1.1**). Males have a greater chance of dying from cancer at 28.5% (1 in 3.5) compared to females at 24.0% (1 in 4.2).

As with the chance of developing cancer, the probability of dying from cancer varies based on cancer type:

- Among males, the probability is highest for lung (1 in 14.3), prostate (1 in 26.8) and colorectal (1 in 28.6) cancers.
- Among females, the probability is highest for lung (1 in 18.3), breast (1 in 29.8) and colorectal (1 in 33.4) cancers.

The probability of dying from cancer also generally increases as an individual ages (see **Table DA.2** in the *Data appendix*):

- Among males, the probability of dying from cancer is less than 1% between the ages of 15 and 29, but it increases to 13.3% (1 in 7.5) for those aged 80 years and older.
- Among females, the probability of dying from cancer increases from less than 1% for those between the ages of 15 and 29 to 11.8% (1 in 8.5) for those 80 years of age and older.

The subsequent chapters present both actual and projected data for incidence and mortality, as well as estimates for relative survival and prevalence.

In Ontario, males have a greater chance of dying from cancer than females

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Table 1.1 **Lifetime probability of developing or dying from cancer, by cancer type and sex, Ontario, 2009–2012**

Cancer type	Probability of developing cancer						Probability of dying from cancer					
	Total		Males		Females		Total		Males		Females	
	%	1 in	%	1 in	%	1 in	%	1 in	%	1 in	%	1 in
All cancers	**47.5**	**2.1**	**49.9**	**2.0**	**45.6**	**2.2**	**26.0**	**3.8**	**28.5**	**3.5**	**24.0**	**4.2**
Bladder	2.1	47.4	3.3	30.4	1.1	95.2	0.8	119.5	1.2	80.9	0.5	202.0
Brain	0.8	120.7	0.9	111.6	0.8	131.3	0.6	169.7	0.7	150.2	0.5	193.8
Breast (female)	12.8	7.8	—	—	12.8	7.8	3.4	29.8	—	—	3.4	29.8
Cervix	0.8	131.8	—	—	0.8	131.8	0.2	437.4	—	—	0.2	437.4
Colorectal	7.2	13.9	7.8	12.8	6.6	15.1	3.2	30.9	3.5	28.6	3.0	33.4
Esophagus	0.7	149.4	1.0	99.5	0.4	280.6	0.7	153.8	1.0	102.5	0.3	287.2
Hodgkin lymphoma	0.2	444.7	0.2	416.2	0.2	477.2	0.0	2,331.4	0.1	2,144.9	0.0	2,532.5
Kidney	1.4	71.8	1.7	57.2	1.1	94.8	0.5	190.3	0.7	153.0	0.4	244.7
Larynx	0.3	308.1	0.6	177.5	0.1	984.5	0.1	728.8	0.2	427.3	0.1	2,036.0
Leukemia	2.0	50.1	2.3	42.7	1.7	59.4	1.0	99.7	1.2	84.3	0.8	118.7
Liver	0.8	118.3	1.2	84.9	0.5	188.4	0.8	122.2	1.1	93.1	0.6	172.1
Lung	8.0	12.5	8.8	11.4	7.3	13.7	6.2	16.2	7.0	14.3	5.5	18.3
Melanoma	2.1	48.5	2.4	41.4	1.8	57.1	0.4	260.3	0.5	203.9	0.3	347.7
Myeloma	1.0	104.7	1.1	92.6	0.8	118.7	0.5	200.1	0.5	182.6	0.5	218.9
Non-Hodgkin lymphoma	2.6	39.0	2.8	35.6	2.3	42.6	1.0	102.0	1.1	92.5	0.9	111.8
Oral cavity and pharynx	1.2	81.7	1.6	60.7	0.8	122.4	0.4	255.7	0.5	185.5	0.3	396.6
Ovary	1.7	58.7	—	—	1.7	58.7	1.1	91.6	—	—	1.1	91.6
Pancreas	1.5	65.6	1.5	67.8	1.6	63.9	1.5	68.3	1.4	71.3	1.5	66.1
Prostate	15.4	6.5	15.4	6.5	—	—	3.7	26.8	3.7	26.8	—	—
Stomach	1.2	85.7	1.5	66.9	0.9	115.5	0.7	143.0	0.9	114.7	0.5	183.8
Testis	0.4	235.6	0.4	235.6	—	—	0.0	5,258.2	0.0	5,258.2	—	—
Thyroid	1.6	61.3	0.8	129.3	2.5	40.4	0.1	1,404.5	0.1	1,697.4	0.1	1,224.2
Uterus	3.2	31.4	—	—	3.2	31.4	0.7	149.7	—	—	0.7	149.7

Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: Ontario Cancer Registry (November 2015), CCO; Statistics Canada, Canadian Vital Statistics, Birth and Death Databases and population estimates, CANSIM table 102-0504; CCO SEER*Stat Package Release 10—OCR (August 2015); Statistics Canada, Estimates of population, by age group and sex for July 1, Canada, provinces and territories, annual, CANSIM table 051-0001

85,648 **new cancer cases expected in 2016**

2

Incidence

The number of new cancer cases diagnosed each year in Ontario (the incidence), and the incidence rate, has increased since at least 1981.

In general, the incidence of cancer is influenced by:

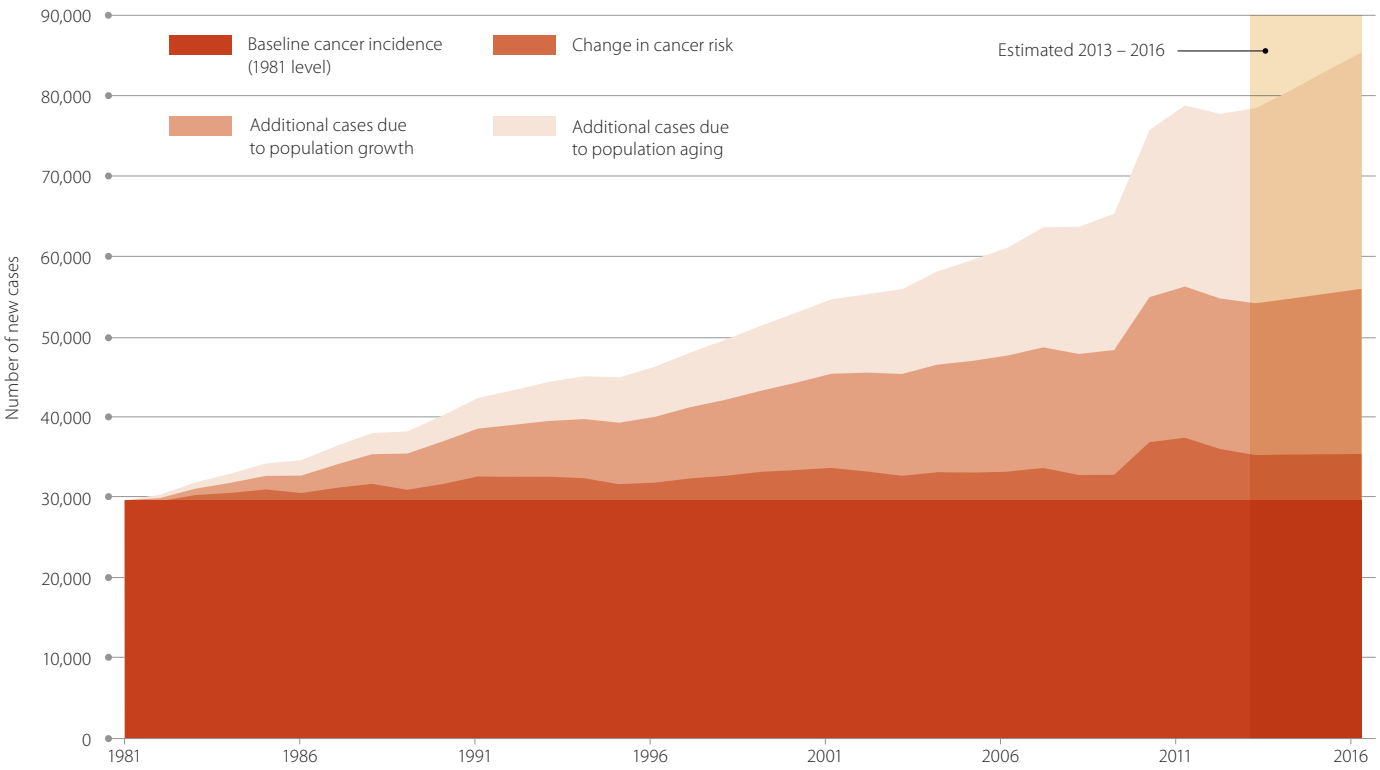
- socio-demographic factors;
- the availability of early detection and screening for cancer; and
- the prevalence of risk factors.

Risk factors can include unhealthy behaviours (e.g., smoking, poor diet, alcohol consumption and physical inactivity), non-modifiable factors (e.g., age at menarche and menopause), lifestyle factors (e.g., oral contraceptive or hormone-replacement therapy use), exposure to certain environmental and occupational carcinogens (e.g., radon, certain viral infections and air pollution), and genetic predispositions (e.g., BRCA1 and BRCA2 gene mutations).

Over the past three decades, aging of the population and population growth contributed far more to the number of new cancer cases than actual changes in cancer risk and cancer control practices (**Figure 2.1**). In 2016, approximately 85,648 new cases of cancer are expected to be diagnosed, representing a 188.9% increase over the 29,649 cancer cases diagnosed in 1981. Of this 188.9% increase, 89.2% will be attributable to aging of the population, 80.2% to population growth, and only 19.5% to changes in cancer risk and cancer control practices.

Over the past three decades, aging of the population and population growth contributed far more to the number of new cancer cases than actual changes in cancer risk and cancer control practices.

Figure 2.1 **Trend in incidence attributed to changes in cancer risk, population growth and aging, Ontario, 1981–2016**



Note: Rates standardized to the 2011 Canadian population
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

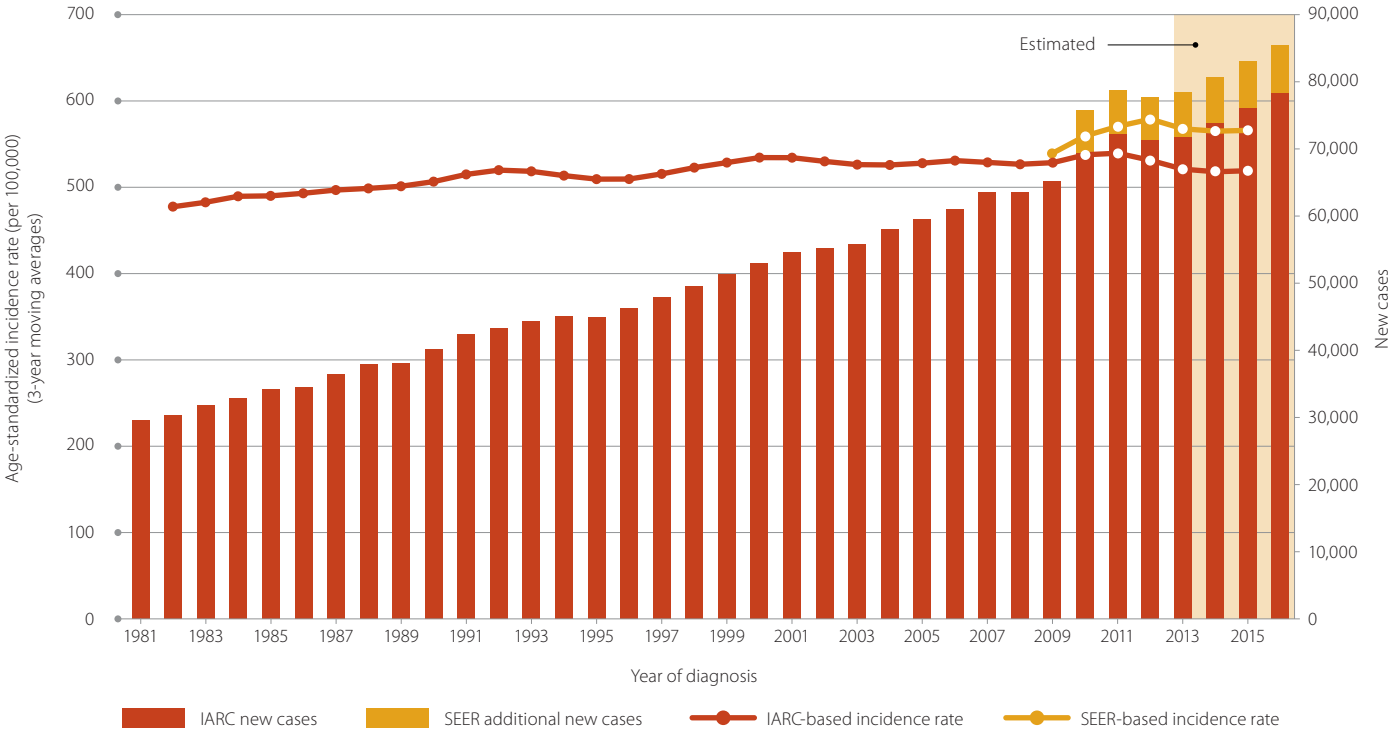
Multiple primary rules

Figures 2.2, 2.3 and **2.4** show the annual counts and age-standardized incidence rates (ASIR) for all cancers combined using the International Agency for Research on Cancer/International Association of Cancer Registries (IARC/IACR) rules for counting multiple primary cancers and, for more recent years, the Surveillance, Epidemiology and End Results (SEER) Program rules. The figures also include projected counts and rates for the years 2013–2016.

The SEER multiple primary rules were implemented for Ontario data starting with the diagnosis year 2010. The rates and counts using both methods of counting multiple primaries are presented here to illustrate the impact of the new rules. The SEER rules are more liberal than the IARC/IACR in what is considered a new primary case of cancer. As a result, the SEER rules lead to higher counts and rates.

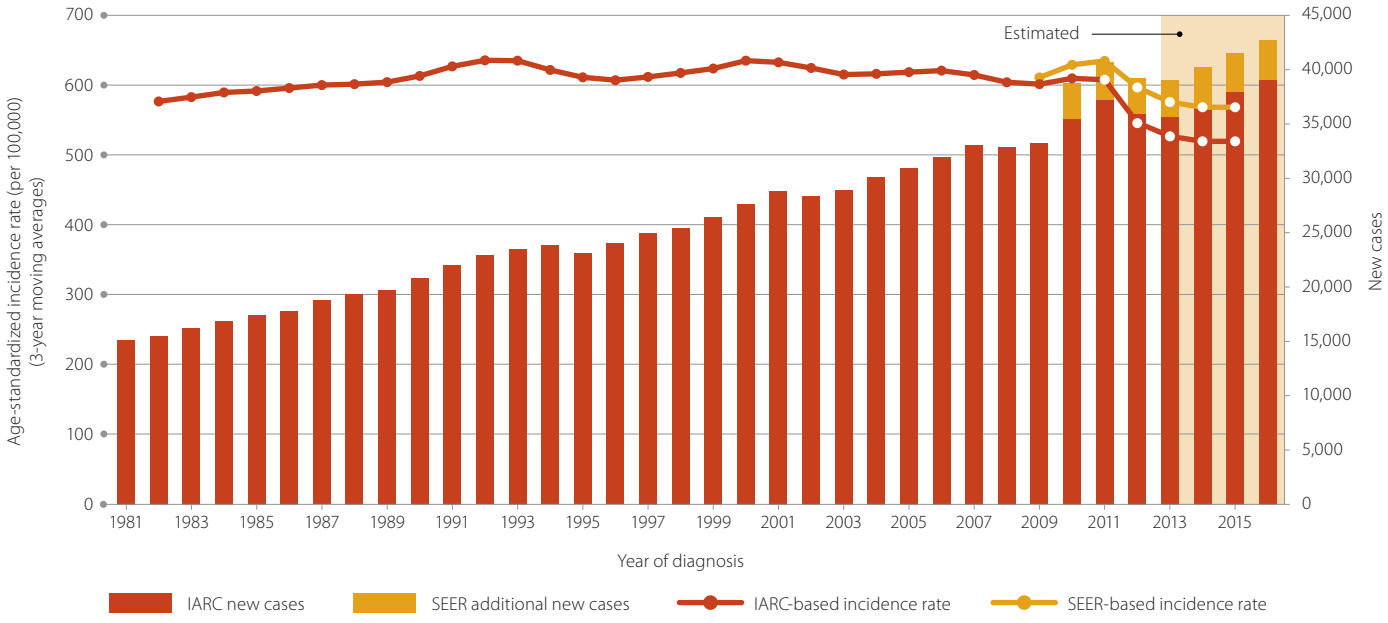
For 2012, the SEER multiple primary rules resulted in 6,295 additional cases of cancer being counted compared to the IARC/IACR rules. These additional cases are the result of a different method of counting cancers, not an actual increase in cancer incidence (see the *Technical appendix* for more details).

Figure 2.2 **Incidence counts and age-standardized rates, all cancers combined, Ontario, 1981–2016**



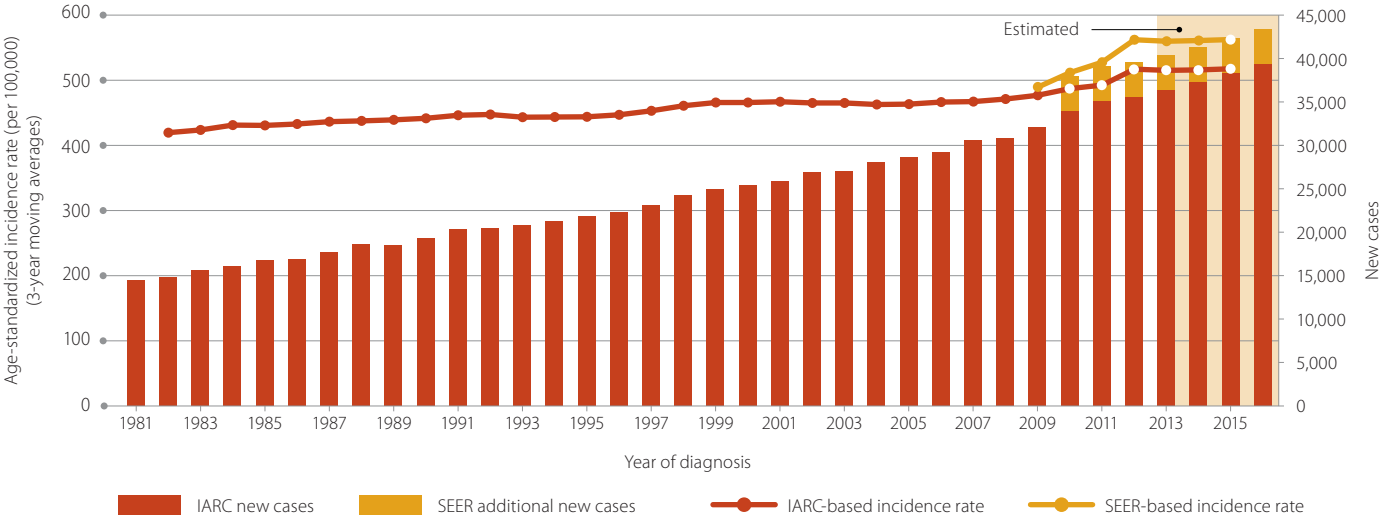
Note: Rates standardized to the 2011 Canadian population
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Figure 2.3 **Incidence counts and age-standardized rates, all cancers combined, males, Ontario, 1981–2016**



Note: Rates standardized to the 2011 Canadian population
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Figure 2.4 **Incidence counts and age-standardized rates, all cancers combined, females, Ontario, 1981–2016**



Note: Rates standardized to the 2011 Canadian population
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

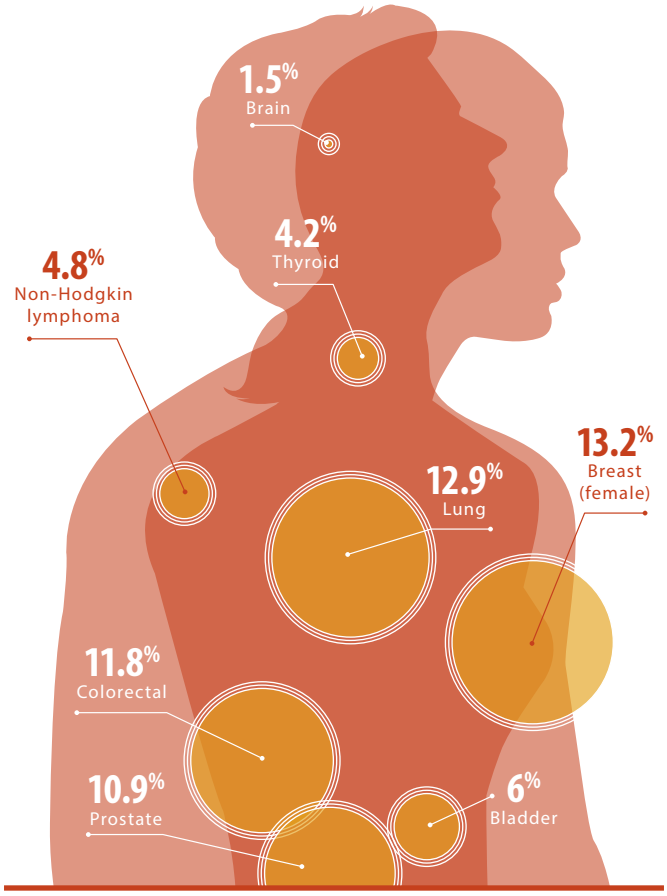
Incidence counts and rates

In 2012 (the most recent year of non-projected data available), there were 77,941 new cases of cancer in Ontario, resulting in an ASIR of 578.1 per 100,000 (**Table 2.1**). The ASIR was significantly higher in males (638.1 per 100,000) than in females (537.0 per 100,000).

The most commonly diagnosed cancers for males were prostate (21.6% of all new male cases), lung (13.3%), colorectal (12.4%) and bladder (8.9%). In females, the leading cancer types were breast (26.6% of all new female cases), lung (12.6%) and colorectal (11.1%).

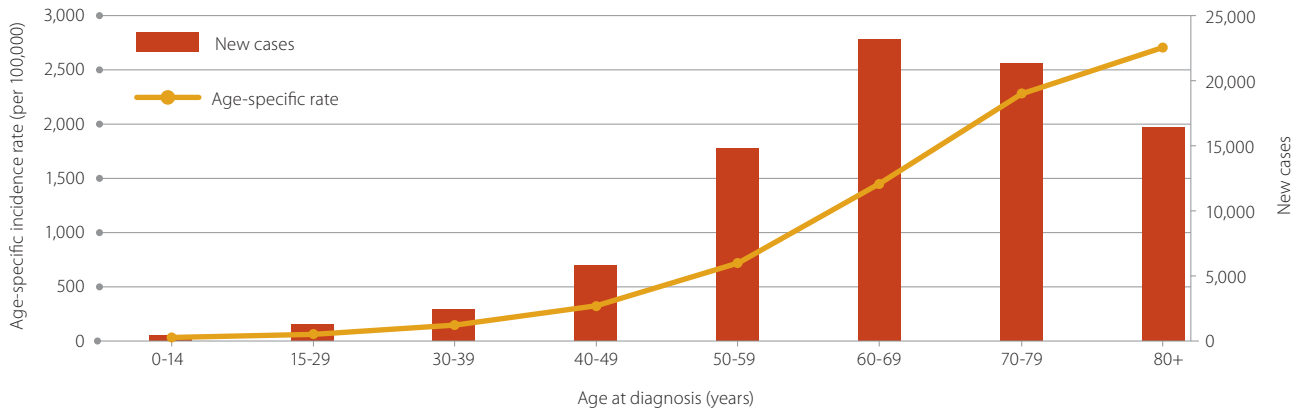
It is estimated that in 2016 the ASIR for all cancers combined will be 569.9 per 100,000, representing 85,648 new cases (data not shown). For males, the ASIR is estimated to be 614.0 per 100,000, representing 42,881 new cases. For females, the ASIR is estimated to be 540.6 per 100,000, representing 42,767 new cases. The lower estimated ASIR in males in 2016 compared to 2012 is likely due to a decline in prostate cancer cases.

Distribution of new cases for selected cancers, 2012



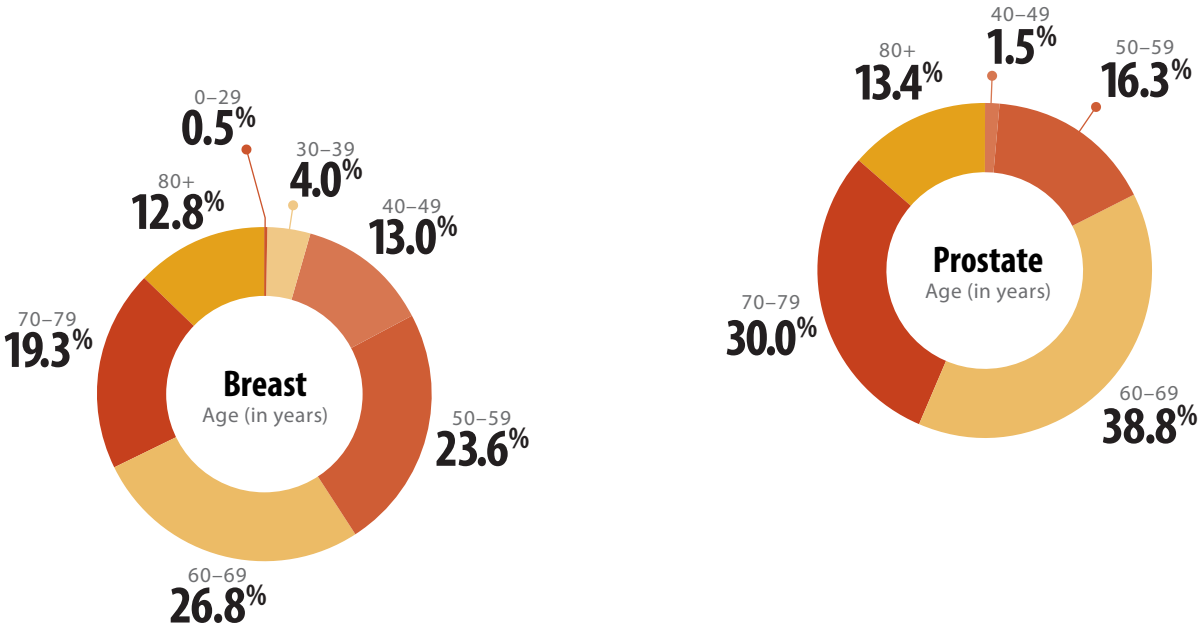
Number of new cases of cancer projected to occur in 2016

Figure 2.5 **Estimated incidence counts and age-specific rates, all cancers combined, by age group, Ontario, 2016**



Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Figure 2.6 **Estimated distribution of most common cancers, by age group, Ontario, 2016**



Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

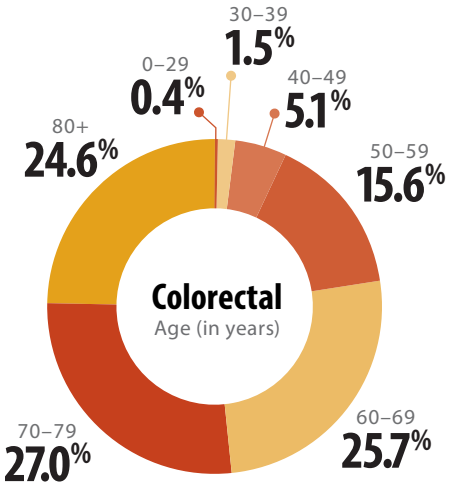
Incidence by age group

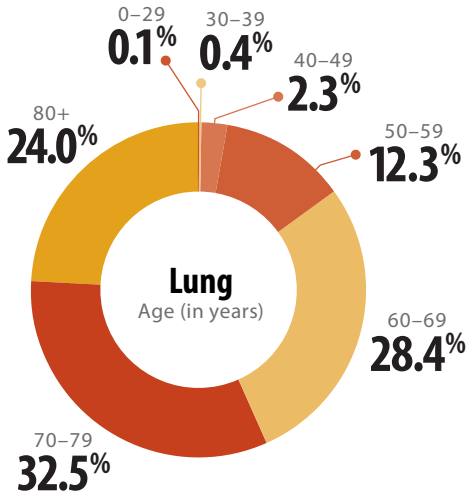
Over the past three decades, the incidence of cancer in Ontario has generally increased in every age group (**Table 2.2**). In 2016, the highest number of cases are projected to occur in people 60 years of age and older and the lowest number in children 0 to 14 years of age.

Cancer primarily affects Ontarians over the age of 50. In 2016, 88.4% of all new cases will be diagnosed in people in this age group (**Figure 2.5**). Incidence by age group is projected as follows:

- 19.2% of all new cases will occur in people 80 years of age or older.
- 24.9% of all new cases will occur in people 70 to 79 years of age.
- 27.1% of all new cases will occur in people 60 to 69 years of age.
- 17.2% of all new cases will occur in people 50 to 59 years of age.
- 9.6% of all new cases will occur in people between 30 and 49 years of age.
- Less than 3% of all new cases will occur in people under the age of 30.

In 2016, the greatest proportion of new cases of female breast and prostate cancers are projected to occur in people 60 to 69 years of age. This age group will account for 26.8% of all new cases of female breast cancer and 38.8% of all new cases of prostate cancer (**Figure 2.6**). Lung and colorectal cancer incidence rates will peak in people 70 to 79 years of age, with 32.5% of all new lung cancer cases and 27.0% of all new colorectal cancer cases occurring in this age group. More than half of all new lung and colorectal cancer cases will be in people 70 years of age and older.





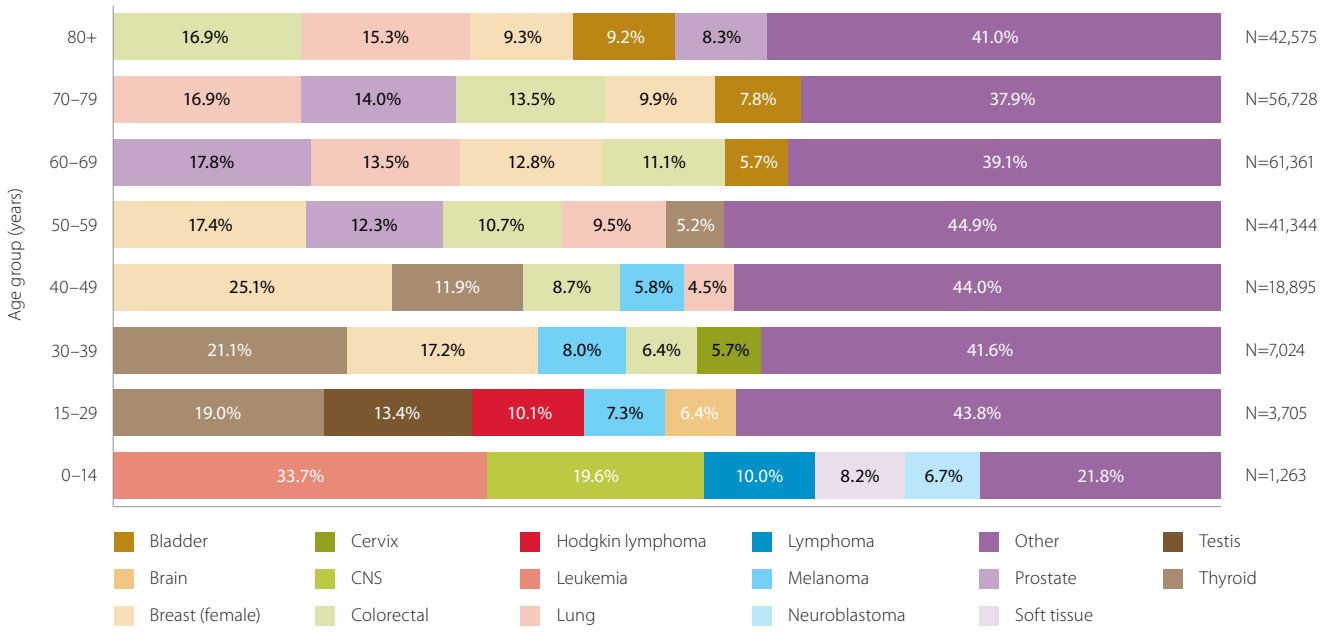
Cancer type distribution by age group

In 2012, the median age at cancer diagnosis was 66 years. The median age at diagnosis was higher for males (68 years) than females (65 years) (see **Table DA.3** in the *Data appendix*). Bladder cancer had the highest median age of diagnosis among males (74 years) and females (76 years). The lowest median age at diagnosis was for testicular cancer (33 years) among males and Hodgkin lymphoma (34 years) among females.

Between 2010 and 2012, the most common childhood cancers were leukemia (33.7%) and central nervous system (CNS) cancers. These cancer types accounted for more than half of all the cancers in children 0 to 14 years of age (**Figure 2.7**). Lymphomas, soft tissue cancers and neuroblastomas were also among the more common childhood cancers. The most common cancers in adolescents and young adults (15 to 29 years of age) were thyroid cancer (19.0%), followed by testicular cancer, Hodgkin lymphoma, melanoma and brain cancer.

Thyroid and female breast were the two most commonly diagnosed cancers among people 30 to 49 years of age, representing more than one-third of all the cancers in these age groups. Among people 50 to 59 years of age, female breast (17.4%) and prostate (12.3%) were the most common cancers. Prostate cancer (17.8%) was also the most commonly diagnosed cancer among those 60 to 69 years of age, followed by lung cancer (13.5%). For people 80 years of age and older, the most commonly diagnosed cancers were colorectal (16.9%) and lung (15.3%).

Figure 2.7 **Distribution of cancer incidence, by age group and cancer type, Ontario, 2010–2012**



Note: CNS=Central nervous system
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Incidence trends over time

Between 1981 and 2012 there were two periods of significant increase in the ASIR for all cancers combined (**Table 2.3**):

- Between 1981 and 1991 the incidence rate increased by 0.8% per year.
- Between 1991 and 2012 it increased by 0.2% per year.

PROSTATE CANCER

The prostate cancer ASIR rose by 1.0% per year between 1992 and 2007, and then fell by 4.9% per year between 2007 and 2012. A peak in the incidence rate in 1993 coincided with the introduction of prostate-specific antigen (PSA) testing in 1988. An abrupt rise and fall in the incidence rate is common when a new method of early diagnosis is introduced.

There was also a large drop in the prostate cancer incidence rate between 2011 and 2012. This decline in incidence was likely due to recommendations from the U.S. Preventative Services Task Force against using PSA for screening healthy men.

FEMALE BREAST CANCER

The ASIR for breast cancer increased by 2.0% per year during the 1980s and early 1990s. This increase in the incidence rate was likely due to a rise in both opportunistic and then programmatic mammography screening through the Ontario Breast Screening Program (OBSP). The OBSP began in 1990 and resulted in increased detection of breast cancer.

Between 1992 and 2012 the incidence rate for breast cancer in women in Ontario decreased. The substantial decrease in the incidence rate that occurred around 2002 coincides with a reduction in use of hormone replacement therapy (HRT), which is associated with an increased risk of breast cancer, among post-menopausal women.[1,2]

COLORECTAL CANCER

The ASIR for colorectal cancer for both sexes combined fell by 0.4% per year between 1981 and 2012.

Among females, the changes in the colorectal cancer incidence rate were complex. The rate fell by 1.2% per year through 1996, was stable between 1996 and 1999, and fell again after 1999 (0.6% annually). These incidence rate fluctuations reflect an increase in rectal cancer between 1996 and 1999 and a steady decrease in colon cancer between 1981 and 2012 in females (data not shown).

In males, the colorectal cancer incidence rate declined steadily from the early 1980s by 0.3% per year. Individually, incidence rates for both colon and rectal cancers also declined during this period (data not shown).

Prostate cancer incidence fell by 4.9% between 2007 and 2012

Breast cancer incidence fell by 0.2% per year between 1992 and 2012

Colorectal cancer incidence fell by 0.4% per year 1981 and 2012

LUNG CANCER

In males, the ASIR for lung cancer decreased by 2.1% per year between 1989 and 2008, and then stabilized. In females, the incidence rate has been increasing since the 1980s, but the upward trend has been slowing. The female rate increased by 6.4% per year from 1981 to 1985, by 2.1% per year from 1985 to 1996, and then by 0.8% per year from 1996 to 2012.

The long-term decline in the lung cancer incidence rate in males and the slowing increase in the incidence rate in females over the last two decades reflects differences in historical smoking rates between the sexes.[3] Tobacco use is the primary cause of lung cancer, but other causes include exposure to radon, asbestos, environmental tobacco smoke and air pollution.

OTHER CANCERS

The following are noteworthy changes in incidence rates that occurred between 1981 and 2012 for cancers other than the most common types.

