

# CANADIAN CANCER STATISTICS 2012

## **Members of the Steering Committee on Cancer Statistics**

#### Heather Chappell, MSc, CHE (Co-Chair)

Cancer Control Policy, Canadian Cancer Society, Toronto, Ontario

#### Les Mery, MSc (Co-Chair)

Centre for Chronic Disease Prevention and Control, Public Health Agency of Canada, Ottawa, Ontario

#### Prithwish De, PhD

Cancer Control Policy, Canadian Cancer Society, Toronto, Ontario

#### Dagny Dryer, MD, FRCPC

PEI Cancer Treatment Centre and Cancer Registry, Charlottetown, Prince Edward Island

#### Larry Ellison, MSc

Health Statistics Division, Statistics Canada, Ottawa, Ontario

#### Maureen MacIntvre, MHSA

Surveillance and Epidemiology Unit, Cancer Care Nova Scotia, Halifax, Nova Scotia

#### Loraine Marrett, PhD

Prevention and Cancer Control, Cancer Care Ontario, Toronto, Ontario

#### Hannah K. Weir, PhD

Division of Cancer Prevention and Control, Centers for Disease Control and Prevention, Atlanta, Georgia

#### Analytic and statistical support

#### Robert Semenciw, MSc

Centre for Chronic Disease Prevention and Control, Public Health Agency of Canada, Ottawa, Ontario

#### Lin Xie, MSc (Statistics), MSc (MIS)

Centre for Chronic Disease Prevention and Control, Public Health Agency of Canada, Ottawa, Ontario

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

Cette publication est disponible en Français.

#### 1. Incidence and mortality by cancer type

- ◆ An estimated 186,400 new cases of cancer (excluding 81,300 non-melanoma skin cancers) and 75,700 deaths from cancer will occur in Canada in 2012.
- Of the newly diagnosed cases, more than one-half will be lung, colorectal, prostate and breast cancers.
- Over one-quarter (27%) of all cancer deaths are attributed to lung cancer.
- ◆ Colorectal cancer has a significant impact on mortality for men and women combined, with an estimated 9,200 deaths (12% of all cancer deaths).

#### 2. Incidence and mortality by geographic region

- Generally, both incidence and mortality rates are higher in Atlantic Canada and Quebec. They are lowest in British Columbia.
- In both men and women, lung cancer incidence rates are highest in Quebec and lowest in British Columbia.
- ◆ The highest colorectal cancer incidence rates among men and women occur in Newfoundland and Labrador. For women, high rates also occur in Prince Edward Island and Nova Scotia. The lowest rates for both sexes are in British Columbia.
- ◆ The prostate cancer mortality rate is highest in Saskatchewan.
- ♦ Little variation is seen in breast cancer incidence and mortality rates across Canada.

## 3. Incidence and mortality by age and sex

- ◆ Age is a key factor in cancer burden, with 69% of new cases and 62% of cancer deaths occurring among those 50 to 79 years of age.
- ♦ Incidence and mortality rates for males surpass those for females around age 55.
- ◆ Mortality is declining for males in most age groups and for females under 70.

## 4. Time trends in incidence and mortality

- Increases in the number of new cancer cases are due mainly to a growing and aging population.
- ◆ Between 1998 and 2007 for males and between 2002 and 2007 for females, thyroid cancer incidence rates rose an average of almost 7% per year. Liver cancer rates rose nearly 4% per year for males and more than 2% per year for females between 1998 and 2007. Kidney cancer rates rose nearly 3% per year for males since 2003.
- Between 1998 and 2007, incidence rates declined, on average, by at least 2% per year for stomach cancer in males and for larynx cancer in both sexes.

## **HIGHLIGHTS**

- ◆ Between 2001 and 2007 for males and between 1998 and 2007 for females, overall mortality rates declined significantly. The rates declined, on average, by at least 2% per year for the following cancers:
  - O prostate cancer (since 2001), lung cancer (since 1998), larynx (since 2001) and colorectal cancer (since 2003) in males
  - O breast and cervical cancers (since 1998) in females
  - stomach cancer (since 1998) and non-Hodgkin lymphoma (since 2000) in both sexes
- ◆ Between 1998 and 2007, the liver cancer mortality rate increased more than 2% per year in males.

## **ABOUT THIS PUBLICATION**

Canadian Cancer Statistics is part of an annual series that began in 1987 and has been developed by members of the Steering Committee on Cancer Statistics, which is supported by the Canadian Cancer Society. The Steering Committee is responsible for developing content, reviewing statistical information, interpreting data and writing the text. The Steering Committee includes individuals from the Canadian Cancer Society, the Public Health Agency of Canada (PHAC), Statistics Canada, the Canadian Council of Cancer Registries, US Centers for Disease Control and Prevention as well as researchers based in universities and provincial or territorial cancer agencies.

#### Purpose and intended audiences

The aim of this annual publication is to provide health professionals, researchers and policy-makers with detailed information regarding incidence, mortality and other measures of cancer burden for the most common types of cancer, presented by age, sex, time period and province or territory. These data can help stimulate new research as well as assist decision-making and priority-setting at the community, provincial/territorial and national levels. Educators, the media and members of the public who have an interest in cancer may also find value in this report.

#### **Format**

This publication has recently undergone an evaluation, and we extend our thanks to all our readers who participated in the evaluation process.

In 2013, we will launch a revised version of the publication based on the feedback we received through the evaluation and on current testing of a possible future format. To make this process possible, the 2012 edition has been shortened so that we may dedicate our resources to improving future editions. The 2012 publication therefore does not include the sections on five-year relative survival, prevalence, probability of developing or dying from cancer, cancer in children and youth, or a special topic. Similarly, we will not produce a printed (hard copy) edition for 2012. The publication will continue to be available at no charge through the Canadian Cancer Society's website at www.cancer.ca/statistics.

## Data sources (see Appendix II for detailed information)

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

- Provincial and territorial cancer registries collect clinical and demographic data on newly diagnosed cancer cases for people residing in the province or territory. These data are reported annually to Statistics Canada and added to the CCR.
- Provincial and territorial registrars of vital statistics collect demographic and cause of death information for people residing in the province or territory at the time of death. These data are reported annually to Statistics Canada and added to the CVS: D.
- Cancers included in this publication are defined according to the groupings listed in Table A1, unless otherwise noted.
- ◆ The following types of tumours are not included:
  - non-melanoma skin cancers (basal and squamous): Most provincial and territorial cancer registries do not collect non-melanoma skin cancer incidence

## **ABOUT THIS PUBLICATION**

- data. Canada-wide non-melanoma skin cancer estimates are based on data from three provinces and are shown only in Tables 1.1 and 1.2.
- benign tumours and carcinomas in situ: The exception is in situ carcinomas of the bladder, which are included for provinces and territories other than Ontario.

# Actual and estimated data (see *Appendixes I* and *II* for detailed information)

- ◆ The information provided in this publication includes both actual and estimated data.
- ◆ Actual cancer incidence data used in this publication cover the period of 1983 to 2009 (except for Quebec, for which data in the CCR were available to 2007 in time for this publication).
- ◆ Actual mortality data used in this publication cover the period of 1983 to 2007 for all provinces and territories. However, at press time, data for 2008 became available and can be obtained through Statistics Canada (see *Appendix I*).
- ◆ Incidence data for 2010 to 2012 and mortality data for 2008 to 2012 are estimated (see *Appendix II*).

#### Review and analysis

- ◆ The Chronic Disease Surveillance and Monitoring Division of the Centre for Chronic Disease Prevention and Control (CCDPC), part of the Public Health Agency of Canada (PHAC), conducted the data analysis. The analysts were supported by Ms. Brenda Branchard, who updated the tables and figures.
- Provincial and territorial cancer registries were consulted regarding the cancer incidence and mortality estimates for their own jurisdictions. The results of this consultation are noted in Tables A3 and A4.
- ◆ The French version of this publication was reviewed by Rabia Louchini of the Ministère de la Santé et Services sociaux and Jean-Marc Daigle of the Institut national de santé publique du Québec.

## Special topic

For a complete list of previously published special topics, see *Appendix III*. Special topics (1988–2011) are available online at www.cancer.ca/statistics or can be obtained in hard copy by e-mailing stats@cancer.ca.

#### Production and distribution

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

## How to access the contents of this publication

All figures from this publication and some additional tables and figures are available on the Canadian Cancer Society's website at www.cancer.ca/statistics. This material may be used without permission. Please refer to the front of this publication for proper citation information.

For additional resources related to cancer surveillance in Canada, please refer to the section entitled *For further information*.

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In 2012, Canada will continue to see an increase in the number of individuals diagnosed with cancer. Every hour of every day, an average of 21 people will be diagnosed with some type of cancer, and nine people will die from cancer.

Incidence describes the number of new cases of cancer diagnosed in a year, while mortality indicates the number of deaths attributed to cancer. Together, these statistics (outlined in Tables 1.1 and 1.2) provide a fundamental understanding of the cancer burden.

An estimated 186,400 new cases of cancer and 75,700 cancer deaths are expected in Canada in 2012. More men than women will be diagnosed with a new cancer and will die from cancer (52% of all new cases and deaths in men vs. 48% in women). In addition, 81,300 new cases and 320 deaths from non-melanoma skin cancer (basal and squamous) are expected in 2012. Although non-melanoma skin cancer represents the most common cancer diagnosed among Canadians, it is reported separately because it accounts for very few deaths, and most cancer registries do not routinely collect information on these cases.

Prostate cancer remains the most common cancer diagnosed in men, with 26,500 cases expected in 2012. Breast cancer continues to be the most frequently diagnosed cancer in women, with 22,700 new cases expected. In men and women combined, lung cancer is the second most common cancer (14%), and colorectal cancer is the third most common (13%). In 2012, four cancers (breast, lung, colorectal and prostate) will account for 53% of all cancers diagnosed in Canada.

Lung cancer remains the leading cause of cancer death in both men (27%) and women (26%), as shown in Figures 1.1 and 1.2. While prostate cancer is the most common cancer diagnosed in men, it ranks third in terms of mortality for men, with approximately 4,000 deaths. Breast cancer, which represents 26% of all newly diagnosed cancer cases in women, ranks second in mortality for women at 14%. Colorectal cancer has a significant impact on mortality for men and women combined, with 9,200 deaths expected (12% of all cancer deaths).

Every day, over 500 Canadians are diagnosed with cancer and 200 die from this disease.

Table 1.1
Estimated New Cases and Age-Standardized Incidence Rates for Cancers by Sex, Canada, 2012

	N	ew Cases		Cases	per 100,0	00
	Total*	М	F	Total*	М	F
All Cancers	186,400	97,600	88,800	406	456	368
Prostate	26,500	26,500	_	_	121	_
Lung	25,600	13,300	12,300	54	62	49
Colorectal <sup>†</sup>	23,300	13,000	10,300	49	60	40
Breast	22,900	200	22,700	50	1	96
Non-Hodgkin Lymphoma	7,800	4,300	3,500	17	20	14
Bladder <sup>‡</sup>	7,800	5,800	2,000	16	27	8
Melanoma	5,800	3,100	2,700	13	15	12
Kidney	5,600	3,500	2,200	12	16	9
Leukemia	5,600	3,200	2,400	13	16	10
Thyroid	5,600	1,250	4,400	14	6	22
Body of Uterus	5,300	_	5,300	_	_	22
Pancreas	4,600	2,200	2,300	10	10	9
Oral	4,000	2,700	1,350	9	12	5
Stomach	3,300	2,100	1,150	7	10	5
Brain	2,800	1,600	1,200	7	8	6
Ovary	2,600	_	2,600	_	_	11
Multiple Myeloma	2,400	1,350	1,050	5	6	4
Liver	2,000	1,500	470	4	7	2
Esophagus	1,850	1,400	450	4	6	2
Cervix	1,350	_	1,350	_	_	7
Larynx	1,050	860	180	2	4	1
Hodgkin Lymphoma	940	510	430	3	3	2
Testis	940	940	_	_	6	_
All Other Cancers	16,700	8,400	8,400	36	40	33
Non-Melanoma Skin	81,300	44,800	36,500	_		_

<sup>-</sup> Not applicable.