The ASIR for thyroid cancer increased significantly throughout the time period. The greatest increase occurred between 1998 and 2002: the ASIR increased by 12.9% per year during this period. It continued to increase, albeit at a slower pace of 6.8% per year between 2002 and 2012. This increase in the incidence rate has been attributed to improved diagnostic technology which may have allowed for detection of subclinical tumours.[4,5]

The myeloma incidence rate increased by 6.6% per year between 2008 and 2012. This increase was driven mainly by the increased ASIR in males, which went up by 6.0% per year between 2007 and 2012. The rate for females increased by 0.4% per year between 1981 and 2012. Increasing trends in other jurisdictions suggest that the rise in myeloma rates may be due to improvements in diagnostics and better case ascertainment.[6]

Changes in incidence rates between 1981 and 2012 for other cancer types are provided in **Table 2.3**.

Ten-year trends

Over the most recent 10-year period of 2003 to 2012 (**Figure 2.8**), the average annual percent change (AAPC) in ASIR for males:

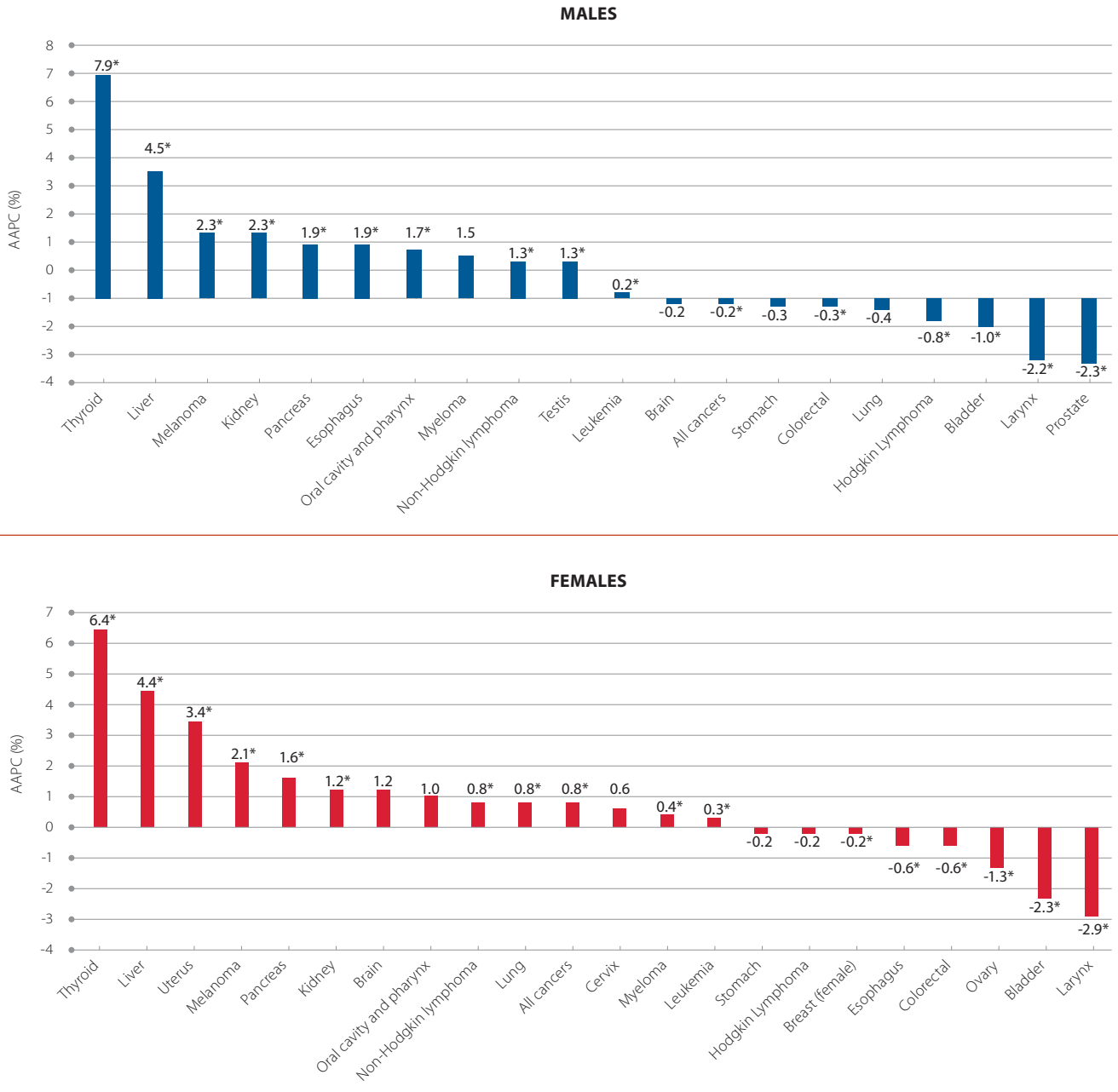
- decreased most for prostate (2.3% per year), laryngeal (2.2%) and bladder (1.0%) cancers;
- increased most for thyroid (7.9%) and liver (4.5%) cancers and melanoma (2.3%); and
- was stable for lung, stomach and brain cancers and myeloma.

Over the most recent 10-year period of 2003 to 2012 (**Figure 2.8**), the AAPC in ASIR for females:

- decreased most for laryngeal (2.9% per year), bladder (2.3%) and ovarian (1.3%) cancers;
- increased most for thyroid (6.4%), liver (4.4%) and uterine (3.4%) cancers; and
- was stable for oral cavity and pharynx, brain, cervical and stomach cancers and Hodgkin lymphoma.

Thyroid cancer incidence increased by 6.8% per year between 2002 and 2012

Average annual percent change (AAPC) in age-standardized incidence rates, by cancer type and sex, Ontario, 2003–2012



*Statistically significant AAPC
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Incidence by stage at diagnosis

Stage is defined as the classification of people with cancer into prognostically similar groups according to the extent of the disease. Stage at diagnosis is the extent of the disease at the time of initial diagnosis. Knowing the stage of the disease helps physicians plan appropriate treatment and determine the likely outcome or course of the disease. A cancer diagnosed at an early stage is more likely to be treated successfully. If the cancer has spread, treatment becomes more difficult and a person's chances of survival are generally much lower.

Information about stage at diagnosis is one of the most important prognostic factors for cancer. High-quality stage data at the population level supports healthcare providers, administrators, researchers and decision-makers in planning, evaluation, and efforts to enhance quality of care and improve treatment outcomes.

Currently, Ontario data on stage at diagnosis is available for five cancers — female breast, prostate, colorectal, lung and cervix. Between 2010 and 2012, 95,143 new cases of these cancers were staged in the OCR. Of these new cancer cases, 28.8% were diagnosed at stage I, 31.9% at stage II, 18.7% at stage III and 20.6% at stage IV.

STAGE DISTRIBUTION BY AGE GROUP

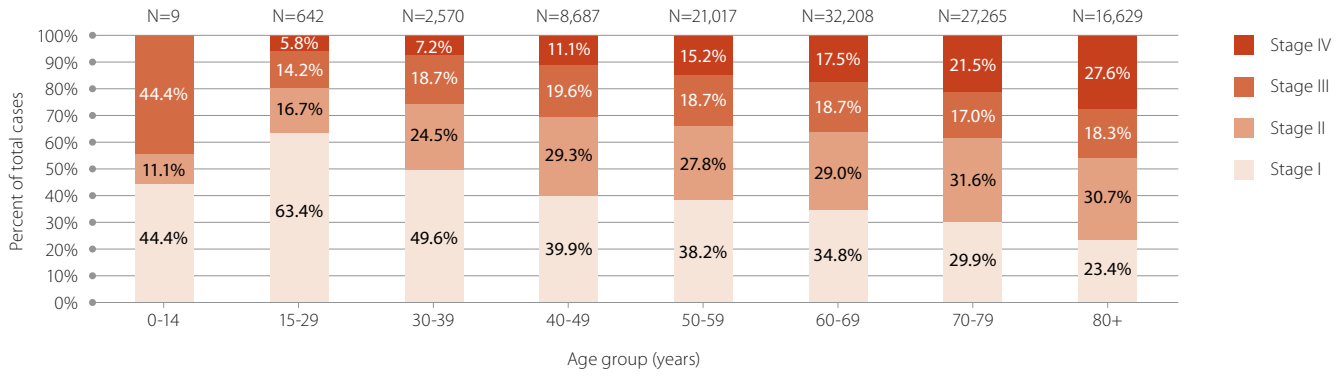
Between 2010 and 2012 the majority of new cancer cases were diagnosed at stage I or II in every age group (**Figure 2.9**). The greatest proportion of staged cancers in those aged 69 and younger were diagnosed at stage I. The proportion of cancers diagnosed at stage IV increased with age.

STAGE BY CANCER TYPE

Of the staged cancers (prostate, female breast, colorectal, lung and cervix) in 2012, lung cancer cases were the most likely to be diagnosed at stage IV. Stage IV cancers accounted for 49.4% of all staged lung cancer cases (**Table 2.4**).

The majority of colorectal cancer cases that were staged were diagnosed at stage II (26.2%) or stage III (31.4%). For breast, prostate and cervical cancers, the highest proportion of cases were stage I or II. This could be the result of organized and opportunistic screening, which may have increased detection of these cancers at early stages.

Figure 2.9 **Stage distribution of new cases, by age group, Ontario, 2010–2012**



Note: Excludes 1,609 cases of unknown stage. Figure represents stage distribution for five cancers – female breast, prostate, colorectal, lung and cervix
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Incidence by geography

Geographic factors, such as the following, can affect incidence rates:

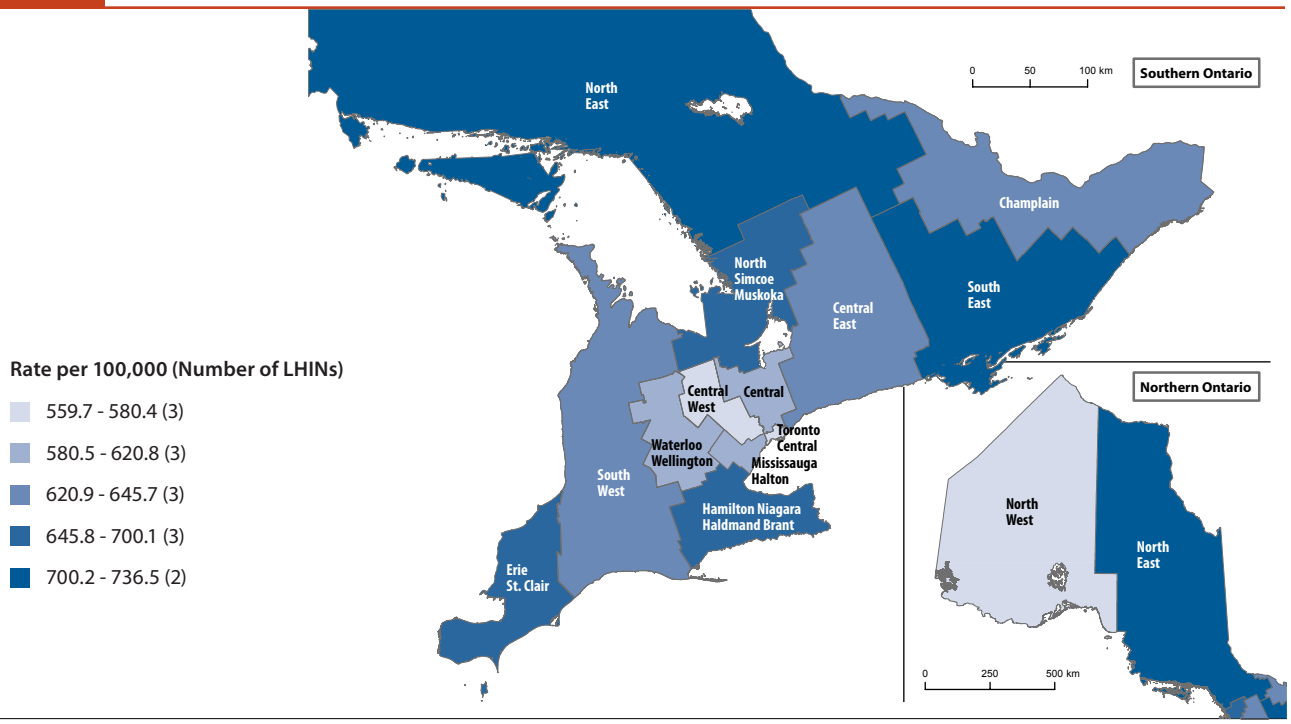
- the prevalence of risk factors
- the demographic makeup
- regional differences in diagnostic and treatment practices.

The province of Ontario can be broken down into a number of different geographic regions. Two methods to partition the province are by Local Health Integration Networks (LHINs) and Public Health Units (PHUs), which are considered here. Incidence rates by geography are presented for all cancers combined.

Among males (**Figure 2.10** and **Table DA.5** in the *Data appendix*):

- The LHINs with the lowest ASIR were in the south-central region of Ontario, which includes the Toronto area. The ASIR in the Central, the Central West, the Mississauga Halton and the Toronto Central LHINs were all significantly lower than the Ontario ASIR. The North West LHIN also had one of the lowest incidence rates.
- The North East and the South East LHINs had the highest male ASIR, both of which were significantly higher than the Ontario ASIR. Additionally, the incidence rates recorded at the Erie St. Clair and the North Simcoe Muskoka LHINs were significantly higher than the Ontario average rate.
- The rates varied substantially across the northern Ontario LHINs.

Figure 2.10 **Age-standardized incidence rates, males, by LHIN,† Ontario, 2012**



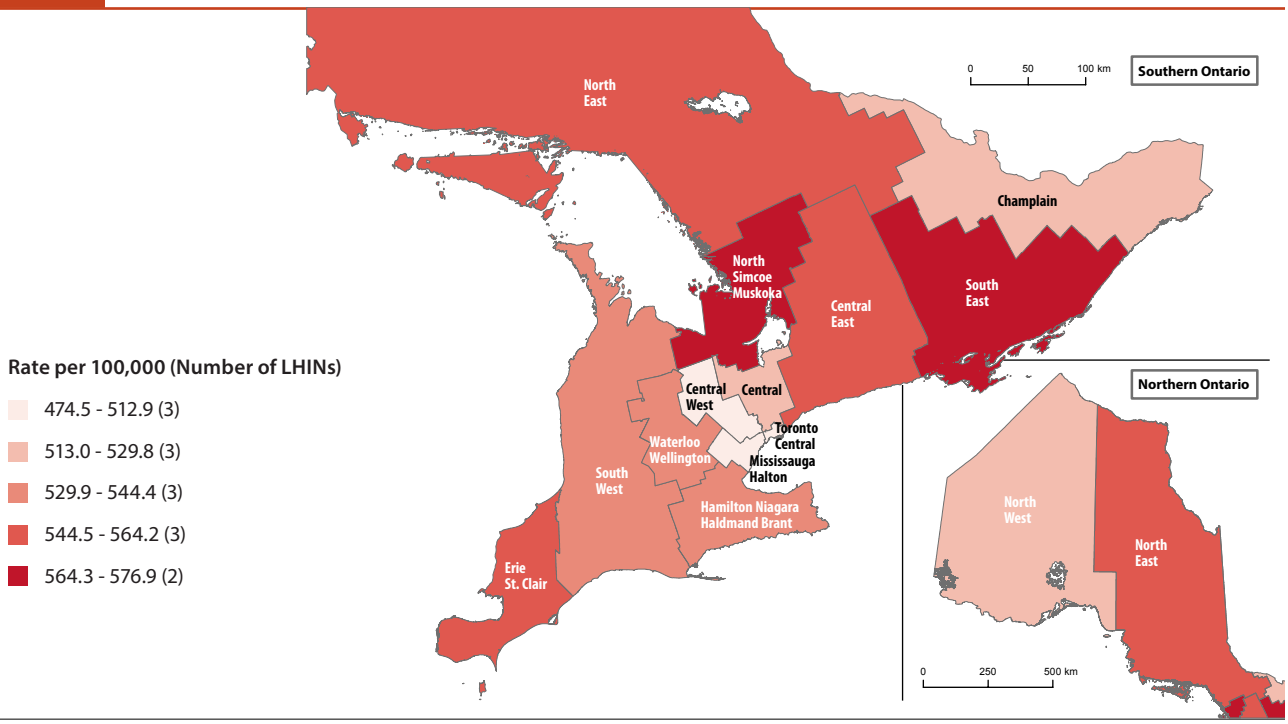
†LHIN=Local Health Integration Network
Note: Rates standardized to the 2011 Canadian population
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Among females (**Figure 2.11** and **Table DA.6** in the Data appendix):

- Similar to the incidence rates among males, the LHINs with the lowest ASIR among females were in the south-central region of Ontario, which is made up of the Central, the Central West, the Mississauga Halton and the Toronto Central LHINs. All of these LHINs recorded significantly lower rates than the Ontario ASIR.
- The North Simcoe Muskoka and the South East LHINs recorded the highest ASIR among females. However, only the South East LHIN had a rate significantly higher than the Ontario ASIR.

LHINs with the lowest ASIR among both males and females were in the south-central region of Ontario.

Figure 2.11 **Age-standardized incidence rates, females, by LHIN,† Ontario, 2012**

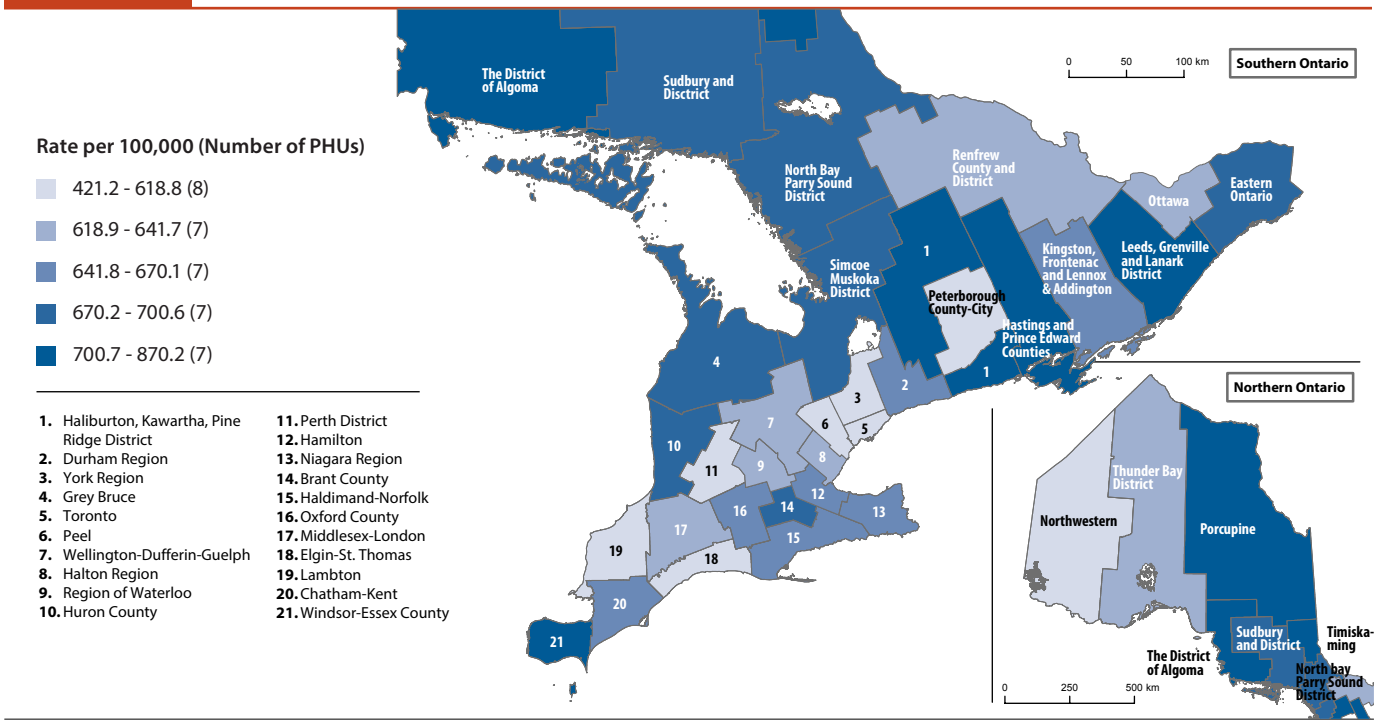


†LHIN=Local Health Integration Network
Note: Rates standardized to the 2011 Canadian population
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

The additional granularity of the PHUs provides further details for the patterns observed by the LHINs. For example, among males (**Figure 2.12** and **Table DA.7** in the *Data appendix*):

- The lowest ASIR occurred in the Northwestern, Peel, Toronto and York Region PHUs, which all had significantly lower incidence rates than the Ontario ASIR. Incidence rates within the remaining southern Ontario PHUs were not significantly lower than the Ontario ASIR and were geographically dispersed.
- The highest ASIR were observed within nine PHUs located throughout the province: Timiskaming; the District of Algoma; Hastings and Prince Edward Counties; Haliburton, Kawartha, Pine Ridge District; Porcupine; Leeds, Grenville and Lanark District; Sudbury and District; Windsor-Essex County; and Simcoe Muskoka. The rates in all these PHUs were significantly higher than the Ontario ASIR with the exception of Porcupine, which had a high variance in the ASIR because of its small population.
- There was an increasing west to east gradient in male ASIR across northern Ontario, giving additional detail to the disparate incidence rates evident by LHIN.

Figure 2.12 **Age-standardized incidence rates, males, by PHU,† Ontario, 2012**

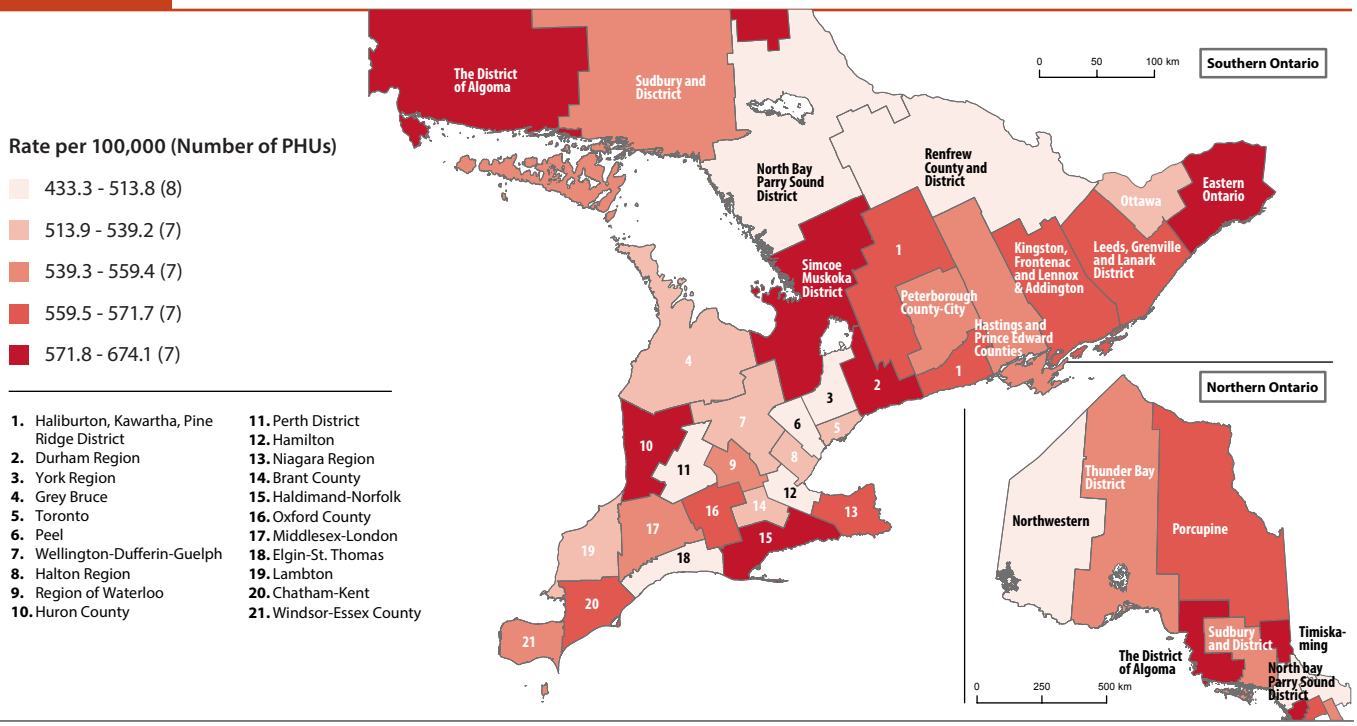


†PHU=Public Health Unit
Note: Rates standardized to the 2011 Canadian population
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Among females (**Figure 2.13** and **Table DA.8** in the *Data appendix*):

- The Northwestern, Peel, Toronto and York Region PHUs had significantly lower ASIR. (These same PHUs had lower incidence rates for males.) Other PHUs also had low rates (e.g., Perth District and Hamilton), but they were not significantly different from the Ontario ASIR.
- The female ASIR were significantly higher than the Ontario ASIR in three of the same PHUs that had higher incidence rates for males: District of Algoma, Simcoe Muskoka District and Timiskaming. However, incidence rates for females were also significantly higher within the Durham Region, Haldimand-Norfolk, Niagara Region and Eastern Ontario PHUs compared to the Ontario rate.
- High variability in female ASIR across northern Ontario was also evident by PHU. However, higher incidence rates among females were recorded in the Algoma and Timiskaming PHUs, rather than in the Porcupine PHU (which had high incidence rates for males).

Figure 2.13 **Age-standardized incidence rates, females, by PHU,† Ontario, 2012**



†PHU=Public Health Unit
Note: Rates standardized to the 2011 Canadian population
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

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Table 2.1 Cancer incidence counts and rates, by cancer type and sex, Ontario, 2012

Cancer type	Total				Males				Females			
	New cases	% of new cases	Crude rate (per 100,000)	ASIR† (per 100,000)	New cases	% of new cases	Crude rate (per 100,000)	ASIR (per 100,000)	New cases	% of new cases	Crude rate (per 100,000)	ASIR (per 100,000)
All cancers	**77,941**	**100.0%**	**581.2**	**578.1**	**39,337**	**100.0%**	**597.2**	**638.1**	**38,604**	**100.0%**	**565.8**	**537.0**
Bladder	4,696	6.0%	35.0	34.7	3,500	8.9%	53.1	58.2	1,196	3.1%	17.5	16.0
Brain	1,198	1.5%	8.9	8.9	660	1.7%	10.0	10.4	538	1.4%	7.9	7.6
Breast (female)	10,283	13.2%	150.7	145.1	—	—	—	—	10,283	26.6%	150.7	145.1
Cervix	621	0.8%	9.1	9.0	—	—	—	—	621	1.6%	9.1	9.0
Colorectal	9,172	11.8%	68.4	67.9	4,897	12.4%	74.3	80.2	4,275	11.1%	62.7	57.7
Esophagus	840	1.1%	6.3	6.2	646	1.6%	9.8	10.5	194	0.5%	2.8	2.6
Hodgkin lymphoma	358	0.5%	2.7	2.7	203	0.5%	3.1	3.1	155	0.4%	2.3	2.3
Kidney	2,079	2.7%	15.5	15.4	1,316	3.3%	20.0	20.9	763	2.0%	11.2	10.7
Larynx	405	0.5%	3.0	3.0	341	0.9%	5.2	5.5	64	0.2%	0.9	0.9
Leukemia	2,311	3.0%	17.2	17.1	1,351	3.4%	20.5	22.1	960	2.5%	14.1	13.1
Liver	1,104	1.4%	8.2	8.2	759	1.9%	11.5	12.3	345	0.9%	5.1	4.7
Lung	10,072	12.9%	75.1	74.5	5,223	13.3%	79.3	86.1	4,849	12.6%	71.1	66.3
Melanoma	3,074	3.9%	22.9	22.8	1,732	4.4%	26.3	28.1	1,342	3.5%	19.7	18.8
Myeloma	1,222	1.6%	9.1	9.0	691	1.8%	10.5	11.4	531	1.4%	7.8	7.1
Non-Hodgkin lymphoma	3,726	4.8%	27.8	27.6	2,087	5.3%	31.7	33.7	1,639	4.2%	24.0	22.6
Oral cavity and pharynx	1,912	2.5%	14.3	14.2	1,313	3.3%	19.9	20.8	599	1.6%	8.8	8.2
Ovary	1,157	1.5%	17.0	16.3	—	—	—	—	1,157	3.0%	17.0	16.3
Pancreas	1,862	2.4%	13.9	13.8	931	2.4%	14.1	15.1	931	2.4%	13.6	12.5
Prostate	8,500	10.9%	129.0	136.2	8,500	21.6%	129.0	136.2	—	—	—	—
Stomach	1,478	1.9%	11.0	10.9	927	2.4%	14.1	15.1	551	1.4%	8.1	7.4
Testis	429	0.6%	6.5	6.5	429	1.1%	6.5	6.5	—	—	—	—
Thyroid	3,282	4.2%	24.5	24.6	770	2.0%	11.7	11.9	2,512	6.5%	36.8	36.8
Uterus	2,527	3.2%	37.0	35.9	—	—	—	—	2,527	6.5%	37.0	35.9

†ASIR=Age-standardized incidence rate
Note: Rates standardized to the 2011 Canadian population
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Table 2.2 **Incidence counts and age-specific rates, all cancers combined, by age group, Ontario, 1986, 1996, 2006, 2016**

	Year							
	1986		1996		2006		2016 (estimates)	
Age group	New cases	Age-specific rate (per 100,000)	New cases	Age-specific rate (per 100,000)	New cases	Age-specific rate (per 100,000)	New cases	Age-specific rate (per 100,000)
0–14	327	17.1	323	14.3	339	15.4	395	17.9
15–29	846	33.4	821	35.4	1,065	42.0	1,227	44.0
30–39	1,484	96.0	1,967	100.2	2,072	113.6	2,297	124.8
40–49	2,772	260.5	4,118	255.4	5,506	266.2	5,425	292.7
50–59	5,695	600.7	6,772	614.8	11,386	681.2	13,732	649.8
60–69	9,381	1,206.0	12,221	1,346.7	15,109	1,418.8	21,319	1,306.4
70–79	9,207	2,001.1	13,226	2,112.3	15,658	2,111.7	19,290	2,052.9
80+	4,938	2,396.6	6,895	2,336.4	10,092	2,293.0	14,867	2,434.6

Notes: New cases and rates are calculated based on IARC rules to compare over time
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Table 2.3 **Annual percent change (APC) in age-standardized incidence rates, by cancer type and sex, 1981–2012**

Cancer type	Both Sexes			Males			Females		
	Period	APC		Period	APC		Period	APC	
All cancers	**1981–1991**	**0.8**	↑	**1981–1992**	**0.9**	↑	**1981–2008**	**0.4**	↑
	1991–2012	**0.2**	↑	**1992–2012**	**-0.2**	↓	**2008–2012**	**1.2**	↑
Bladder†	1989–2012	-0.9	↓	1989–2012	-1.0	↓	1989–2003	-0.4	
							2003–2012	-2.3	↓
Brain	1981–2006	-0.5	↓	1981–2012	-0.2		1981–2008	-0.5	↓
	2006–2012	1.6					2008–2012	3.5	
Breast (female)							1981–1992	2.0	↑
							1992–2012	-0.2	↓
Cervix							1981–2006	-2.1	↓
							2006–2012	2.0	
Colorectal	1981–2012	-0.4	↓	1981–2012	-0.3	↓	1981–1996	-1.2	↓
							1996–1999	1.3	
							1999–2012	-0.6	↓
Esophagus	1981–2007	0.1		1981–2006	0.4	↑	1981–2012	-0.6	↓
	2007–2012	2.7	↑	2006–2012	2.7	↑			
Hodgkin lymphoma	1981–2012	-0.5	↓	1981–2012	-0.8	↓	1981–2012	-0.2	
Kidney	1981–1989	5.2	↑	1981–1989	4.6	↑	1981–1985	11.4	↑
	1989–1997	-0.4		1989–2001	0.0		1985–2012	1.2	↑
	1997–2012	1.8	↑	2001–2012	2.3	↑			
Larynx	1981–2012	-2.2	↓	1981–2012	-2.2	↓	1981–1988	3.2	
							1988–2012	-2.9	↓
Leukemia	1981–2012	0.3	↑	1981–2012	0.2	↑	1981–2012	0.3	↑
Liver	1981–2012	4.5	↑	1981–2012	4.5	↑	1981–2012	4.4	↑
Lung	1981–1989	1.2	↑	1981–1989	-0.1		1981–1985	6.4	↑
	1989–2008	-0.8	↓	1989–2008	-2.1	↓	1985–1996	2.1	↑
	2008–2012	1.9	↑	2008–2012	1.8		1996–2012	0.8	↑

†Bladder cancer trend begins at 1989 due to classification changes and excludes carcinomas in situ
Notes: Statistically significant changes in trend and their direction are indicated by corresponding arrows.
Rates standardized to the 2011 Canadian population
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Table 2.3 *(Cont'd)* **Annual percent change (APC) in age-standardized incidence rates, by cancer type and sex, 1981–2012**

Cancer type	Both Sexes			Males			Females		
	Period	APC		Period	APC		Period	APC	
Melanoma	1981–1987	5.2	↑	1981–1988	5.7	↑	1981–1987	4.1	↑
	1987–1992	-1.4		1988–1992	-1.4		1987–1992	-2.5	
	1992–2012	2.2	↑	1992–2012	2.3	↑	1992–2012	2.1	↑
Myeloma	1981–2004	0.7	↑	1981–2004	0.6	↑	1981–2012	0.4	↑
	2004–2008	-3.1		2004–2007	-5.2				
	2008–2012	6.6	↑	2007–2012	6.0	↑			
Non-Hodgkin lymphoma	1981–1994	2.1	↑	1981–1990	2.6	↑	1981–1997	1.9	↑
	1994–2012	1.1	↑	1990–2012	1.3	↑	1997–2012	0.8	↑
Oral cavity and pharynx	1981–2003	-1.5	↓	1981–2003	-2.0	↓	1981–2003	-0.8	↓
	2003–2012	1.5	↑	2003–2012	1.7	↑	2003–2012	1.0	
Ovary							1981–2002	0.3	↑
							2002–2012	-1.3	↓
Pancreas	1981–2006	-0.7	↓	1981–2004	-1.3	↓	1981–2006	-0.3	↓
	2006–2012	3.0	↑	2004–2012	2.3	↑	2006–2012	2.6	↑
Prostate				1981–1989	2.1				
				1989–1992	10.9				
				1992–2007	1.0	↑			
				2007–2012	-4.9	↓			
Stomach	1981–2007	-1.9	↓	1981–2008	-1.9	↓	1981–1998	-2.9	↓
	2007–2012	1.6		2008–2012	1.8		1998–2012	-0.2	
Testis				1981–2012	1.3	↑			
Thyroid	1981–1998	4.7	↑	1981–1998	4.3	↑	1981–1998	4.9	↑
	1998–2002	12.9	↑	1998–2012	7.9	↑	1998–2002	14.6	↑
	2002–2012	6.8	↑				2002–2012	6.4	↑
Uterus							1981–1989	-2.4	↓
							1989–2006	0.6	↑
							2006–2012	4.8	↑

†Bladder cancer trend begins at 1989 due to classification changes and excludes carcinomas in situ
Notes: Statistically significant changes in trend and their direction are indicated by corresponding arrows.
Rates standardized to the 2011 Canadian population
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Table 2.4 Distribution of new cases and age-standardized rates, by stage, Ontario, 2012

Cancer type	Stage I		Stage II		Stage III		Stage IV	
	% of cases	Age-standardized rate (per 100,000)	% of cases	Age-standardized rate (per 100,000)	% of cases	Age-standardized rate (per 100,000)	% of cases	Age-standardized rate (per 100,000)
Breast (female)	43.5	29.3	37.5	25.3	13.9	9.4	5.1	3.4
Cervix[†]	57.6	4.5	15.0	1.2	15.2	1.2	12.2	1.0
Colorectal	23.5	11.9	26.2	13.3	31.4	16.0	18.9	9.6
Lung	20.5	11.7	9.0	5.1	21.1	12.0	49.4	28.1
Prostate	23.8	26.7	53.7	61.2	13.8	15.3	8.7	10.4

[†]Due to the low number of cases of cervix cancer, the results provided are based on the combined data for 2011 and 2012.
Note: Stage 0 (in situ) cases: lung n=34; colorectal n=451, breast n=1,617; prostate n=923; cervix=6,253
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: Ontario Cancer Registry (November 2015), CCO

IN FOCUS

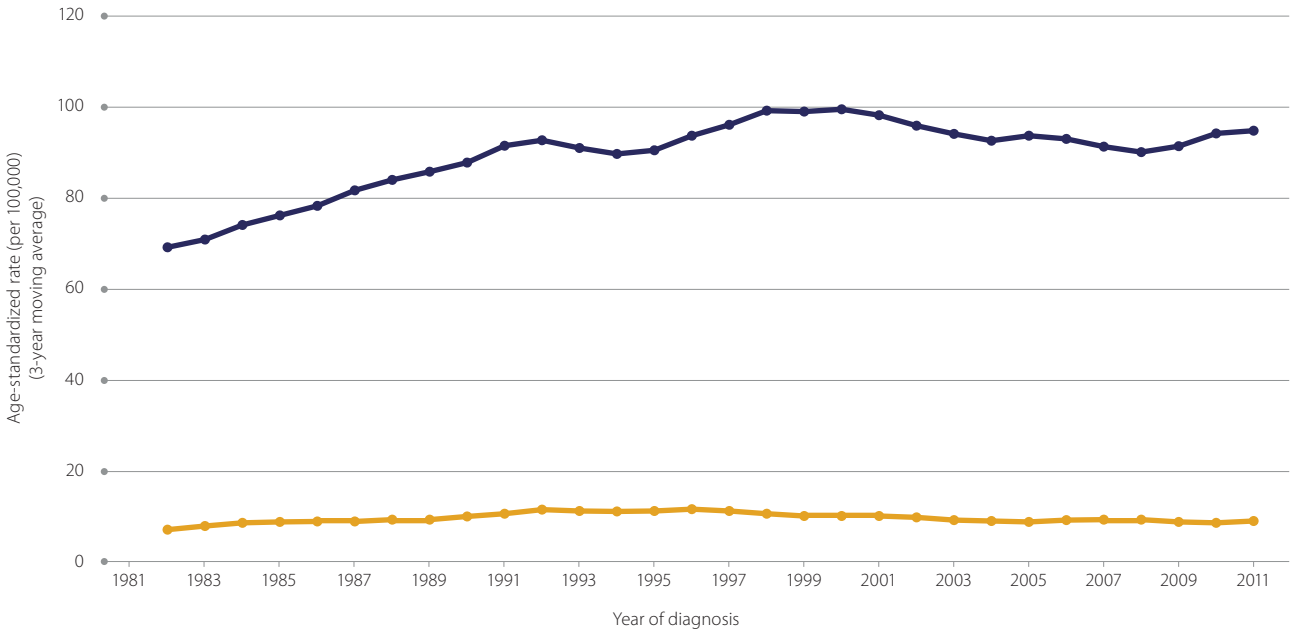
Breast cancer

Ductal carcinoma incidence is increasing

Female breast cancer is a heterogeneous disease with distinct types that have different prognoses and treatment options. Ductal carcinoma (either invasive or in situ) is the most common type of adenocarcinoma of the breast, making up 70% to 80% of all breast cancers. About 5% to 10% of all breast cancers are lobular carcinomas.

Between 1981 and 2012, the incidence rates of both ductal carcinoma and lobular carcinoma increased significantly in Ontario. The largest increases for both types occurred roughly during the first decade of this period (**Figure A.1**).

Figure A.1 **Age-standardized incidence rates, female breast cancer, by type, Ontario, 1981–2012**



Ductal carcinoma	
Year	APC
1981–1988	3.5*
1988–1999	1.4*
1999–2008	-1.1
2008–2012	1.4

Lobular carcinoma	
Year	APC
1981–1992	4.5*
1992–2012	-1.3

*Statistically significant
Note: Ductal carcinoma (ICD-O-3: C50, histology:8500 (invasive and in situ)); lobular carcinoma (ICD-O-3: C50, histology:8520)
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

The luminal A molecular subtype is the most common breast cancer in Ontario

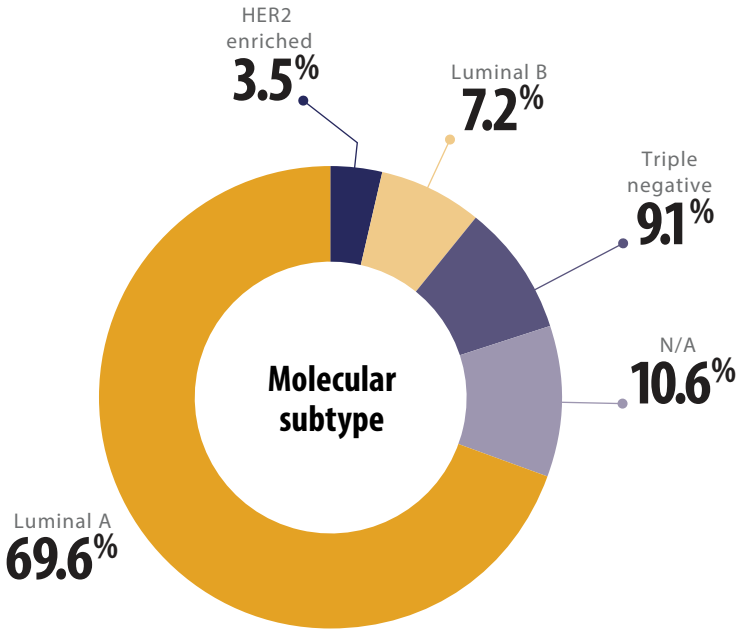
The prevalence of biomarkers can inform treatment and be used as a prognostic measure. Overexpression of the human epidermal growth factor receptor 2 (HER2) plays an important role in the development and progression of certain aggressive types of breast cancer. The presence of estrogen receptors (ERs) and progesterone receptors (PRs) in breast cancer cells also determines the preferred treatment approach.[1] Combinations of these receptors make up the major molecular subtypes of breast cancer, which are referred to as luminal A, luminal B, HER2 enriched and triple negative.

Consistent with most other jurisdictions,[1] luminal A was the most common molecular subtype among new cases in Ontario between 2010 and 2012, followed by the triple negative subtype (**Figure A.2**). In the future, having long-term population-level trend data on receptor status, especially if stratified by individual characteristics, will be important for monitoring clinical outcomes in women diagnosed with different molecular subtypes of breast cancer.[1]

REFERENCES

1. Howlader N, Altekruse SF, Li CI, Chen VW, Clarke CA, Ries LA, et al. U.S. incidence of breast cancer subtypes defined by joint hormone receptor and HER2 status. J Natl Cancer Inst. 2014; 106(5).

Figure A.2 **Distribution of new cases, female breast cancer, by molecular subtype, Ontario, 2010–2012**



Note: Luminal A=ER+/PR+/HER2-; ER+/PR-/HER2-; ER-/PR+/HER2-; Luminal B=ER+/PR+/HER2+; ER+/PR-/HER2+; ER-/PR+/HER2+; HER2 Enriched= ER-/PR-/HER2+; Triple negative= ER-/PR-/HER2-; N/A=Other than above, including "unknown," "N/A," "borderline," "blank" and "test ordered but not done", Case counts: n =14,039
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: Ontario Cancer Registry (November 2015), CCO

29,288 **expected cancer deaths in 2016, nearly double the number of deaths in 1981**

3

Mortality

While the number of cancer deaths in Ontario (mortality count) has increased annually since at least 1981, the mortality rate has declined.

In general, cancer mortality is affected by:

- the incidence of cancer;
- socio-demographic factors;
- the extent of early detection for cancer; and
- the availability of and access to effective treatment for cancer.

Mortality counts and rates

In 2012, there were 27,442 cancer deaths in Ontario, resulting in an age-standardized mortality rate (ASMR) of 202.4 per 100,000 (**Table 3.1**). For both sexes combined, the highest ASMR were for lung (49.9 per 100,000), colorectal (22.9 per 100,000) and pancreatic (12.1 per 100,000) cancers.

The ASMR for all cancers was higher for males (243.7 per 100,000) than for females (173.5 per 100,000). Males had higher mortality rates than females for every type of cancer analyzed. Among males the highest ASMR were for lung, colorectal and prostate cancers. For females, the highest ASMR were for lung, breast and colorectal cancers.

While the most commonly diagnosed cancers (lung, colorectal, breast and prostate) were responsible for almost 50% of all cancer mortality in 2012, some of the less commonly diagnosed cancers made a relatively large contribution to mortality due to their poor prognosis and low survival rates. For example, pancreatic, stomach and brain cancers combined accounted for more than 11% of all cancer deaths in 2012.

Pancreatic, stomach and brain cancers combined accounted for more than 11% of all cancer deaths in 2012.

Although the number of cancer deaths has been increasing since 1981, the ASMR for all cancers decreased between 1981 and 2016 for both sexes combined and for males and females individually (**Figures 3.1, 3.2** and **3.3**).

Projected mortality for 2016 estimates that 29,288 deaths will be caused by cancer, resulting in an ASMR of 190.4 per 100,000 (data not shown). The ASMR is projected to be significantly higher for males (227.3 per 100,000) than for females (163.1 per 100,000), but lower for each sex compared to actual rates in 2012. These lower anticipated rates in 2016 are mainly due to expected decreases in prostate cancer mortality.

Distribution of deaths for selected cancers, 2012

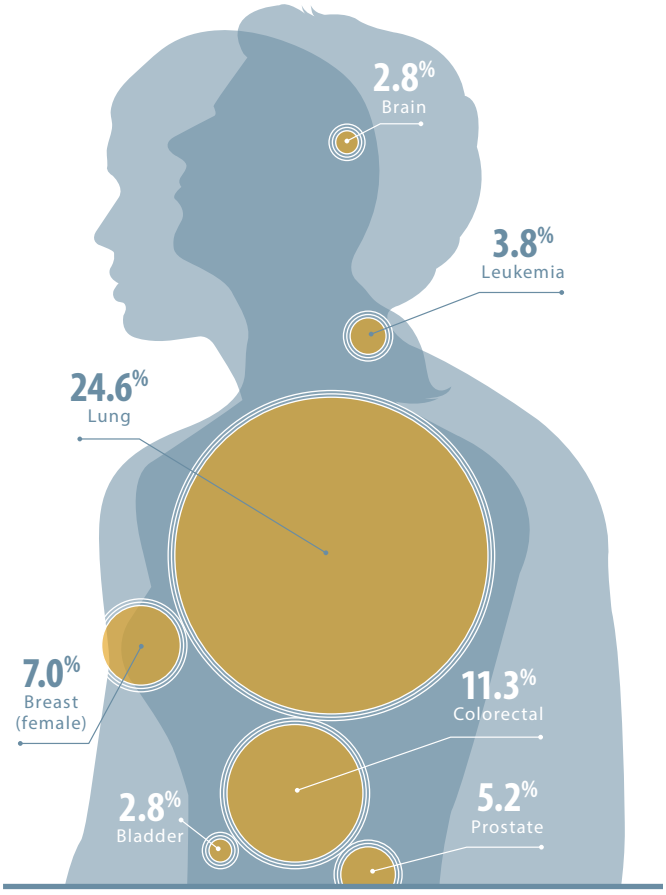


Figure 3.1 Mortality counts and age-standardized rates, all cancers combined, Ontario, 1981–2016

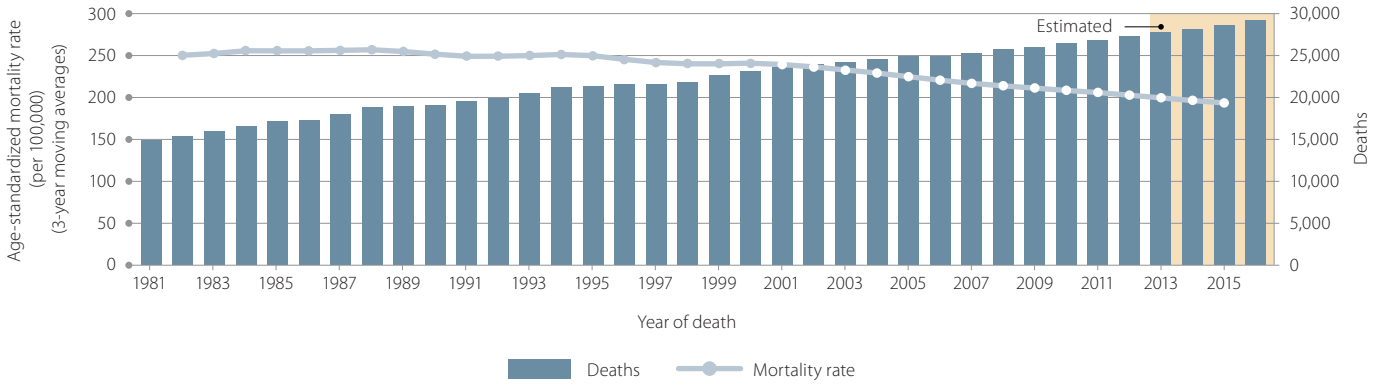


Figure 3.2 Mortality counts and age-standardized rates, all cancers combined, males, Ontario, 1981–2016

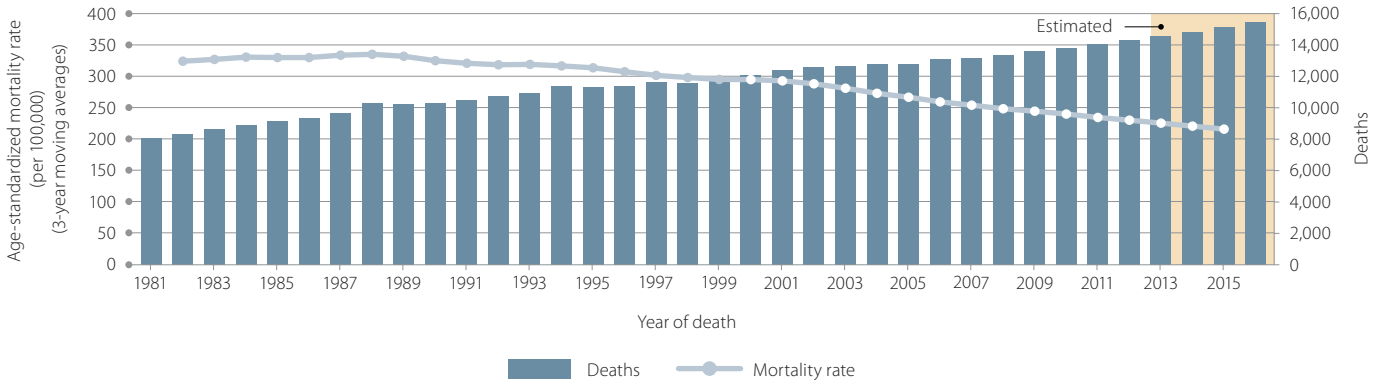
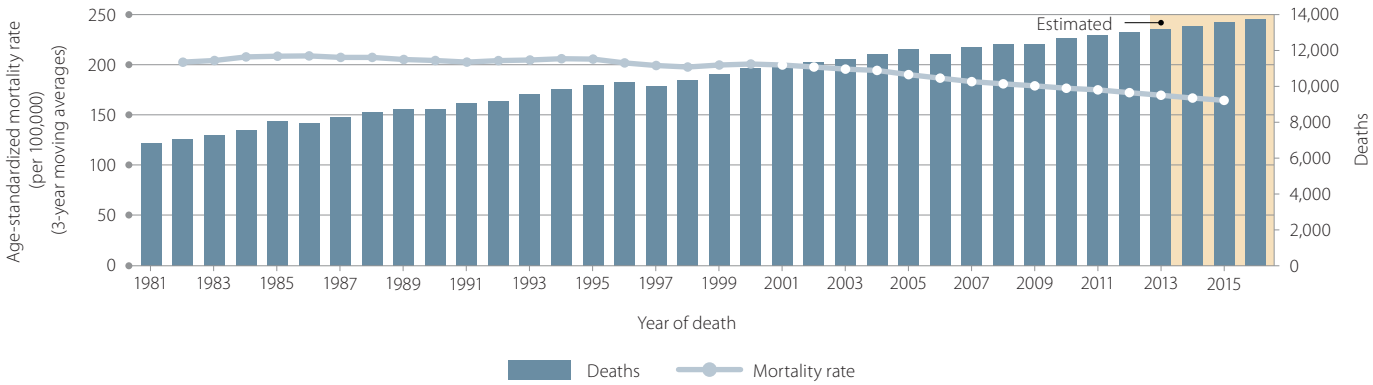


Figure 3.3 Mortality counts and age-standardized rates, all cancers combined, females, Ontario, 1981–2016



Note: Rates standardized to the 2011 Canadian population
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

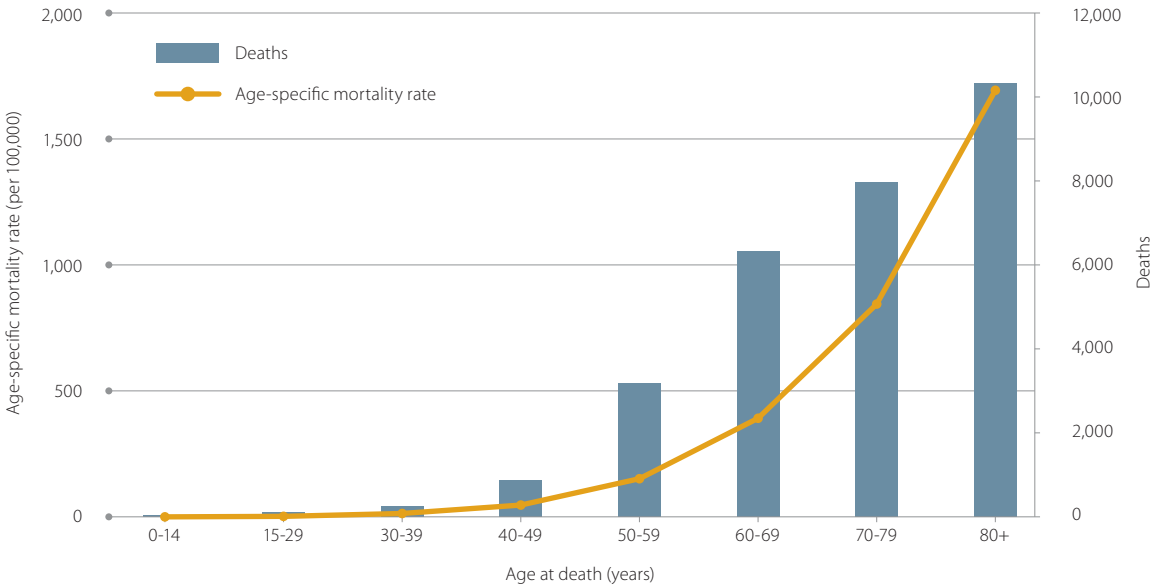
Mortality by age group

Mortality projections for the year 2016 estimate that more than 60% of all cancer deaths in Ontario will occur in people 70 years of age and older (**Figure 3.4**). Mortality by age group is projected as follows:

- 35.6% of all cancer deaths will occur in people 80 years of age or older.
- 27.4% of all cancer deaths will occur in people 70 to 79 years of age.
- 21.7% of all cancer deaths will occur in people 60 to 69 years of age.
- 10.9% of all cancer deaths will occur in people 50 to 59 years of age.
- 3.0% of all cancer deaths will occur in people 40 to 49 years of age.
- 1.4% of all cancer deaths will occur in people younger than 40 years of age.

Mortality projections for the year 2016 estimate that more than 60% of all cancer deaths in Ontario will occur in people 70 years of age and older.

Figure 3.4 **Estimated mortality counts and age-specific rates, all cancers combined, by age group, Ontario, 2016**



Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

The greatest proportion of female breast cancer deaths (31.9%) will occur among women 80 years of age and older (**Figure 3.5**). However, 2.2% of all breast cancer deaths will occur in females under the age of 40, meaning that, of the four most common cancers, breast cancer will cause the most mortality in younger people.

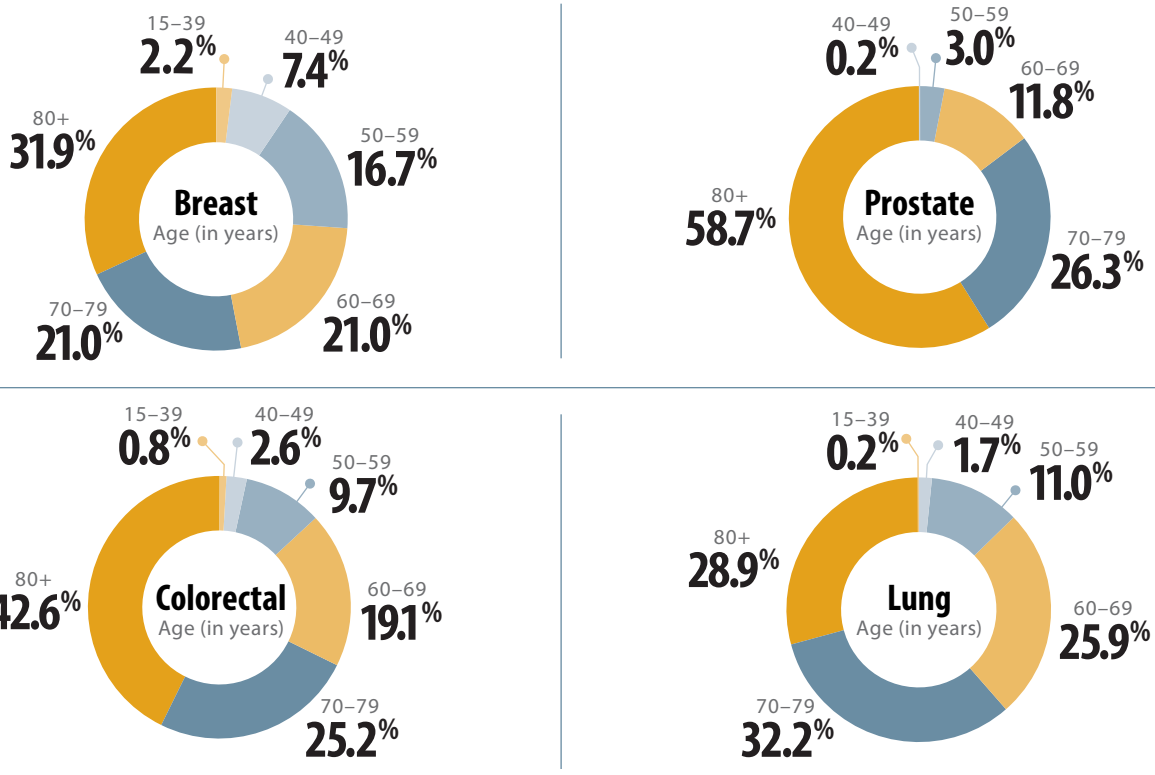
While prostate cancer will be diagnosed most frequently in males 65 to 74 years of age in 2016, most deaths from prostate cancer will occur in males 80 years and older. These mortality patterns reflect the often slow progression of the disease.

For many cancers the number of deaths increases with age. Deaths from lung cancer, however, will peak in people 70 to 79 years of age. This peak is a result of high incidence in this age group and poor overall survival for lung cancer.

The majority of cancer deaths due to colorectal cancer will occur in Ontarians 70 to 79 years of age (25.2%) and 80 years of age and older (42.6%). This reflects the large proportion of new colorectal cancer cases that occur in these particular age groups.

Between 1986 and 2016, the mortality rate for all cancers combined declined in people of all ages except those 80 years of age and older (**Table 3.2**). For those diagnosed at age 80 or older, the mortality rate remained fairly stable over this time period.

Figure 3.5 **Estimated mortality distribution for most common cancers, by age group, Ontario, 2016**



Note: There were no deaths from prostate cancer under the age of 40
Estimated number of deaths: breast n=1929; colorectal n=3342; lung n=7178; prostate n=1559
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Mortality trends over time

After a period of increase, the cancer mortality rate in Ontario has been decreasing in recent decades. Between 1981 and 1985, the ASMR increased by 1.1% per year. The rate then decreased by 0.5% per year between 1985 and 2001, and by 1.5% between 2001 and 2012 (**Table 3.3**).

PROSTATE CANCER

The prostate cancer ASMR increased between 1981 and 1994 by 1.6% per year and then decreased by 2.8% per year from 1994 to 2012. This decline in mortality is likely due to early detection and improved treatments.

Prostate cancer ASMR decreased 2.8% per year between 1994 to 2012

FEMALE BREAST CANCER

The breast cancer ASMR has been declining since the mid-1980s. From 1986 to 1995 it decreased by 1.1% per year, and the decrease accelerated to 2.5% per year from 1995 to 2012. This fall in the mortality rate is likely due to increased participation in mammography screening, especially after the introduction of the provincial organized screening program. In addition, improved treatment and the use of more effective therapies following breast cancer surgery likely also contributed to the improvement in the mortality rate.[1]

Breast cancer ASMR decreased 2.5% per year between 1995 to 2012

COLORECTAL CANCER

The colorectal cancer ASMR has continuously declined in both sexes since 1981. In males, the rate decreased by 1.2% per year from 1981 to 2003 and accelerated to 2.8% per year from 2003 to 2012. In females, the mortality rate has decreased by 1.9% per year since 1981. These strong declines are consistent with changes in risk factors and protective factors, earlier diagnosis due to greater uptake of screening and improvements in treatment.[2]

Colorectal cancer ASMR in males decreased 2.8% per year between 2003 to 2012

Lung cancer ASMR decreased by 1.3% between 2001 and 2012

Liver cancer ASMR increased by 2.4% between 1994 and 2012

Stomach cancer ASMR decreased by 2.3% between 1993 and 2012

LUNG CANCER

In males, the lung cancer ASMR began to level off in the late 1980s and declined by 2.1% per year between 1988 and 2012. The mortality rate in females increased by 7.4% per year from 1981 to 1985 and slowed to 1.9% per year from 1985 to 2000. The rate then stabilized between 2000 and 2012. Decreases in lung cancer mortality are largely attributable to decreased tobacco use. Tobacco use began to decline in the late 1950s for males and in the mid-1970s for females.[3,4] This approximately 15-year gap in peak smoking rates between males and females corresponds to the gap in the stabilization of lung cancer mortality rates between males and females.

OTHER TYPES OF CANCER

The liver cancer ASMR increased significantly after 1981. It increased by 4.2% per year between 1981 and 1994 but slowed to 2.4% per year between 1994 and 2012. This increase was probably at least partially driven by changes in the incidence rate, which increased over the same time period.

The stomach cancer mortality rate, on the other hand, decreased significantly between 1981 and 2012. It declined by 3.6% per year between 1981 and 1993 and slowed to 2.3% per year between 1993 and 2012. The decline in the stomach cancer mortality rate has been attributed to decreased exposure to *Helicobacter pylori (H.pylori)* infection, improvements in food preservation and refrigeration, lifestyle changes and better treatment.[5]

Changes in mortality rates between 1981 and 2012 for other cancer types are provided in **Table 3.3**.

Ten-year trends

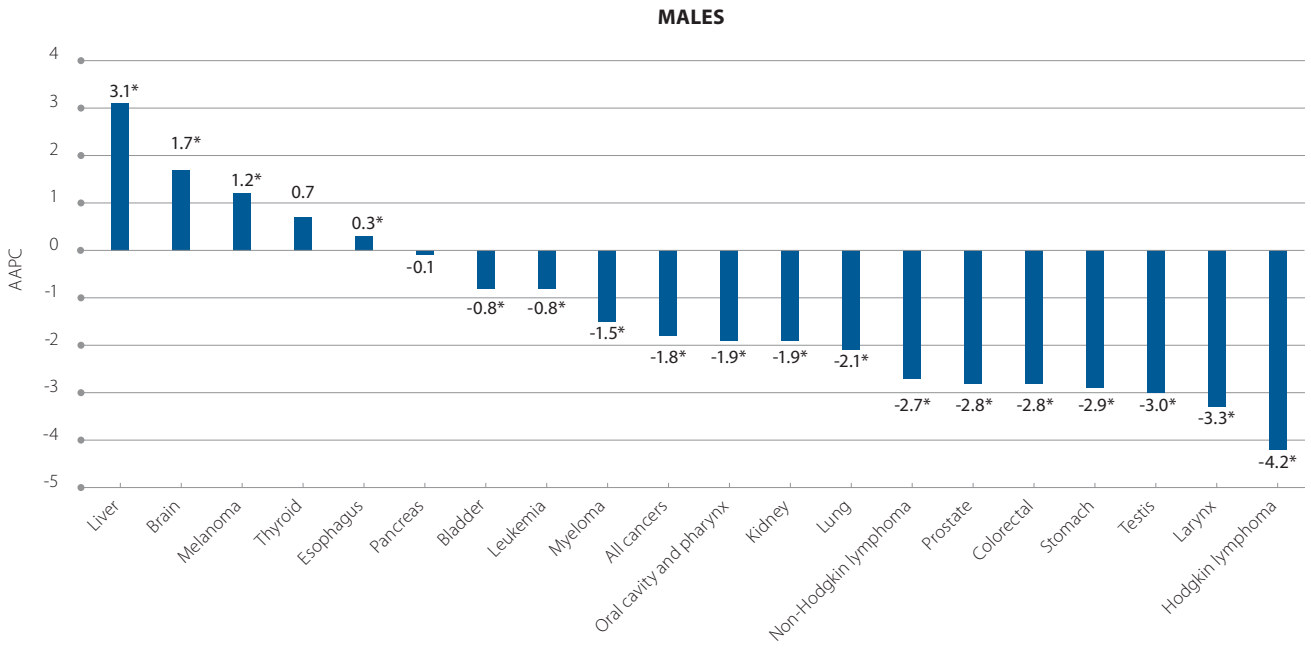
Over the most recent 10-year period of 2003 to 2012 (**Figure 3.6**) the average annual percent change (AAPC) in the ASMR for males:

- decreased for most types of cancer, including Hodgkin lymphoma (4.2% per year), laryngeal cancer (3.3%) and testicular cancer (3.0%);
- increased for liver cancer (3.1%), brain cancer (1.7%), melanoma (1.2%) and esophageal cancer (0.3%); and
- was stable for thyroid and pancreatic cancers.

Fastest increase in mortality rates over the past 10 years

LIVER, BRAIN AND UTERINE CANCERS AND MELANOMA

Figure 3.6 **Average annual percent change (AAPC) in mortality rates, by cancer type and sex, Ontario, 2003–2012**



*Statistically significant AAPC
Note: Rates standardized to the 2011 Canadian population
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

For some cancers, such as liver cancer and melanoma, the increase in mortality rates are likely reflective of increases in incidence rates.

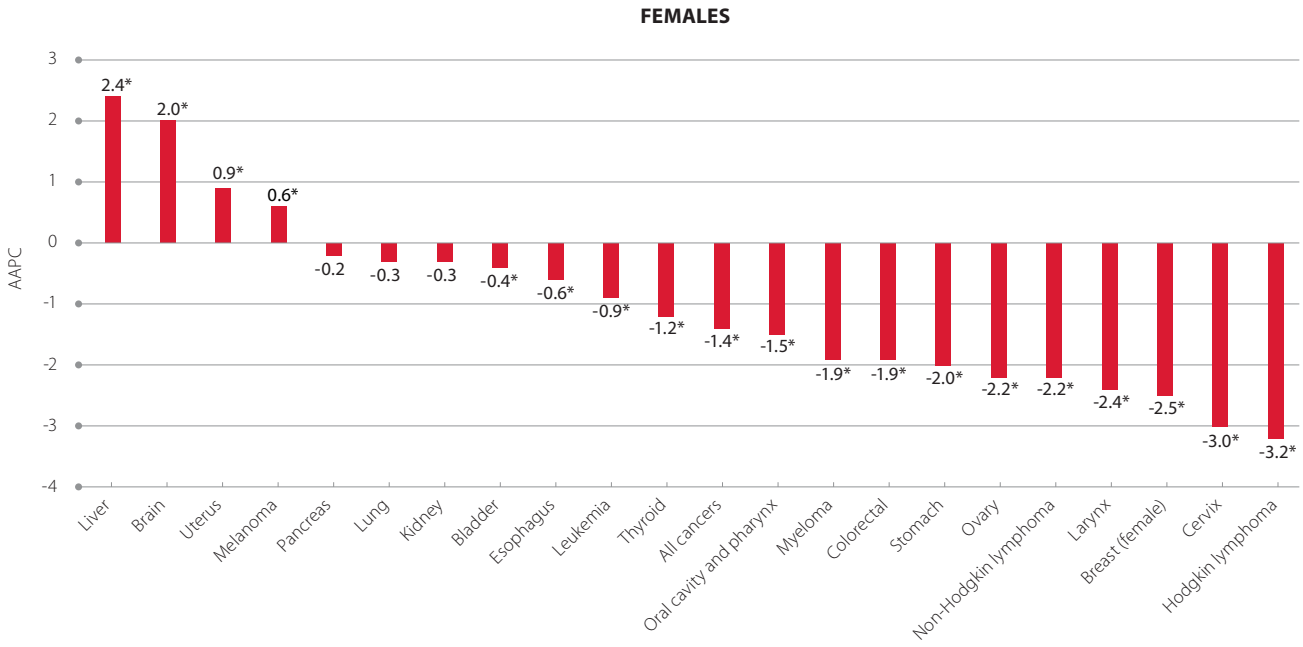
HODGKIN LYMPHOMA, FEMALE BREAST, LARYNGEAL, TESTIS AND CERVICAL CANCERS

Fastest decline in mortality rates over the past 10 years

Over the most recent 10-year period of 2003 to 2012 (**Figure 3.6**), the AAPC in the ASMR for females:

- decreased for most types of cancer, including Hodgkin lymphoma (3.2% per year), cervical cancer (3.0%) and breast cancer (2.5%);
- increased for liver cancer (2.4%), brain cancer (2.0%), uterine cancer (0.9%) and melanoma (0.6%); and
- was stable for pancreatic, lung and kidney cancers.

For some cancers, such as liver cancer and melanoma, the increase in mortality rates are likely reflective of increases in incidence rates.



Potential years of life lost

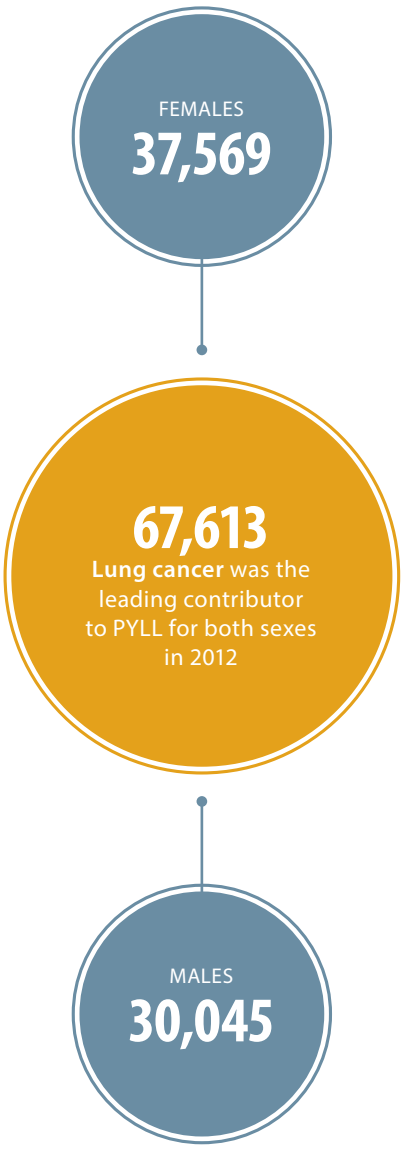
One frequently used measure of premature death in a population is the potential years of life lost (PYLL), which is the number of years of life lost when a person dies prematurely (defined in this report as before the average life expectancy for the population). PYLL gives more weight to deaths that occur among younger people. More years of life are lost due to cancers that are more common, have an earlier age of onset or have high mortality.

In 2012, the PYLL due to cancer in Ontario was 286,009 years for both sexes combined. The PYLL for females was 162,465 years, which was higher than the 123,544 years for males (**Table 3.4**). This difference was likely because women generally live longer than men and some female cancers, such as breast cancer, tend to cause death at a younger age.

Lung cancer was the leading contributor to PYLL for both sexes (67,613 years), accounting for 23.6% of all PYLL caused by cancer. Even though pancreatic cancer made up only 2.4% of the total cancer cases diagnosed in Ontario in 2012, it was the fourth highest contributor to PYLL (16,159 years) among all cancers. In both cases, the high PYLL number is the reflection of poor survival and the resulting high mortality. On the other hand, prostate was the fourth most commonly diagnosed cancer in 2012 but contributed only 1.7% of the total PYLL. This is because prostate cancer has high survival and tends to occur most often in older men.

Among males, lung cancer had the highest PYLL (30,045 years), followed by colorectal, stomach and pancreatic cancers. These four cancers together accounted for 50.2% of the total PYLL due to cancer in males. Although prostate cancer is more common than lung cancer among males (the number of new prostate cancer cases was more than 1.5 times higher than the number of new lung cancer cases in males in 2012), the PYLL due to lung cancer is more than six times higher than the PYLL due to prostate cancer (4,802 years).

Among females, lung (37,569 years), breast (29,450 years) and colorectal (13,569 years) cancers were the three most common causes of premature death from cancer, accounting for 49.6% of the total PYLL due to cancer. In comparison to males, the PYLL from female breast cancer far exceeds the PYLL from prostate cancer, reflecting the relatively young age at which women die from breast cancer.