**Note:** "All Cancers" excludes the estimated new cases of non-melanoma skin cancer (basal and squamous). **Analysis by:** Chronic Disease Surveillance and Monitoring Division, CCDPC, Public Health Agency of Canada. **Data source:** Canadian Cancer Registry database at Statistics Canada.

<sup>\*</sup> Column totals may not sum to row totals due to rounding.

<sup>&</sup>lt;sup>†</sup> Definition for this cancer has changed; see Table A2.

<sup>&</sup>lt;sup>‡</sup> Ontario does not currently report in situ bladder cases.

Table 1.2
Estimated Deaths and Age-Standardized Mortality Rates for Cancers by Sex, Canada, 2012

		Deaths		Death	s per 100,	000
	Total*	М	F	Total*	М	F
All Cancers	75,700	39,500	36,200	156	184	135
Lung	20,100	10,800	9,400	42	50	36
Colorectal <sup>†</sup>	9,200	5,000	4,200	19	23	15
Breast	5,200	55	5,100	11	< 0.5	19
Pancreas	4,300	2,100	2,100	9	10	8
Prostate	4,000	4,000	_	_	19	_
Non-Hodgkin Lymphoma	2,800	1,500	1,300	6	7	5
Leukemia	2,600	1,500	1,100	5	7	4
Stomach	2,100	1,350	790	4	6	3
Bladder	2,100	1,450	670	4	7	2
Esophagus	1,850	1,450	410	4	7	1
Brain	1,850	1,050	760	4	5	3
Ovary	1,750	_	1,750	_	_	7
Kidney	1,700	1,050	650	4	5	2
Multiple Myeloma	1,400	750	620	3	4	2
Oral	1,150	780	380	2	4	1
Melanoma	970	600	370	2	3	1
Liver	900	690	210	2	3	1
Body of Uterus	900	_	900	_	_	3
Cervix	390	_	390	_	_	2
Larynx	390	300	80	1	1	<0.5
All Other Cancers	10,100	5,200	5,000	20	24	18

<sup>-</sup> Not applicable.

Note: "All Other Cancers" includes 320 deaths from non-melanoma skin cancer (basal and squamous).

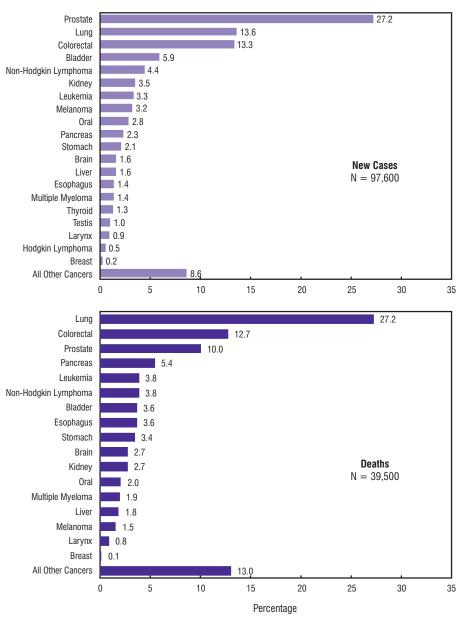
Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDPC, Public Health Agency of Canada.

Data source: Canadian Vital Statistics Death database at Statistics Canada.

<sup>\*</sup> Column totals may not sum to row totals due to rounding.

<sup>&</sup>lt;sup>†</sup> Definition for this cancer has changed; see Table A2.

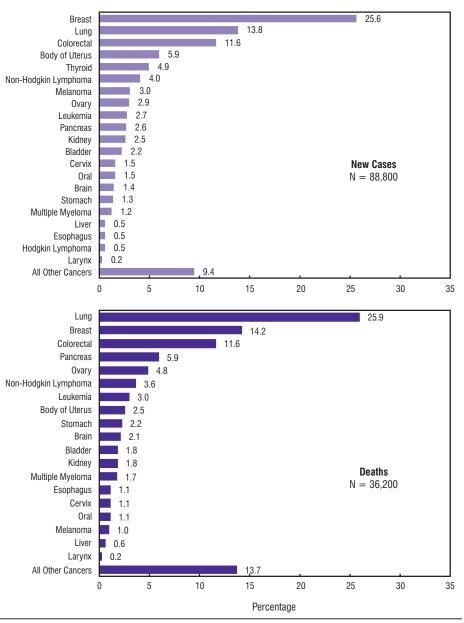
Figure 1.1
Percentage Distribution of Estimated New Cases and Deaths for Selected Cancers, Males, Canada, 2012



**Note:** New cases exclude an estimated 44,800 cases of non-melanoma skin cancer (basal and squamous). The number of deaths for "All Other Cancers" includes about 200 deaths with underlying cause "other malignant neoplasms" of skin.

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

Figure 1.2
Percentage Distribution of Estimated New Cases and Deaths for Selected Cancers, Females, Canada, 2012



Note: New cases exclude an estimated 36,500 cases of non-melanoma skin cancer (basal and squamous).

Deaths for "All Other Cancers" includes about 110 deaths with underlying cause "other malignant neoplasms" of skin.

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

Table 2.1 presents population projections and estimates of new cases and deaths for all cancers combined, by sex and province/territory for 2012. Tables 2.2 and 2.3 present estimates of the number of new cases and the age-standardized incidence rates for selected cancers by sex and province for 2012. The corresponding estimates of the number of cancer deaths and the age-standardized mortality rates are presented in Tables 2.4 and 2.5. *Appendix I* provides references to the most recent actual numbers and rates.

Since the risk of developing cancer increases with age, age standardization (also called age adjustment) is used to adjust for differences in the age profiles of different populations. This allows for better comparison among populations that are quite different. Thus, cancer rates among the provinces and territories are compared using age-standardized rates. The calculation of age-standardized rates, using the 1991 Canadian population as the standard, is described in the *Glossary* and in more detail in *Appendix II*.

#### Incidence

The estimated incidence rates for all cancers combined in males is highest in the Atlantic Provinces, Quebec and Ontario (Table 2.3). For females, highest rates occur in Quebec, Nova Scotia, Ontario and New Brunswick. Lowest rates for males and females are in British Columbia. It should be noted that rates in Newfoundland and Labrador are considered to be lower than actual figures due to missing data (see *Appendix II*).

Prostate cancer incidence rates continue to show large provincial differences. Variation in the use of prostate-specific antigen (PSA) testing is generally believed to account for the difference in provincial prostate cancer incidence rates.

In both men and women, lung cancer incidence rates are highest in Quebec and lowest in British Columbia.

The highest colorectal cancer incidence rates among men and women are in Newfoundland and Labrador. For women, high rates also occur in Prince Edward Island and Nova Scotia. The lowest rates for both sexes are in British Columbia.

Female breast cancer incidence rates appear to be fairly consistent across the country, with no discernible geographic pattern.

## **Mortality**

For males, the estimated mortality rates for all cancers combined continue to be higher in Atlantic Canada, Quebec and Manitoba, with lower rates in Western Canada (Table 2.5). The pattern is similar for females, although overall differences across the country are smaller than for males.

Among males, the lung cancer mortality rate is highest in Quebec and Nova Scotia and lowest in British Columbia. Among females, the lung cancer mortality rate is highest in Quebec and lowest in Ontario.

Colorectal cancer mortality rates for both sexes are highest in Newfoundland and Labrador, almost twice that in British Columbia.

The mortality rate for prostate cancer continues to be highest in Saskatchewan.

Female breast cancer mortality rates appear to be fairly consistent across the country, with no discernible geographic pattern.

#### Interpretation

The population-based provincial/territorial and national cancer registries serve as important resources that enable geographic comparisons of cancer trends. Interpretation of geographic differences should, however, be approached with caution since there may be a number of explanations for the variation. True differences in incidence or mortality rates among provinces and territories may be due to the variation in any one of several factors, including the following:

- the prevalence of cancer risk factors (e.g., higher historic smoking rates in Quebec and Atlantic Canada as the likely cause of higher rates of lung cancer)
- the early detection of cancer due to different rates of participation in formal screening programs (e.g., mammographic screening for breast cancer) or other screening procedures (e.g., PSA testing for prostate cancer)
- the availability of diagnostic services
- access to and quality of health services, most notably treatment
- cancer registry practices

However, even if the above situations apply, it cannot be assumed that they are the cause of the variation in cancer rates across Canada. Such a determination can be made only after conducting more detailed studies involving individual people. It is also important to note that for many cancers the interval between exposure to a risk factor and the occurrence of the disease is quite long, making it difficult to collect detailed information on the prevalence of past exposure to risk factors. Where true differences in cancer risk exist and can be causally attributed to modifiable risk factors, these findings can be used in planning cancer control programs that aim to reduce the burden of cancer.

When interpreting interprovincial variation, it should be kept in mind that the number of cases and the annual rates in a given province or territory may be unreliable and vary considerably from year to year when a cancer is rare or the population is small.

While the completeness of registration of new cancer cases is generally very good across the country, there are exceptions. Death certificate information has not been available for registry purposes in Newfoundland and Labrador until very recently and was not available for this publication. This has led to an underestimation of the actual data and therefore the projected number of newly diagnosed cases, mainly among those cancers with a poor prognosis, such as lung and pancreas (see *Appendix II*). The degree to which death certificate information is checked against hospital records also varies across provinces and territories, and this affects the accuracy of incidence data (e.g., year of diagnosis). In Quebec, because of the registry's dependence on hospital data, the numbers of prostate, melanoma and bladder cases are believed to be underreported.<sup>1</sup>

- ◆ The method of projection selected by the provincial registries for 2012 estimates (Nordpred Power5 regression model or a five-year averaging) varies across provinces and cancer type (see *Methods* in *Appendix II*).
- ◆ The large interprovincial differences seen in bladder cancer incidence rates are likely due to differences in reporting of in situ cases, particularly in Ontario, where such cases were not collected until recently and were not available for this publication.

There continues to be large variation in reported incidence and mortality rates across Canada.

Canada is one of the few nations in the world with a cancer registry system that allows cancer patterns to be monitored and compared across the entire population. Such comparisons can provide valuable information for research, knowledge exchange, planning and decision-making.

Table 2.1
Estimated Population, New Cases and Deaths for All Cancers by Sex and Geographic Region, Canada, 2012

	Populatio	n (in tho	usands)	N	ew Cases	3	Deaths			
	Total*	М	F	Total*	М	F	Total*	М	F	
CANADA	34,922	17,324	17,598	186,400	97,600	88,800	75,700	39,500	36,200	
British Columbia (BC)	4,671	2,317	2,354	23,300	12,500	10,800	9,800	5,200	4,600	
Alberta (AB)	3,841	1,957	1,883	16,100	8,800	7,400	6,300	3,300	2,900	
Saskatchewan (SK)	1,048	521	527	5,500	2,900	2,600	2,400	1,250	1,100	
Manitoba (MB)	1,261	628	633	6,200	3,100	3,000	2,800	1,500	1,350	
Ontario (ON)	13,598	6,706	6,892	72,300	37,300	35,000	27,900	14,500	13,400	
Quebec (QC) <sup>†</sup>	8,025	3,980	4,045	47,600	24,500	23,100	20,000	10,200	9,700	
New Brunswick (NB)	759	373	386	5,000	2,700	2,200	1,900	1,000	910	
Nova Scotia (NS)	953	463	490	6,100	3,200	2,800	2,700	1,450	1,200	
Prince Edward Island (PE)	145	71	74	890	510	370	370	190	190	
Newfoundland and Labrador (NL) <sup>†</sup>	509	249	260	3,100	1,750	1,400	1,400	790	630	
Yukon (YT)	34	17	17	130	65	65	75	45	35	
Northwest Territories (NT)	44	23	22	140	75	65	60	30	30	
Nunavut (NU)	33	17	16	70	35	35	50	25	20	

<sup>\*</sup> Column totals may not sum to row totals due to rounding.

**Note:** The Canada and provincial/territorial totals exclude non-melanoma skin cancer (basal and squamous). **Analysis by:** Chronic Disease Surveillance and Monitoring Division, CCDPC, Public Health Agency of Canada. **Data sources:** Canadian Cancer Registry and Canadian Vital Statistics Death databases, and Census and Demographics Branch at Statistics Canada.<sup>2</sup>

<sup>&</sup>lt;sup>†</sup> The actual data used to calculate the projected overall 2012 estimates were underestimated for some cancers for this province.

Table 2.2
Estimated New Cases for Selected Cancers by Sex and Province, Canada, 2012

					Ne	w Cases	3				
	Canada*	ВС	AB	SK	MB	ON	QC <sup>†</sup>	NB	NS	PE	NL <sup>†</sup>
Males											
All Cancers	97,600	12,500	8,800	2,900	3,100	37,300	24,500	2,700	3,200	510	1,750
Prostate	26,500	3,700	2,500	880	750	10,900	5,400	860	920	160	490
Lung	13,300	1,550	1,000	360	430	4,400	4,300	410	480	70	250
Colorectal <sup>‡</sup>	13,000	1,600	1,100	420	490	4,800	3,400	340	470	60	310
Bladder§	5,800	820	550	180	210	1,500	2,000	170	210	30	85
Non-Hodgkin Lymphoma	4,300	590	410	120	140	1,750	930	110	110	15	60
Kidney	3,500	320	330	100	130	1,300	920	120	150	20	65
Leukemia	3,200	430	320	110	120	1,300	720	70	75	15	30
Melanoma	3,100	490	270	80	85	1,500	350	90	140	20	45
Oral	2,700	340	220	60	110	1,100	630	65	90	15	45
Pancreas	2,200	300	200	65	70	810	610	60	70	10	25
Stomach	2,100	270	190	60	85	750	550	55	65	5	50
Brain	1,600	180	150	45	45	620	440	35	45	10	25
Liver	1,500	240	150	25	40	600	410	15	30	5	10
Esophagus	1,400	180	150	35	45	540	320	40	55	10	20
Multiple Myeloma	1,350	160	130	35	40	540	350	30	40	10	15
Thyroid	1,250	95	110	15	30	600	290	30	30	5	15
Females											
All Cancers	88,800	10,800	7,400	2,600	3,000	35,000	23,100	2,200	2,800	370	1,400
Breast	22,700	3,000	1,950	690	800	9,100	5,500	550	740	95	330
Lung	12,300	1,500	1,000	390	400	4,100	3,800	370	450	60	200
Colorectal <sup>‡</sup>	10,300	1,250	830	310	380	3,900	2,800	250	390	55	220
Body of Uterus	5,300	720	480	150	210	2,200	1,200	120	140	20	85
Thyroid	4,400	260	350	50	90	2,200	1,150	95	85	5	40
Non-Hodgkin Lymphoma	3,500	460	330	110	130	1,350	820	100	120	15	65
Melanoma	2,700	420	240	60	75	1,350	280	85	130	20	35
Ovary	2,600	300	190	75	95	1,150	650	65	65	10	30
Leukemia	2,400	300	230	80	85	1,050	540	45	60	10	20
Pancreas	2,300	280	210	75	75	780	720	70	75	10	20
Kidney	2,200	190	190	70	85	840	600	70	95	10	45
D 8	2,000	270	180	65	70	510	740	60	65	10	35
Bladder§	2,000										25
Bladder <sup>3</sup> Cervix	1,350	160	160	45	50	550	280	30	45	10	20
	,	160 170	160 100	45 35	50 50	550 570	280 320	30 25	45 35	10 5	
Cervix	1,350										15
Cervix Oral	1,350 1,350	170	100	35	50	570	320	25	35	5	15 20 30

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

Note: New cases for "All Cancers" exclude non-melanoma skin cancer (basal and squamous).

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

<sup>†</sup> The actual data used to calculate the projected overall 2012 estimates were underestimated for some cancers for this province.

<sup>&</sup>lt;sup>‡</sup> Definition for this cancer has changed; see Table A2.

<sup>§</sup> Interprovincial variation. Ontario does not currently report in situ bladder cases.

Table 2.3
Estimated Age-Standardized Incidence Rates for Selected Cancers by Sex and Province, Canada, 2012

				C	ases p	er 100,0	000				
	Canada*	ВС	AB	SK	MB	ON	QC <sup>†</sup>	NB	NS	PE	NL <sup>†</sup>
Males											
All Cancers	456	413	442	449	425	459	474	523	498	528	485
Prostate	121	119	127	136	101	131	100	157	136	156	129
Lung	62	49	52	55	58	53	83	78	73	74	68
Colorectal <sup>‡</sup>	60	53	57	64	65	58	65	65	72	63	86
Bladder§	27	27	29	28	28	19	38	33	32	32	25
Non-Hodgkin Lymphoma	20	20	21	19	19	22	18	22	17	17	17
Kidney	16	11	16	16	18	16	18	22	22	21	17
Leukemia	16	15	16	17	16	17	15	14	13	16	9
Melanoma	15	17	13	13	12	19	7	18	22	21	13
Oral	12	11	10	9	14	13	12	12	13	15	13
Pancreas	10	10	10	10	10	10	12	12	10	12	7
Stomach	10	9	9	9	11	9	11	10	10	7	15
Brain	8	6	7	7	7	8	9	8	8	9	8
Liver	7	8	7	4	5	7	8	3	5	4	3
Thyroid	6	4	5	3	4	8	6	6	5	5	5
Esophagus	6	6	7	6	6	6	6	8	8	8	6
Multiple Myeloma	6	5	6	5	5	7	7	6	6	9	4
Females											
All Cancers	368	324	335	354	354	382	383	379	383	337	359
Breast	96	92	88	98	97	100	94	95	100	89	84
Lung	49	42	46	52	45	43	60	59	57	51	49
Colorectal <sup>‡</sup>	40	35	36	39	41	39	42	38	48	48	54
Body of Uterus	22	21	21	22	26	23	19	19	19	18	21
Thyroid	22	10	17	9	14	29	25	21	15	9	13
Non-Hodgkin Lymphoma	14	14	15	15	15	15	14	17	16	12	16
Melanoma	12	14	11	9	9	16	5	16	19	17	10
Ovary	11	9	8	11	11	13	11	11	8	9	7
Leukemia	10	9	11	11	10	12	9	9	9	9	6
Kidney	9	5	9	9	10	9	10	12	12	10	11
Pancreas	9	8	9	9	8	8	11	10	9	8	4
Bladder§	8	7	8	9	8	5	12	10	8	8	9
Cervix	7	6	8	9	8	7	6	7	9	9	8
Brain	6	5	5	6	5	6	7	6	6	5	5
Oral	5	5	5	5	6	6	5	4	4	6	4
Stomach	5	4	3	4	4	5	5	5	5	5	8
Multiple Myeloma	4	3	4	4	3	4	4	4	3	4	3

<sup>\*</sup> Canada totals include provincial and territorial estimates. Territories are not listed separately due to small numbers.

**Note:** Rates for "All Cancers" exclude non-melanoma skin cancer (basal and squamous). Rates are agestandardized to the 1991 Canadian population.

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

<sup>&</sup>lt;sup>†</sup> The actual data used to calculate the projected overall 2012 estimates were underestimated for some cancers for this province.

<sup>&</sup>lt;sup>‡</sup> Definition for this cancer has changed; see Table A2.

<sup>§</sup> Interprovincial variation. Ontario does not currently report in situ bladder cases.

Table 2.4
Estimated Deaths for Selected Cancers by Sex and Province, Canada, 2012

					[	Deaths					
	Canada*	ВС	AB	SK	MB	ON	QC	NB	NS	PE	NL
Males											
All Cancers	39,500	5,200	3,300	1,250	1,500	14,500	10,200	1,000	1,450	190	790
Lung	10,800	1,250	790	290	350	3,600	3,400	330	420	60	210
Colorectal <sup>†</sup>	5,000	630	390	150	180	1,900	1,300	110	200	25	130
Prostate	4,000	530	370	210	180	1,500	830	100	120	25	70
Pancreas	2,100	320	180	65	75	760	540	60	75	10	35
Non-Hodgkin Lymphoma	1,500	200	140	60	65	570	330	45	55	5	20
Leukemia	1,500	190	130	55	60	610	350	30	55	10	20
Bladder	1,450	220	120	45	55	540	340	35	50	5	25
Esophagus	1,450	230	140	40	55	560	290	40	55	5	25
Stomach	1,350	140	110	35	50	510	360	35	50	5	45
Brain	1,050	150	110	30	30	360	300	30	35	5	20
Kidney	1,050	120	85	35	50	380	270	35	45	5	25
Oral	780	100	75	20	35	300	180	20	25	5	15
Multiple Myeloma	750	100	65	25	25	300	180	20	25	5	10
Liver	690	120	55	5	20	290	170	10	15	_	5
Melanoma	600	90	55	15	15	270	110	10	25	5	10
Females											
All Cancers	36,200	4,600	2,900	1,100	1,350	13,400	9,700	910	1,200	190	630
Lung	9,400	1,150	720	260	340	3,200	2,800	280	330	45	170
Breast	5,100	630	390	160	210	2,000	1,350	110	160	30	90
Colorectal <sup>†</sup>	4,200	520	330	130	150	1,550	1,150	100	160	30	100
Pancreas	2,100	290	200	65	70	740	600	60	70	10	25
Ovary	1,750	240	150	60	80	690	380	45	60	5	30
Non-Hodgkin Lymphoma	1,300	170	100	45	60	490	340	30	50	10	15
Leukemia	1,100	140	100	40	45	420	260	30	40	5	10
Body of Uterus	900	100	75	25	25	410	200	20	25	5	10
Stomach	790	90	60	20	30	280	220	20	30	5	30
Brain	760	100	70	25	25	250	220	20	25	5	15
Bladder	670	80	45	15	15	290	180	10	20	5	10
Kidney	650	70	55	25	25	250	160	20	25	5	15
Multiple Myeloma	620	80	60	20	30	240	150	15	25	_	10
Esophagus	410	80	35	15	20	170	80	10	15	_	5
Cervix	390	45	50	10	20	160	65	10	20	_	10
Oral	380	55	35	10	15	150	95	5	10	_	5
Melanoma	370	60	35	10	10	160	65	10	15	_	5

<sup>-</sup> Fewer than three deaths.