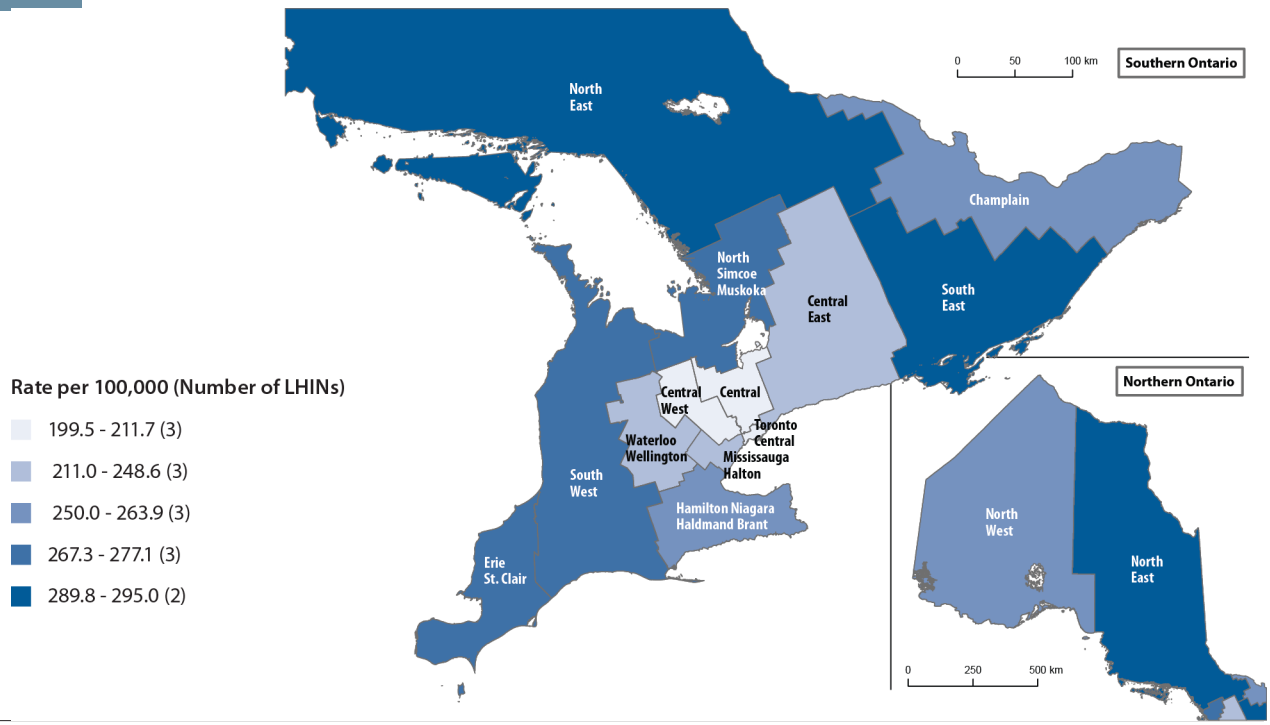
Mortality by geography

The same geographic factors that influence incidence—the prevalence of risk factors, the demographic makeup and regional differences in diagnostic and treatment practices—also affect mortality. Mortality rates by geography are presented for all cancers combined.

Among males (**Figure 3.7** and **Table DA.9** in the *Data appendix*):

- The LHINs with the lowest ASMR were Central, Central West and Toronto Central. Additionally, the mortality rates were significantly lower than the Ontario ASMR in the Mississauga Halton and Central East LHINs. Therefore, lower mortality rates occurred around the south-central Ontario region, somewhat coincident with lower incidence rates.
- Corresponding to the male incidence rates (**Figure 2.10**), the North East and the South East LHINs had the highest ASMR, both of which were significantly higher than the Ontario rate. Mortality rates were also significantly higher in the Erie St. Clair, the South West and the Hamilton Niagara Haldimand Brant LHINs.
- Similar to the incidence rates (**Figure 2.10**), the ASMR varied substantially across the LHINs in northern Ontario.

Figure 3.7 **Age-standardized mortality rates, males, by LHIN,† Ontario, 2012**



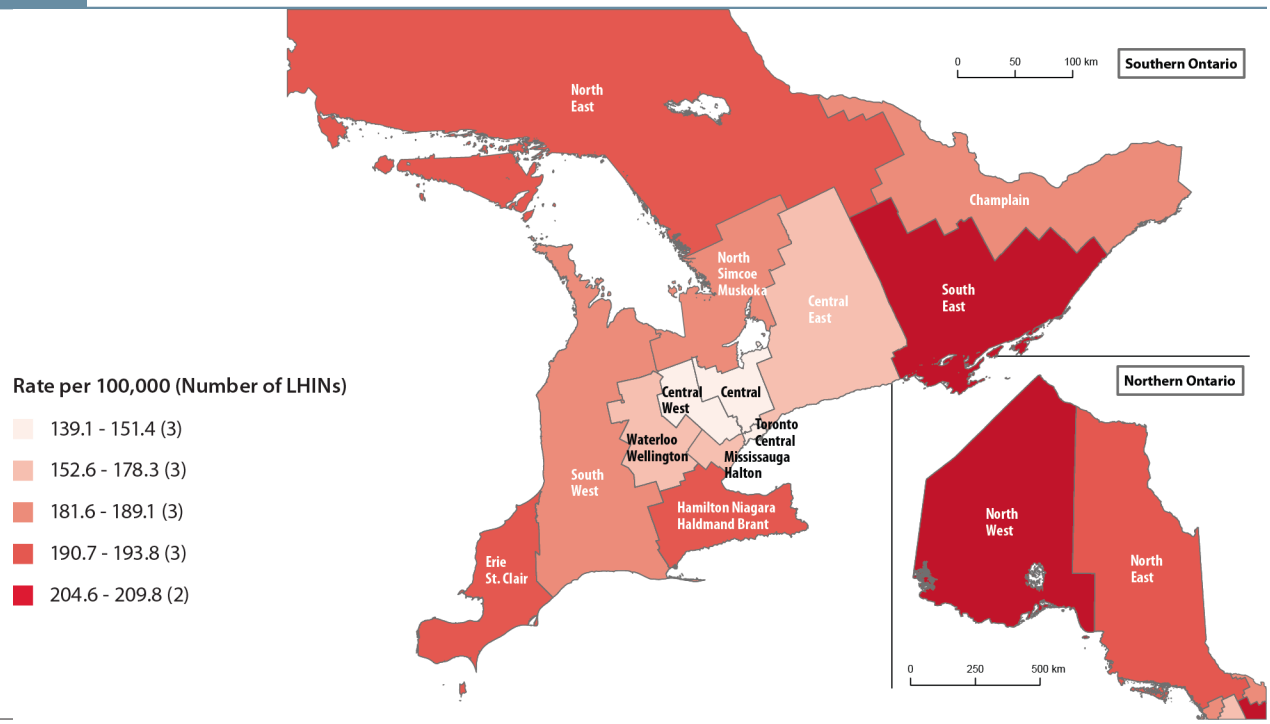
†LHIN=Local Health Integration Network
Note: Rates standardized to the 2011 Canadian population
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

The North West, South East and North East LHINs recorded the highest ASMR among females.

Among females (**Figure 3.8** and **Table DA.10** in the *Data appendix*):

- The Central, Central West, Mississauga Halton and Toronto Central LHINs recorded ASMR significantly lower than the Ontario ASMR.
- The North West, South East and North East LHINs recorded the highest ASMR among females. Rates were significantly higher than the Ontario rate in these LHINs, and the Erie St. Clair and Hamilton Niagara Haldimand Brant LHINs.
- In general, female mortality rates paralleled male mortality rates across the LHIN's, with two exceptions. The North West LHIN's ASMR for females was significantly higher than the Ontario rate, but there was so significant difference in rates among males. The South West LHIN's ASMR for males was significantly higher than the Ontario rate, but there was no significant difference in rates among females.

Figure 3.8 **Age-standardized mortality rates, females, by LHIN,† Ontario, 2012**

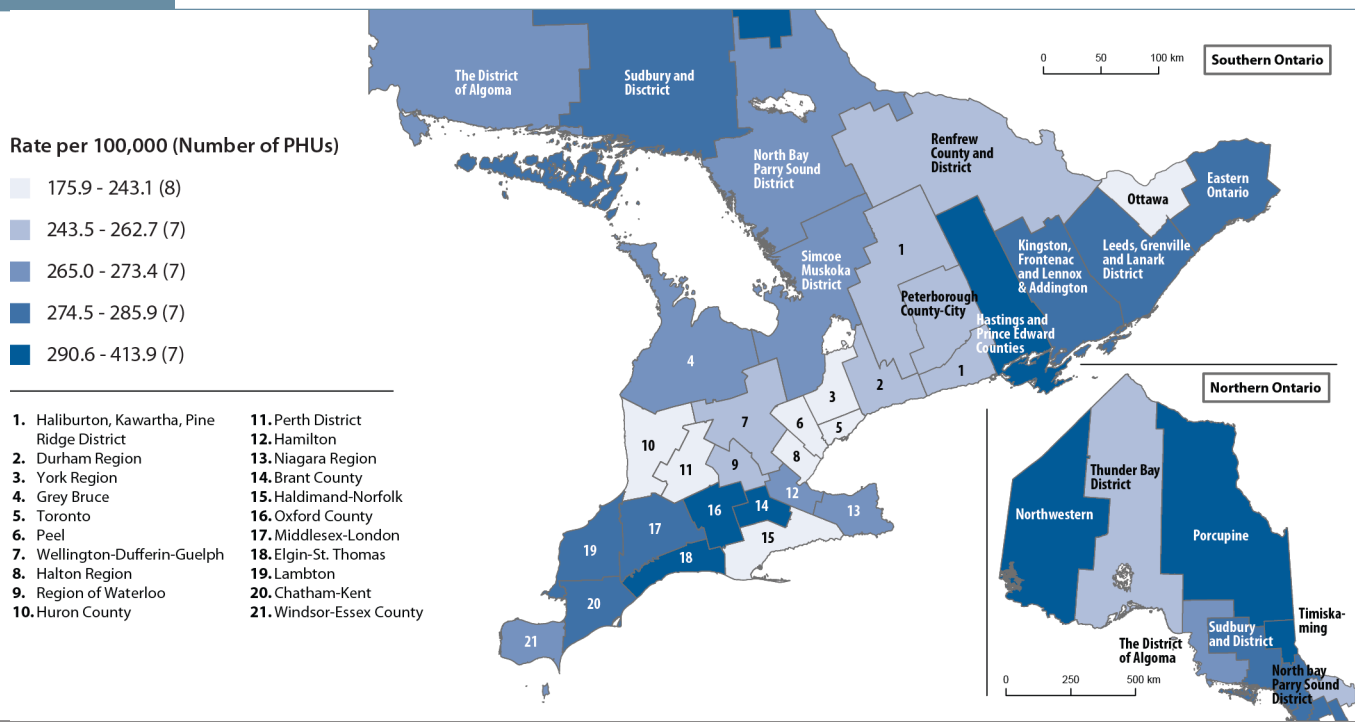


†LHIN=Local Health Integration Network
Note: Rates standardized to the 2011 Canadian population
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

The smaller geographical unit of PHUs allow for more detailed patterns to be analyzed. Among males (**Figure 3.9** and **Table DA.11** in the *Data appendix*):

- PHUS in the Greater Toronto Area, (York Region, Peel and Toronto) had ASMR significantly lower than the Ontario ASMR.
- Thirteen PHUs had significantly higher ASMR among males compared to the Ontario rate: Timiskaming; Porcupine; Brant County; Elgin-St Thomas; Hastings and Prince Edward Counties; Oxford County; Kingston, Frontenac and Lennox & Addington; Leeds, Grenville and Lanark District; Eastern Ontario; Middlesex-London; Windsor-Essex County; Simcoe Muskoka District and City of Hamilton. Generally, higher rates tended to be found in small groups of adjacent PHUs across Ontario.
- Within the remaining south Ontario PHUs, the male ASMR were not significantly different than the Ontario rate and were geographically dispersed.
- High variability in ASMR among males was found in northern Ontario PHUs, and the pattern did not correspond to incidence rates found among males (see **Figure 2.12**).

Figure 3.9 **Age-standardized mortality rates, males, by PHU,† Ontario, 2012**

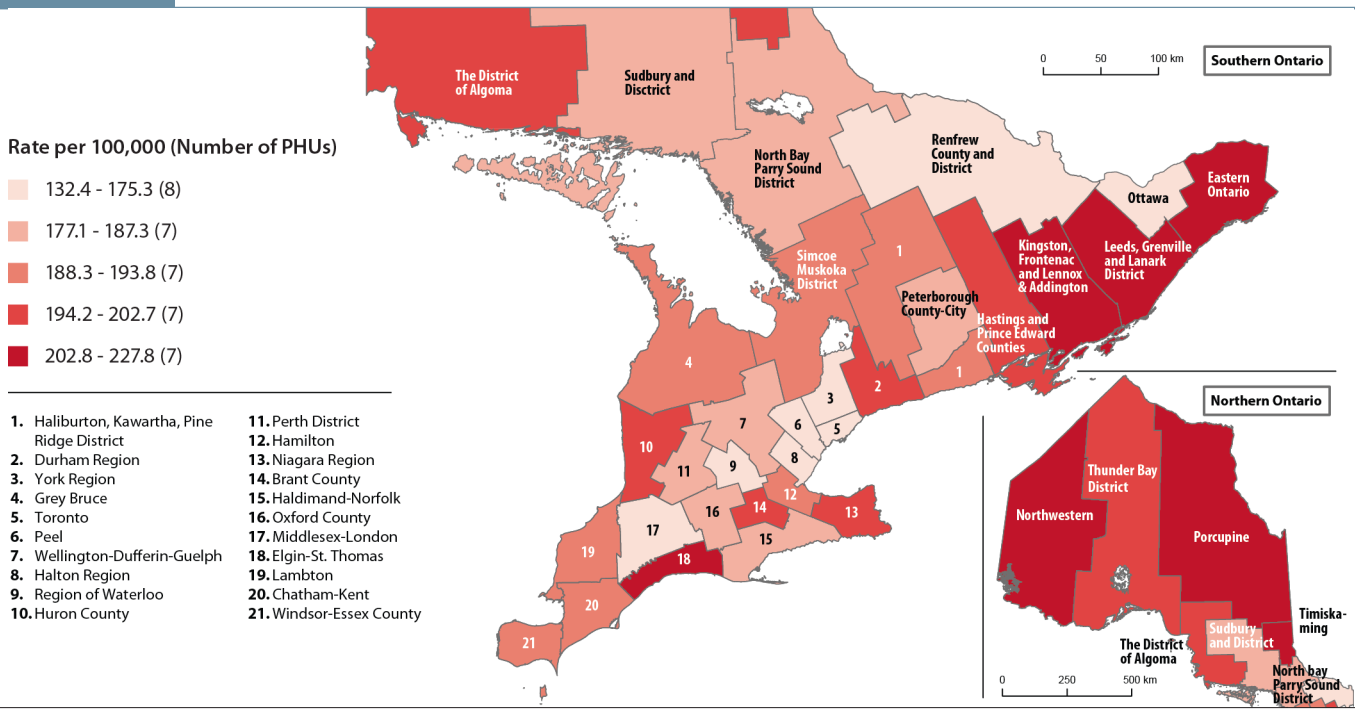


†PHU=Public Health Unit
Note: Rates standardized to the 2011 Canadian population
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Among females (**Figure 3.10** and **Table DA.12** in the *Data appendix*):

- The same PHUs that had significantly lower ASMR compared to the Ontario ASMR for males also had lower ASMR for females: York Region, Peel and Toronto.
- Several of the PHUs that had significantly higher mortality rates compared to the Ontario rate for males also had higher mortality rates for females: Elgin-St. Thomas; Leeds, Grenville and Lanark District; City of Hamilton; Kingston, Frontenac and Lennox & Addington; and Eastern Ontario. However, the following PHUs also had female mortality rates that were significantly higher than the Ontario rate: Northwestern; Durham Region; and Niagara Region. In general, the PHUs in south-eastern Ontario had higher mortality rates among females compared to Ontario.
- The pattern of high mortality rate variability across the northern Ontario PHUs was different compared to the distribution of incidence rates among females in that region, particularly in the Northwestern PHU where the female incidence rate was significantly lower than Ontario while the female mortality rate was significantly higher than Ontario (**Figure 2.13**).

Figure 3.10 **Age-standardized mortality rates, females, by PHU,† Ontario, 2012**



†PHU=Public Health Unit
Note: Rates standardized to the 2011 Canadian population

Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

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Table 3.1 Cancer mortality counts and rates, by cancer type and sex, Ontario, 2012

Cancer type	Total				Males				Females			
	Deaths	% of deaths	Crude Rate (per 100,000)	ASMR† (per 100,000)	Deaths	% of deaths	Crude Rate (per 100,000)	ASMR (per 100,000)	Deaths	% of deaths	Crude Rate (per 100,000)	ASMR (per 100,000)
All cancers	**27,442**	**100.0%**	**204.6**	**202.4**	**14,360**	**100.0%**	**218.0**	**243.7**	**13,082**	**100.0%**	**191.7**	**173.5**
Bladder	761	2.8%	5.7	5.6	543	3.8%	8.2	9.6	218	1.7%	3.2	2.7
Brain	762	2.8%	5.7	5.7	427	3.0%	6.5	6.8	335	2.6%	4.9	4.6
Breast (female)	1,912	7.0%	28.0	25.7	—	—	—	—	1,912	14.6%	28.0	25.7
Cervix	187	0.7%	2.7	2.6	—	—	—	—	187	1.4%	2.7	2.6
Colorectal	3,103	11.3%	23.1	22.9	1,692	11.8%	25.7	29.0	1,411	10.8%	20.7	18.1
Esophagus	758	2.8%	5.7	5.6	583	4.1%	8.9	9.6	175	1.3%	2.6	2.3
Hodgkin lymphoma	61	0.2%	0.5	0.5	35	0.2%	0.5	0.6	26	0.2%	0.4	0.3
Kidney	556	2.0%	4.1	4.1	352	2.5%	5.3	5.9	204	1.6%	3.0	2.7
Larynx	132	0.5%	1.0	1.0	106	0.7%	1.6	1.8	26	0.2%	0.4	0.3
Leukemia	1,052	3.8%	7.8	7.7	599	4.2%	9.1	10.2	453	3.5%	6.6	6.0
Liver	1,004	3.7%	7.5	7.4	672	4.7%	10.2	11.0	332	2.5%	4.9	4.4
Lung	6,764	24.6%	50.4	49.9	3,638	25.3%	55.2	60.6	3,126	23.9%	45.8	42.0
Melanoma	460	1.7%	3.4	3.4	286	2.0%	4.3	4.7	174	1.3%	2.6	2.3
Myeloma	526	1.9%	3.9	3.9	293	2.0%	4.4	4.9	233	1.8%	3.4	3.0
Non-Hodgkin lymphoma	1,014	3.7%	7.6	7.5	556	3.9%	8.4	9.5	458	3.5%	6.7	6.0
Oral cavity & pharynx	432	1.6%	3.2	3.2	304	2.1%	4.6	4.9	128	1.0%	1.9	1.7
Ovary	629	2.3%	9.2	8.6	—	—	—	—	629	4.8%	9.2	8.6
Pancreas	1,638	6.0%	12.2	12.1	790	5.5%	12.0	13.1	848	6.5%	12.4	11.1
Prostate	1,415	5.2%	21.5	26.0	1,415	9.9%	21.5	26.0	—	—	—	—
Stomach	691	2.5%	5.2	5.1	413	2.9%	6.3	7.0	278	2.1%	4.1	3.7
Testis	18	0.1%	0.3	0.3	18	0.1%	0.3	0.3	—	—	—	—
Thyroid	62	0.2%	0.5	0.5	29	0.2%	0.4	0.5	33	0.3%	0.5	0.4
Uterus	408	1.5%	6.0	5.5	—	—	—	—	408	3.1%	6.0	5.5

†ASMR=Age-standardized mortality rate
Note: Rates standardized to the 2011 Canadian population
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Table 3.2 **Mortality counts and age-specific rates, all cancers combined, by age group, Ontario, 1986, 1996, 2006, 2016**

	Year							
	1986		1996		2006		2016 (estimates)	
Age group	Deaths	Age-specific rate (per 100,000)	Deaths	Age-specific rate (per 100,000)	Deaths	Age-specific rate (per 100,000)	Deaths	Age-specific rate (per 100,000)
0–14	69	3.6	73	3.3	45	2.0	45	2.0
15–29	146	5.8	133	5.7	108	4.3	103	3.7
30–39	347	22.5	371	18.9	244	13.3	248	13.5
40–49	919	88.0	1,153	72.0	1,082	53.1	882	47.7
50–59	2,574	271.3	2,477	225.3	3,050	182.5	3,202	151.0
60–69	4,850	623.4	5,208	571.9	5,108	479.4	6,366	388.5
70–79	4,996	1088.1	7,049	1129.7	7,612	1022.9	8,024	857.2
80+	3,438	1675.4	5,201	1783.7	7,722	1779.0	10,418	1685.5

Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Table 3.3 Annual percent change (APC) in age-standardized mortality rates, by cancer type and sex, Ontario, 1981–2012

Cancer type	Both Sexes			Males			Females		
	Period	APC		Period	APC		Period	APC	
All Cancers	**1981-1985**	**1.1**	↑	**1981-1988**	**0.5**	↑	**1981-1985**	**1.0**	
	1985-2001	**-0.5**	↓	**1988-2001**	**-0.9**	↓	**1985-2002**	**-0.3**	↓
	2001-2012	**-1.5**	↓	**2001-2012**	**-1.8**	↓	**2002-2012**	**-1.4**	↓
Bladder	1981-1992	-1.7	↓	1981-2012	-0.8	↓	1981-2012	-0.4	↓
	1992-2012	-0.2							
Brain	1981-2005	-1.0	↓	1981-2004	-1.0	↓	1981-2006	-1.1	↓
	2005-2012	2.6	↑	2004-2012	2.0	↑	2006-2012	3.6	↑
Breast (female)							1981-1986	1.3	
							1986-1995	-1.1	↓
							1995-2012	-2.5	↓
Cervix							1981-2012	-3.0	↓
Colorectal	1981-2004	-1.4	↓	1981-2003	-1.2	↓	1981-2012	-1.9	↓
	2004-2012	-2.8	↓	2003-2012	-2.8	↓			
Esophagus	1981-2012	0.2		1981-2012	0.3	↑	1981-2012	-0.6	↓
Hodgkin lymphoma	1981-2012	-3.8	↓	1981-2012	-4.2	↓	1981-2012	-3.2	↓
Kidney	1981-2012	-0.2	↓	1981-2008	0.1		1981-2012	-0.3	
				2008-2012	-4.3	↓			
Larynx	1981-1991	0.5		1981-1989	1.6		1981-2012	-2.4	↓
	1991-2012	-3.3	↓	1989-2012	-3.3	↓			
Leukemia	1981-2012	-0.8	↓	1981-2012	-0.8	↓	1981-2012	-0.9	↓
Liver	1981-1994	4.2	↑	1981-2012	3.1	↑	1981-2012	2.4	↑
	1994-2012	2.4	↑						
Lung	1981-1988	1.5	↑	1981-1988	0.4		1981-1985	7.4	↑
	1988-2001	-0.7	↓	1988-2012	-2.1	↓	1985-2000	1.9	↑
	2001-2012	-1.3	↓				2000-2012	-0.3	
Melanoma	1981-2012	0.9	↑	1981-2012	1.2	↑	1981-2012	0.6	↑
Myeloma	1981-1999	0.5		1981-1998	0.5		1981-1999	0.6	
	1999-2012	-1.5	↓	1998-2012	-1.5	↓	1999-2012	-1.9	↓

Note: Statistically significant changes in trend and their direction are indicated by corresponding arrows
Rates standardized to the 2011 Canadian population
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

***(Cont'd)* Annual percent change (APC) in age-standardized mortality rates, by cancer type and sex, Ontario, 1981–2012**

Cancer type	Both Sexes			Males			Females		
	Period	APC		Period	APC		Period	APC	
Non-Hodgkin lymphoma	1981-2000	1.9	↑	1981-2001	1.8	↑	1981-1998	2.2	↑
	2000-2012	-2.5	↓	2001-2012	-2.7	↓	1998-2012	-2.2	↓
Oral cavity and pharynx	1981-2012	-1.7	↓	1981-2012	-1.9	↓	1981-2012	-1.5	↓
Ovary							1981-2003	-0.5	↓
							2003-2012	-2.2	↓
Pancreas	1981-2006	-0.7	↓	1981-1999	-1.4	↓	1981-2012	-0.2	
	2006-2012	0.9		1999-2012	-0.1				
Prostate				1981-1994	1.6	↑			
				1994-2012	-2.8	↓			
Stomach	1981-1993	-3.6	↓	1981-2012	-2.9	↓	1981-1993	-4.1	↓
	1993-2012	-2.3	↓				1993-2012	-2.0	↓
Testis				1981-2012	-3.0	↓			
Thyroid	1981-2012	-0.6	↓	1981-2012	0.7		1981-2012	-1.2	↓
Uterus							1981-1992	-1.9	↓
							1992-2012	0.9	↑

Note: Statistically significant changes in trend and their direction are indicated by corresponding arrows
Rates standardized to the 2011 Canadian population
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Table 3.4 Potential years of life lost (PYLL), by cancer type and sex, Ontario, 2012

Cancer type	Total		Males		Females	
	Years	% of all PYLL	Years	% of all male PYLL	Years	% of all female PYLL
All cancers	**286,009**	**100%**	**123,544**	**100%**	**162,465**	**100%**
Bladder	4,231	1.5%	2,665	2.2%	1,566	1.0%
Brain	14,004	4.9%	7,323	5.9%	6,681	4.1%
Breast (female)	29,450	10.3%	—	—	29,450	18.1%
Cervix	4,407	1.5%	—	—	4,407	2.7%
Colorectal	26,858	9.4%	13,290	10.8%	13,569	8.4%
Esophagus	8,392	2.9%	6,718	5.4%	1,674	1.0%
Hodgkin lymphoma	1,252	0.4%	785	0.6%	467	0.3%
Kidney	5,587	2.0%	3,592	2.9%	1,996	1.2%
Larynx	1,209	0.4%	1,069	0.9%	141	0.1%
Leukemia	11,862	4.1%	6,049	4.9%	5,813	3.6%
Liver	11,085	3.9%	7,030	5.7%	4,055	2.5%
Lung	67,613	23.6%	30,045	24.3%	37,569	23.1%
Melanoma	6,202	2.2%	3,445	2.8%	2,757	1.7%
Myeloma	4,502	1.6%	2,622	2.1%	1,881	1.2%
Non-Hodgkin lymphoma	9,994	3.5%	5,089	4.1%	4,905	3.0%
Oral cavity and pharynx	5,637	2.0%	3,898	3.2%	1,740	1.1%
Ovary	9,850	3.4%	—	—	9,850	6.1%
Pancreas	16,159	5.6%	7,445	6.0%	8,715	5.4%
Prostate	4,802	1.7%	4,802	3.9%	—	—
Stomach	18,315	6.4%	11,261	9.1%	7,054	4.3%
Testis	594	0.2%	594	0.5%	—	—
Thyroid	827	0.3%	302	0.2%	525	0.3%
Uterus	5,736	2.0%	—	—	5,736	4.6%

Note: Premature death is defined as dying before the average life expectancy for the population.
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

IN FOCUS

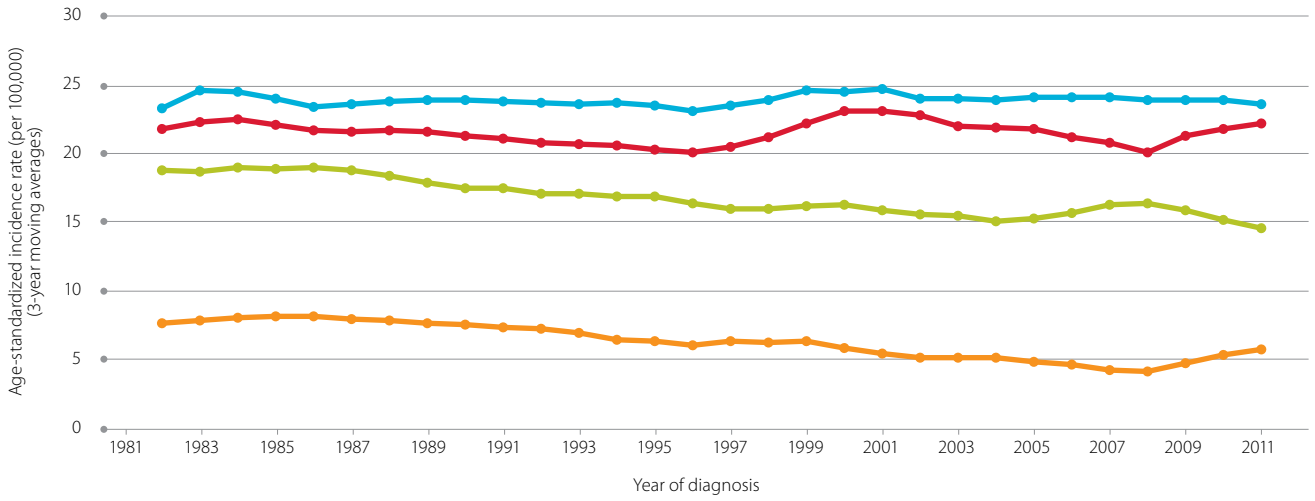
Colorectal cancer

Downward trend in distal colon cancer

Colorectal cancers can been classified into proximal (also called right-sided colon), distal (also called left-sided colon) and rectal subsites. Oncologists can better identify tumours in the distal colon and rectum because polyps are more likely to occur in these areas and they are more accessible by screening procedures such as sigmoidoscopy and colonoscopy.[1]

From 1981 to 2005, and then again from 2008 to 2012, there was a significant decrease in the incidence rate for distal colon cancer (**Figure B.1**). In contrast, the incidence rate for rectal cancer declined only slightly between 1981 and 1997. The incidence rate for proximal colon cancer did not change between 1981 and 2012. With the introduction of Ontario's colorectal cancer screening program (ColonCancerCheck) in 2007, it is expected that long-term trends in the incidence rate for colorectal cancer will change.

Figure B.1 **Age-standardized incidence rates, colorectal cancer, by subsite, Ontario, 1981–2012**



Proximal colon	
Year	APC
1981–2012	0

Rectal	
Year	APC
1981-1997	-0.6*
1997-2000	3.9
2000-2012	-0.6

Distal colon	
Year	APC
1981-2005	-1.1*
2005-2008	3.6
2008-2012	-4.5*

Other	
Year	APC
1981-1986	2.7
1986-2008	-2.9*
2008-2012	7.8*

*Statistically significant
Note: Proximal colon: cecum (ICD-O-3: C18.0), ascending colon (ICD-O-3: C18.2), hepatic flexure (ICD-O-3: C18.3), transverse colon (ICD-O-3: C18.4), splenic flexure (ICD-O-3: C18.5); Distal colon: descending colon (ICD-O-3: C18.6) and sigmoid colon (ICD-O-3: C18.7); Rectal: rectum (ICD-O-3: C20.9) and rectosigmoid junction (ICD-O-3: C19.9); Other: large intestine, NOS (ICD-O-3: C18.8-C189, C26.0) and appendix (ICD-O-3: C18.1)
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Declining mortality rate for colon cancer compared to rectal cancer

The mortality rate for colon cancer has been decreasing in Ontario since the 1980s. The greatest decline of 3.6% per year occurred between 2002 and 2012 (**Figure B.2**). For rectal cancer, the greatest decline in the mortality rate occurred between 1981 and 1998 (3.3% per year). Since then the mortality rate has increased slightly.

The observed declines in mortality are likely due to improved chemotherapies, along with more intense screening using the fecal occult blood test, flexible sigmoidoscopy and colonoscopy (the latter was introduced in the 1970s).

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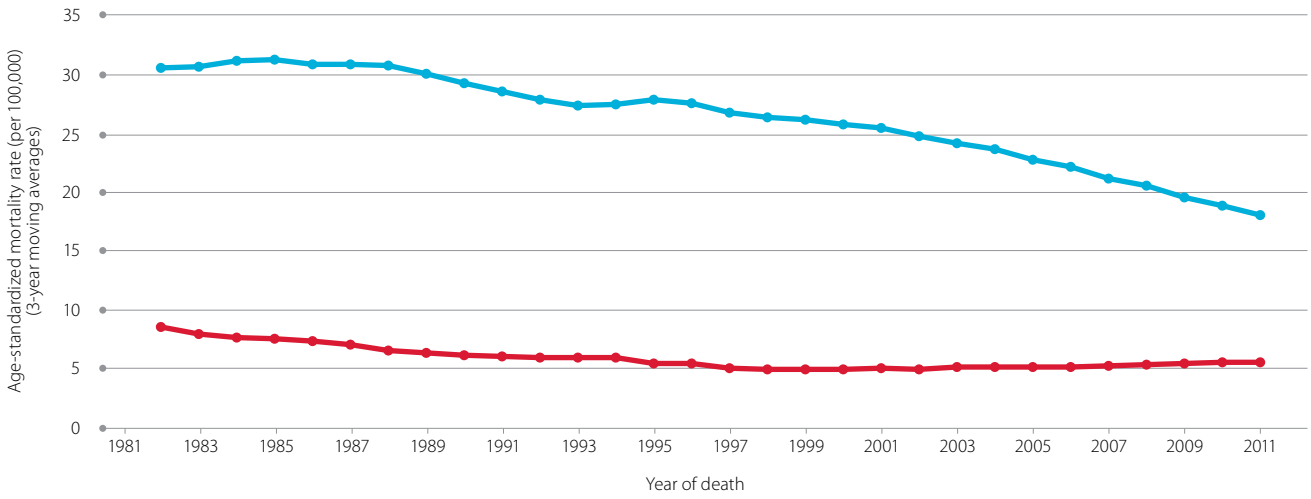
Figure B.2 **Age-standardized mortality rates, colorectal cancer, by site, Ontario, 1981–2012**



Colon		Rectal	
Year	APC	Year	APC
1981-2002	-1.1*	1981-1998	-3.3*
2002-2012	-3.6*	1998-2012	0.9*

*Statistically significant
Note: Colon: proximal and distal colon (ICD-O-3: C18, C26.0); Rectal: rectum and rectosigmoid junction (ICD-O-3: C19–C20)
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

IN FOCUS

Lung cancer

Incidence trends differ between small cell and non–small cell lung cancers

The two main types of lung cancer are small cell lung carcinoma (SCLC) and non–small cell lung carcinoma (NSCLC). NSCLCs are the most common type of lung cancer and they are more often diagnosed at advanced stages.[1] SCLCs make up a smaller proportion of cases, are almost entirely caused by tobacco use and tend to spread quickly.

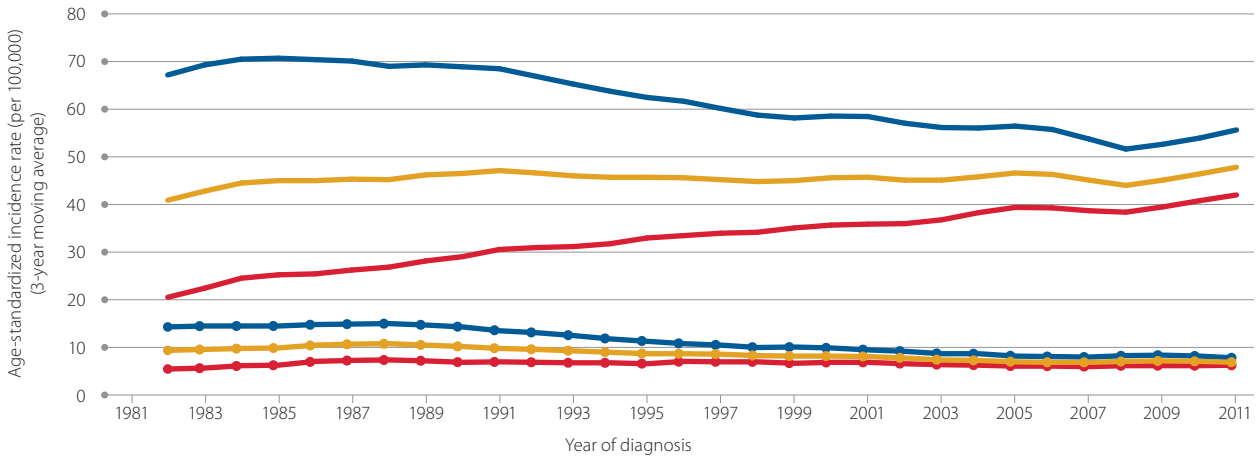
In 2012, 70.9% of all lung cancer cases diagnosed in Ontario were NSCLCs. SCLCs made up 10.0% of all cases, while 19.0% of lung cancers were other histologies or undifferentiated.

For both sexes combined, the incidence rate of NSCLC increased by 5.7% per year from 1981 to 1984 and then stabilized (**Figure C.1**). The rate of NSCLC declined or remained stable among males after 1984, but increased among females over the same period.

SCLC incidence rates for both sexes stabilized later than NSCLC rates. The SCLC rate increased between 1981 and 1987 (3.1% per year), decreased between 1987 and 2006 (2.2% per year), and then remained stable from 2006 to 2012 (**Figure C.1**). As SCLCs are heavily associated with smoking, this decrease and stabilization may be the result of the historical decline in tobacco use in Ontario.

SCLC incidence by sex declined or remained stable for males and females after 1987, but the decline was greater for males. The early 1980s, however, saw a difference in incidence rates for males and females. Among females, the incidence rate for SCLCs increased by 5.9% per year between 1981 and 1987, while it remained stable among males. This may reflect the fact that smoking rates peaked during a later time period for females than males.[2-4]

Figure C.1 **Age-standardized incidence rates, lung cancer, by type, Ontario, 1981–2012**



NSCLC (Both sexes)		NSCLC (Males)		NSCLC (Females)		SCLC (Both sexes)		SCLC (Males)		SCLC (Females)	
Year	APC	Year	APC	Year	APC	Year	APC	Year	APC	Year	APC
1981-1984	5.7*	1981-1984	4.3*	1981-1983	12.8*	1981-1987	3.1*	1981-1988	0.9	1981-1987	5.9*
1984-2012	0.1	1984-2009	-1.3*	1983-1992	3.4*	1987-2006	-2.2*	1988-2004	-3.5*	1987-2012	-0.7*
		2009-2012	2.6	1992-2012	1.5*	2006-2012	0.2	2004-2012	-0.8		

*Statistically significant
Note: NSCLC=Non-small-cell lung cancer (ICD-O-3: C34.0-C34.9; histology: 8010-8015. 8022, 8030-8031, 8050-8052, 8056, 8070-8073, 8140-8239, 820-8246, 8250-8255, 8260-8550); SCLC=Small-cell lung cancer (ICD-O-3: C34.0-C34.9; histology: 8002, 8041-8045); Rates standardized to the 2011 Canadian population
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)
Data source: Ontario Cancer Registry (November 2015), CCO

MALES WITH LUNG CANCER ARE MORE LIKELY TO BE DIAGNOSED AT AN ADVANCED STAGE

The distribution of stage at diagnosis for lung cancer varied by both sex and age. In both males and females, cases were more likely to be diagnosed at stage I or stage IV than stage II or stage III (**Table C.1**). For all ages combined, the greatest proportion of male cases were diagnosed at stage IV while females were most likely to be diagnosed at stage I. This was also true within each age group.

Compared to other age groups, males 80 years of age and older were the most likely to be diagnosed with stage IV lung cancer and the least likely to be diagnosed with stage I. A similar pattern was observed among females.

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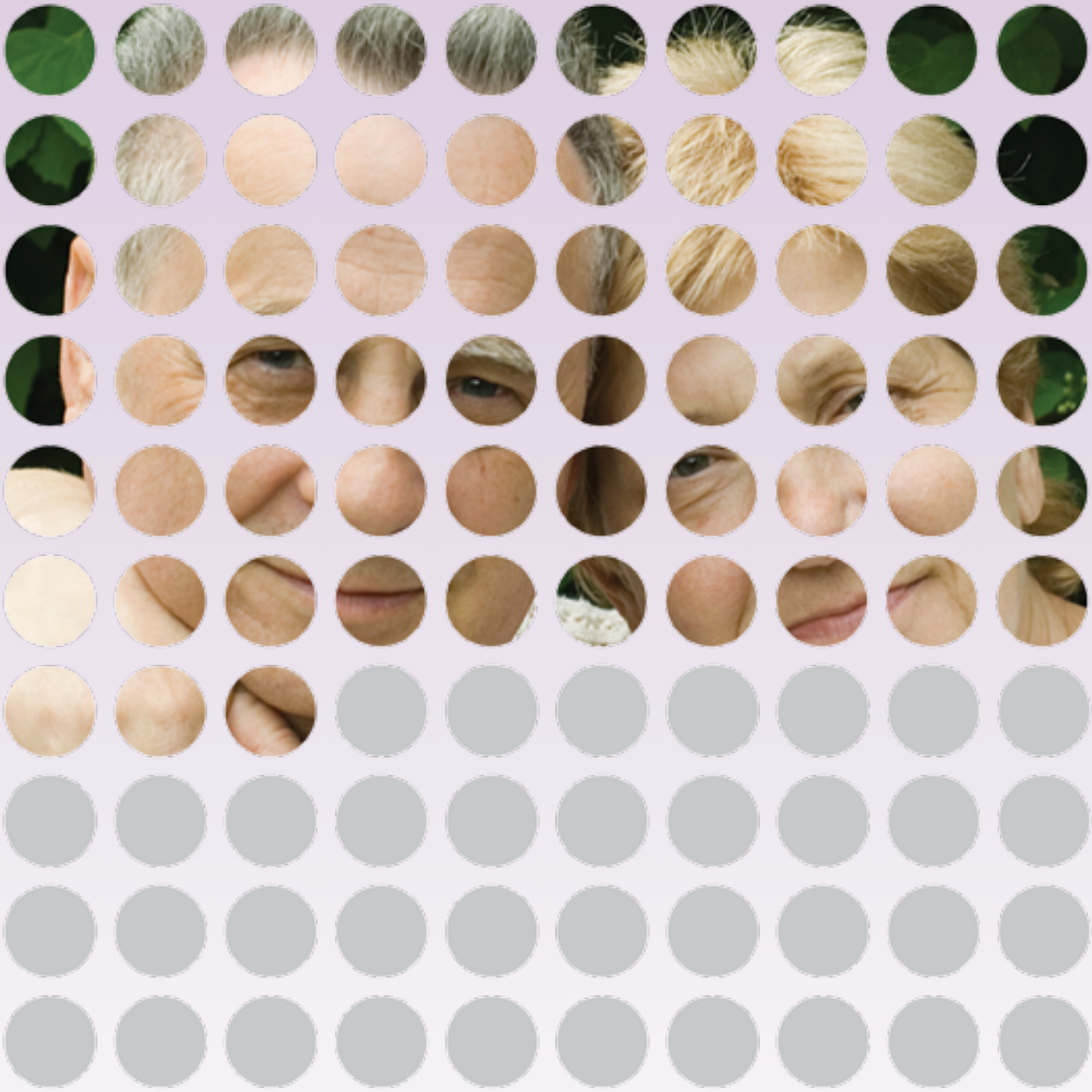
Table C.1 Distribution of new cases, lung cancer, by stage, age group and sex, Ontario, 2010–2012

Males				
Age group (years)	Stage I	Stage II	Stage III	Stage IV
All ages	29.1%	11.9%	21.5%	37.5%
40–59	30.3%	10.9%	22.3%	36.5%
60–79	27.6%	21.2%	19.4%	31.7%
80+	24.9%	10.5%	21.3%	43.3%
Females				
Age group (years)	Stage I	Stage II	Stage III	Stage IV
All ages	37.5%	10.8%	18.0%	33.6%
40–59	45.5%	11.6%	18.9%	24.0%
60–79	40.4%	10.9%	18.0%	30.6%
80+	26.8%	10.1%	17.6%	45.4%

Note: Case counts: Males n=15,345 (excludes unknown stage=10,774), Females n=14,073 (excludes unknown stage=9,924)
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: Ontario Cancer Registry (November 2015), CCO



63% 5-year relative survival for all cancers combined

4

Relative survival

Survival from cancer has increased steadily over the past three decades in Ontario.

Survival statistics are a key indicator of the effectiveness of cancer treatment and control programs. Relative survival ratios (RSRs) indicate the likelihood of people diagnosed with cancer surviving for a certain amount of time (e.g., one, three or five years) compared to similar people (i.e., people of the same age and sex) in the general population. During the first five years following diagnosis, the services offered to people with cancer usually include primary treatment and close clinical assessment for recurrence. After five years, the use of the healthcare system and the chance of recurrence both decrease. Thus, the first five years after diagnosis is a critical period for examining survival.

The survival of a person with cancer depends on several factors, such as the cancer type (including its morphology), sex, age at diagnosis, stage at diagnosis and available treatments. While RSRs give a general expectation of survival at the population level, these statistics may not reflect the prognosis of an individual, whose survival can also depend on their health status, the presence of co-morbidities and other personal and tumour-related factors.

Improvements in survival over time can be attributed to better methods and higher use of early detection, as well as more effective treatments. Even small improvements in survival can reflect a large number of avoided premature deaths at the population level.[1]

Relative survival by cancer type and sex

The overall five-year RSR for all cancers diagnosed between 2008 and 2012 was 63.1% (**Table 4.1**). This means that people diagnosed with cancer between 2008 and 2012 were 63.1% as likely to survive five years after their cancer diagnosis as similar people in the general population. Males had a significantly lower five-year RSR (61.8%) than females (64.5%). The difference in RSRs can be explained by the generally higher survival ratios in females compared to males for cancer types that are common in both sexes.

For both sexes combined:

- The five-year RSRs were highest for thyroid cancer (98.6%), melanoma (85.0%) and Hodgkin lymphoma (84.2%).
- The five-year RSRs were lowest for pancreatic (9.0%), esophageal (14.9%) and lung (18.0%) cancers. Low survival ratios for these cancers are largely attributed to the fact that most cases are diagnosed at an advanced stage, when the cancer has metastasized beyond the primary site.[2,3]

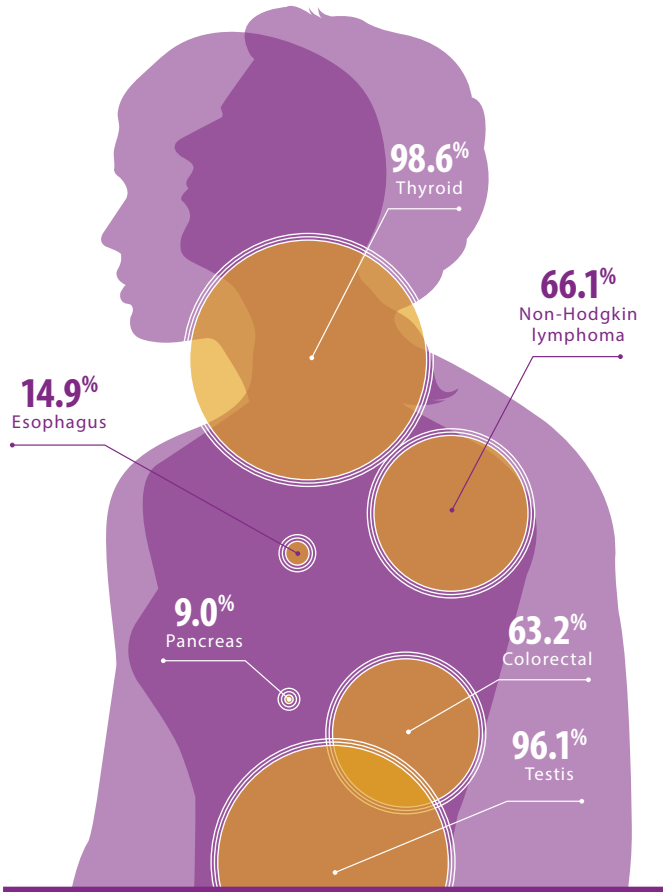
Among males, the five-year RSRs were:

- highest for testicular (96.1%), thyroid (95.6%) and prostate (95.2%) cancers; and
- lowest for pancreatic (9.1%), esophageal (14.7%) and lung (15.1%) cancers.

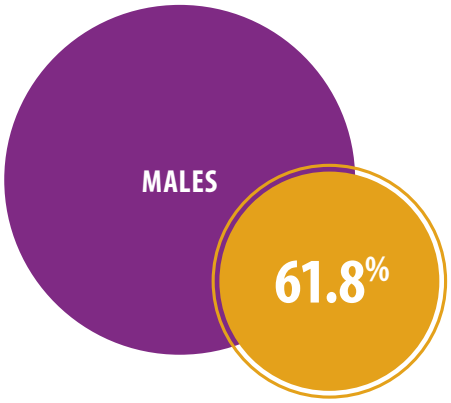
Among females, the five-year RSRs were:

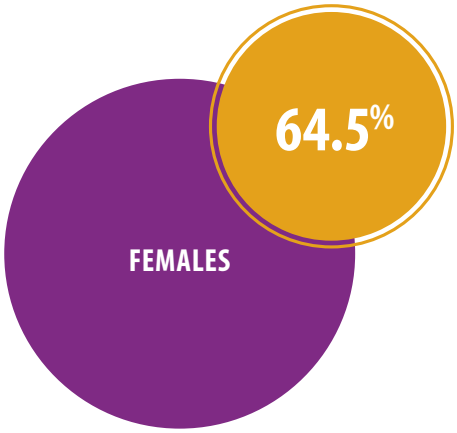
- highest for thyroid cancer (99.4%), melanoma (89.5%) and breast cancer (87.2%); and
- lowest for pancreatic (9.0%), esophageal (15.2%) and lung (21.2%) cancers.

Five-year relative survival ratios for selected cancers, 2008-2012



Five-year RSR for all cancers diagnosed between 2008–2012





For most cancers, there was no statistical difference in the five-year RSR between the sexes, with some exceptions:

- Lung cancer survival was significantly lower for males (15.1%) than for females (21.2%). Possible reasons for lower survival among males include a greater proportion of more aggressive histological lung cancer types in males and a higher propensity for males to be diagnosed at a later stage (see the *In Focus: Lung cancer* section on page 68).[4, 5]
- Melanoma survival was also significantly lower for males (81.2%) than for females (89.5%). This lower survival among males has been attributed to tumour–host interaction that leads to a higher chance of metastasis in males than in females.[6-8]
- Bladder cancer survival was significantly higher for males (64.9%) than for females (57.0%). Lower survival in females may be the result of their typically more advanced stage at diagnosis compared to males, differences in their ability to metabolize carcinogens and a greater presence of sex steroids in females that could impact the progression of cancer.[9,10]

The five-year RSRs for both sexes were lowest for pancreatic (9.0%), esophageal (14.9%) and lung (18.0%) cancers.

Relative survival by age group

Survival tends to vary by age at diagnosis and generally decreases with advancing age. During the diagnosis years 2008–2012, the five-year RSR for all cancers combined was 83.8% for people diagnosed between the ages of 15 and 44 years compared to 34.6% for those 85 to 99 years of age at diagnosis (**Table 4.2**).

The higher survival ratio in younger people is likely due to better general health and more favourable responses to treatment. In addition, poor survival in older adults may be influenced by under-representation in clinical trials, an inability to tolerate more aggressive treatments and underlying differences in tumour biology.[11-13]

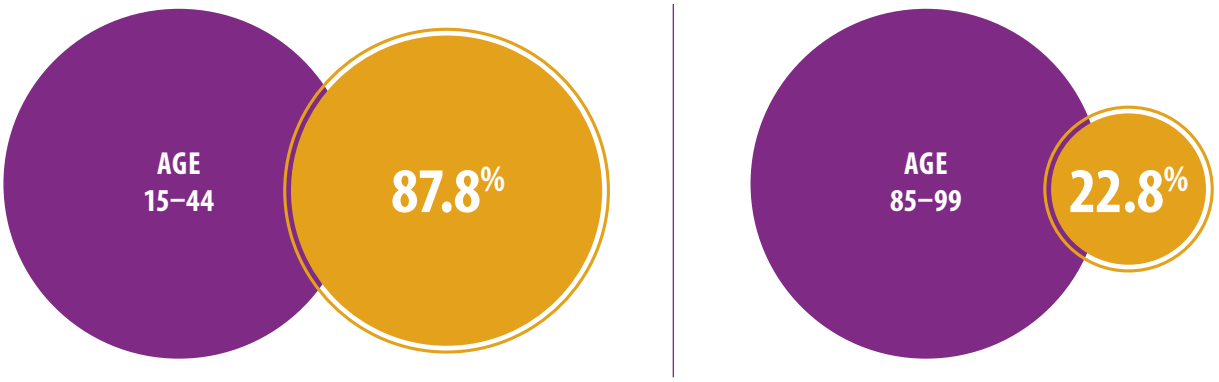
A significant decreasing trend in five-year RSRs across increasing age groups was found for all cancers examined (**Table 4.2**) with the exception of female breast, prostate, testicular, thyroid and uterine cancers:

- While prostate, thyroid and uterine cancer survival decreased with increasing age, the trend was not significant.
- Female breast cancer presented an unusual pattern with the RSR peaking in females 45 to 54 years of age (90.0%) and then declining with advancing age. Females diagnosed between the ages of 15 and 44 had a lower RSR (87.1%) than those diagnosed between the ages of 45 and 74. Lower survival in the youngest age group may be because younger women are more likely to develop aggressive tumours[14-16] and have a higher risk of being diagnosed at later stages.[17] In addition, improvements in treatment for breast cancer types that are common in middle-aged and older women have not been matched in treatment options available for breast cancer types more common in younger women.[18]
- Testicular cancer survival decreased with age, but RSRs could not be produced for the three oldest age groups due to the small number of cases and deaths.

The greatest differences in five-year RSRs between the youngest age group (15 to 44 years) and the oldest age group (85 to 99 years) were in cancers of the cervix (87.8% for the youngest age group, 22.8% for the oldest), ovary (76.4% vs. 12.2%) and kidney (88.7% vs. 25.4%).

On the other hand, esophageal cancer (18.0% in the youngest age group, 7.6% in the oldest), melanoma (91.4% vs. 74.6%) and female breast cancer (87.1% vs. 66.6%) had the smallest differences.

Cervical cancer
5-year RSR



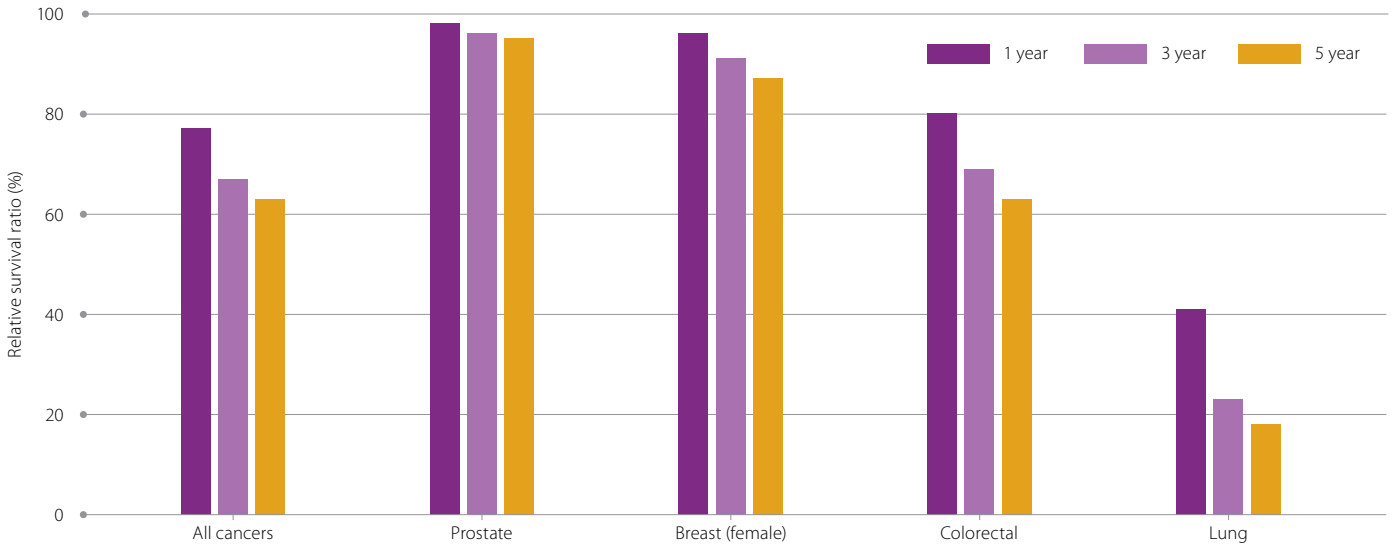
Relative survival by survival duration

The RSR for all cancers combined between 2008 and 2012 was 76.8% after one year, 67.0% after three years and 63.1% after five years (**Figure 4.1**). As with most individual cancers, overall cancer survival declined most during the first year after diagnosis, followed by progressively smaller decreases in survival as the time from diagnosis increased.

Between 2008 and 2012, the following was observed for the four most common cancers:

- Prostate cancer had the highest RSR over all three survival durations. The one-year RSR was 97.5%, and there was no significant difference between the three-year RSR (95.8%) and the five-year RSR (95.2%).
- While prostate cancer survival remained fairly stable across the survival durations, female breast cancer survival declined from 96.0% at one-year to 91.1% after three years, and then to 87.2% after five years.
- Colorectal cancer survival declined even more as time from diagnosis increased, with a one-year RSR of 80.5%, a three-year RSR of 68.8 % and a five-year RSR of 63.2%.
- Lung cancer had the lowest relative survival of the four most common cancers. The one-year RSR was 40.8%, the three-year RSR was 22.7% and the five-year RSR was 18.0%. Not only did lung cancer have the lowest survival ratios across all three survival periods, it also had the greatest decrease in survival between one and three years after diagnosis, with an absolute survival difference of almost 20%.

Figure 4.1 **Relative survival ratios (RSR), by survival duration and cancer type, Ontario, 2008-2012**



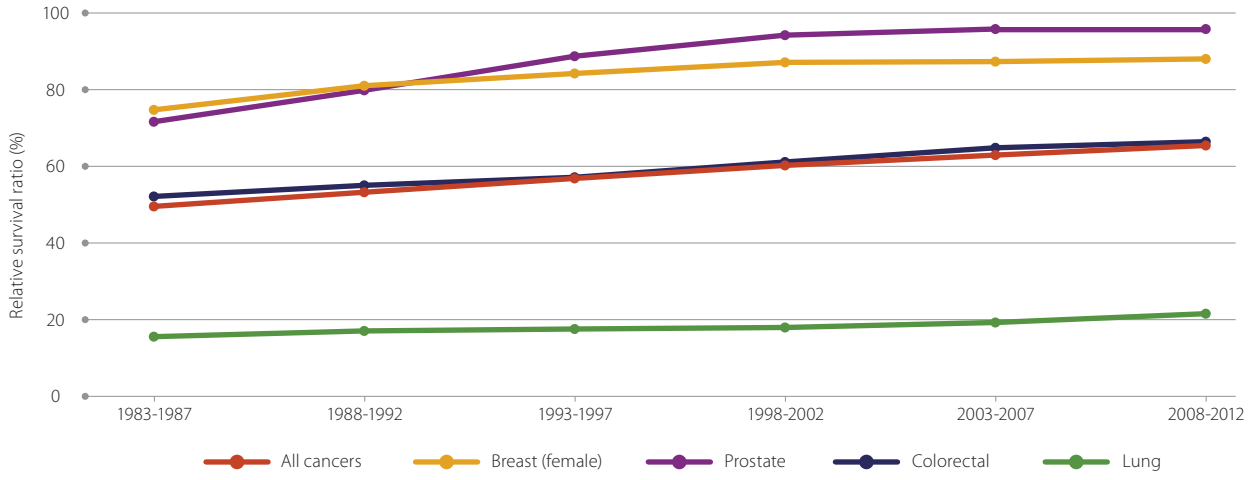
Note: Analysis restricted to ages 15-99
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: Ontario Cancer Registry (November 2015), CCO

Relative survival over time

To account for changes in the age structure of the population over time, RSRs are age-standardized when comparing ratios between two time periods. The age-standardized five-year RSR for all cancers combined increased over time, from 47.6% for cases diagnosed between 1983 and 1987 to 62.5% for the years 2008 to 2012. In addition, survival for people diagnosed with the four most common cancers also increased over the same time period (**Figure 4.2**):

- Prostate cancer had the greatest RSR increase (24.2 percentage points). It rose from 69.7% for the period 1983–1987 to 93.9% for 2008–2012. While female breast cancer survival was higher than prostate cancer between 1983 and 1987, a decade later (1993 to 1997) the prostate cancer RSR was higher than the breast cancer RSR. Between 2008 and 2012 the RSR for prostate cancer was almost eight percentage points higher than for breast cancer. This increase in survival may be a result of greater use of PSA testing and more frequent identification of early-stage, slow-growing cancers. Lead-time bias for prostate cancer is estimated to be between five and 12 years.[19]
- The RSR for female breast cancer also increased over time, but not to the same extent as the RSR for prostate cancer. Between 1983 and 1987, the RSR for female breast cancer was 72.8%. It rose 13.3 percentage points to 86.1% for the period 2008–2012. Similar to prostate cancer, the rate of increase for female breast cancer slowed from the diagnosis years 1998–2002 onward. The increase in breast cancer survival is likely due to a combination of screening and improved treatments (e.g., adjuvant systemic therapy), especially since the implementation of a provincially coordinated organized screening program in the late 1980s.[20]
- Between the periods 1983–1987 and 2008–2012, colorectal cancer survival increased by 14.3 percentage points and lung cancer survival increased by 6.0 percentage points. The absolute increase in survival for lung cancer was the smallest among the most common cancers, but this increase was still substantial because survival was so low for lung cancer. Lung cancer consistently had the lowest RSR of the top four cancers for all periods examined.

Figure 4.2 **Age-standardized five-year relative survival ratios (RSR), by cancer type, Ontario, 1983–1987 to 2008–2012**

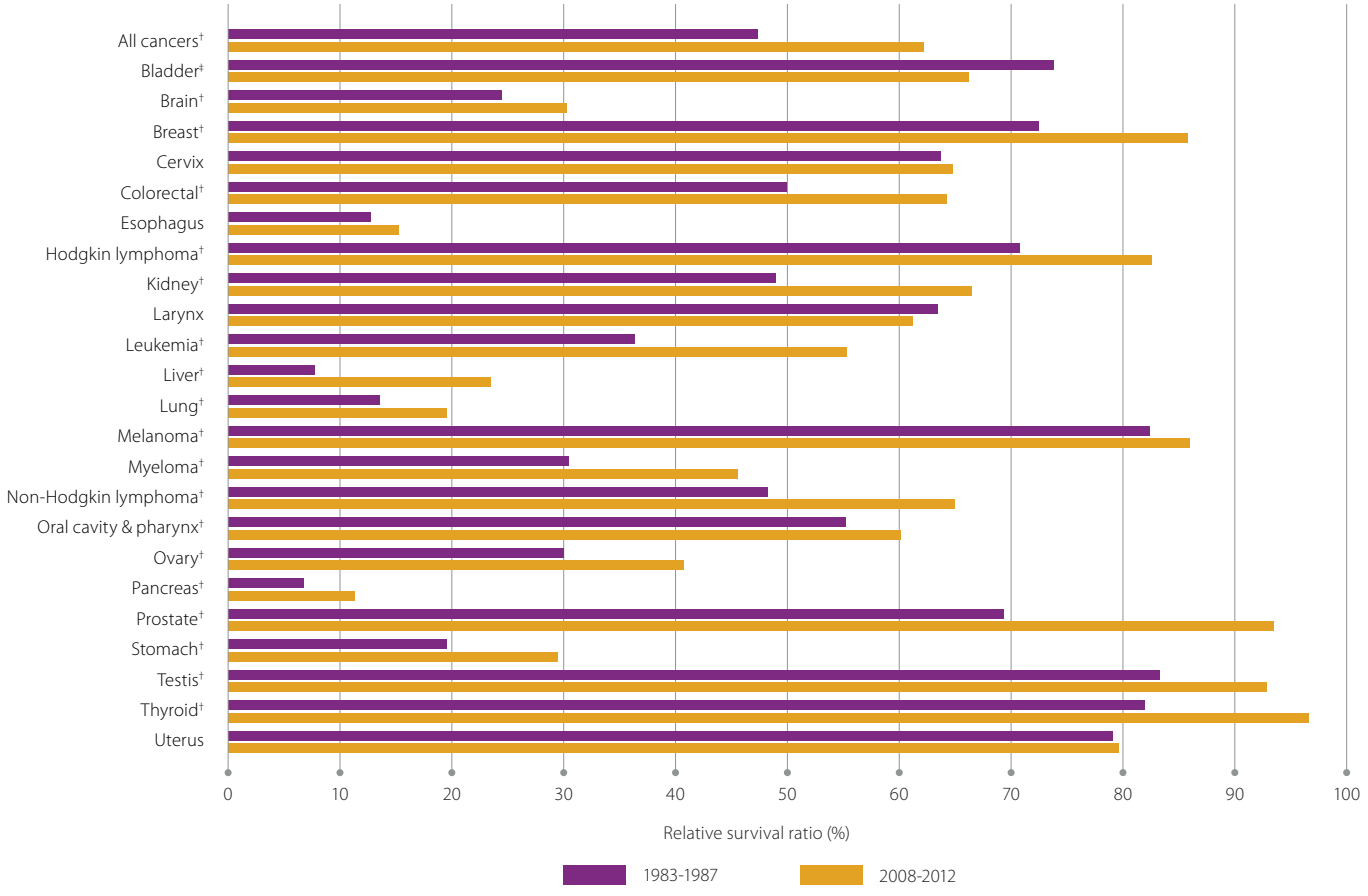


Note: Analysis restricted to ages 15-99
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: Ontario Cancer Registry (November 2015), CCO

The five-year RSR improved, to varying degrees, for all other cancer types during the periods 1983–1987 and 2008–2012 (**Figure 4.3**) with the following exceptions:

- There was no significant change in survival for cervical, esophageal, uterine and laryngeal cancers between the two time periods.
- The RSR for bladder cancer experienced a significant decrease, declining from 74.2% for the period 1983–1987 to 66.5% for the period 2008–2012. Decreasing or stabilizing trends in bladder cancer survival have also been observed in other jurisdictions[21-22] and are probably the result of changes to classification and coding practices that have coded more cancers as *in situ* or "uncertain" in recent years.[23,24]

Figure 4.3 **Age-standardized five-year relative survival ratios (RSR), by cancer type and time period, Ontario, 1983–1987 and 2008–2012**

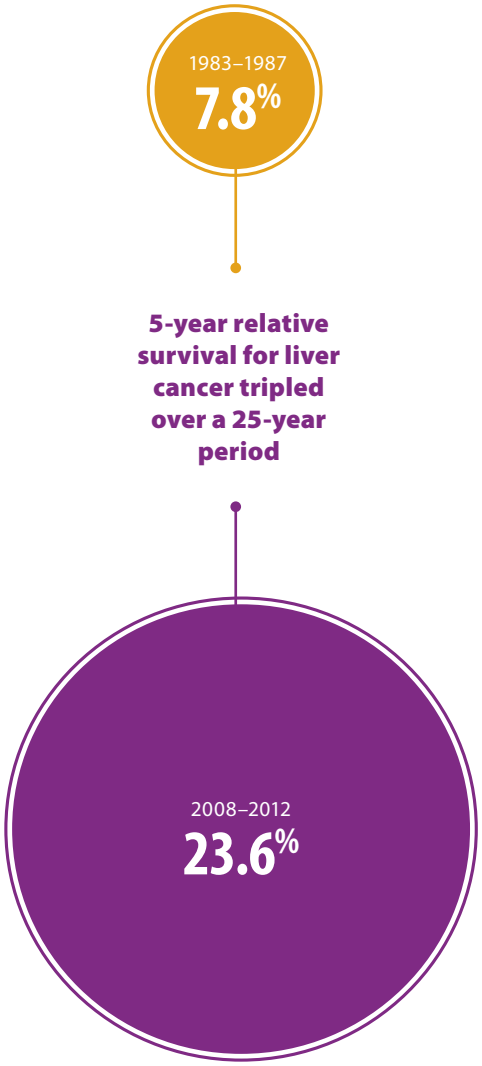


†Significantly higher five-year RSR in 2008-2012 compared to 1983-1987
‡Significantly lower five-year RSR in 2008-2012 compared to 1983-1987
Note: Analysis restricted to ages 15-99
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: Ontario Cancer Registry (November 2015), CCO

Five-year relative survival increased by 15 percentage points between 1983–1987 and 2008–2012.

Although all other cancers had significant increases in survival, some increases were particularly notable. Between the periods 1983–1987 and 2008–2012:

- The RSR for liver cancer tripled from 7.8% to 23.6%. A similar increase in the United States has been attributed to more awareness of the disease and its risk factors, more frequent screening for hepatitis infection and earlier diagnosis of people with a high-risk of developing the disease.[25] Diagnostic improvements may have also been achieved through the use of ultrasound and measurement of alpha-fetoprotein beginning in the 1980s.[26,27]
- The RSR for pancreatic cancer almost doubled from 6.8% to 11.4%. Despite this increase, survival ratios for pancreatic cancer remain among the lowest of all cancer types. An increase in pancreatic cancer survival has also been reported in the United States, where the five-year RSR doubled over a similar time period, albeit from a lower baseline value.[28] In contrast, in the United Kingdom the five-year relative survival for pancreatic cancer has remained stable since the 1970s.[29]
- The RSR for stomach cancer increased by about half from 19.6% to 29.6%.
- The RSR for leukemia increased by almost half from 36.5% to 55.6%.
- The RSR for myeloma increased by about half from 30.6% to 45.8%.



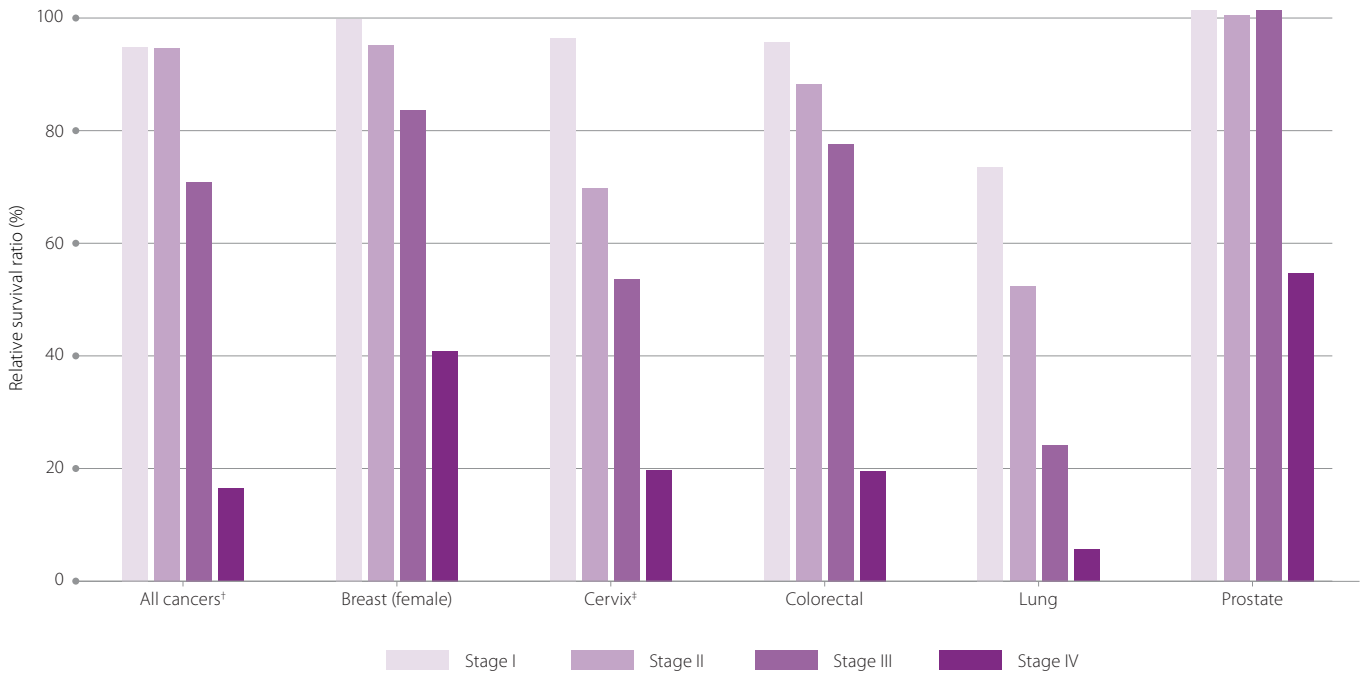
Relative survival by stage at diagnosis

Stage at diagnosis is one of the most important predictors of cancer survival. Survival generally tends to decrease as stage at diagnosis increases. Because of limited availability of stage data at the time of this analysis, this section examines three-year RSRs for cancers diagnosed between 2010 and 2012.

For all cancers for which stage data was available (prostate, female breast, colorectal, lung and cervix), the three-year RSR was 94.9% for cases diagnosed at stage I. Survival declined non-significantly to 94.7% for cases diagnosed at stage II, and significantly to 70.9% for stage III and 16.5% for stage IV (**Figure 4.4**). In other words, while individuals diagnosed at stage I or II had less than a 6% reduction in the probability of surviving another three years compared to their counterparts in the general population, those diagnosed at stage IV had a reduction of almost 85%.

While stage at diagnosis is an important prognostic factor for most cancers, the impact was less pronounced for prostate cancer. The three-year RSR for prostate cancer was over 100% for stages I, II and III. This means that men diagnosed with prostate cancer at these stages were just as likely (or more likely) to survive three years after their diagnosis compared to similar men in the general population. However, the three-year survival for stage IV prostate cancer was only 54.7%.