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

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

Definition for this cancer has changed; see Table A2.

Table 2.5
Estimated Age-Standardized Mortality Rates for Selected Cancers by Sex and Province, Canada, 2012

					eaths p	er 100,	000				
	Canada*	ВС	AB	SK	MB	ON	QC	NB	NS	PE	NL
Males											
All Cancers	184	167	174	187	197	177	198	193	223	195	230
Lung	50	41	42	44	47	44	65	64	65	64	60
Colorectal <sup>†</sup>	23	20	20	22	24	23	25	22	31	24	39
Prostate	19	17	20	29	24	18	16	19	19	26	22
Pancreas	10	10	9	10	10	9	10	12	12	10	9
Leukemia	7	6	7	8	8	8	7	7	9	10	6
Non-Hodgkin Lymphoma	7	7	7	9	9	7	7	9	8	7	5
Bladder	7	7	6	7	7	6	7	7	8	7	8
Esophagus	7	7	7	6	7	7	5	7	8	6	6
Stomach	6	4	6	5	7	6	7	7	8	5	12
Brain	5	5	5	5	4	5	6	6	6	5	5
Kidney	5	4	4	5	6	5	5	7	7	6	7
Multiple Myeloma	4	3	3	3	4	4	3	4	4	5	3
Oral	4	3	3	3	4	4	3	4	4	3	4
Melanoma	3	3	3	3	2	3	2	2	4	3	4
Liver	3	4	3	1	3	3	3	1	2	_	2
Females											
All Cancers	135	125	127	137	144	131	146	138	145	152	149
Lung	36	33	33	34	37	32	45	43	41	40	40
Breast	19	17	17	21	22	20	20	17	20	24	22
Colorectal <sup>†</sup>	15	13	14	15	14	14	16	14	18	22	24
Pancreas	8	8	9	7	7	7	9	9	9	6	6
Ovary	7	7	7	8	9	7	6	8	7	5	7
Non-Hodgkin Lymphoma	5	4	4	6	6	5	5	5	6	6	4
Leukemia	4	4	4	5	5	4	4	4	5	5	3
Body of Uterus	3	3	3	3	3	4	3	3	3	2	3
Brain	3	3	3	3	3	3	4	3	4	5	4
Stomach	3	2	3	2	3	3	3	3	3	4	7
Kidney	2	2	2	3	3	2	2	3	3	5	3
Multiple Myeloma	2	2	3	2	3	2	2	2	3	_	2
Bladder	2	2	2	2	2	3	2	1	2	2	2
Cervix	2	1	2	2	2	2	1	2	3	_	2
Esophagus	1	2	1	2	2	2	1	2	2	_	1
Melanoma	1	2	2	1	1	2	1	1	2	_	1
Oral	1	1	1	1	2	1	1	1	1	_	1

<sup>-</sup> Fewer than three deaths.

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

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

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

<sup>&</sup>lt;sup>†</sup> Definition for this cancer has changed; see Table A2.

#### Trends by age

Canadians aged 50–79 years will represent almost 70% of all new cancer cases and 62% of cancer deaths in 2012. The highest proportion of new cancer cases (28%) will occur in the 60–69 age group, while the highest proportion of deaths from cancer (34%) is expected in the 80 and older age group (Table 3.1). Cancer continues to affect Canadians of all ages:

- ◆ The youngest Canadians, between the ages of 0 and 49, will account for an estimated 12% (21,700 cases) of all new cancer diagnoses and 5% (3,680 deaths) of all cancer deaths in 2012.
- ◆ In 2012, there will be about 51,200 new cancer cases in Canadians in the 60–69 age range, which is the highest burden of new cancer diagnoses (28%), and approximately 16,900 cancer deaths (22%).
- ◆ Canadians aged 80 years and older will experience the highest proportion of cancer deaths at 34% (25,400 deaths). They will account for 19% of all new cancer diagnoses (35,400 cases) in 2012.

The burden of cancer in older Canadians remains significant. Table 3.1 indicates that Canada's population is estimated at 35 million. According to Statistics Canada, the number of people aged 65 or older is now close to 5 million, or 14% of the total population.<sup>3</sup> This proportion is expected to continue to grow as the baby boomers begin to reach age 65.<sup>2</sup>

Figure 3.1 displays age-specific rates of cancer incidence and mortality by five-year age groups. Cancer incidence and mortality rates increase with age for both sexes. The incidence rate for males surpasses that for females around age 55, and a similar pattern is observed for mortality.

Age and sex distributions for the most common cancers among Canadians in 2012 are presented in Table 3.2, which shows the following:

- ◆ Four major cancers (breast, lung, colorectal and prostate) represent the majority (53%) of newly diagnosed cancers in both men and women. Prostate cancer is the most common cancer in men (27%), while breast cancer (26%) is the most common cancer in women.
- ◆ Half of all newly diagnosed lung and colorectal cancer cases will occur among people aged 70 years or older.
- ◆ Breast cancer occurs primarily in females 50–69 years of age. Thirty percent of breast cancer cases will be diagnosed among women over the age of 69, while 19% will occur in those under age 50. It is notable that although over half of the new cases of breast cancer occur between ages 50 and 69, more deaths from breast cancer will occur in females 80 years and older than in any other age group, reflecting the benefits of screening and treatment in prolonging life in middle-aged women.
- ◆ Prostate cancer will be diagnosed most frequently in males aged 60–69 years, but more prostate cancer deaths will occur in males 80 years and older. This pattern likely reflects the effect of screening men for prostate cancer in their 60s and the long natural history of the disease.
- ◆ Unlike other major cancers, for which the number of deaths increases with age, deaths for lung cancer peak at age 70–79 for both males and females.

#### Trends by sex

Trends in age-standardized incidence and mortality rates for all cancers combined for males and females are shown in Figure 3.2.

Cancer is more common in males than females among those 19 years and younger and 60 years and older, but this trend reverses between ages 20 and 50, with a higher incidence in females. In the 50–59 age group, male and female rates are very similar. Sex-specific cancers (breast and cervical cancer in particular) as well as melanoma and thyroid cancer account for the higher cancer incidence in younger females.

Breast cancer is the most common cancer in females over the age of 20. Deaths from breast cancer are more frequent than deaths from other common cancers only in women 30–39 years of age.

The overall cancer incidence rate in males over age 69 has been dropping, primarily due to a declining rate of lung cancer from decreased tobacco use. The overall incidence rate in females has only recently begun to level off. Lung cancer remains the most common cause of cancer death in both sexes.

Since 1989, the mortality rate for all cancers combined has been dropping for males up to age 79 and for females up to age 69. But for females, this rate begins to increase from age 70. Mortality rates for males and females in the youngest age groups (0–19, 20–29) are very similar in recent years and show limited variation up to age 59, after which male mortality rates are notably higher than those for females.

Table 3.1
Estimated New Cases and Deaths for All Cancers by Age Group and Sex, Canada, 2012

Age	Populati	on (in tho	usands)	N	ew Cases		Deaths			
Group	Total*	М	F	Total*	М	F	Total*	М	F	
All Ages	34,922	17,324	17,598	186,400	97,600	88,800	75,700	39,500	36,200	
0–19	7,878	4,043	3,836	1,400	760	650	160	85	75	
20-29	4,858	2,476	2,383	2,100	970	1,100	190	99	85	
30–39	4,721	2,364	2,357	4,900	1,700	3,200	630	260	370	
40–49	5,087	2,563	2,524	13,300	4,700	8,600	2,700	1,150	1,500	
50-59	5,139	2,555	2,584	33,300	16,300	17,000	9,000	4,500	4,500	
60–69	3,707	1,808	1,899	51,200	29,600	21,600	16,900	9,300	7,600	
70–79	2,113	981	1,132	44,800	25,800	18,900	20,700	11,600	9,100	
<del>+</del> 08	1,418	534	883	35,400	17,700	17,700	25,400	12,500	12,900	

<sup>\*</sup> Column totals may not sum to row totals due to rounding. Canada totals include provincial and territorial estimates

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

**Analysis by:** Chronic Disease Surveillance and Monitoring Division, CCDPC, Public Health Agency of Canada. **Data sources:** Canadian Cancer Registry and Canadian Vital Statistics Death databases, and Census and Demographics Branch at Statistics Canada.<sup>2</sup>

Table 3.2
Estimated New Cases and Deaths for the Most Common Cancers by Age Group and Sex, Canada, 2012

Age _		Lung		C	Colorectal		Prostate	Breast
Group	Total	М	F	Total	М	F	M	F
New Cases	6							
All Ages	25,600	13,300	12,300	23,300	13,000	10,300	26,500	22,700
0–19	5	5	_	10	5	5	_	5
20-29	20	10	10	70	35	35	_	110
30–39	95	40	55	260	140	120	5	850
40–49	810	340	460	1,100	580	520	460	3,300
50-59	3,800	1,800	2,000	3,500	2,000	1,450	4,600	5,600
60–69	7,400	3,900	3,500	6,100	3,800	2,300	10,500	6,000
70–79	7,900	4,300	3,600	6,500	3,800	2,700	7,100	4,000
<del>*************************************</del>	5,500	2,900	2,700	5,800	2,600	3,200	3,800	2,800
Deaths								
All Ages	20,100	10,800	9,400	9,200	5,000	4,200	4,000	5,100
0–19	_	_	_	_	_	_	_	_
20–29	5	5	5	10	10	5	_	5
30–39	45	15	30	55	30	25	_	90
40–49	530	240	280	260	140	120	10	410
50-59	2,600	1,300	1,300	940	550	390	120	920
60–69	5,400	2,900	2,400	1,900	1,150	710	500	1,100
70–79	6,300	3,500	2,800	2,500	1,500	970	1,100	1,000
80+	5,300	2,800	2,500	3,600	1,650	2,000	2,200	1,600

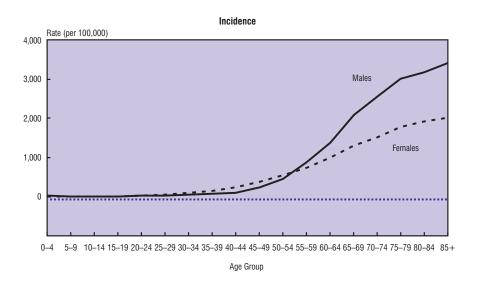
Fewer than three cases or deaths.

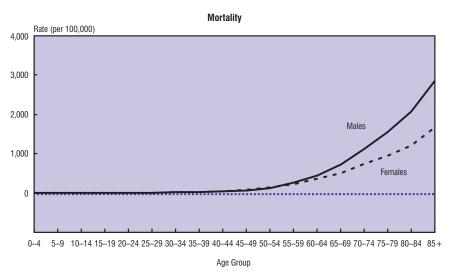
Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDPC, Public Health Agency of Canada. Data sources: Canadian Cancer Registry and Canadian Vital Statistics Death databases at Statistics Canada.

Cancer risk increases with age, and the number of new cancer diagnoses will continue to increase as the baby boomer population begins to reach age 65. Notable declines in mortality rates for all cancers combined have occurred in both sexes and in most age groups.

Figure 3.1

Age-Specific Incidence and Mortality Rates for All Cancers by Sex, Canada, 2007





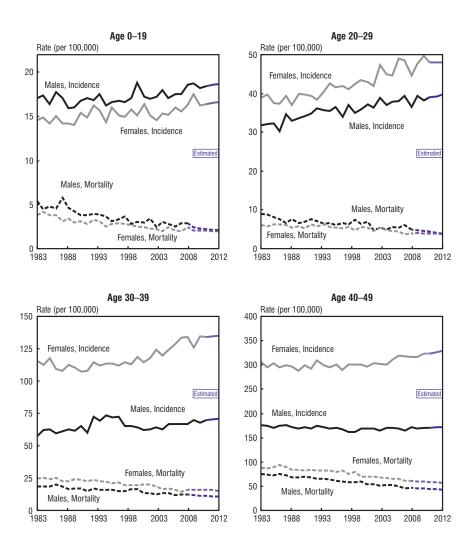
Note: Incidence rates exclude non-melanoma skin cancer (basal and squamous).

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDPC, Public Health Agency of Canada.

Data sources: Canadian Cancer Registry and Canadian Vital Statistics Death databases at Statistics Canada.

Figure 3.2

Age-Standardized Incidence and Mortality Rates for All Cancers by Age Group, Canada, 1983–2012

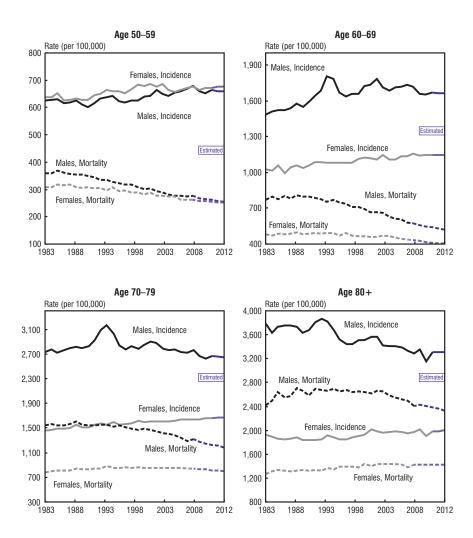


**Note:** The range of the rate scales differs widely among the four age groups. Incidence rates exclude non-melanoma skin cancer (basal and squamous). Actual incidence data were available to 2009 for all provinces except Quebec (2007), and actual mortality data were available to 2007.

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

#### Figure 3.2 (continued)

Age-Standardized Incidence and Mortality Rates for All Cancers by Age Group, Canada, 1983–2012



**Note:** The range of the rate scales differs widely among the four age groups. Incidence rates exclude non-melanoma skin cancer (basal and squamous). Actual incidence data were available to 2009 for all provinces except Quebec (2007), and actual mortality data were available to 2007.

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

The numbers of new cases and deaths are important measures of cancer burden on the Canadian population and healthcare system. Incidence trends generally signal changes in population structure or the prevalence of risk factors, or they may indicate changes in screening or diagnostic practices. Incidence trends are one statistic that can be directly used to indicate how many new people may seek diagnosis, primary treatment, potential further treatment or palliative care in the future. Trends in mortality rates reflect changes in disease incidence, survival or both. A decreasing trend in mortality indicates progress in cancer control.

Trends in incidence and mortality are often assessed by comparing annual agestandardized rates. Age standardization results in more meaningful comparisons of changes in cancer risk or diagnostic practices over place and time because it adjusts for variation in the age distribution and growth of populations. Unless otherwise specified, this section reports average annual percent changes over 10 years.

#### Trends for all cancers combined

Figure 4.1 presents the number of new cases for all cancers combined, together with the corresponding age-standardized incidence rates for 1983 to 2009, with estimates to the year 2012. Figure 4.2 presents the number of deaths and age-standardized mortality rates for 1983 to 2007, with estimates to 2012. Despite the relative stability in age-standardized rates, the number of new cancer cases continues to rise steadily as the Canadian population grows and ages. In 2012, the number of new cancer cases is estimated to be 186,400, and the number of cancer deaths is estimated to be 75,700.

Among males, the overall cancer incidence rate rose in the early 1990s and then declined sharply (Figure 4.1). This reflects a similar trend in the incidence of prostate cancer, the leading type of cancer in men, during the same period. Since 1993, there has been a decline in the overall cancer incidence rate in males. In contrast, the cancer mortality rate in males, after reaching a peak in 1988, has been declining steadily because of decreases in mortality rates for prostate, lung, colorectal and other cancers (Figure 4.2).

Among females, the overall cancer incidence rate has been increasing slowly since the early 1990s (Figure 4.1), while the mortality rate has been declining slowly since the mid-1990s (Figure 4.2).

Figures 4.3 and 4.4 show the relative contributions to the changes in the total number of new cases and deaths that can be attributed to changes in cancer risk or diagnostic practices, population size and aging of the population. The major contributors to the rising number of new cancer cases are population growth and the aging of the population:

- ◆ The lowest solid line represents the total number of new cancer cases (or deaths) that would have occurred each year if the population size and age structure had remained the same as they were in 1983. This line reflects the impact of changes in cancer risk or diagnostic practices.
- ◆ The middle line represents the number of new cases (or deaths) that would have occurred if the age structure of the population had remained the same as it was in 1983. This line reflects the impact of changes in cancer risk and population growth.

◆ The top line represents the number of new cases (or deaths) that actually occurred and thus reflects the combined impact of changes in risk, population growth and aging of the population.

These figures indicate that the increase in the number of cancer cases and deaths that has occurred over the last 30 years is primarily the result of an aging population and, to a lesser extent, an increase in population size. As long as current demographic trends continue, there will be a corresponding annual increase in the number of new cases and deaths from cancer.

#### Trends for selected cancers

Trends in annual rates for selected cancers over the past 30 years are presented in Figures 4.5 to 4.8, with the data provided in Tables 4.1 to 4.4.

The annual percent change (APC) in cancer-specific incidence rates and mortality rates (1998–2007) is listed in Table 4.5. The overall incidence rate increased significantly for females between 1998 and 2007 (0.3% per year). The overall mortality rate declined significantly between 1998 and 2007 for females (-0.8% per year) and between 2001 and 2007 for males (-2.0% per year). It should be noted that these short-term trends do not necessarily reflect the longer term or earlier trends evident in Tables 4.1 to 4.4 and Figures 4.5 to 4.8. The descriptions that follow should be interpreted with this in mind.

For the cancers listed in Table 4.5, several statistically significant increases or decreases of 2% or more per year are observed:

- increases in incidence rate
  - $\circ$  liver cancer in both males (3.6%) and females (2.4%)
  - thyroid cancer in both males (6.8%) and females (6.9%)
  - kidney cancer in males (2.6%)
- decreases in incidence rate
  - O larynx cancer in both males (-3.8%) and females (-3.4%)
  - o stomach cancer in males (-2.0%)
- increases in mortality rate
  - O liver cancer in males (2.2%)
- decreases in mortality rate
  - o in males, deaths from all cancers combined (-2.0%), lung cancer (-2.3%), colorectal cancer (-2.6%), non-Hodgkin lymphoma (-2.6%), stomach cancer (-3.0%), prostate cancer (-4.3%) and larynx cancer (-6.2%)
  - o in females, breast cancer (-2.2%), non-Hodgkin lymphoma (-2.7%), stomach cancer (-2.9%) and cervical cancer (-2.9%)

# Discussion of leading and selected cancers with significantly changing trends

#### Breast cancer

Breast cancer incidence rates rose from 1983 through the early 1990s, in part because of increased mammography screening. Reasons for the pattern of modest declines and increases observed since then are unclear but likely relate to factors such as the continuing rise in mammography screening throughout the 1990s, along with the fluctuating patterns of hormone replacement therapy use among post-menopausal women during this time.

Female breast cancer mortality rates have been declining since the mid-1980s. The mortality rate has fallen by almost 40% since peaking in 1986, from 32.0 to 19.5 per 100,000 (Table 4.4). The downward trend has accelerated to 2.2% per year in recent years. This is likely the result of a combination of increased mammography screening and the use of more effective adjuvant therapies following breast cancer surgery. The breast cancer mortality rate is the lowest it has been since 1950. Similar declines have also occurred in the United States, United Kingdom and Australia.<sup>5</sup>

#### Cervical cancer

Incidence and mortality rates have continued declining for cervical cancer, by 1.4% and 2.9% per year, respectively, since 1998 (Table 4.5). This is largely due to widespread, regular screening with the Papanicolaou (Pap) test, which detects premalignant and malignant lesions early so that they can be treated.

The immunization of school-aged children with the vaccine for human papillomavirus (HPV) is anticipated to further reduce incidence and mortality over the longer term but will not eliminate cervical cancer. The continuation of Pap screening is still a necessary and important part of preventive healthcare.

#### Colorectal cancer

Colorectal cancer incidence rates between 1983 and 2000 were relatively stable in men and declined slightly in females. In both sexes, the incidence rate has declined significantly (0.8% per year) since 2000 (Table 4.5).

Mortality rates continue to decline in both sexes—by 2.6% per year in males since 2003 and 1.8% per year in females since 1998 (Table 4.5). This is likely the result of improvements in treatment, such as chemotherapy.

Screening for colorectal cancer can reduce both incidence (by identifying and removing precancerous polyps) and mortality. Screening has already been occurring in several provinces, which may partly account for the decline in mortality, though screening rates are low. All provinces have announced or have started implementing organized screening programs.

#### Kidney cancer

Figure 4.5 indicates that incidence rates of kidney cancer in Canadian men increased during the 1980s, stabilized between 1988 and 1998 and rose again thereafter. During the period from 2003 to 2007, kidney cancer incidence rates among males increased significantly by 2.6% per year (Table 4.5). Between 1998 and 2007, the incidence increased significantly among women by 1.9% per year.

The rising incidence of kidney cancer is consistent with trends observed in several developed countries.<sup>6–8</sup> The upward trend in kidney cancer in Canada may be partly explained by the increasing use of high-tech diagnostic imaging, increase in cigarette smoking (prior to its decline) and increased obesity over the past 25 years.<sup>9</sup>

Mortality rates for kidney cancer have decreased slightly by 0.8% per year for men and by 0.9% for women during the period of 1998 to 2007.

#### Larynx cancer

Incidence rates of larynx cancer (1998–2007) have decreased for both males (-3.8% per year) and females (-3.4% per year), while mortality rates for males showed a significant decline of 6.2% since 2001 (Table 4.5).

Cancer of the larynx is most strongly associated with smoking<sup>10</sup> and alcohol use. <sup>11</sup> Incidence and mortality rates reflect the decreasing trends in these risk factors. <sup>4,12</sup>

#### Liver cancer

In males, the incidence rate of liver cancer increased by 3.6% per year, and the mortality rate increased by 2.2% per year (Table 4.5) between 1998 and 2007. Both increases were statistically significant. In females, the incidence rate increased by 2.4% per year (Table 4.5).

Some of the observed increase may be explained by the rising immigration of people from world regions where risk factors for liver cancer, such as hepatitis B virus infection and exposure to aflatoxins, are prevalent.<sup>13</sup>

Other factors include increased rates of hepatitis C infection and alcohol abuse, which both increase the risk of liver cirrhosis and therefore liver cancer. 14

#### Lung cancer

In males, incidence and mortality rates for lung cancer began to level off in the mid-1980s and have been declining ever since (Tables 4.1 and 4.2). Rates have dropped significantly, by 1.8% per year for incidence and by 2.3% per year for mortality (Table 4.5).