Figure 4.4 **Three-year relative survival ratios (RSR), by stage and cancer type, Ontario, 2010–2012**



†For this figure, all cancers refers to cancers for which stage data was available (prostate, breast (female), colorectal, lung and cervix)
‡Due to stage data availability, the cervical cancer RSRs use data from the diagnosis years 2011 and 2012
Note: Analysis restricted to ages 15-99; Case counts: prostate n=24,965 (excludes unknown stage=3,080), breast n=26,7617 (excludes unknown stage=3,976), colorectal n=20,718 (excludes unknown stage=7,463), lung n=22,684 (excludes unknown stage=5,904), cervix n=1,458 (excludes unknown stage=487)
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: Ontario Cancer Registry (November 2015), CCO

The three-year RSRs for the other cancers for which data are available are as follows:

- The RSR for breast cancer was high for those diagnosed in stage I (99.8%) and stage II (95.3%) but fell to 83.7% for stage III and 40.9% for stage IV.
- The colorectal cancer RSR declined substantially from a high of 95.7% at stage I to 19.6% at stage IV.
- The RSR for lung cancer declined significantly at every stage: 73.6% at stage I, 52.4% at stage II, 24.2% at stage III and 5.6% at stage IV.
- The RSR for cervical cancer was high for those diagnosed in stage I (96.4%) but declined by almost 30 percentage points to 69.8% for stage II. The RSRs were even lower for diagnoses at stage III (53.6%) and stage IV (19.8%).

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Table 4.1 Five-year relative survival ratios (RSR), by cancer type and sex, Ontario, 2008–2012

Cancer type	Both sexes	Males	Females
All cancers	**63.1%**	**61.8%**	**64.5%**
Bladder	62.9%	64.9%	57.0%
Brain	25.9%	24.8%	27.2%
Breast (female)	—	—	87.2%
Cervix	—	—	71.4%
Colorectal	63.2%	63.2%	63.1%
Esophagus	14.9%	14.7%	15.2%
Hodgkin lymphoma	84.2%	83.0%	85.6%
Kidney	69.0%	68.8%	69.4%
Larynx	61.0%	61.6%	57.6%
Leukemia	54.3%	54.8%	53.5%
Liver	24.1%	24.5%	22.7%
Lung	18.0%	15.1%	21.2%
Melanoma	85.0%	81.2%	89.5%
Myeloma	42.6%	43.4%	41.5%
Non-Hodgkin lymphoma	66.1%	64.6%	67.9%
Oral cavity and pharynx	63.1%	61.9%	65.3%
Ovary	—	—	45.8%
Pancreas	9.0%	9.1%	9.0%
Prostate	—	95.2%	—
Stomach	28.4%	27.7%	29.6%
Testis	—	96.1%	—
Thyroid	98.6%	95.6%	99.4%
Uterus	—	—	82.6%

Note: Analysis restricted to ages 15-99
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: Ontario Cancer Registry (November 2015), CCO

Table 4.2 **Five-year relative survival ratio (RSR), by cancer type and age group , Ontario, 2008–2012**

Cancer type	Age group (years)					
	15–44	45–54	55–64	65–74	75–84	85–99
All cancers†	**83.8%**	**74.8%**	**69.9%**	**63.3%**	**49.4%**	**34.6%**
Bladder†	78.3%	74.2%	72.9%	69.8%	57.3%	38.5%
Breast (female)	87.1%	90.0%	89.7%	89.7%	82.3%	66.6%
Cervix†	87.8%	70.2%	64.7%	53.5%	33.8%	22.8%
Colorectal†	70.9%	70.1%	69.1%	67.6%	57.8%	45.3%
Esophagus†	18.0%	21.3%	18.0%	15.3%	10.6%	7.6%
Hodgkin lymphoma†	93.5%	87.7%	77.3%	61.7%	52.0%	—
Kidney†	88.7%	78.6%	73.6%	68.8%	56.5%	25.4%
Larynx†	89.6%	67.4%	64.1%	61.9%	54.7%	38.5%
Leukemia†	71.3%	70.6%	67.4%	56.2%	39.9%	25.4%
Liver†	43.1%	33.6%	32.3%	22.0%	11.1%	4.6%
Lung†	36.7%	23.5%	22.0%	19.4%	13.8%	6.4%
Melanoma†	91.4%	88.3%	85.6%	84.6%	79.1%	74.6%
Myeloma†	73.2%	62.5%	54.4%	45.7%	27.6%	19.5%
Non-Hodgkin lymphoma†	83.7%	78.1%	74.8%	66.0%	50.9%	36.5%
Oral cavity & pharynx†	82.6%	73.8%	66.4%	58.6%	50.0%	36.8%
Ovary†	76.4%	62.0%	49.1%	37.3%	25.2%	12.2%
Pancreas†	40.5%	17.6%	13.7%	7.3%	5.3%	1.3%
Prostate	94.0%	98.0%	98.4%	98.6%	89.4%	58.4%
Stomach†	38.6%	35.9%	34.3%	30.5%	23.7%	11.9%
Testis	96.8%	96.0%	91.8%	—	—	—
Thyroid	99.9%	99.8%	98.7%	96.3%	88.9%	—
Uterus	90.1%	87.6%	87.5%	79.6%	74.5%	50.4%

†Statistically significant decreasing trend in RSR across age groups
Note: Analysis restricted to ages 15-99
For some age group and cancer combinations there were too few cases and/or deaths to produce reliable estimates
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: Ontario Cancer Registry (November 2015), CCO

IN FOCUS

Prostate cancer

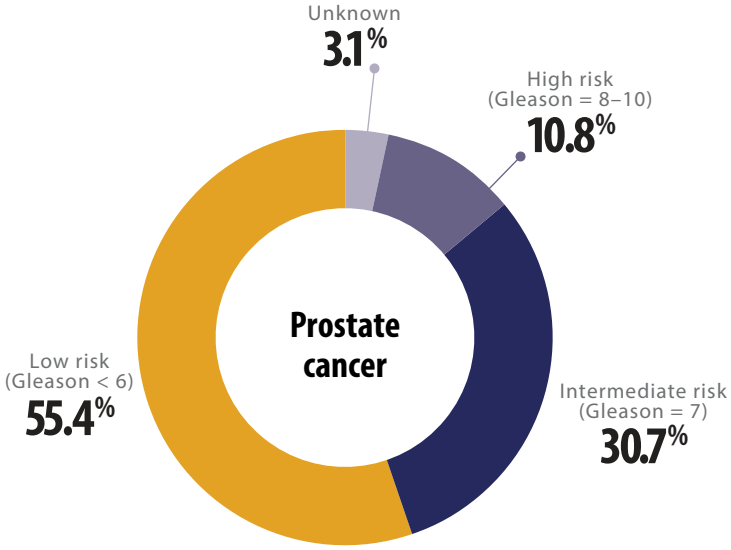
Most prostate cancer cases are low risk

The severity of a prostate tumour can be graded by its Gleason score: low risk cancers have a score of 6 or less; intermediate risk cancers have a score of 7; and high risk cancers have a score of 8 to 10.[1-4]

The majority of prostate cancer cases diagnosed in Ontario in 2012 were low risk cancers (55.4%) based on their Gleason score (**Figure D.1**). High risk cancers made up only 10.8% of all diagnosed cases. The large proportion of cases that were low risk indicates the possibility of over-diagnosis (i.e., cases which were clinically insignificant) and over-treatment, which can have a significant impact on an individual's quality of life.[5-8]

From 2010 to 2012, high risk cases were more common in older males. In that time frame, 16.7% of all cases in males 80 years of age or older were high risk, compared to 10.5% in males 60 to 79 years of age and 5.2% in males 40 to 59 years of age (data not shown).

Figure D.1 **Distribution of new cases, prostate cancer, by Gleason score, Ontario, 2012**



Note: Case counts: High risk n=920; Intermediate risk n=2615; Low risk n=4710; Unknown n=262
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: Ontario Cancer Registry (November 2015), CCO

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IN FOCUS

Cervical cancer

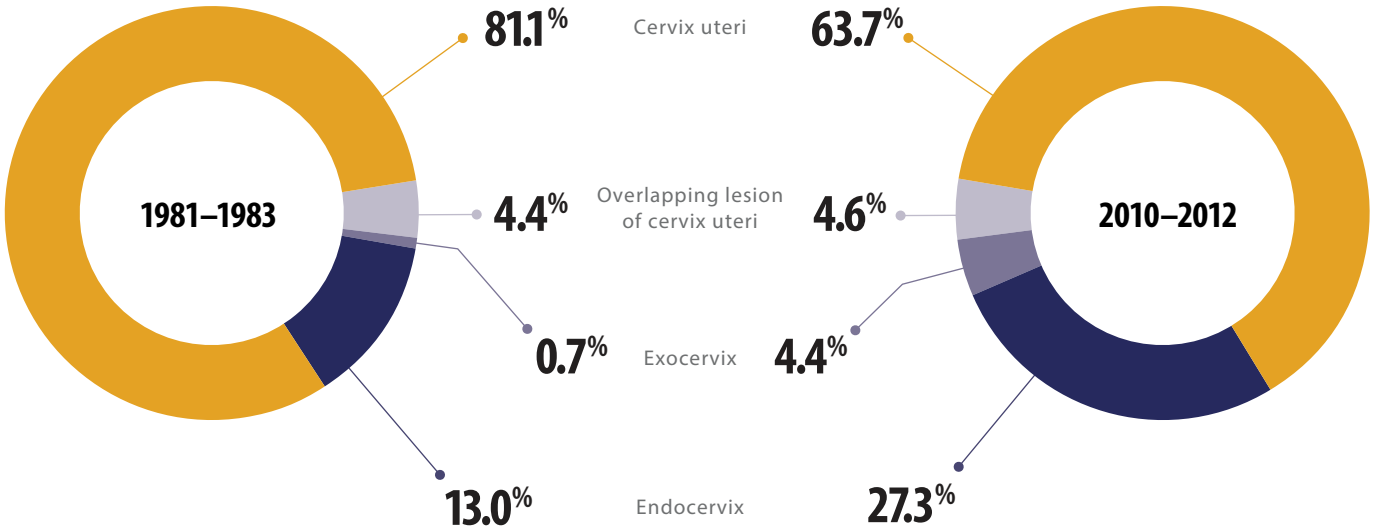
Cervix uteri now accounts for a smaller proportion of cervical cancers

Cervical cancer can occur in a number of subsites, including the cervix uteri, the endocervix, the exocervix and the overlapping lesion of the cervix uteri. While the majority of cases occur in the cervix uteri, the distribution of cases changed between 1981 and 2012. The proportion of cancers occurring in the cervix uteri decreased while the proportion occurring in the endocervix and exocervix cancers increased (**Figure E.1**).

Squamous cell carcinoma incidence decreasing over time

In 2012, 64.4% of cases of cervical cancer were squamous cell carcinomas and 28.1% were adenocarcinomas. These two most common histological types of cervical cancer had differing incidence trends over time (**Figure E.2**). Between 1981 and 2005, the incidence rate for squamous cell carcinoma of the cervix decreased by 3.2% per year. Since then, the rate has remained stable. On the other hand, the incidence rate for adenocarcinoma of the cervix increased by 2.6% per year between 1981 and 1996 and 6.0% per year between 2005 and 2012. Between 1996 and 2005 the rate of adenocarcinoma

Figure E.1 **Distribution of new cases, cervical cancer, by subsite, Ontario, 1981–1983 and 2010–2012**



Note: Cervix uteri (ICD-O-3: C53.9); Endocervix (ICD-O-3: C53.0); Exocervix (ICD-O-3: C53.1); Overlapping lesion of cervix uteri (ICD-O-3: 53.8). Cervix uteri cases may include not otherwise specified (NOS) cases. Case counts: (1981–1983: n=1,621, 2010-2012: n=1,909)
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

decreased by 6.6% per year. As a result, the rate of adenocarcinoma in 2012 was similar to the rate in 1981, while the rate of squamous cell carcinoma was more than halved over the same time period.

Over the past three decades, cervical cancer incidence rates in Ontario have decreased. This decrease is likely due to the effects of organized screening programs. Screening, however, did not appear to have the same effect on the incidence of adenocarcinomas as it did on squamous cell carcinomas. This is particularly concerning because studies have shown that adenocarcinomas have a poorer prognosis than squamous cell carcinomas.[1] At diagnosis, adenocarcinomas tend to be large and exhibit a tendency for early lymphatic and hematogeneous metastasis.[1,2] Previous research in Canada found that the increase in adenocarcinoma was mainly due to increases in incidence among women 20 to 49 years of age.[3]

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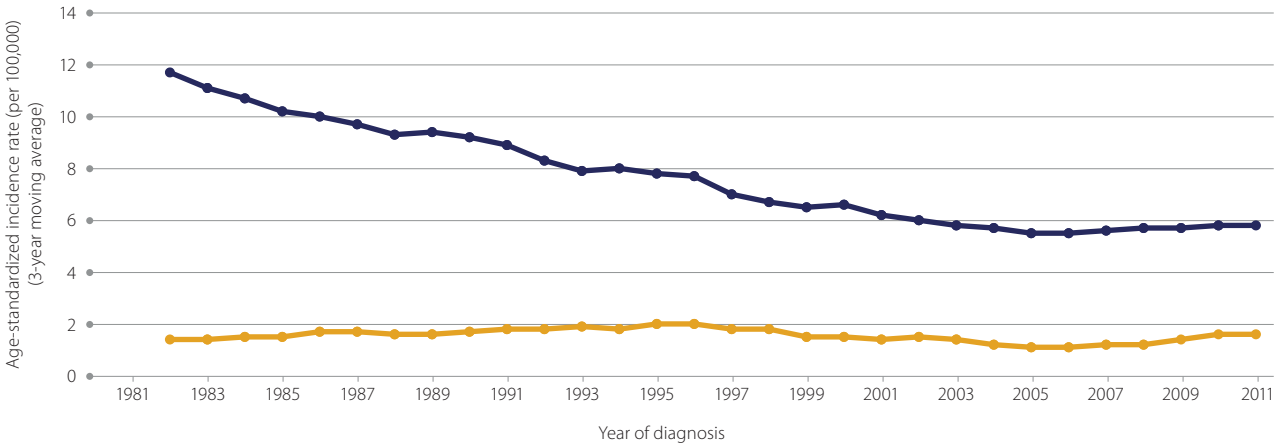
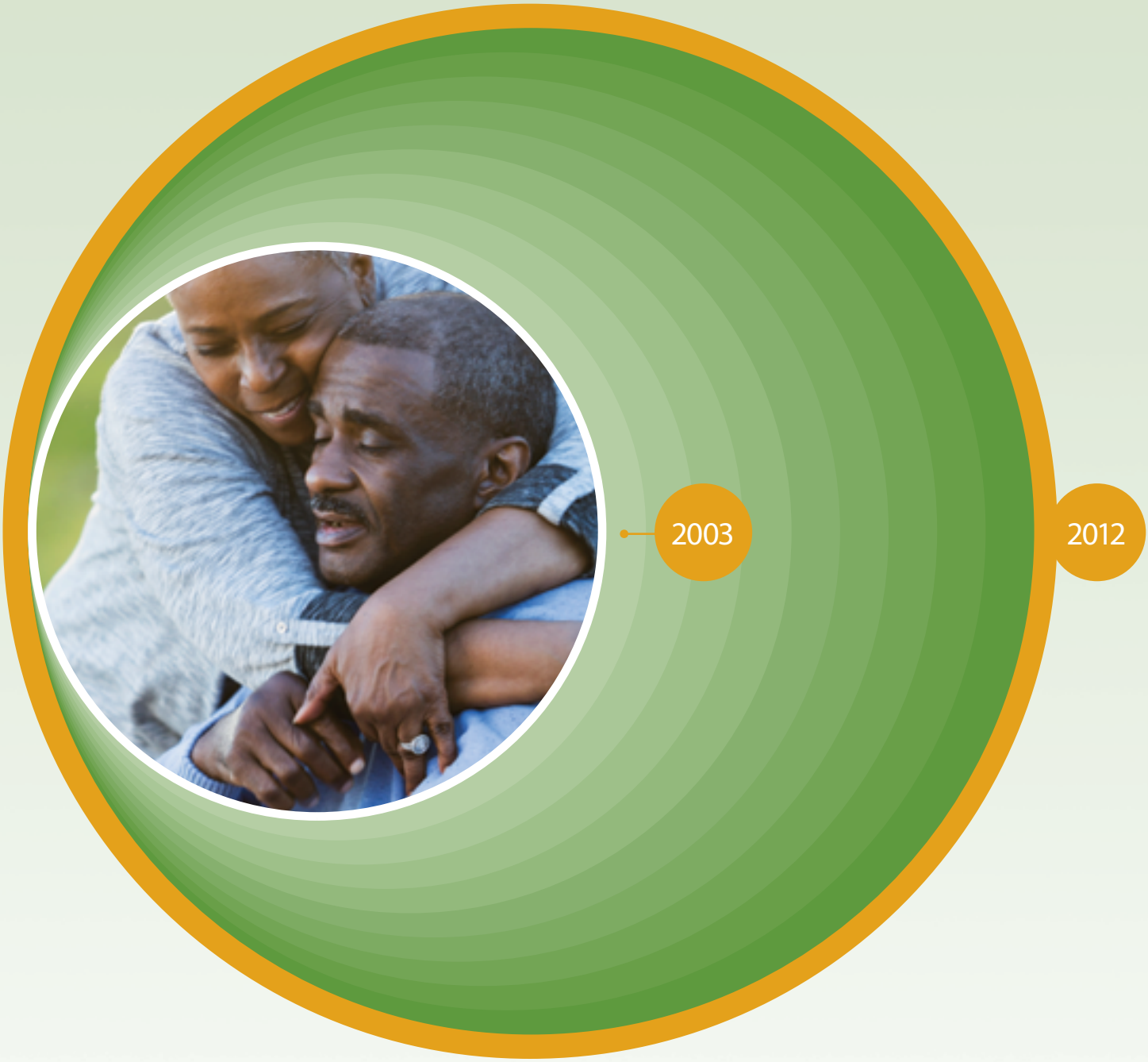
Figure E.2 **Age-standardized incidence rates, cervical cancer, by histological type, Ontario, 1981–2012**



Squamous cell carcinoma		Adenocarcinoma	
Year	APC	Year	APC
1981–2005	-3.2*	1981–1996	2.6*
2005–2012	0.9	1996–2005	-6.6*
		2005–2012	6.0*

*Statistically significant
Note: Squamous cell carcinoma: histologies 8010, 8052–8078, 8083–8084; Adenoncarcinoma: histologies 8140–8147, 8255–8384, 8480–8772
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)



362,557 **people living in Ontario with a cancer diagnosis within the previous 10 years**

5

Prevalence

There are more people in Ontario living with a diagnosis of cancer today then there were 20 years ago.

The number of people previously diagnosed with a malignant cancer who are alive at a given point in time is known as the prevalence. Cancer prevalence is a function of the incidence of and survival from cancer. As both incidence and survival rates have been increasing in Ontario, prevalence over time has also been increasing.

Trends in cancer prevalence reflect the increase, decrease or stability of cancer rates in the population. As a result, they can be used to help determine the allocation of diagnostic, treatment and care resources.[1]

This chapter presents limited-duration, person-based prevalence. Limited-duration cancer prevalence describes the number of people alive on a certain date (the index date) who were diagnosed with cancer within a specified previous number of years (e.g., two, five or 10 years). In this report, the index date is January 1, 2013.

Cancer cases diagnosed in the previous 10 years represent the greatest impact on the healthcare system. In the first two years after diagnosis, healthcare services used would likely include primary treatment. During the next three years, services would include close clinical assessment for recurrence. In the final five years after diagnosis, the use of healthcare services would consist mainly of follow-up.

Prevalence by cancer type and sex

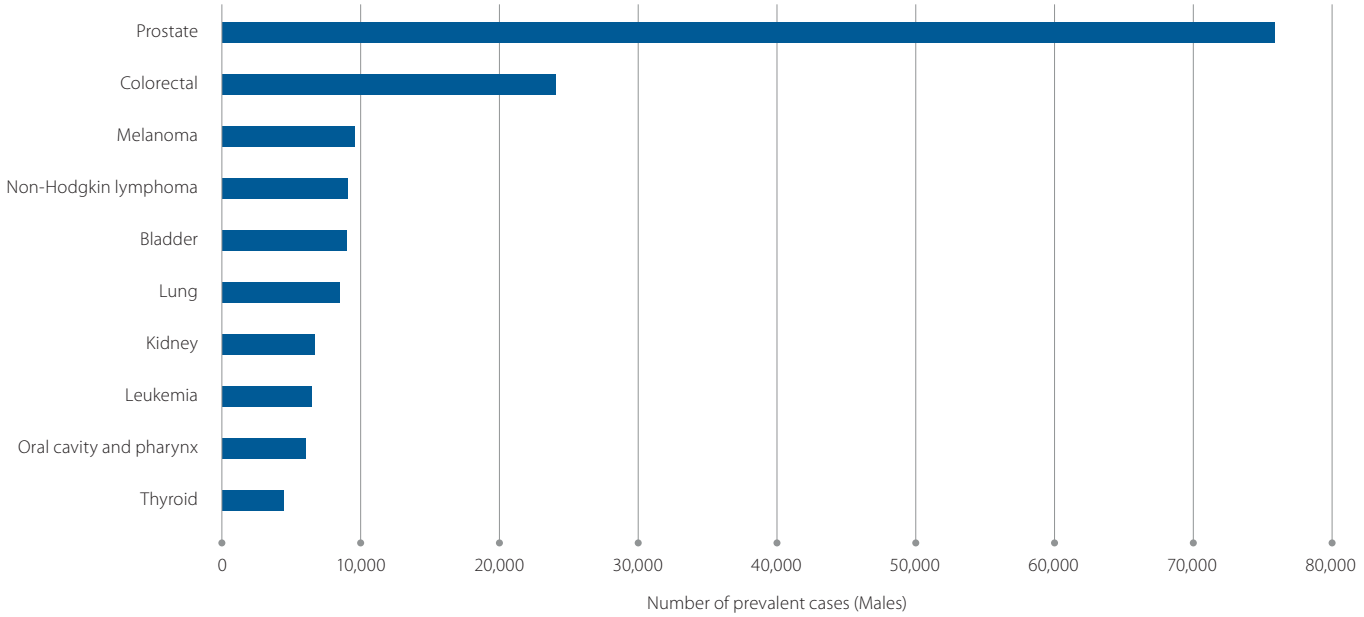
As of January 1, 2013, there were an estimated 362,557 people living in Ontario (about 2.7% of the population) who had been diagnosed with cancer within the previous 10 years. The split between the sexes was fairly even: 49.3% of prevalent cases were male and 50.7% were female.

Among males, those diagnosed with prostate cancer (75,945 cases) formed the largest proportion of 10-year prevalent cases (**Figure 5.1**), which reflects the high incidence and survival for this cancer. Colorectal cancer (24,065) was the second most prevalent cancer among males, followed by melanoma (9,572) and non-Hodgkin lymphoma (9,083).

Among females, those diagnosed with breast cancer (67,779) formed the largest proportion of 10-year prevalent cases. Like prostate cancer, the high prevalence of breast cancer reflects both high incidence and high survival. As with males, colorectal cancer (20,494) was the second most prevalent cancer. The next most prevalent cancers in females were thyroid (17,180) and uterus (14,930).

For both males and females, lung cancer was not among the four most prevalent cancers despite being the second most commonly diagnosed cancer for each sex in 2012. This reflects the low survival ratios for lung cancer. As a result, less commonly diagnosed cancers (melanoma and non-Hodgkin lymphoma in males and thyroid and uterus in females) were more prevalent in the population.

Figure 5.1 **Distribution of 10-year prevalence, by cancer type and sex, Ontario, January 1, 2013**

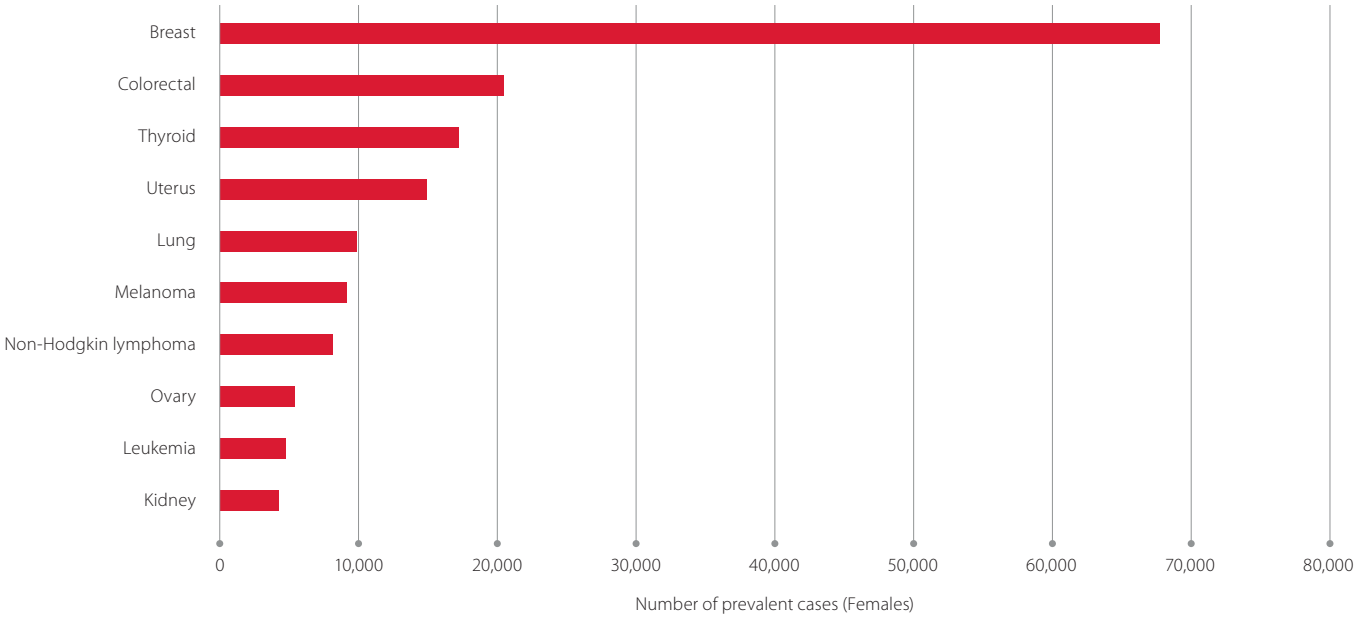


Note: Prevalence counts: males n=178,825; females n=183,732.
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Prostate, female breast and colorectal cancers had the highest 10-year prevalence.

There were some notable differences in 10-year prevalence between the sexes:

- Bladder cancer accounted for 8,951 prevalent cases among males and 2,794 among females. The higher prevalence of bladder cancer in males is in part due to the higher incidence rate in males (ASIR of 58.2 per 100,000 in 2012) compared to females (ASIR of 16.0 per 100,000). Males also have higher relative survival compared to females.
- The prevalence of head and neck cancers was higher among males than among females. Oral cavity and pharynx cancer accounted for 5,999 prevalent cases among males compared to 3,062 among females, while there were 1,945 prevalent cases of laryngeal cancer among males and 374 among females. Like bladder cancer, the incidence rates for oral cavity and laryngeal cancers are higher among males than females.
- On the other hand, thyroid cancer was more prevalent among females (17,180) than among males (4,439). Thyroid cancer incidence and survival is higher among females than males, resulting in more prevalent cases among females.



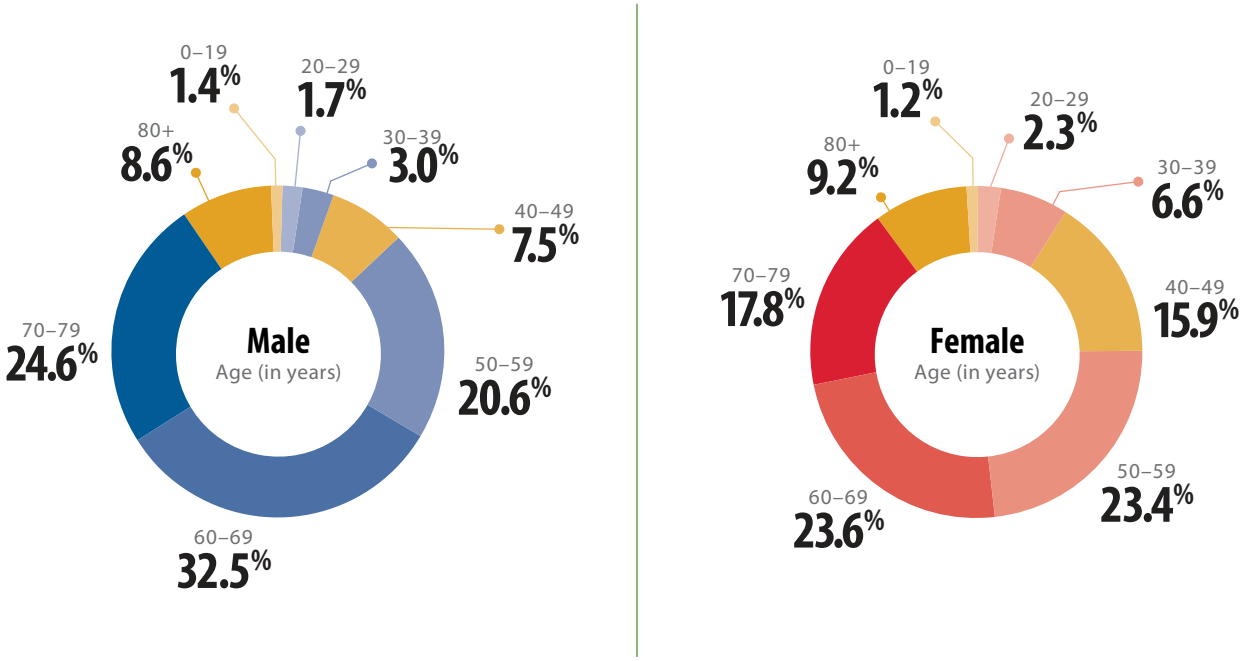
Prevalence by age group

The vast majority (80.1%) of 10-year prevalent cases were in people over the age of 50 at diagnosis. The most prevalent age group was 60 to 69 years at diagnosis, with 28.0% of all prevalent cases occurring in this age group. Cancer prevalence was low in children and adolescents, with only 1.3% of prevalent cases diagnosed in people younger than 20 years of age, reflecting the low incidence of cancer in this age group.

Between the sexes, there were some notable differences in 10-year prevalence (**Figure 5.2**):

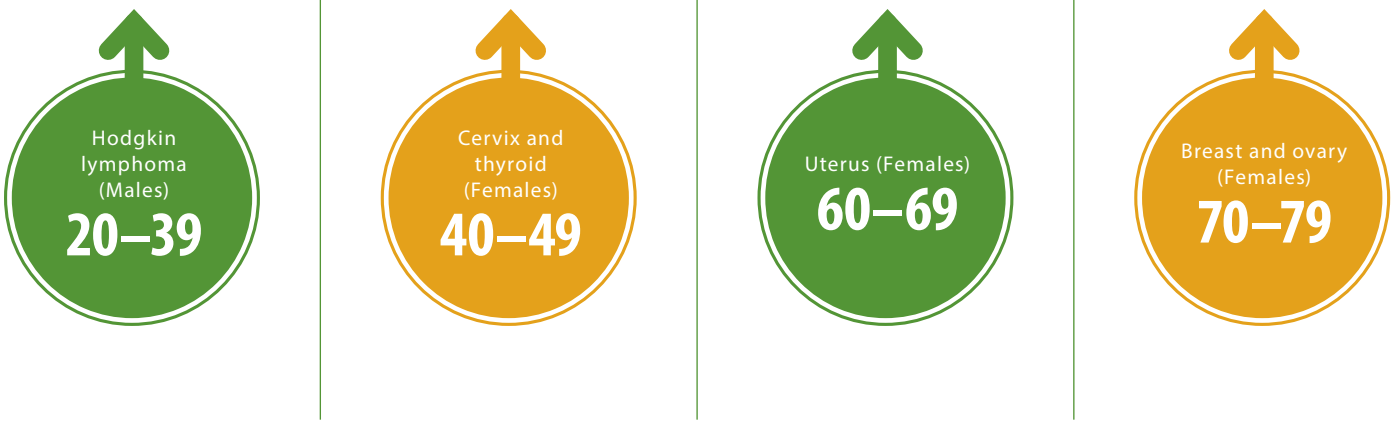
- While the age group with the most prevalent cases for both sexes was 60 to 69 years, a larger percentage of prevalent cases was found among males in this age group at 32.5% than among females at 23.6%.
- Prevalent cases were more likely to have been diagnosed at younger ages among females than males. For males, 6.1% of 10-year prevalent cases were diagnosed in people under the age of 40. For females, 10.1% were diagnosed in this age group. In addition, 33.2% of cases were diagnosed after the age of 70 among males compared to 27.0% of cases among females. This is likely due to the high prevalence of breast cancer in females, which has a wide age distribution at diagnosis, and the high prevalence of prostate cancer in males, which is more commonly diagnosed at older ages.

Figure 5.2 **Distribution of 10-year prevalence, by sex and age group, Ontario, January 1, 2013**



Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Peak age (in years) for 10-year cancer prevalence proportions



Among male adults, significant increases with advancing age in 10-year prevalence proportions were seen for all cancers except for Hodgkin lymphoma and testicular, brain and thyroid cancers (**Table 5.1**).

- For Hodgkin lymphoma and testicular cancer, which both peaked in the youngest age group (20 to 39 years of age), 10-year prevalence proportions decreased significantly with increasing age.
- The 10-year prevalence proportion for brain cancer peaked in people 50 to 59 years of age and then decreased in the older age groups, while the proportion for thyroid cancer peaked among people 60 to 69 years of age.

Among female adults, 10-year prevalence proportions increased significantly with increasing age for all cancers except brain, breast, cervix, Hodgkin lymphoma, ovary, thyroid and uterus (**Table 5.1**).

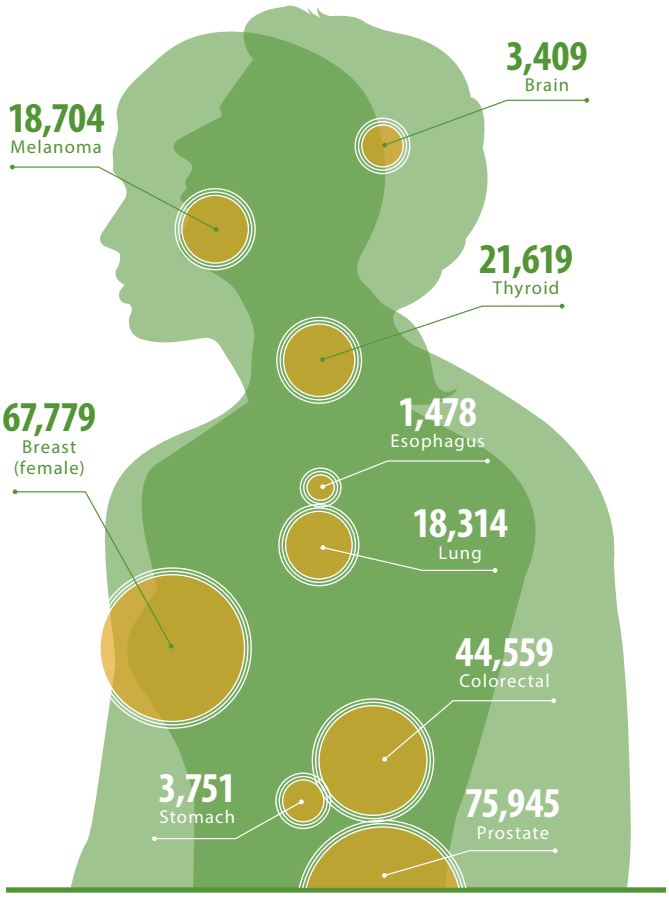
- As with males, the 10-year prevalence proportion for Hodgkin lymphoma decreased significantly with increasing age, peaking in the youngest age group (people 20 to 39 years of age).
- Prevalence proportions for breast and ovarian cancers increased with age group, peaking in those 70 to 79 years of age and decreasing in those 80 years of age and older.
- The uterine cancer prevalence proportion peaked in women 60 to 69 years of age and then decreased among women in older age groups.
- Cervical and thyroid cancers peaked among women 40 to 49 years of age and then decreased in women in older age groups.

Prevalence by duration

Among people alive on January 1, 2013, the 10-year prevalence proportion was 2,689.5 per 100,000 (**Table 5.3**). The five-year prevalence proportion was 1,646.8 per 100,000 and the two-year prevalence proportion was 786.9 per 100,000. For all cancers combined, the split between males and females was relatively even in each duration period.

- Prostate cancer (1,147.0 per 100,000) and female breast cancer (988.2 per 100,000) accounted for almost 40% of all 10-year prevalent cancers. The relative contribution of both female breast and prostate cancers decreased with shorter prevalence periods. Prostate cancer made up 16.4% and female breast cancer accounted for 16.2% of two-year prevalent cases.
- Lung cancer, on the other hand, accounted for a greater proportion of prevalent cases as the prevalence duration shortened. At 135.9 per 100,000 lung cancer accounted for 5.1% of 10-year prevalent cases compared to 8.3% of two-year prevalent cases (65.7 per 100,000).
- In comparison, colorectal cancer contributed a fairly equal proportion of prevalent cases regardless of the prevalence duration. It accounted for 12.3%, 12.6% and 12.3% of all prevalent cases in each duration period, respectively.

Number of 10-year prevalent cases for selected cancers, January 1, 2013



Prevalence over time

The 10-year prevalence proportion of cancer in Ontario has increased over time. For all cancers combined, the prevalence proportion per 100,000 people was 1,677.9 in 1992, 2,161.8 in 2002 and 2,689.5 in 2012. There was an increase of 24.4% between 1992 and 2002 and of 28.8% between 2002 and 2012 (**Table 5.4**). As these rates are not age-standardized, part of this increase is likely due to an aging population and population growth rather than just increased incidence rates or survival.

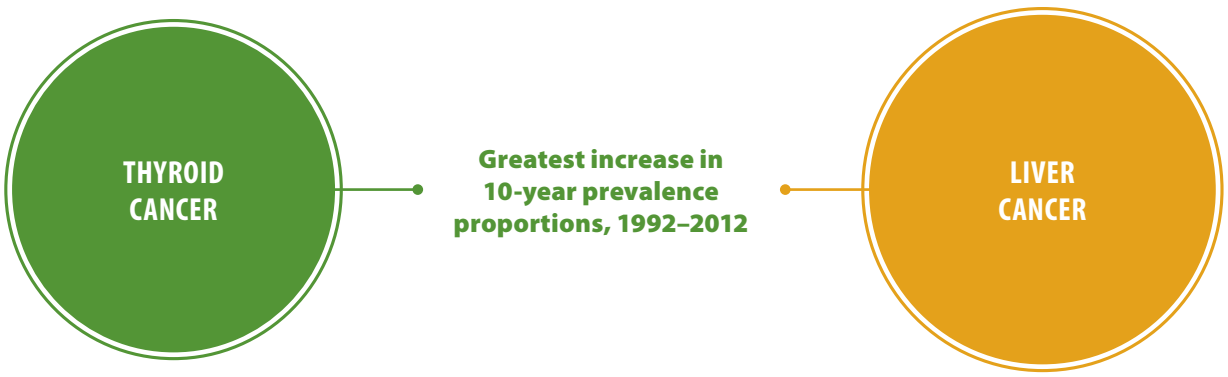
Between 1992 and 2002, males (37.0%) had a greater increase in 10-year cancer prevalence than did females (21.9%). The gap narrowed between 2002 and 2012 to a 26.3% increase for males and a 22.6% increase for females.

Over time, 10-year prevalence proportions increased for most cancers. The greatest increases were for thyroid and liver cancers:

- Thyroid cancer increased by 102.2% between 1992 and 2002 and by 125.5% between 2002 and 2012.
- Liver cancer increased by 143.2% between 1992 and 2002 and by 100.7% between 2002 and 2012.

While the prevalence proportion of most cancers increased between 1992 and 2012, for some cancer types it decreased over the same time period:

- The prevalence proportion for laryngeal cancer for both sexes combined decreased by 17.4% between 1992 and 2002 and by 9.6% between 2002 and 2012. The decrease was greater for females than males.
- The prevalence proportion for cervical cancer decreased by 7.8% between 1992 and 2002 and by 8.0% between 2002 and 2012. This probably reflects the significant decreases in cervical cancer incidence over this time period.
- The prevalence proportion for bladder cancer decreased by 10.3% between 1992 and 2002 and increased by 0.6% between 2002 and 2012. While the prevalence proportion increased for both sexes combined between 2002 and 2012, it decreased by 6.2% among females.
- The prevalence proportion for Hodgkin lymphoma increased by 1.9% between 1992 and 2002 before it decreased by 3.2% between 2002 and 2012.
- The prevalence proportion for oral cavity and pharynx cancer decreased by 3.1% between 1992 and 2002, and then increased by 22.0% between 2002 and 2012. The decrease between 1992 and 2002, however, was only among males and not females.



While the prevalence proportions of most cancers increased between 1992 and 2012, some cancer types decreased over the same time period.

There were some notable differences in the prevalence of lung cancer between males and females over time. The male prevalence proportion decreased by 5.2% between 1992 and 2002, and then increased by 7.4% between 2002 and 2012. In comparison, the prevalence proportion among females increased by 30.1% between 1992 and 2002 and by 36.9% between 2002 and 2012. This greater increase among females probably reflects differing historical smoking rates between men and women. The male lung cancer incidence rate has been stable or decreasing since 1981 while the female rate has been increasing over the same time period, resulting in increased prevalence among females.

The prevalence of esophageal cancer also varied by sex. Male prevalence proportions increased by of 29.2% between 1992 and 2002 followed by an increase of 54.2% between 2002 and 2012. Female proportions also increased, but the level of increase was smaller at 4.6% between 1992 and 2002 and 14.3% between 2002 and 2012.

Lung cancer prevalence proportions, 2002–2012

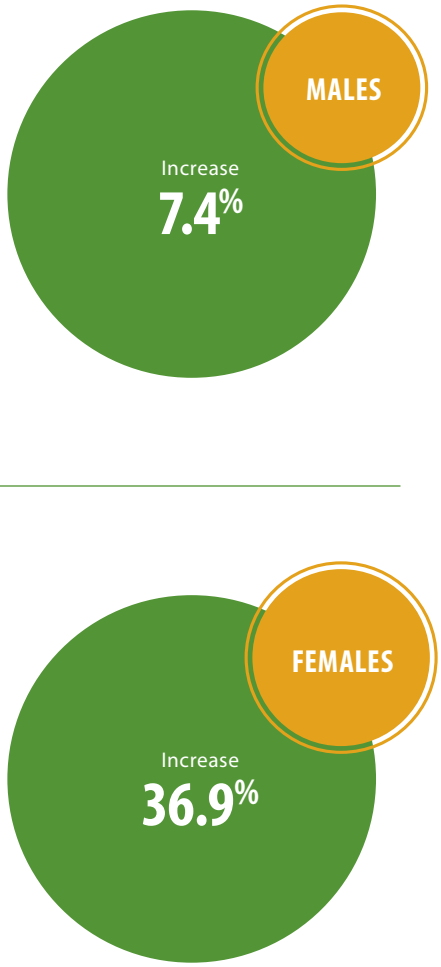


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Table 5.1 Ten-year prevalence proportions (per 100,000), by age group, cancer type and sex, Ontario, January 1, 2013

Cancer type	Males						
	Age group (years)						
	All ages	20–39	40–49	50–59	60–69	70–79	80+
All cancers†	**2700.7**	**482.2**	**1,393.7**	**3,821.2**	**8,595.9**	**11,596.9**	**7,507.0**
Bladder†	131.9	5.3	37.7	132.2	377.2	784.9	768.3
Brain	27.4	24.6	31.6	34.5	33.5	29.2	17.8
Colorectal†	363.4	30.5	163.4	488.5	1,090.7	1,777.5	1,388.1
Esophagus†	16.7	0.7	8.5	26.0	54.1	73.3	49.7
Hodgkin lymphoma‡	24.0	36.1	28.3	17.3	19.5	17.7	3.9
Kidney†	104.4	16.8	106.5	178.7	275.2	328.0	186.7
Larynx†	29.4	1.1	12.9	48.5	95.3	129.2	83.4
Leukemia†	97.6	22.1	62.5	127.1	231.7	328.0	315.9
Liver†	23.3	2.1	14.4	48.6	65.0	80.6	42.0
Lung†	127.6	5.4	37.2	136.8	403.3	735.8	515.1
Melanoma†	144.6	48.8	126.8	208.7	348.5	510.4	484.2
Myeloma†	33.4	2.2	19.7	45.5	96.5	155.8	132.6
Non-Hodgkin lymphoma†	137.2	44.0	120.0	198.6	342.1	470.7	368.5
Oral cavity and pharynx†	90.6	16.9	98.2	184.2	238.8	239.0	176.5
Pancreas†	15.7	2.7	10.1	23.2	46.9	67.1	38.1
Prostate†	1147.0	1.3	197.5	1,614.4	4,577.6	5,590.2	2,539.8
Stomach†	34.8	3.4	21.8	42.6	100.8	165.2	137.5
Testis‡	51.6	119.1	73.0	26.0	10.1	7.0	5.3
Thyroid	67.0	52.3	109.6	110.0	114.8	102.5	39.5

†Statisically significant increasing trend in prevalence proportions across age groups
‡Statistically significant decreasing trend in prevalence proportions across age groups
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Table 5.1 ***(Cont'd)*** **Ten-year prevalence proportions (per 100,000), by age group, cancer type and sex, Ontario, January 1, 2013**

Cancer type	Females						
	Age group (years)						
	All ages	20–39	40–49	50–59	60–69	70–79	80+
All cancers†	**2,678.7**	**898.5**	**2976.6**	**4341.6**	**5970.3**	**7348.0**	**4996.7**
Bladder†	40.7	2.6	10.8	39.0	90.1	183.1	163.7
Brain	23.2	20.7	28.1	26.4	28.5	29.4	17.1
Breast (female)	988.2	19.6	129.2	179.0	232.0	247.6	154.1
Cervix	61.3	7.9	12.4	7.6	6.3	4.7	2.3
Colorectal†	298.8	27.0	161.1	369.0	697.6	1276.8	1140.9
Esophagus†	5.4	0.4	2.5	8.1	13.9	21.8	17.1
Hodgkin lymphoma‡	20.2	36.4	17.6	13.6	12.5	15.6	6.8
Kidney†	61.9	13.4	55.1	110.0	151.7	208.5	111.5
Larynx†	5.5	0.9	2.4	8.9	16.2	19.8	10.3
Leukemia†	68.7	18.6	45.1	75.9	132.7	221.2	192.6
Liver†	8.8	1.5	6.1	13.5	20.3	30.3	21.5
Lung†	143.8	7.3	56.4	186.7	440.7	649.1	345.4
Melanoma†	133.1	80.8	168.7	196.1	237.0	289.3	264.9
Myeloma†	26.5	1.5	15.5	34.5	65.0	110.7	92.3
Non-Hodgkin lymphoma†	118.3	33.5	93.9	170.7	281.3	397.4	260.8
Oral cavity and pharynx†	44.6	13.1	43.3	75.5	93.8	133.0	93.2
Ovary	78.6	32.0	106.0	138.5	165.0	171.5	85.0
Pancreas†	15.1	2.4	10.3	20.7	43.6	52.6	33.9
Stomach†	21.1	4.5	15.1	25.6	48.2	85.1	64.0
Thyroid	250.5	260.2	467.2	397.8	309.4	223.0	65.5
Uterus	217.7	21.3	153.3	472.2	662.7	564.7	259.9

†Statisically significant increasing trend in prevalence proportions across age groups
‡Statistically significant decreasing trend in prevalence proportions across age groups
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Table 5.2 Number of prevalent cancer cases by duration, cancer type and sex, Ontario, January 1, 2013

	10-year prevalence			5-year prevalence			2-year prevalence		
	Total	Males	Females	Total	Males	Females	Total	Males	Females
All cancers	**362,557**	**178,825**	**183,732**	**221,988**	**109,701**	**112,287**	**106,073**	**52,599**	**53,474**
Bladder	11,745	8,951	2,794	7,268	5,601	1,667	3,484	2,673	811
Brain	3,409	1,816	1,593	2,242	1,208	1,034	1,261	683	578
Breast (female)	67,779	—	67,779	39,014	—	39,014	17,181	—	17,181
Cervix	4,208	—	4,208	2,390	—	2,390	1,078	—	1,078
Colorectal	44,559	24,065	20,494	27,886	15,193	12,693	13,039	7,138	5,901
Esophagus	1,478	1,106	372	1,145	878	267	768	590	178
Hodgkin lymphoma	2,975	1,587	1,388	1,591	852	739	679	379	300
Kidney	10,954	6,711	4,243	6,812	4,263	2,549	3,200	2,037	1,163
Larynx	2,319	1,945	374	1,367	1,154	213	646	534	112
Leukemia	11,175	6,460	4,715	6,986	4,081	2,905	3,297	1,936	1,361
Liver	2,143	1,540	603	1,591	1,129	462	951	651	300
Lung	18,314	8,450	9,864	13,904	6,480	7,424	8,851	4,225	4,626
Melanoma	18,704	9,572	9,132	11,216	5,929	5,287	5,011	2,691	2,320
Myeloma	4,029	2,214	1,815	2,907	1,612	1,295	1,651	910	741
Non-Hodgkin lymphoma	17,198	9,083	8,115	10,782	5,802	4,980	5,251	2,853	2,398
Oral cavity and pharynx	9,061	5,999	3,062	5,721	3,863	1,858	2,883	1,998	885
Ovary	5,393	—	5,393	3,390	—	3,390	1,659	—	1,659
Pancreas	2,071	1,037	1,034	1,639	836	803	1,138	593	545
Prostate	75,945	75,945	—	41,917	41,917	—	17,420	17,420	—
Stomach	3,751	2,304	1,447	2,599	1,635	964	1,505	972	533
Testis	3,418	3,418	—	1,829	1,829	—	784	784	—
Thyroid	21,619	4,439	17,180	12,997	2,776	10,221	6,113	1,419	4,694
Uterus	14,930	—	14,930	9,212	—	9,212	4,371	—	4,371

Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Table 5.3 **Prevalence proportions (per 100,000), by duration, cancer type and sex, Ontario, January 1, 2013**

	10-year prevalence			5-year prevalence			2-year prevalence		
	Total	Males	Females	Total	Males	Females	Total	Males	Females
All cancers	**2,689.5**	**2,700.8**	**2,678.7**	**1,646.8**	**1,656.8**	**1,637.1**	**786.9**	**794.4**	**779.6**
Bladder	87.1	135.2	40.7	53.9	84.6	24.3	25.8	40.4	11.8
Brain	25.3	27.4	23.2	16.6	18.2	15.1	9.4	10.3	8.4
Breast (female)	988.2	—	988.2	568.8	—	568.8	250.5	—	250.5
Cervix	61.3	—	61.3	34.8	—	34.8	15.7	—	15.7
Colorectal	330.5	363.5	298.8	206.9	229.5	185.1	96.7	107.8	86.0
Esophagus	11.0	16.7	5.4	8.5	13.3	3.9	5.7	8.9	2.6
Hodgkin lymphoma	22.1	24.0	20.2	11.8	12.9	10.8	5.0	5.7	4.4
Kidney	81.3	101.4	61.9	50.5	64.4	37.2	23.7	30.8	17.0
Larynx	17.2	29.4	5.5	10.1	17.4	3.1	4.8	8.1	1.6
Leukemia	82.9	97.6	68.7	51.8	61.6	42.4	24.5	29.2	19.8
Liver	15.9	23.3	8.8	11.8	17.1	6.7	7.1	9.8	4.4
Lung	135.9	127.6	143.8	103.1	97.9	108.2	65.7	63.8	67.4
Melanoma	138.8	144.6	133.1	83.2	89.5	77.1	37.2	40.6	33.8
Myeloma	29.9	33.4	26.5	21.6	24.3	18.9	12.2	13.7	10.8
Non-Hodgkin lymphoma	127.6	137.2	118.3	80.0	87.6	72.6	39.0	43.1	35.0
Oral cavity and pharynx	67.2	90.6	44.6	42.4	58.3	27.1	21.4	30.2	12.9
Ovary	78.6	—	78.6	49.4	—	49.4	24.2	—	24.2
Pancreas	15.4	15.7	15.1	12.2	12.6	11.7	8.4	9.0	7.9
Prostate	1,147.0	1,147.0	—	633.1	633.1	—	263.1	263.1	—
Stomach	27.8	34.8	21.1	19.3	24.7	14.1	11.2	14.7	7.8
Testis	51.6	51.6	—	27.6	27.6	—	11.8	11.8	—
Thyroid	51.6	67.0	250.5	96.4	41.9	149.0	45.3	21.4	68.4
Uterus	217.7	—	217.7	134.3	—	134.3	63.7	—	63.7

Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Table 5.4 Ten-year prevalence proportions (per 100,000), by time period, cancer type and sex, Ontario, January 1, 1993, January 1, 2003, January 1, 2013

	1992			2002			2012		
	Total	Males	Females	Total	Males	Females	Total	Males	Females
All cancers	**1,677.9**	**1,561.0**	**1,792.1**	**2,161.8**	**2,137.8**	**2,185.4**	**2,689.5**	**2,700.8**	**2,678.7**
Bladder	96.5	144.5	49.5	86.6	130.8	43.4	87.1	135.2	40.7
Brain	21.4	22.8	20.0	22.8	24.1	21.6	25.3	27.4	23.2
Breast (female)	671.2	—	671.2	872.9	—	872.9	988.2	—	988.2
Cervix	72.7	—	72.7	67.1	—	67.1	61.3	—	61.3
Colorectal	230.9	234.6	227.3	270.8	288.9	253.2	330.5	363.5	298.8
Esophagus	6.4	8.4	4.5	7.8	10.8	4.7	11.0	16.7	5.4
Hodgkin lymphoma	22.4	24.5	20.2	22.8	24.9	20.7	22.1	24.0	20.2
Kidney	40.6	48.1	33.2	55.6	66.4	45.1	81.3	101.4	61.9
Larynx	23.0	38.5	7.9	19.0	32.1	6.2	17.2	29.4	5.5
Leukemia	48.3	55.5	41.2	58.8	68.1	49.7	82.9	97.6	68.7
Liver	3.3	4.7	1.9	7.9	11.5	4.4	15.9	23.3	8.8
Lung	102.8	125.3	80.8	111.9	118.8	105.1	135.9	127.6	143.8
Melanoma	82.8	78.9	86.5	100.0	101.2	98.8	138.8	144.6	133.1
Myeloma	16.6	16.7	16.5	21.4	22.7	20.1	29.9	33.4	26.5
Non-Hodgkin lymphoma	65.8	69.4	62.3	90.3	92.6	88.0	127.6	137.2	118.3
Oral cavity and pharynx	56.8	76.8	37.3	55.1	73.1	37.5	67.2	90.6	44.6
Ovary	54.9	—	54.9	71.0	—	71.0	78.6	—	78.6
Pancreas	9.2	8.6	9.8	10.8	10.6	10.9	15.4	15.7	15.1
Prostate	426.5	426.5	—	864.6	864.6	—	1,147.0	1,147.0	—
Stomach	21.0	25.5	16.5	22.8	27.8	17.9	27.8	34.8	21.1
Testis	40.2	40.2	—	47.4	47.4	—	51.6	51.6	—
Thyroid	35.2	16.1	53.8	71.1	30.5	110.8	160.4	67.0	250.5
Uterus	150.4	—	150.4	160.2	—	160.2	217.7	—	217.7

Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

IN FOCUS

Head and neck cancers

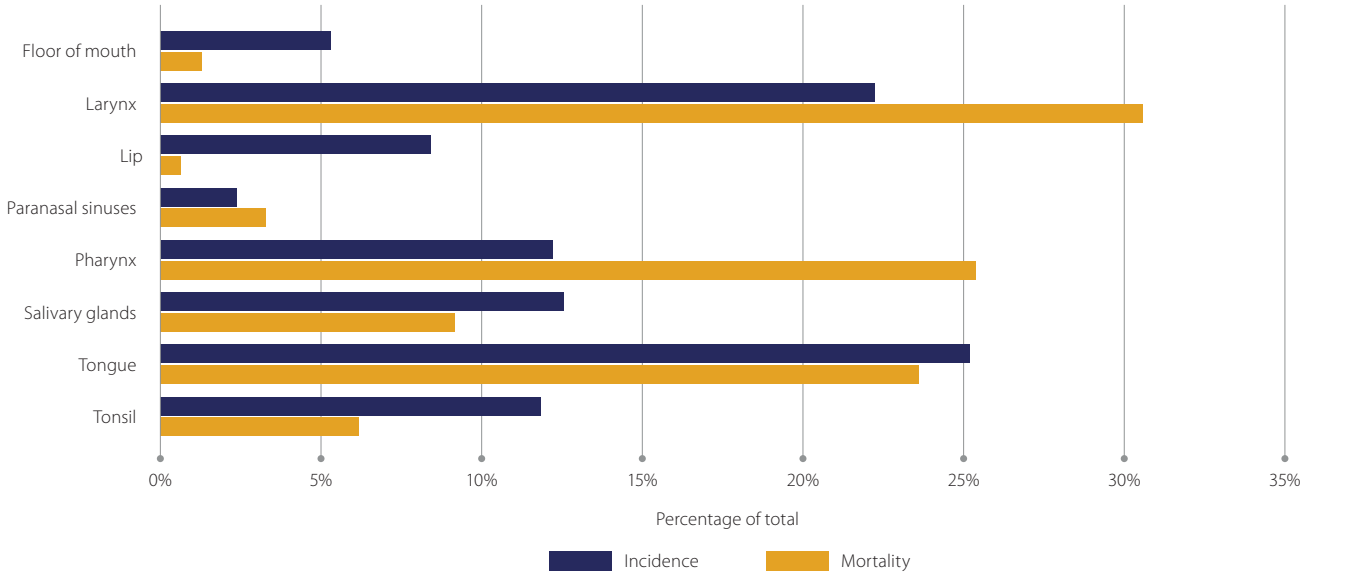
Tongue cancer is the most commonly diagnosed head and neck cancer

On average, about 5,700 head and neck cancers (HNCs) are diagnosed in Ontario every year. Between 2010 and 2012, cancer of the tongue accounted for the greatest proportion of HNC incidence (25.2%), followed by laryngeal cancer (22.2%) (**Figure F.1**). In the same time period, laryngeal cancer was the greatest contributor to HNC mortality (accounting for 30.5% of all deaths) followed by pharynx (25.4%) and tongue cancers (23.6%). Pharynx cancer was responsible for 25.4% of all HNC mortality but only 12.2% of HNC incidence. Lip cancer accounted for 8.4% of HNC incidence but only 0.6% of HNC mortality.

There are several noteworthy trends in HNC incidence rates over time:

- The incidence rate for cancer of the tongue increased by 3.8% per year between 2003 and 2012, after remaining stable between 1981 and 2003 (**Figure F.2**). Increases in the incidence of tongue cancer have also been reported in other jurisdictions.[1]
- The rate of tonsil cancer was stable between 1981 and 1998 and then increased by 3.1% per year between 1998 and 2012.
- Laryngeal cancer was the most commonly diagnosed HNC in Ontario in 1981. The incidence rate declined by 2.2% per year between then and 2012, when it became the second most commonly diagnosed HNC in Ontario. Between 1981 and 2012, the incidence rate of glottis cancer decreased by 1.9% per year, while that of supraglottis cancer decreased by 2.1% per year (data not shown).

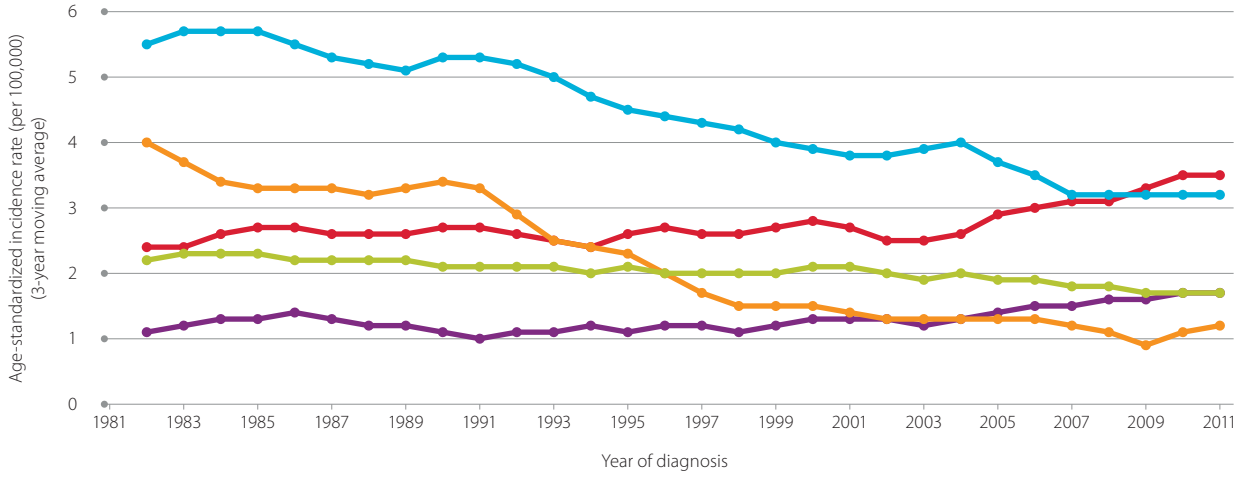
Figure F.1 **Distribution of new cases and deaths, head and neck cancers, by site, Ontario, 2010–2012**



Note: Case counts: Floor of mouth (incidence n=304, mortality n=18); Larynx (incidence n=1273, mortality n-430); Lip (incidence n=481, mortality n=9); Paranasal sinuses (incidence n=136, mortality n=46); Pharynx (incidence n=698, mortality n=357); Salivary glands (incidence n=718, mortality n=129); Tongue (incidence n=1442, mortality n=332); Tonsil (incidence n=677, mortality n=87)
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

- The rate of pharynx cancer decreased by 1.0% per year between 1981 and 2012. Among cancers of the pharynx, oropharynx and nasopharynx cancers had no significant change in incidence, but the incidence of hypopharynx cancer decreased by 2.6% per year between 1981 and 2012 (data not shown). An increase in the incidence rate of oropharynx cancer over similar time periods were found in other jurisdictions, such as Alberta,[2] Canada,[3] the United States[4] and developed countries in general.[5] This trend is mainly due to increases in HPV-positive oropharynx cancers. It was not possible, however, to distinguish between HPV-positive and HPV-negative oropharynx cancers in this analysis.
- Lip cancer had the greatest decrease, declining by 1.8% per year between 1981 and 1991, 9.8% per year between 1991 and 1997 and 4.2% between 1997 and 2010.
- Cancer of the salivary glands increased by 1.8% per year between 1981 and 2012.
- Cancer of the paranasal sinuses decreased by 1.2% per year between 1981 and 2012.
- Cancer of floor of the mouth decreased by 2.5% per year between 1981 and 2012.

Figure F.2 **Age-standardized incidence rates, selected head and neck cancers, by site, Ontario, 1981–2012**



Larynx		Lip		Pharynx		Tongue		Tonsil	
Year	APC	Year	APC	Year	APC	Year	APC	Year	APC
1981–2012	-2.2*	1981–1991 1991–1997 1997–2010 2010–2012	-1.8* -9.8* -4.2* 22.1	1981–2012	-1.0*	1981–2003 2003–2012	0.1 3.8*	1981–1998 1998–2012	-0.3 3.1*

Cancer	Year	APC
Paranasal sinuses	1981–2012	-1.2*
Salivary glands	1981–2012	1.8*
Floor of mouth	1981–2012	-2.5*

*Statistically significant
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

IN FOCUS

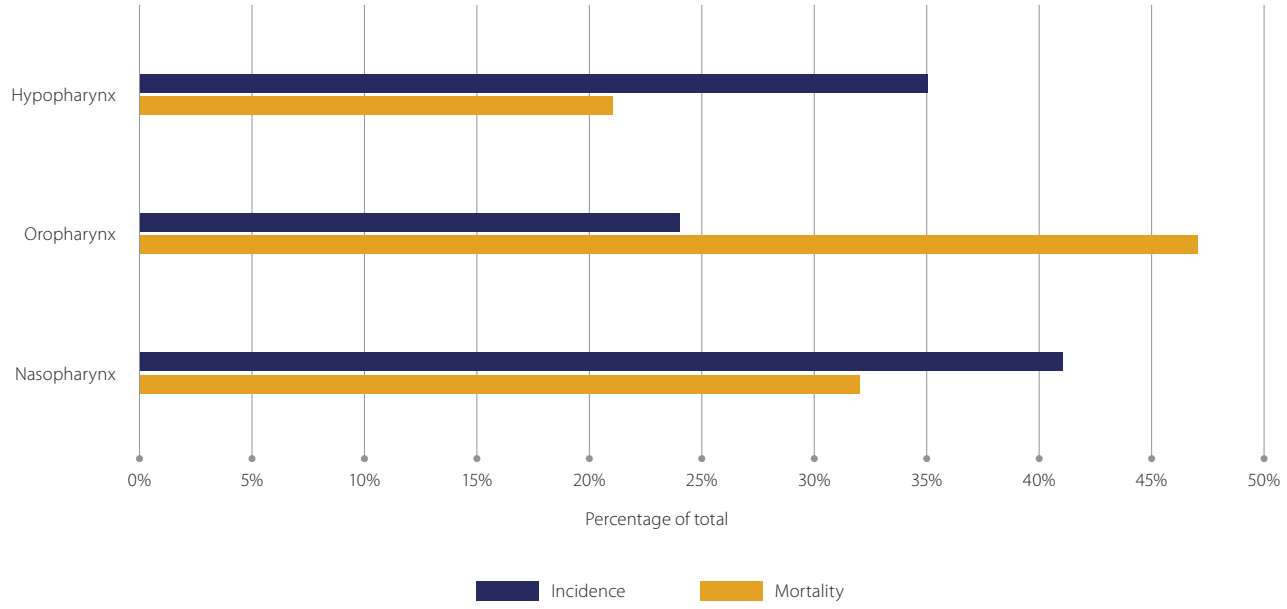
Head and neck cancers

Nasopharynx and glottis cancers are the most commonly diagnosed subsites

Pharynx cancer includes cancers of the nasopharynx, oropharynx and hypopharynx. Notably, cancer of the nasopharynx accounted for most (40.8%) of the cases of pharynx cancer diagnosed between 2010 and 2012 (**Figure F.3**), while oropharynx cancer made up the greatest proportion (47.1%) of pharynx cancer deaths. In fact, oropharynx cancer accounted for a greater proportion of deaths than new cases, reflecting poor survival rates for this subsite.[6]

Cancer of the nasopharynx accounted for most (40.8%) of the cases of pharynx cancer diagnosed between 2010 and 2012.

Figure F.3 **Distribution of new cases and deaths, pharynx cancer, by subsite, Ontario, 2010–2012**



Note: Case counts: Nasopharynx (incidence n=226, mortality n=113); Oropharynx (incidence n=197, mortality n=168); Hypopharynx (incidence n=291, mortality n=76)
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Laryngeal cancers include three main subsites: glottis (which includes the true vocal cords and the anterior and posterior commissures), supraglottis (which includes the epiglottis, false vocal cords, ventricles, aryepiglottic folds and arytenoids) and subglottis. Between 2010 and 2012, the majority of diagnosed laryngeal cancers were of the glottis (58.3%) or supraglottis (30.7%) (**Figure F.4**).

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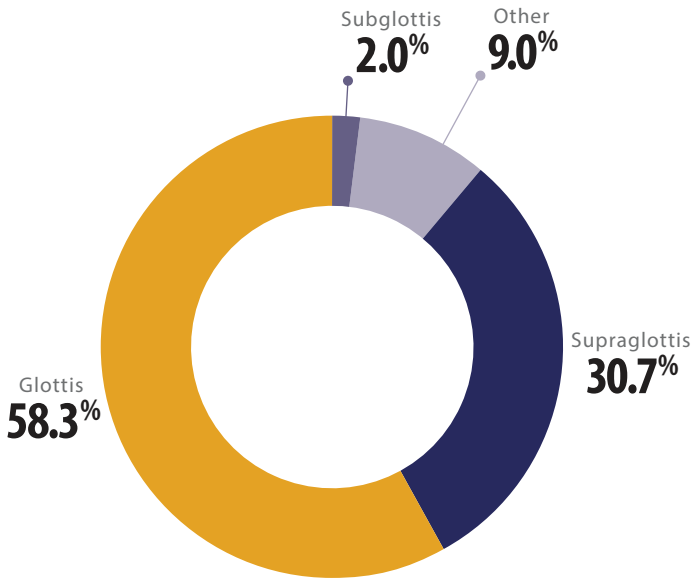
Figure F.4 **Distribution of new cases, larynx cancer, by subsite, Ontario, 2010–2012**



Note: Case counts: Glottis n=745; Supraglottis n=392; Subglottis n=26; Other n=126
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Glossary

AGE-STANDARDIZED INCIDENCE RATE (ASIR)
The number of new cases of cancer per 100,000 people in a five-year age group (0–4, 5–9, …, 85+) diagnosed during a year divided by the total number of people in that age group that year. Age-standardized rates are weighted averages of these age-specific rates using a standard population. They give the rate that would occur if the population of interest had the same age distribution as a given standard population. In this report the standard population is the 2011 Canadian population.

AGE-STANDARDIZED MORTALITY RATE (ASMR)
The number of deaths from cancer per 100,000 people in a five-year age group (0–4, 5–9, …, 85+) that occurred during a year divided by the number of people in that age group that year. Age-standardized rates are weighted averages of these age-specific rates using a standard population. They give the rate that would occur if the population of interest had the same age distribution as a given standard population. In this report the standard population is the 2011 Canadian population.

ANNUAL PERCENT CHANGE (APC)
A measure to assess the rate of change over time of an incidence or mortality rate, calculated by fitting a linear model to the annual rates after applying a logarithmic transformation. The estimated slope is then transformed back to represent a percentage increase or decrease per year. The method allows for a series of straight line segments with different slopes to be fitted to long-term trend data.

AVERAGE ANNUAL PERCENT CHANGE (AAPC)
The weighted average of the APCs during a specified time period.

CANCER INCIDENCE
The number of new cancer cases diagnosed during a specific time period in a population.

CANCER MORTALITY
The number of deaths due to cancer during a specific time period in a population.

DEATH CERTIFICATE ONLY (DCO)
Cases for which the only data source is a death certificate. Such cases are excluded from survival analyses.

LOCAL HEALTH INTEGRATED NETWORK (LHIN)
The authority responsible for the regional provision of healthcare for the province of Ontario. There are 14 LHINs in Ontario.

MEDIAN AGE
The age at which exactly one half of the population of interest is older and the other half is younger.

POPULATION AGING
Refers to an increasing proportion of people 65 years of age or older in the population, as defined in demographic terms.

PUBLIC HEALTH UNIT (PHU)
An official health agency established by a group of urban and rural municipalities in Ontario to provide health promotion and disease prevention programs. There are 36 PHUs in Ontario.

RELATIVE SURVIVAL RATIO (RSR)
The proportion of people alive after a specific period of time after cancer diagnosis (e.g., five years) compared to the expected survival of similar people (based on age, sex and time period) in the general population.

POTENTIAL YEARS OF LIFE LOST (PYLL)
The number of years of life lost when a person dies prematurely (defined in this report as before the average life expectancy for the population).

Technical appendix

Data sources

CANCER DATA

Cancer data in this report come from the Ontario Cancer Registry (OCR), which is maintained by Cancer Care Ontario. The goal of the registry is to generate, analyze and disseminate timely and high-quality information describing cases of cancer diagnosed among Ontario residents.

The OCR is a dynamic database. Data are added to the OCR multiple times over the year, which means the data may change over time. Consequently, the results of analyses may vary based on the date that data are extracted from the OCR. The data used in this report were extracted from the OCR between August and November of 2015.

OCR records are created using data collected for purposes other than cancer registration. This information comes from various administrative databases, laboratory reports and clinical records. Four primary sources are used to generate case records in the OCR:

- pathology reports;
- activity-level reporting (ALR) from Regional Cancer Centres (RCCs) and non-RCC hospital records (see **Table TA.4** in this appendix for list of contributing hospitals and regional cancer centres);
- surgery and discharge data from the Canadian Institute for Health Information (CIHI); and
- death certificates from the Ontario Registrar General.

Safeguarding confidential information is a guiding principle for Cancer Care Ontario. All activities—from the initial registration of a new cancer case in the OCR, through to research and reporting—are governed by the *Personal Health Information Protection Act* (PHIPA), 2004.[1] This Ontario law governs the collection and use of data and the disclosure of personal health information. PHIPA designates Cancer Care Ontario as a prescribed entity and authorizes Cancer Care Ontario to collect, use and disclose personal health information for the purposes of managing and planning Ontario's health system.

POPULATION DATA

Except where noted otherwise, population data were from the Ontario Ministry of Finance (Fall 2014 release).[2] These population figures are based on the 2011 census, conducted by Statistics Canada. Population figures for Ontario and by LHIN are provided in **Table TA.2**.

Methods

DISEASE SITE GROUPING

The OCR uses disease site groupings based on the third edition of the International Classification of Diseases for Oncology (ICD-O-3).[3] These disease site groupings are recoded based on the Surveillance Epidemiology and End Results (SEER) Groups.

Cancer deaths are classified according to the 10th edition of the International Classification of Diseases and Related Health Problems (ICD-10).[4]

The primary cancer groupings used in this report are found in **Table TA.1**.

For children 0 to 14 years of age, cancers were classified and reported according to the International Classification of Childhood Cancer, Third Edition (ICCC-3). This system acknowledges the major differences between cancers that develop in childhood and those that develop in adulthood.

CANCER STAGE AT DIAGNOSIS

Cancer staging is viewed as an essential element for quality care. These data can assist with evaluation of the effectiveness of screening and treatment programs, analyses of prevalence and survival, research into new treatments and resource planning for healthcare management.