In females, the incidence rate has been increasing since 1983, with a significant upward trend of 1.1% per year between 1998 and 2007. The mortality rate for females shows a slight (0.7%) but statistically significant increase.

Despite the diverging trends, males are projected to continue to have higher incidence and mortality rates than females in 2012 (incidence: 62 vs. 49 per 100,000; mortality: 50 vs. 36 per 100,000).

The differences between male and female lung cancer trends reflect past differences in the patterns of tobacco use. In males, the drop in tobacco consumption began in the mid-1960s, preceding the decline in lung cancer rates by approximately 20 years. In females, tobacco consumption began to decline in the mid-1980s.

#### Non-Hodgkin lymphoma

Incidence rates for non-Hodgkin lymphoma have increased modestly in males (0.8%) and stabilized in females since 1998.

The observed incidence patterns likely result from a combination of improved detection and classification of this complex set of diseases, as well as changes in risk

factors. The clearest risk factor for non-Hodgkin lymphoma is immunosuppression, which can result from immune disorders, immunosuppressive therapy or infection with human immunodeficiency virus (HIV). Other factors that increase risk are poorly understood but may include occupational exposure to pesticides and organochlorines, such as phenoxy herbicides and dioxins.

Mortality rates have declined for males (-2.6% per year) and females (-2.7% per year) since 2000 (Table 4.5).

Declines in mortality may reflect recent improvements in treatment, such as immunotherapy (e.g., rituximab). As well, the introduction of anti-retroviral treatment for HIV infection in the second half of the 1990s has resulted in a decline in the proportion of particularly aggressive forms of non-Hodgkin lymphoma attributable to HIV infection.

#### Oral cancer

This group of cancers includes cancers of the lip, tongue, salivary gland, mouth, nasopharynx and oropharynx. Slight declines have occurred in the incidence rate (-1.0% per year) and mortality rate (-1.8% per year) for males since 1998 (Table 4.5).

A decline in smoking, which is a major risk factor for most oral cancers in Canada, likely accounts for the downward trends in oral cancer incidence and mortality.

Decreases in heavy alcohol use may also be relevant. The contributions of other risk factors, including HPV infection, diet and sun exposure (linked to lip cancer), are unclear.

#### Prostate cancer

The two peaks in the incidence of prostate cancer that occurred in 1993 and 2001, each followed by a decline (Figure 4.5), are compatible with two waves of intensified screening activity with the PSA test for early prostate cancer detection. The first peak follows the introduction of PSA as a screening test. The second may be explained by the publicity around the 2001 prostate cancer diagnosis of the then federal minister of health, as a result of serial PSA tests. The first decline was followed by resumption of the earlier, more gradual increase, whereas the second decline has been followed by a stabilizing of the trend.

Although the long-term, ongoing increase in incidence may be due to gradual changes in early detection, changes in the prevalence of risk factors might also be partly responsible. However, little is known about what these factors are for prostate cancer.

In contrast to incidence, mortality rates for prostate cancer rose much more slowly from 1980 and started to decline in the mid-1990s. Mortality declined significantly by 4.3% per year between 2001 and 2007 (Table 4.5), which likely reflects improved treatment over time.

In 2009, two large randomized trials of PSA testing and its possible relation to reducing mortality in men over age 55 produced conflicting results. <sup>15,16</sup> Ongoing follow-up of men in these studies may help clarify the role of PSA testing in reducing deaths from prostate cancer.

#### Stomach cancer

Incidence rates of stomach cancer are declining in both sexes by 2.0% per year in males and 1.6% per year in females between 1998 and 2007 (Table 4.5). This decline

may be due to changes in diet, decreases in smoking and heavy alcohol use (which can increase the impact of smoking on stomach cancer risk) and increased recognition and treatment of infection with the bacterium *Helicobacter pylori*, which is associated with stomach cancer.

Mortality rates from this cancer have also declined significantly, by 3.0% per year in males and by 2.9% per year in females (Table 4.5).

#### Thyroid cancer

The incidence rate of thyroid cancer is the most rapidly increasing of all cancers (6.8% per year in males since 1998 and 6.9% per year in females since 2002; Table 4.5). Similar increases have been noted in Europe and the United States.

There are two proposed explanations for the rising rates of thyroid cancer. More frequent use of diagnostic testing (ultrasound, computed tomography [CT] and magnetic resonance imaging) may be detecting earlier stage, asymptomatic thyroid cancers more frequently than was possible in the past. <sup>17</sup> Alternatively, a true increase in the risk over time of this cancer could be possible as at least one US research study has found increases in thyroid tumours of all sizes and stages. <sup>18</sup>

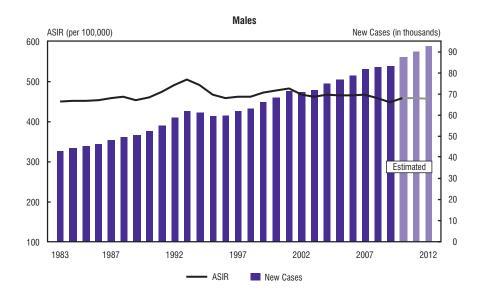
Mortality rates have remained stable, most likely because modern treatment is highly effective in the management of early thyroid cancers.

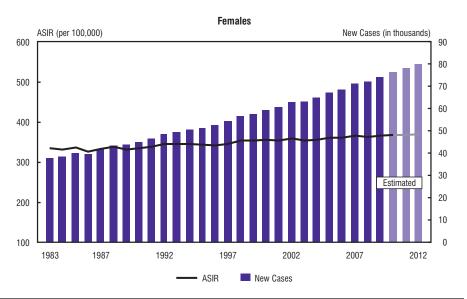
#### **Implications**

The strong declines in mortality rates for several cancers suggest that there has been important progress in cancer control, specifically due to early detection and treatment, as seen in improved five-year relative survival in the most recent time period for the leading cancers. However, the increasing or stable trends in incidence rates for many cancers suggest a need for more primary prevention. Furthermore, Figure 4.1 and Figure 4.2 highlight the fact that the rise in new cases of cancer will place an increasing burden on Canadian society, largely independent of the trend in incidence and mortality rates. This vividly illustrates why cancer prevention and health promotion programs are so vital. There is a need to enhance capacity for primary prevention, early detection and treatment to further reduce overall cancer incidence and mortality.

Incidence and mortality are measures of disease burden, and their trends can inform the need for clinical services. Overall, incidence rates are stable (males) or show modest increases (females), but mortality rates are declining, suggesting better survival for some cancers. The trends call for an enhancement of primary prevention efforts; a sustained focus on screening for breast, colorectal and cervical cancers; more emphasis on early detection measures and public education on the early signs of cancer; and improved treatment options and health promotion.

Figure 4.1
New Cases and Age-Standardized Incidence Rates (ASIRs) for All Cancers, Canada, 1983–2012

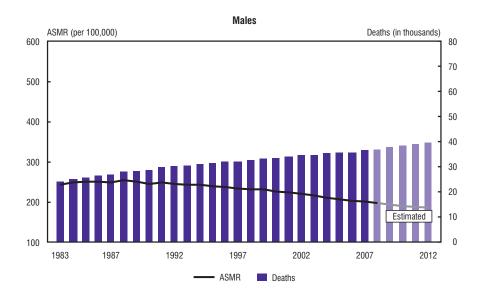


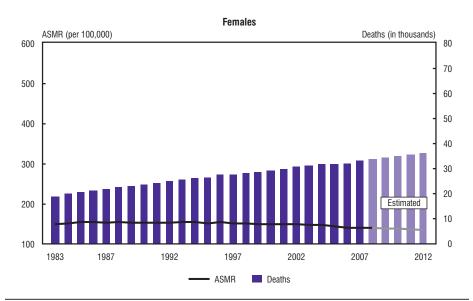


**Note:** "All cancers" excludes non-melanoma skin cancer (basal and squamous). Rates are age-standardized to the 1991 Canadian population. Actual incidence data were available to 2009 except for Quebec (2007). Please refer to *Appendix II: Data sources and methods* for further details.

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

Figure 4.2
Deaths and Age-Standardized Mortality Rates (ASMRs) for All Cancers, Canada, 1983–2012

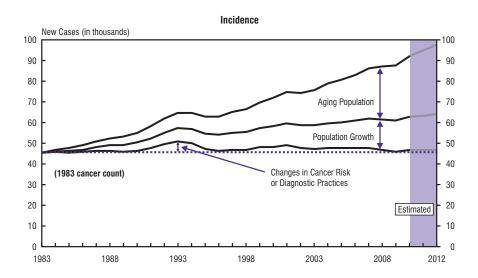


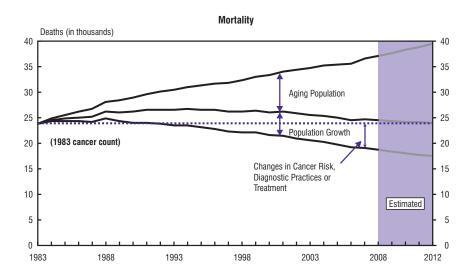


**Note:** Rates are age-standardized to the 1991 Canadian population. Actual data were available to 2007. **Analysis by:** Chronic Disease Surveillance and Monitoring Division, CCDPC, Public Health Agency of Canada. **Data source:** Canadian Vital Statistics Death database at Statistics Canada.

Figure 4.3

Trends in New Cases and Deaths for All Cancers and Ages, Attributed to Cancer Rate, Population Growth and Aging Population, Males, Canada, 1983–2012



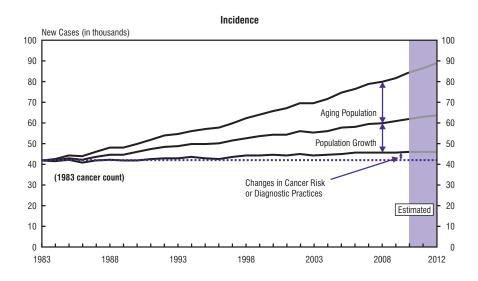


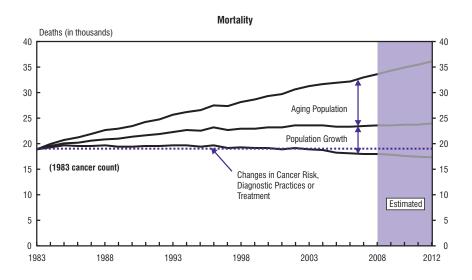
**Note:** New cases excludes non-melanoma skin cancer (basal and squamous). Actual incidence data were available to 2009 for all provinces except Quebec (2007), and actual mortality data were available to 2007. The range of scales differs between the figures.

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

#### Figure 4.4

Trends in New Cases and Deaths for All Cancers and Ages, Attributed to Cancer Rate, Population Growth and Aging Population, Females, Canada, 1983–2012

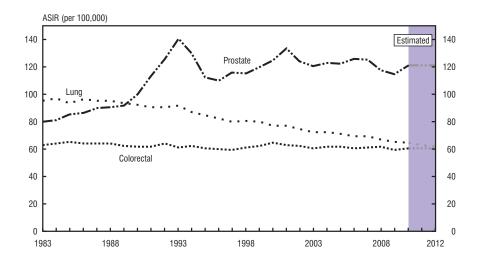


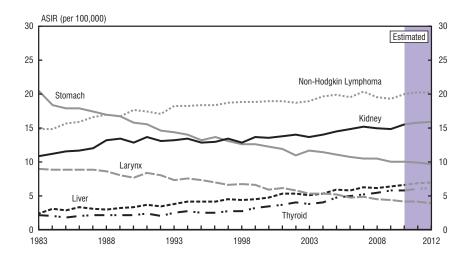


**Note:** New cases exclude non-melanoma skin cancer (basal and squamous). Actual incidence data were available to 2009 for all provinces except Quebec (2007), and actual mortality data were available to 2007. The range of scales differs between the figures.

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

Figure 4.5
Age-Standardized Incidence Rates (ASIRs) for Selected\* Cancers, Males, Canada, 1983–2012





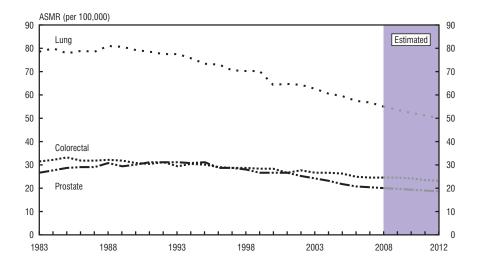
<sup>\*</sup> Five most frequent cancers (both sexes combined) and cancers with a statistically significant change in incidence rate of at least 2% per year (see Table 4.5).

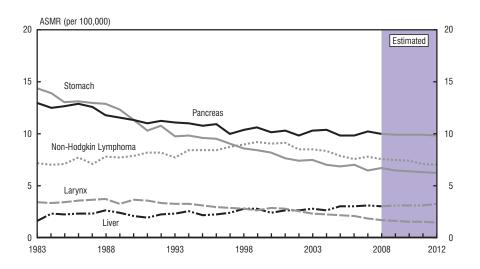
Note: Rates are age-standardized to the 1991 Canadian population. See Table 4.1 for data points. Actual data for incidence were available to 2009 except for Quebec (2007). The range of scales differs widely between the figures.

Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDPC, Public Health Agency of Canada.

Data sources: Canadian Cancer Registry and National Cancer Incidence Reporting System databases at Statistics Canada.

Figure 4.6
Age-Standardized Mortality Rates (ASMRs) for Selected\* Cancers, Males, Canada, 1983–2012



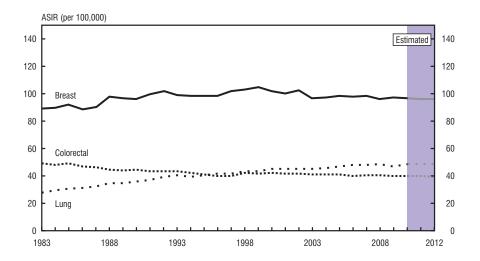


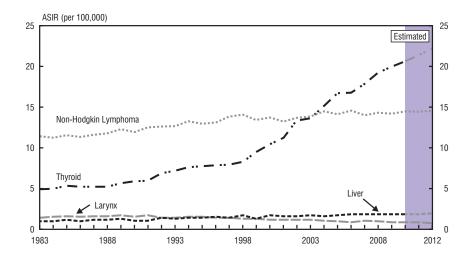
<sup>\*</sup> Five most frequent causes of cancer deaths (both sexes combined) and cancers with a statistically significant change in mortality rate of at least 2% per year (see Table 4.5).

**Note:** Rates are age-standardized to the 1991 Canadian population. See Table 4.2 for data points. Actual data for mortality were available to 2007. The range of scales differs widely between the figures.

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

Figure 4.7
Age-Standardized Incidence Rates (ASIRs) for Selected\* Cancers, Females, Canada, 1983–2012



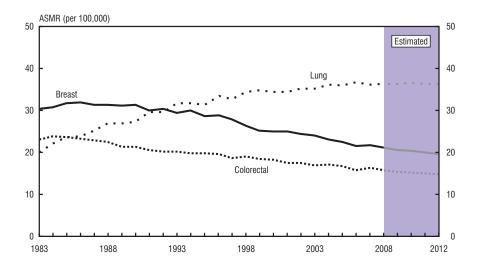


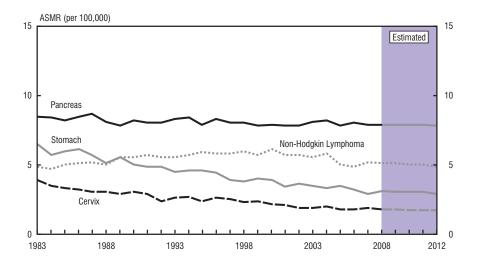
<sup>\*</sup> Five most frequent cancers (both sexes combined) and cancers with a statistically significant change in incidence rate of at least 2% per year (see Table 4.5).

Note: Rates are age-standardized to the 1991 Canadian population. See Table 4.3 for data points. Actual data for incidence were available to 2009 except for Quebec (2007). The range of scales differs widely between the figures. Analysis by: Chronic Disease Surveillance and Monitoring Division, CCDPC, Public Health Agency of Canada. Data sources: Canadian Cancer Registry and National Cancer Incidence Reporting System databases at Statistics Canada.

Figure 4.8

Age-Standardized Mortality Rates (ASMRs) for Selected\* Cancers, Females, Canada, 1983–2012





<sup>\*</sup> Five most frequent causes of cancer deaths (both sexes combined) and cancers with a statistically significant change in mortality rate of at least 2% per year (see Table 4.5).

**Note:** Rates are age-standardized to the 1991 Canadian population. See Table 4.4 for data points. Actual data for mortality were available to 2007. The range of scales differs widely between the figures.

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

Table 4.1

Age-Standardized Incidence Rates for Selected\* Cancers, Males, Canada, 1983–2012

					Cases per 100	0,000				
Year	All Cancers	Prostate	Lung	Colorectal	Non-Hodgkin Lymphoma	Kidney	Stomach	Liver	Thyroid	Larynx
1983	450.5	79.7	95.0	62.9	14.9	10.8	20.5	2.4	2.1	9.0
1984	452.3	81.0	96.9	63.8	14.9	11.3	18.4	3.1	2.0	8.9
1985	452.3	85.1	93.0	65.2	15.7	11.5	18.0	2.8	1.8	8.8
1986	453.9	86.1	96.1	63.5	16.0	11.6	18.0	3.3	2.0	8.8
1987	458.5	89.5	94.8	63.4	16.6	12.0	17.4	3.1	2.2	8.8
1988	460.9	90.4	95.1	63.4	17.0	13.3	17.0	3.0	2.1	8.6
1989	453.8	91.8	93.3	62.0	16.7	13.4	16.7	3.2	2.1	8.1
1990	460.2	99.8	92.4	61.9	17.7	12.9	15.8	3.4	2.2	7.7
1991	472.4	112.5	90.5	61.8	17.4	13.6	15.6	3.6	2.4	8.4
1992	490.6	125.7	90.6	63.3	17.2	13.1	14.6	3.5	2.0	8.1
1993	503.1	140.7	91.5	61.0	18.2	13.2	14.3	3.8	2.6	7.4
1994	491.3	129.8	86.8	62.1	18.2	13.4	14.1	4.2	2.7	7.5
1995	467.1	111.8	84.7	60.5	18.3	12.8	13.3	4.2	2.6	7.4
1996	458.1	110.1	82.2	59.4	18.3	13.0	13.6	4.2	2.6	6.9
1997	461.0	115.6	79.4	59.1	18.8	13.4	13.1	4.5	2.7	6.6
1998	460.8	115.0	80.5	61.2	18.9	12.9	12.6	4.4	2.7	6.7
1999	471.9	119.6	79.5	62.2	18.9	13.6	12.6	4.6	3.2	6.6
2000	476.5	124.8	77.1	64.2	19.0	13.5	12.3	4.7	3.5	5.9
2001	482.3	133.2	77.0	63.2	19.0	13.8	11.9	5.3	3.6	6.1
2002	466.7	123.8	74.5	62.6	18.8	14.0	11.0	5.3	4.0	5.8
2003	462.4	120.4	72.4	60.3	19.0	13.6	11.7	5.1	3.7	5.4
2004	466.4	122.6	72.3	61.5	19.7	14.0	11.4	5.4	4.0	5.3
2005	465.3	121.9	71.1	61.4	20.0	14.4	11.1	5.9	4.7	5.2
2006	464.9	126.1	69.1	60.4	19.5	14.9	10.7	5.8	5.0	4.7
2007	467.1	125.5	68.9	60.8	20.4	15.3	10.5	6.3	5.2	4.8
2008	458.0	117.2	67.0	61.4	19.6	15.0	10.5	6.1	5.5	4.5
2009	448.8	114.6	65.1	59.2	19.3	14.9	10.1	6.4	5.8	4.4
2010 <sup>†</sup>	458.0	121.2	64.2	60.6	20.1	15.6	10.0	6.6	5.8	4.2
2011 <sup>†</sup>	457.0	121.2	63.0	60.5	20.2	15.8	9.9	6.8	6.0	4.1
2012 <sup>†</sup>	456.1	121.2	61.8	60.5	20.2	15.9	9.7	6.9	6.1	3.9

<sup>\*</sup> Five most frequent cancers (both sexes combined) and cancers with a statistically significant change in incidence rate of at least 2% per year (see Table 4.5).

**Note:** Rates for "All Cancers" exclude non-melanoma skin cancer (basal and squamous). Rates are agestandardized to the 1991 Canadian population.

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

<sup>&</sup>lt;sup>†</sup> Actual data were available to 2009 except for Quebec (2007). Estimated rates for all provinces/territories. These estimates are based on long-term trends and may not reflect recent changes.