The tumour-node-metastasis (TNM) system is the most widely used classification system for stage at diagnosis and it is recognized as the international standard for describing the anatomic extent of various cancers. TNM definitions are maintained by the Union for International Cancer Control (UICC) and the American Joint Committee on Cancer (AJCC).[5]

Collaborative Staging (CS) is a staging approach used by central cancer registries. CS brings together the principles of the National Cancer Institute (NCI)/SEER Summary Stage, the TNM categories and stage groupings, and the SEER Extent of Disease coding structure. Most of the CS data items have traditionally been collected by some cancer registries, including tumour size, extension, lymph node status and metastatic status. Other data such as site/histology-specific factors (e.g., Gleason score and receptor status) are new. The data derive the "best stage" grouping consistent with the AJCC Cancer Staging Manual (currently in its seventh edition).[6]

CS values for invasive cancer range from stage I, which means the disease is in the early phase, to stage IV, which means the cancer has spread (or metastasized) to other organs or places in the body. An unknown stage is the result of limited stage work-up, limited documentation in the person's health record or both.

Starting with cases diagnosed in 2007, the OCR implemented various versions of CS in a phased approach by reporting hospital and by selected cancer type. More specifically, full implementation of CS for breast, lung, colorectal and prostate cancers occurred in 2010, for ovarian, uterus and cervical cancers and melanomas in 2011, and for thyroid cancer in 2013. Stage data included in the current report are for the diagnosis years 2010 to 2012.

CODING RULES FOR MULTIPLE PRIMARY CANCERS

Different rules exist to determine if a cancer is a new primary cancer or an extension of a previous cancer. Following a recent rebuild, the OCR adopted the Surveillance, Epidemiology and End Results (SEER) Program rules for counting multiple primaries and assigning histology,[7] similar to other North American cancer registries. In this report, the SEER rules for multiple primary cancers have been applied to cases in the OCR that were diagnosed on or after January 1, 2010. The SEER counting rules take into account histology, site, laterality and time since the initial diagnosis to identify multiple primary cancers. The SEER rules are more liberal in their consideration of what constitutes a new primary case.

Cases from the years prior to SEER adoption (i.e., 1964 to 2009) have been imported into the new OCR from the Ontario Cancer Registry Information System (OCRIS) to allow for continued analytic use. OCRIS applied a modified version of the International Agency for Research on Cancer/International Association of Cancer Registries (IARC/IACR) rules,[8] which are more conservative than the SEER rules. Under the IARC/IACR rules, only one tumour is registered for an organ, irrespective of time, unless there are histological differences. In this report, data were converted using the IARC/IACR rules for all trend analyses that span both OCR and OCRIS eras or whenever comparisons are made between data from the two registry systems. When data are presented only from 2010 onward, the SEER rules were applied.

The SEER rules are less conservative than the IARC/IACR rules, so applying the SEER rules results in an increase in the number of cases included in incidences counts. This is simply a result of using a different methodology and does not reflect an actual increase in the number of people being diagnosed with cancer. The impact of applying the SEER versus IARC/IACR rules on new cases differed by cancer type. For example, the largest increases in new cases due to the adoption of the SEER rules is observed for melanoma (15.9% higher based on SEER rules), breast cancer (14.0% higher) and testicular cancer (9.8% higher) for 2011 to 2012 data, whereas the smallest changes are for Hodgkin lymphoma (0.5%), pancreatic cancer (0.5%) and prostate cancer (0.8%).

PROBABILITY OF DEVELOPING OR DYING FROM CANCER

The probability of developing or dying from cancer refers to the probability of a newborn child developing or dying from cancer at some point during his or her lifetime. Lifetime risk calculations are based on current incidence and mortality rates and are therefore calculated under the assumption that the current rates, within each age group, will remain constant during the life of the newborn child.

The probability of developing or dying from cancer was calculated using DevCan software.[9] The DevCan software program uses life-table methods based on cross-sectional incidence, mortality and population data for 18 age groups to compute the lifetime and age-conditional probabilities of developing or dying from cancer.

NON-MELANOMA SKIN CANCER

Data presented in this document exclude cases of basal cell and squamous cell carcinoma of the skin, which are the most common types of non-melanoma skin cancer. Although approximately 30% of the malignant cancers diagnosed among Ontarians each year are basal cell and squamous cell carcinomas of the skin, these tumours are generally not life-threatening and are often treated in out-patient settings. As a result, they are too inconsistently reported to the OCR to allow meaningful analysis.

SIGNIFICANCE TESTING

Throughout this report, the word significant refers to statistical significance at an alpha level of 0.05 for changes in trend or when comparing differences in rates or ratios. Non-significant changes in trend are described in this report as "stable."

CANCER INCIDENCE AND MORTALITY

Counts

Incidence counts are the number of new cancer cases diagnosed in a population during a specific time period. In this report, this refers to the number of new cancer diagnoses in a calendar year in Ontario. Currently, complete death-cleared incidence data are available up to 2012.

Mortality counts describe the number of deaths attributed to cancer during a specific period of time in a specific population. In this report, mortality refers to the number of deaths due to cancer in a calendar year in Ontario. For consistency, this report uses data for the same range of years for incidence and mortality (i.e., 1981 to 2012).

Rates

Incidence and mortality rates are the number of new cancer cases or deaths per 100,000 people in a population during a specific time period. This is sometimes called the crude rate since it does not adjust for the age distribution of the population.

Age-standardized rates

Age-standardized rates are weighted averages of age-specific rates using a standard population. Age-standardized incidence rates (ASIR) and age-standardized mortality rates (ASMR) are adjusted for differences in the age structure of different populations, which permits comparisons of cancer incidence or mortality among populations that differ in size, structure, time period or all three factors. Age-standardized rates give the rate that would have occurred if the population of Ontario had the same age distribution as the standard population.

The standard population used in this report is the 2011 Canadian census population (**Table TA.3**). Previous surveillance reports published by Cancer Care Ontario used the 1991 Canadian census population. The 1991 standard population is no longer appropriate as the population has aged considerably since then. Using the 2011 standard population results in age-standardized rates that are closer to the crude rate (e.g., the 2012 ASIR for prostate cancer using the 1991 population was 47.8 per 100,000 compared to 63.1 per 100,000 using the 2011 standard population, while the crude rate was 63.4 per 100,000). Given the change in standard population, the age-standardized rates in this report should not be compared to previously published rates that used the 1991 population for standardization.

Time trends

Incidence and mortality trends were determined using annual percentage change (APC) and average annual percent change (AAPC), which were calculated using age-standardized rates. APCs and AAPCs were determined using Joinpoint regression software (version 4.2.0.2).[10] Joinpoint regression uses piecewise regression to model the change in rates on the log scale. A statistical algorithm finds the optimal number and location of places where a trend changes. The point (in time) where a trend changes is called a joinpoint.

In general, the model that Joinpoint found to be the best fit was used. However, for some types of cancer, models other than what the Joinpoint software suggested were used to best describe the trend of the data. A maximum of five joinpoints were allowed. If the Joinpoint regression software found a best-fit model with a joinpoint at three or less observations from the end of the data, the model was rerun using five as the minimum number of observations from a joinpoint to the end of the data.

Joinpoint models are based on yearly rates. As a result, there may be slight differences in the rates presented in the text (yearly rates) and the graphs (where ASIR and ASMR are shown as three-year moving averages).

Three-year moving averages are used to smooth out year-to-year fluctuations in graphs so the underlying trend may be more easily observed. They are calculated based on aggregating three years of data. This smoothing of trends is especially important when the number of cancer cases per year is relatively small and, therefore, year-to-year variability can be quite large.

Projections

Incidence and mortality projections for the years 2013 to 2016 were calculated using the Nordpred package in R software.[11]

For incidence projections, cases meeting the IARC/IACR multiple primary rules from 1983 to 2012 were grouped by five-year age groups and time periods. Population data were similarly aggregated (with the exception of bladder cancer where cases were grouped from 1993 to 2012 due to the classification changes since 1989). To obtain projections for all cancers combined, projections were calculated separately for female breast, prostate, colorectal, lung, thyroid and bladder cancers and for all other cancers by sex, and then summed.

Projections were performed using a Nordpred Power 5 age-period-cohort model (with the exception of prostate cancer incidence). Nordpred is based on an age-period-cohort Poisson regression model. It has enhancements that overcome difficulties in the standard Poisson model and improve projection accuracy.[12] Further details of Nordpred's background methods can be found elsewhere.[13] Projections were produced in five-year periods and linear interpolation was used to create annual counts. Finally an inflation factor was applied based on the age-specific increase in multiple primary cancers due to the application of the SEER counting rules in 2010 to 2012.

Due to the major drop in incidence rates in the past few years, the age-period-cohort models do not fit for prostate incidence. Instead, an age-only model based on DCO-corrected data from 2013 to 2014 was used. This method is more appropriate when there has been a recent change in the trend.

Mortality projections were also performed using a Nordpred Power 5 age-period-cohort model using cancer deaths from 1983 to 2012 divided into five-year age groups and time periods. To obtain mortality projections for all cancers combined, projections were calculated separately for female breast, prostate, colorectal and lung cancers and for all other cancers by sex, and then summed.

Potential years of life lost (PYLL)

Potential years of life lost is a measure of premature death based on sex-specific life expectancy. The most recent life expectancy estimates available (2007/2009) were used. The estimates produced by Statistics Canada were 79 years of age for males and 84 years of age for females.[14]

Geospatial analysis

In this report, geospatial analysis (e.g., maps) was performed by obtaining digital boundary files for the LHINs and PHUs from Statistics Canada.[15] Using the Geographic Information System (GIS) software (ArcGIS®), the age-standardized rates were linked to the geographic boundary files and mapped to display the rates for each LHIN and PHU.

SURVIVAL

Relative survival ratios (RSRs) are estimated by comparing the survival of people with cancer to the expected survival for the general population of Ontarians of the same age and sex during the same time period. Relative survival shows the extent to which a diagnosis of cancer shortens a life span. The relative survival ratio is usually expressed as a percentage (%), and the closer the value is to 100%, the more similar the survival pattern is to the general population.

Survival analyses were based on first primary cancers. RSRs are provided for cases diagnosed in people between 15 and 99 years of age. Cases in which the age of the person was unknown, that were diagnosed on the basis of an autopsy only or whose date of diagnosis and date of death are the same (i.e., death certificate only (DCO) cases — cases that were only diagnosed at or following death) were excluded from the survival analyses (see **Table DA.13** for details on DCO cases).

Analyses were done using a publicly available algorithm,[16] with some minor adaptations. Expected survival proportions were derived using the Ederer II approach,[17] from provincial life tables produced by Statistics Canada.

RSRs were estimated by the cohort method when complete follow-up data after diagnosis (e.g., at least five years of follow-up to estimate a five-year ratio) were available. For recently diagnosed cases whose complete follow-up data were not available, the estimates were computed using the period method. However, comparisons between cohort and period RSRs should be interpreted with caution because of the two different methods used to derive the respective ratios. RSRs were age-standardized by weighting with the International Cancer Survival Standard weights[18] (see **Table TA.5** for further details on weightings).

PREVALENCE

Prevalence analyses were performed using SEER*Stat software.[19] This report provides person-based prevalence; that is, the number of people diagnosed with malignant cancer over a specific time period (e.g., two years, five years or 10 years) who were still alive on the index date. The chosen index date was January 1, 2013.

Multiple primary cancers were treated as follows. Only the first primary was included in the prevalence count for all cancers combined. However, for individual cancer types, each individual could contribute a case for each cancer. For example, a person with a first primary of prostate cancer and a second primary of colorectal cancer would be included once in the prevalence count for all cancers, but twice in the individual cancer type counts (i.e., once in the prostate prevalence count and once in the colorectal prevalence count).

Population estimates for January 1, 2013, were derived by averaging the 2012 and 2013 mid-year population estimates for Ontario.

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Table TA.1 Cancer definitions by coding methodology

Cancer type: short form	Cancer type: full name	Incidence ICD-O-3† definition	Mortality ICD-10‡ definition
All cancers		C00.0–C80.9	C00–C97
Bladder	Urinary bladder and renal pelvis	C65.9, C67	C67
Brain	Brain and other nervous system	C70–C72	C70–C72
Breast (female)		C50	C50
Cervix	Cervix uteri	C53	C53
Colorectal	Colon and rectum	C18.0, C18.2–C20, C26.0	C18–C20, C26
Esophagus		C15	C15
Hodgkin lymphoma		All sites with histologies 9550–9667	C81
Kidney		C64.9	C64–C65
Larynx		C32	C32
Leukemia		C42.0, C42.1, C42.4 with histologies 9811–9818, 9837,9823. Histologies 9826, 9835–9836, 9820, 9832–9834, 9940, 9840, 9861, 9865–9867, 9869, 9871–9874, 9895–9897, 9898, 9910–9911, 9920, 9891, 9863, 9875–9876, 9945–9946, 9860, 9930, 9801, 9805–9809, 9931, 9733, 9742, 9800, 9831, 9870, 9948, 9963–9964, 9827	C90.1, C91.0–C91.5, C91.7, C91.9, C92.0–C92.1, C92.4–C92.5, C92.7, C92.9, C93.0–C93.2, C93.7, C93.9, C94.0–C94.2, C94.4–C94.5, C94.7, C95.0–C95.2, C95.7, C95.9
Liver	Liver and intrahepatic bile duct	C22.0, C22.1	C22.0, C22.2–C22.4, C22.7, C22.9
Lung	Lung and bronchus	C34	C34
Melanoma	Melanoma of skin	C44 with histologies 8720–8790	C43
Myeloma	Mutliple myeloma	Histologies 9731–9732, 9734	C90.0, C90.2
Non-Hodgkin lymphoma		Histologies 9590–9596, 9670–9671, 9673, 9675, 9678–9680, 9684, 9687, 9689–9691, 9695, 9698–9702, 9705, 9708–9709, 9714–9719, 9727–9729; All sites other than C42.0, C42.1, C42.4 with histologies 9823, 9827	C82–C85, C96.3
Oral cavity and pharynx		C00–C06, C07.9, C08.9, C09–C11, C12.9, C13, C14.0, C14.2, C14.8	C00–C14
Ovary		C56.9	C56
Pancreas		C25	C25
Prostate		C61.9	C61
Stomach		C16	C16
Testis		C62	C62
Thyroid		C73.9	C73
Uterus	Corpus and uterus NOS	C54, C55.9	C54–55

†ICD-O-3=*International Classification of Disease for Oncology, Third Edition*
‡ICD-10=*International Statistical Classification of Diseases and Related Health Problems, Tenth Revision*
Note: All cancer types exclude basal cell and squamous cell carcinoma of the skin
Histology types 9590-9989 (leukemias, lymphomas and hematopoietic diseases), 9050-9055 (mesothelioma) and 9140 (Kaposi sarcoma) are excluded from other specific organ sites

Table TA.2 Population estimates by sex and LHIN,[†] Ontario, 2012

LHIN	Both sexes	Males	Females
Ontario	*13,410,082*	*6,655,842*	*6,823,194*
Central	1,788,873	876,551	912,323
Central East	1,561,235	762,171	799,064
Central West	879,984	435,870	444,114
Champlain	1,283,268	630,577	652,691
Erie St. Clair	638,472	315,106	323,366
Hamilton Niagara Haldimand Brant	1,409,455	690,651	718,804
Mississauga Halton	1,169,466	575,177	594,289
North East	569,158	281,851	287,307
North Simcoe Muskoka	460,862	227,884	232,978
North West	236,936	118,043	118,893
South East	492,454	242,396	250,058
South West	956,888	470,975	485,913
Toronto Central	1,209,993	586,053	623,940
Waterloo Wellington	754,950	374,356	380,593

[†]LHIN=Local Health Integration Network
Data source: Population estimates, Ministry of Finance

Table TA.3 Canada 2011 reference population used for calculating age-standardized rates

Age group (years)	Population
0–4	1,899,064
5–9	1,810,433
10–14	1,918,164
15–19	2,238,952
20–24	2,354,354
25–29	2,369,841
30–34	2,327,955
35–39	2,273,087
40–44	2,385,918
45–49	2,719,909
50–54	2,691,260
55–59	2,353,090
60–64	2,050,443
65–69	1,532,940
70–74	1,153,822
75–79	919,338
80–84	701,140
85 and older	643,070

Notes: Postcensal estimates are based on the 2011 Census counts adjusted for census net undercoverage (CNU) (including adjustment for incompletely enumerated Indian reserves (IEIR)) and the components of demographic growth that occurred since that census. Intercensal estimates are produced using counts from two consecutive censuses adjusted for CNU including (IEIR) and postcensal estimates.
Data source: Statistics Canada. Table 051-0001 - Estimates of population, by age group and sex for July 1, Canada, provinces and territories, annual (persons unless otherwise noted)

Table TA.4 Contributors to activity level reporting (ALR), regional cancer centres and hospitals, Ontario

Regional Cancer Centres

- Grand River Regional Cancer Centre
- Juravinski Cancer Centre
- Cancer Centre of Southeastern Ontario
- R.S. McLaughin Durham Regional Cancer Centre
- London Regional Cancer Program
- Simcoe Muskoka Regional Cancer Centre
- Stronach Regional Cancer Centre at Southlake
- Hospital Regional de Sudbury Regional Hospital – Regional Cancer Program
- Odette Cancer Centre
- The Ottawa Hospital Regional Cancer Centre
- Regional Cancer Care North West – Northwest
- Carlo Fidani Peel Regional Cancer Centre
- Princess Margaret Hospital
- Windsor Regional Cancer Centre

Hospitals

- Grand River Hospital
- Hamilton Health Sciences
- Kingston General Hospital
- Lakeridge Health
- London Health Science Centre
- Royal Victoria Hospital
- Southlake Regional Health Centre
- Sudbury Regional Hospital
- Sunnybrook Health Sciences Centre
- The Ottawa Hospital
- Thunder Bay Regional Health Sciences Centre
- Trillium Health Partners
- University Health Network
- Windsor Regional Hospital
- Bluewater Health
- Cambridge Memorial Hospital
- Grey Bruce Health Services
- Headwaters Health Centre
- Humber River Regional Hospital
- Markham-Stouffville Hospital
- Mount Sinai Hospital
- North York General Hospital
- Quinte Healthcare Corporation
- Rouge Valley Health System
- Sault Area Hospital
- St. Joseph's Health Centre
- St. Michael's Hospital
- The Scarborough Hospital
- Toronto East General Hospital
- William Osler Health Centre
- Mackenzie Health (formerly York Central Hospital)

Table TA.5 International Cancer Survival Standards (ICSS) used for standardizing relative survival ratios, by age group and cancer type

Age groups (years)	Weightings	Cancer types
15–44, 45–54, 55–64, 65–74, 75–100	60, 10, 10, 10	Testis, Hodgkin lymphoma, acute lymphatic leukemia
15–44, 45–54, 55–64, 65–74, 75–100	28, 17, 21, 20,14	Nasopharynx, soft tissues, melanoma, cervix uteri, brain, thyroid gland, bone
15–44, 45–54, 55–64, 65–74, 75–100	7, 12, 23, 29	All other cancer types except prostate
15–54, 55–64, 65–74, 75–84, 85–100	19, 23, 29, 23, 6	Prostate

Data appendix

Table DA.1 Lifetime probability of developing cancer, by sex and age group, Ontario, 2009–2012

	Both sexes		Males		Females	
Age group (years)	%	1 in	%	1 in	%	1 in
0–14	0.3%	380.8	0.3%	370.3	0.3%	392.5
15–29	0.6%	162	0.6%	180.4	0.7%	147.4
30–39	1.2%	85.2	0.8%	129.8	1.6%	63.9
40–49	2.6%	37.9	1.9%	54.0	3.4%	29.2
50–59	5.9%	16.9	5.8%	17.4	6.1%	16.4
60–69	10.9%	9.2	12.5%	8.0	9.3%	10.7
70–79	13.0%	7.7	14.9%	6.7	11.2%	8.9
80+	13.1%	7.6	13.3%	7.5	13.0%	7.7

Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: Ontario Cancer Registry (November 2015), CCO; Statistics Canada, Canadian Vital Statistics, Birth and Death Databases and population estimates, CANSIM table 102-0504; CCO SEER*Stat Package Release 10—OCR (August 2015); Statistics Canada, Estimates of population, by age group and sex for July 1, Canada, provinces and territories, annual, CANSIM table 051-0001

Table DA.2 Lifetime probability of dying from cancer, by sex and age group, Ontario, 2009–2012

	Both sexes		Males		Females	
Age group (years)	%	1 in	%	1 in	%	1 in
0–14	0.04%	2,737.9	0.04%	2,631.5	0.03%	2,860.6
15–29	0.07%	1,476.9	0.08%	1,309.2	0.06%	1,700.5
30–39	0.2%	677.4	0.1%	769.1	0.2%	606.8
40–49	0.5%	194.5	0.5%	219.9	0.6%	174.2
50–59	1.7%	60.5	1.7%	58.8	1.6%	62.2
60–69	4.0%	25.1	4.4%	22.5	3.5%	28.3
70–79	7.3%	13.8	8.3%	12.1	6.3%	15.9
80+	12.4%	8.1	13.3%	7.5	11.8%	8.5

Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: Ontario Cancer Registry (November 2015), CCO; Statistics Canada, Canadian Vital Statistics, Birth and Death Databases and population estimates, CANSIM table 102-0504; CCO SEER*Stat Package Release 10—OCR (August 2015); Statistics Canada, Estimates of population, by age group and sex for July 1, Canada, provinces and territories, annual, CANSIM table 051-0001

Table DA.3 Median age at cancer diagnosis, cancer type and sex, Ontario, 2012

Cancer type	Age (years)		
	Both sexes	Males	Females
All cancers	**66**	**68**	**65**
Bladder	74	74	76
Brain	60	59	61
Breast (female)	—	—	62
Cervix	—	—	48
Colorectal	70	69	71
Esophagus	68	66	73
Hodgkin lymphoma	34	36	34
Kidney	64	64	64
Larynx	68	67	68
Leukemia	69	68	70
Liver	68	67	70
Lung	71	71	71
Melanoma	64	65	61
Myeloma	72	71	73
Non-Hodgkin lymphoma	67	66	68
Oral cavity and pharynx	64	63	68
Ovary	—	—	63
Pancreas	71	69	72
Prostate	—	67	—
Stomach	70	69	72
Testis	—	33	—
Thyroid	50	53	50
Uterus	—	—	63

Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Table DA.4 Median age at cancer death, by cancer type and sex, Ontario, 2012

Cancer type	Age (years)		
	Both sexes	Males	Females
All cancers	**74**	**74**	**74**
Bladder	80	79	82
Brain	64	64	66
Breast (female)	—	—	70
Cervix	—	—	62
Colorectal	77	75	79
Esophagus	70	68	76
Hodgkin lymphoma	65	59	70.5
Kidney	73	71	77
Larynx	73	70	81.5
Leukemia	75	75	75
Liver	71	70	74
Lung	73	72	73
Melanoma	70	70	75
Myeloma	75	73	79
Non-Hodgkin lymphoma	75	74	77
Oral cavity and pharynx	70	69	74
Ovary	—	—	72
Pancreas	73	71	76
Prostate	—	81	—
Stomach	74	74	75
Testis	—	37.5	—
Thyroid	72	70	76
Uterus	—	—	70.5

Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Table DA.5 Cancer incidence counts and rates, males, by LHIN,† Ontario, 2012

LHIN	New cases	Age-standardized incidence rate (per 100,000)
Central	4,383	584.1*
Central East	4,580	634.4
Central West	1,862	579.4*
Champlain	3,686	632.2
Erie St. Clair	2,233	688.8*
Hamilton Niagara Haldimand Brant	4,713	660.2
Mississauga Halton	2,804	606.4*
North East	2,345	736.5*
North Simcoe Muskoka	1,678	700.1*
North West	665	559.7*
South East	2,014	718.6*
South West	3,116	645.7
Toronto Central	3,057	580.4*
Waterloo Wellington	1,961	620.8

*Significantly different from the Ontario age-standardized rate
†LHIN=Local Health Integration Network
Notes: Excludes 240 (0.6%) cases with incomplete or unknown residence at time of diagnosis
Rates standardized to the 2011 Canadian population
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Table DA.6 Cancer incidence counts and rates, females, by LHIN,† Ontario, 2012

LHIN	New cases	Age-standardized incidence rate (per 100,000)
Central	4,628	513.6*
Central East	4,689	549.4
Central West	1,828	474.5*
Champlain	3,629	529.8
Erie St. Clair	2,007	548.5
Hamilton Niagara Haldimand Brant	4,508	544.4
Mississauga Halton	2,834	511.4*
North East	1,974	564.2
North Simcoe Muskoka	1,521	565.0
North West	672	518.6
South East	1,812	576.9*
South West	2,967	534.3
Toronto Central	3,278	512.9*
Waterloo Wellington	1,973	530.2

*Significantly different from the Ontario age-standardized rate
†LHIN=Local Health Integration Network
Notes: Excludes 284 (0.7%) cases with incomplete or unknown residence at time of diagnosis
Rates standardized to the 2011 Canadian population
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Table DA.7 Cancer incidence counts and rates, males, by PHU,† Ontario, 2012

PHU	New cases	Age-standardized incidence rate (per 100,000)
Algoma	595	811.7*
Brant County	460	686.7
Chatham-Kent	384	670.1
Durham Region	1,700	652.7
Eastern Ontario	749	680.8
Elgin-St. Thomas	275	617.9
Grey Bruce	697	678.2
Haldimand-Norfolk	413	659.0*
Haliburton, Kawartha, Pine Ridge District	848	708.0
Halton Region	1,398	630.1
Hamilton	1,712	666.0
Hastings and Prince Edward Counties	699	727.8*
Huron County	246	690.0
Kingston, Frontenac and Lennox & Addington	670	661.2
Lambton	462	618.8
Leeds, Grenville and Lanark District	711	700.8*
Middlesex-London	1,335	641.7
Niagara Region	1,610	656.7
North Bay Parry Sound District	530	695.1
Northwestern	159	421.2*
Ottawa	2,448	626.9
Oxford County	353	643.1
Peel	2,860	562.1*
Perth District	236	617.1
Peterborough County-City	498	614.6
Porcupine	308	701.9
Region of Waterloo	1,346	624.8
Renfrew County and District	365	623.7
Simcoe Muskoka District	1,874	699.2*
Sudbury and District	723	700.6*
Thunder Bay District	506	626.6
Timiskaming	183	870.2*
Toronto	7,107	598.6*
Wellington-Dufferin-Guelph	759	626.5
Windsor-Essex County	1,387	719.1*
York Region	2,491	557.4*

*Significantly different from the Ontario age-standardized rate
†PHU=Public Health Unit
Notes: Excludes 240 (0.6%) cases with incomplete or unknown residence at time of diagnosis
Rates standardized to the 2011 Canadian population

Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Table DA.8 Cancer incidence counts and rates, females, by PHU,† Ontario, 2012

PHU	New cases	Age-standardized incidence rate (per 100,000)
Alogma	480	599.8*
Brant County	408	522.8
Chatham-Kent	364	561.7
Durham Region	1,808	577.5*
Eastern Ontario	708	594.4*
Elgin-St. Thomas	253	504.6
Grey Bruce	569	522.5
Haldimand-Norfolk	418	621.5*
Haliburton, Kawartha, Pine Ridge District	711	570.5
Halton Region	1,435	539.2
Hamilton	1,547	513.1
Hastings and Prince Edward Counties	593	554.0
Huron County	223	574.7
Kingston, Frontenac, and Lennox & Addington	654	562.0
Lambton	432	519.4
Leeds, Grenville and Lanark District	627	564.9
Middlesex-London	1,354	540.0
Niagara Region	1,596	571.7*
North Bay Parry Sound District	418	513.8
Northwestern	176	433.3*
Ottawa	2,491	526.9
Oxford County	355	570.2
Peel	2,880	474.8*
Perth District	227	506.9
Peterborough County-City	501	542.7
Porcupine	268	569.3
Region of Waterloo	1,384	543.2
Renfrew County and District	326	505.9
Simcoe Muskoka District	1,725	573.9*
Sudbury and District	646	548.7
Thunder Bay District	496	559.4
Timiskaming	150	674.1*
Toronto	7,516	515.7*
Wellington-Dufferin-Guelph	736	518.2
Windsor-Essex County	1,211	555.2
York Region	2,634	499.4*

*Significantly different from the Ontario age-standardized rate
†PHU=Public Health Unit
Notes: Excludes 284 (0.7%) cases with incomplete or unknown residence at time of diagnosis
Rates standardized to the 2011 Canadian population

Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Table DA.9 Cancer mortality counts and rates, males, by LHIN,† Ontario, 2012

LHIN	Deaths	Age-standardized mortality rate (per 100,000)
Central	1,391	199.5*
Central East	1,592	228.2*
Central West	590	206.3*
Champlain	1,380	250.0
Erie St. Clair	874	277.1*
Hamilton Niagara Haldimand Brant	1,859	263.9*
Mississauga Halton	930	221.0*
North East	894	289.8*
North Simcoe Muskoka	620	267.3
North West	299	261.7
South East	800	295.0*
South West	1,267	271.8*
Toronto Central	1,088	211.7*
Waterloo Wellington	732	248.6

*Significantly different from the Ontario age-standardized rate
†LHIN=Local Health Integration Network
Notes: Excludes 363 (2.5%) cases with incomplete or unknown residence on mortality file
Rates standardized to the 2011 Canadian population
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Table DA.10 Cancer mortality counts and rates, females, by LHIN,† Ontario, 2012

LHIN	Deaths	Age-standardized mortality rate (per 100,000)
Central	1,299	142.0*
Central East	1,589	177.4
Central West	508	139.1*
Champlain	1,302	182.3
Erie St. Clair	754	190.8*
Hamilton Niagara Haldimand Brant	1,720	190.7*
Mississauga Halton	826	152.6*
North East	718	193.8*
North Simcoe Muskoka	539	189.1
North West	290	209.8*
South East	700	204.6*
South West	1,088	181.6
Toronto Central	1,029	151.4*
Waterloo Wellington	684	178.3

*Significantly different from the Ontario age-standardized rate
†LHIN=Local Health Integration Network
Notes: Excludes 340 (2.6%) cases with incomplete or unknown residence on mortality file
Rates standardized to the 2011 Canadian population
Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Table DA.11 Cancer mortality counts and rates, males, by PHU,† Ontario, 2012

PHU	Deaths	Age-standardized mortality rate (per 100,000)
Algoma	191	265.8
Brant County	207	317.9*
Chatham-Kent	165	284.9
Durham Region	595	247.7
Eastern Ontario	290	281.3*
Elgin-St. Thomas	125	301.8*
Grey Bruce	262	270.0
Haldimand-Norfolk	145	238.1
Haliburton, Kawartha, Pine Ridge District	312	262.3
Halton Region	475	228.8
Hamilton	674	267.0*
Hastings and Prince Edward Counties	282	301.5*
Huron County	83	236.8
Kingston, Frontenac, and Lennox & Addington	280	285.9*
Lambton	205	282.1
Leeds, Grenville and Lanark District	276	283.5*
Middlesex-London	554	274.5*
Niagara Region	648	265.0
North Bay Parry Sound District	202	273.4
Northwestern	104	290.6
Ottawa	876	239.0
Oxford County	157	296.9*
Peel	917	204.5*
Perth District	92	243.1
Peterborough County-City	213	259.0
Porcupine	133	325.9*
Region of Waterloo	485	243.5
Renfrew County and District	152	262.7
Simcoe Muskoka District	689	268.0*
Sudbury and District	285	279.8
Thunder Bay District	196	250.4
Timiskaming	81	413.9*
Toronto	2,454	211.4*
Wellington-Dufferin-Guelph	299	262.3
Windsor-Essex County	504	272.4*
York Region	708	175.9*

*Significantly different from the Ontario age-standardized rate
†PHU=Public Health Unit
Notes: Excludes 363 (2.5%) cases with incomplete or unknown residence on mortality file
Rates standardized to the 2011 Canadian population

Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Table DA.12 Cancer mortality counts and rates, females, by PHU,† Ontario, 2012

PHU	Deaths	Age-standardized mortality rate (per 100,000)
Algoma	167	196.1
Brant County	164	197.4
Chatham-Kent	138	192.6
Durham Region	615	196.4*
Eastern Ontario	261	206.6*
Elgin-St. Thomas	112	219.2*
Grey Bruce	225	189.1
Haldimand-Norfolk	132	185.2
Haliburton, Kawartha, Pine Ridge District	272	193.8
Halton Region	478	174.2
Hamilton	624	189.8*
Hastings and Prince Edward Counties	232	198.8
Huron County	81	194.2
Kingston, Frontenac, and Lennox & Addington	255	203.5*
Lambton	174	189.2
Leeds, Grenville and Lanark District	255	210.6*
Middlesex-London	460	171.6
Niagara Region	594	194.4*
North Bay Parry Sound District	165	184.3
Northwestern	96	227.8*
Ottawa	858	175.3
Oxford County	123	185.2
Peel	805	141.4*
Perth District	95	187.3
Peterborough County-City	182	177.1
Porcupine	98	202.8
Region of Waterloo	443	168.5
Renfrew County and District	123	174.3
Simcoe Muskoka District	597	188.3
Sudbury and District	229	187.2
Thunder Bay District	195	202.7
Timiskaming	55	216.5
Toronto	2,359	151.9*
Wellington-Dufferin-Guelph	270	185.3
Windsor-Essex County	442	190.0
York Region	672	132.4*

*Significantly different from the Ontario age-standardized rate
†PHU=Public Health Unit
Note: Excludes 340 (2.6%) cases with incomplete or unknown residence on mortality file
Rates standardized to the 2011 Canadian population

Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: CCO SEER*Stat Package Release 10—OCR (August 2015)

Table DA.13 Death certificate only (DCO) cases, by cancer type, Ontario, 2012

Cancer type	DCO cases	Percent of cases
All cancers	**1,402**	**1.8%**
Bladder	32	1.4%
Brain	26	2.1%
Breast (female)	87	0.8%
Cervix	6	1.0%
Colorectal	204	2.2%
Esophagus	18	2.1%
Hodgkin lymphoma	0	0.0%
Kidney	46	2.0%
Larynx	9	2.2%
Leukemia	73	1.6%
Liver	78	6.8%
Lung	324	3.2%
Non-Hodgkin lymphoma	52	1.2%
Oral cavity and pharynx	33	2.4%
Ovary	36	3.1%
Pancreas	**91**	**4.9%**
Prostate	**64**	**0.8%**
Stomach	**32**	**2.0%**
Testis	**1**	**0.2%**
Thyroid	**3**	**0.1%**
Uterus	**24**	**0.9%**

Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: Ontario Cancer Registry (November 2015), CCO

Table DA.13 Death certificate only (DCO) cases, by cancer type, Ontario, 2012

Cancer type	DCO cases	Percent of cases
All cancers	**1,402**	**1.8%**
Bladder	32	1.4%
Brain	26	2.1%
Breast (female)	87	0.8%
Cervix	6	1.0%
Colorectal	204	2.2%
Esophagus	18	2.1%
Hodgkin lymphoma	0	0.0%
Kidney	46	2.0%
Larynx	9	2.2%
Leukemia	73	1.6%
Liver	78	6.8%
Lung	324	3.2%
Non-Hodgkin lymphoma	52	1.2%
Oral cavity and pharynx	33	2.4%
Ovary	36	3.1%
Pancreas	91	4.9%
Prostate	64	0.8%
Stomach	32	2.0%
Testis	1	0.2%
Thyroid	3	0.1%
Uterus	24	0.9%

Analysis by: Surveillance, Analytics and Informatics, CCO
Data source: Ontario Cancer Registry (November 2015), CCO

Notes

Notes

RELATED RESOURCES

CCO SEER*Stat is a statistical software package containing Ontario cancer incidence and mortality data from the Ontario Cancer Registry and is available for the purpose of health planning, management or research.
cancercare.on.ca/ccoseerstat

Cancer System Quality Index is an interactive web-based tool used to measure the performance of the cancer system in Ontario and provides international comparisons and benchmarking so Ontario can learn from other jurisdictions. The annual CSQI reports on a variety of evidence-based indicators covering every aspect of cancer control, from cancer prevention to survivorship and end-of-life care and tracking progress against seven dimensions of quality.
csqi.on.ca

Ontario Cancer Facts are short, monthly fact sheets intended to increase knowledge about cancer and its risk modifiers in Ontario. Data typically originate from several sources including the Ontario Cancer Registry, Cancer Care Ontario publications, and Canadian, provincial or regional health surveys. Readers may subscribe to receive Ontario Cancer Facts by e-mail.
cancercare.on.ca/cancerfacts

Cancer Risk Factors in Ontario is a series of reports that review the epidemiologic evidence linking a broad range of risk factors to various types of cancer in Ontario. These reports serve as a valuable reference and foundation for prevention efforts, especially for planning and reporting on cancer prevention actions.
cancercare.on.ca/riskfactor

Cancer Care Ontario

Working together to create the best health systems in the world

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