Table 4.2

Age-Standardized Mortality Rates for Selected\* Cancers, Males, Canada, 1983–2012

				De	aths per 10	0,000			
Year	All Cancers	Lung	Colorectal	Prostate	Pancreas	Non-Hodgkin Lymphoma	Stomach	Liver	Larynx
1983	243.1	78.4	31.7	26.7	12.9	7.2	14.3	1.6	3.4
1984	248.1	80.2	32.4	27.5	12.5	7.0	13.9	2.3	3.3
1985	249.2	78.0	33.3	28.9	12.7	7.1	13.0	2.2	3.4
1986	249.0	78.8	31.9	29.4	12.8	7.7	13.1	2.3	3.5
1987	248.1	78.5	31.9	29.4	12.6	7.1	12.9	2.3	3.6
1988	254.6	81.2	32.3	30.7	11.8	7.8	12.8	2.6	3.7
1989	249.4	81.0	31.9	29.7	11.5	7.7	12.3	2.4	3.2
1990	246.4	79.4	30.8	30.1	11.3	7.9	11.3	2.0	3.6
1991	247.5	78.7	30.3	31.2	11.0	8.1	10.3	1.9	3.5
1992	245.2	77.6	31.0	31.1	11.2	8.1	10.7	2.2	3.3
1993	243.2	77.9	29.6	31.1	11.1	7.7	9.7	2.3	3.2
1994	242.3	75.6	30.2	30.8	11.0	8.4	9.8	2.5	3.2
1995	239.3	73.3	30.0	31.1	10.7	8.4	9.6	2.1	3.1
1996	236.6	72.9	29.4	29.0	10.9	8.4	9.5	2.2	2.9
1997	232.3	70.5	28.8	28.8	10.0	8.7	9.0	2.4	2.8
1998	230.7	70.2	28.8	28.1	10.4	8.9	8.6	2.7	2.7
1999	229.8	70.4	28.4	26.9	10.6	9.2	8.4	2.7	2.6
2000	225.8	64.3	28.4	26.9	10.1	9.0	8.1	2.4	2.8
2001	224.3	64.7	27.0	26.7	10.3	9.1	7.6	2.6	2.7
2002	220.3	64.5	27.6	25.1	9.8	8.5	7.3	2.6	2.5
2003	215.4	62.7	26.7	24.0	10.3	8.5	7.4	2.7	2.3
2004	212.1	60.6	26.7	23.4	10.4	8.3	7.0	2.6	2.2
2005	207.7	59.8	26.4	21.9	9.8	7.9	6.8	3.0	2.1
2006	201.5	57.5	24.8	20.8	9.8	7.5	7.0	3.0	2.0
2007	200.1	57.0	24.4	20.4	10.2	7.8	6.5	3.1	1.8
$2008^{\dagger}$	196.4	55.1	24.6	20.3	10.0	7.5	6.6	3.0	1.7
$2009^{\dagger}$	193.3	53.8	24.3	19.8	9.9	7.4	6.5	3.1	1.6
$2010^{\dagger}$	190.3	52.6	24.0	19.4	9.9	7.3	6.4	3.1	1.5
$2011^{\dagger}$	187.2	51.3	23.7	18.9	9.9	7.1	6.3	3.1	1.5
2012 <sup>†</sup>	184.4	50.2	23.4	18.5	9.8	7.0	6.2	3.2	1.4

<sup>\*</sup> Five most frequent causes of cancer deaths (both sexes combined) and cancers with a statistically significant change in mortality rate of at least 2% per year (see Table 4.5).

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

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

Actual data were available to 2007. Estimated rates for all provinces/territories. These estimates are based on long-term trends and may not reflect recent changes.

Table 4.3

Age-Standardized Incidence Rates for Selected\* Cancers, Females, Canada, 1983–2012

				Cases	per 100,00	00		
Year	All Cancers	Breast	Lung	Colorectal	Thyroid	Non-Hodgkin Lymphoma	Liver	Larynx
1983	333.1	89.3	28.2	49.1	4.8	11.5	0.9	1.3
1984	329.9	90.3	29.5	47.8	4.9	11.3	0.9	1.4
1985	336.1	92.2	30.8	49.5	5.3	11.4	1.1	1.5
1986	325.4	88.6	31.5	47.1	5.2	11.3	0.9	1.4
1987	331.6	91.1	33.2	46.7	5.2	11.5	1.1	1.5
1988	336.8	97.8	34.6	45.0	5.1	11.7	1.1	1.5
1989	330.6	96.4	34.9	44.3	5.6	12.2	1.2	1.6
1990	333.6	96.0	36.3	44.5	5.8	12.1	1.0	1.4
1991	338.0	100.2	37.5	43.2	5.9	12.5	1.0	1.6
1992	343.8	101.9	39.7	43.3	6.8	12.6	1.3	1.3
1993	343.3	99.2	40.5	43.1	7.1	12.7	1.2	1.3
1994	343.8	99.0	39.8	42.5	7.6	13.3	1.3	1.4
1995	342.1	98.9	40.7	41.4	7.7	13.1	1.3	1.4
1996	340.0	98.7	42.0	40.1	7.8	13.1	1.4	1.3
1997	344.3	102.3	41.9	40.4	7.9	13.8	1.3	1.3
1998	352.0	103.4	43.6	42.8	8.2	14.0	1.6	1.2
1999	352.8	105.4	43.5	41.9	9.4	13.5	1.2	1.2
2000	354.8	101.7	45.1	42.9	10.4	13.8	1.6	1.1
2001	352.6	100.4	45.1	42.3	11.2	13.3	1.5	1.1
2002	358.6	102.4	45.7	42.1	13.3	13.6	1.5	1.1
2003	351.4	96.9	45.6	41.2	13.6	13.7	1.6	1.1
2004	354.2	97.2	46.3	41.6	15.1	14.4	1.5	1.0
2005	360.9	98.5	47.6	41.5	16.7	14.0	1.6	0.9
2006	361.0	98.3	47.9	40.3	16.8	14.5	1.8	0.8
2007	364.3	98.6	47.7	40.9	17.9	13.9	1.8	1.0
2008	361.9	96.2	48.6	40.7	19.2	14.2	1.8	0.9
2009	364.2	97.6	47.4	39.9	20.0	14.2	1.8	0.8
2010 <sup>†</sup>	365.7	96.5	48.4	40.1	20.6	14.4	1.8	0.8
2011 <sup>†</sup>	366.8	96.2	48.6	39.9	21.4	14.4	1.8	0.8
2012 <sup>†</sup>	367.9	95.9	48.7	39.8	22.2	14.5	1.9	0.7

<sup>\*</sup> Five most frequent cancers (both sexes combined) and cancers with a statistically significant change in incidence rate of at least 2% per year (see Table 4.5).

**Note:** Rates for "All Cancers" exclude non-melanoma skin cancer (basal and squamous). Rates are agestandardized to the 1991 Canadian population.

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

<sup>&</sup>lt;sup>T</sup> Actual data were available to 2009 except for Quebec (2007). Estimated rates for all provinces/territories. These estimates are based on long-term trends and may not reflect recent changes.

Table 4.4

Age-Standardized Mortality Rates for Selected\* Cancers, Females, Canada, 1983–2012

				Deaths	per 100,000	)		
Year	All Cancers	Lung	Breast	Colorectal	Pancreas	Non-Hodgkin Lymphoma	Stomach	Cervix
1983	149.4	19.9	30.4	23.0	8.5	4.9	6.5	3.9
1984	151.8	22.1	30.7	23.8	8.4	4.7	5.7	3.5
1985	154.8	23.7	31.8	23.6	8.2	5.0	6.0	3.3
1986	154.4	23.9	32.0	23.3	8.5	5.1	6.1	3.2
1987	154.0	25.3	31.3	22.8	8.7	5.2	5.7	3.0
1988	155.3	26.9	31.4	22.6	8.1	5.0	5.1	3.0
1989	153.0	26.9	31.2	21.2	7.8	5.5	5.5	2.9
1990	152.9	27.5	31.3	21.2	8.2	5.5	5.0	3.0
1991	153.7	29.5	30.1	20.6	8.0	5.7	4.9	2.9
1992	153.1	29.6	30.4	20.1	8.0	5.5	4.9	2.4
1993	154.9	31.7	29.4	20.2	8.3	5.5	4.5	2.6
1994	155.2	31.9	30.0	19.8	8.4	5.7	4.6	2.7
1995	152.0	31.3	28.7	19.7	7.9	5.9	4.6	2.4
1996	155.2	33.6	28.9	19.6	8.3	5.8	4.4	2.6
1997	150.4	32.6	27.8	18.7	8.0	5.8	3.9	2.5
1998	151.3	34.5	26.4	19.1	8.0	6.0	3.8	2.3
1999	149.8	34.9	25.2	18.5	7.8	5.7	4.0	2.4
2000	149.8	34.4	25.0	18.1	7.9	6.1	3.9	2.2
2001	148.2	34.4	25.0	17.6	7.8	5.7	3.4	2.1
2002	149.2	35.2	24.4	17.5	7.8	5.7	3.6	1.9
2003	148.1	35.3	24.1	16.9	8.1	5.5	3.5	1.9
2004	147.0	36.1	23.1	17.1	8.2	5.8	3.3	2.0
2005	143.7	35.9	22.6	16.7	7.8	5.0	3.5	1.8
2006	141.5	36.8	21.5	15.7	8.0	4.9	3.2	1.8
2007	141.2	36.1	21.8	16.3	7.9	5.2	2.9	1.9
2008 <sup>†</sup>	140.3	36.4	21.1	15.7	7.9	5.1	3.1	1.8
2009 <sup>†</sup>	139.1	36.5	20.7	15.4	7.9	5.1	3.0	1.8
$2010^{\dagger}$	137.9	36.6	20.3	15.2	7.9	5.0	3.0	1.7
2011 <sup>†</sup>	136.7	36.5	19.9	15.0	7.9	5.0	3.0	1.7
2012 <sup>†</sup>	135.5	36.3	19.5	14.8	7.8	4.9	2.9	1.7

<sup>\*</sup> Five most frequent causes of cancer deaths (both sexes combined) and cancers with a statistically significant change in mortality rate of at least 2% per year (see Table 4.5).

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

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

Actual data were available to 2007. Estimated rates for all provinces/territories. These estimates are based on long-term trends and may not reflect recent changes.

Table 4.5
Annual Percent Change (APC) in Age-Standardized Incidence and Mortality Rates for Selected Cancers, Canada, 1998–2007

		Incide	nce			Mortality			
	Male	s	Female	es	Male	s	Fema	les	
	APC	hange- point <sup>†</sup>	APC	Change- point <sup>†</sup>	APC	hange- point <sup>†</sup>	APC	Change- point <sup>†</sup>	
All Cancers	0.1	2003	0.3**		-2.0**	2001	-0.8**		
Prostate	-0.6	2001	_		-4.3**	2001	_		
Lung	-1.8**		1.1**		-2.3**		0.7**		
Colorectal	-0.8**	2000	-0.8**	2000	-2.6**	2003	-1.8**		
Breast	_		-0.7**		_		-2.2**		
Non-Hodgkin Lymphoma	0.8**		0.5		-2.6**	2000	-2.7**	2000	
Bladder	-0.7*		-0.1		-1.1**		0.4		
Melanoma	1.4**		1.4**		0.3		0.1		
Kidney	2.6*	2003	1.9**		-0.8		-0.9*		
Leukemia	0.6		1.2**		-1.2**		-0.9		
Thyroid	6.8**		6.9**	2002	_		_		
Body of Uterus	_		0.7*		_		-0.1		
Pancreas	-0.3		0.4		-0.4		0.1		
Oral	-1.0*		0.2		-1.8*		-1.8		
Stomach	-2.0**		-1.6**		-3.0**		-2.9**		
Brain	-0.4		-0.8		-0.7		-1.4**		
Ovary	_		-0.2		_		-2.2	2003	
Multiple Myeloma	0.4		0.0		-1.5*		-0.9		
Liver	3.6**		2.4*		2.2**		1.1		
Esophagus	0.6		-0.7		-0.1		-1.5*		
Cervix	_		-1.4**		_		-2.9**		
Larynx	-3.8**		-3.4**		-6.2**	2001	-2.8		
Hodgkin Lymphoma	0.4		0.9		_		_		
Testis	1.4*		_		_		_		

Not applicable or small number of deaths.

**Note:** APC is calculated assuming a log linear model; "All Cancers" incidence rates include cancers not found in the table but exclude non-melanoma skin cancer (basal and squamous). When there is no changepoint in the most recent 10 years, the APC was obtained by running a separate changepoint analysis on the most recent 10 years. If there is a changepoint, the APC was taken from the last segment. See *Appendix II: Data sources and methods* for further details.

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

<sup>\*</sup> Significant, p<0.05.

<sup>\*\*</sup> Significant, p<0.01.

<sup>&</sup>lt;sup>†</sup> Changepoint indicates the baseline year, if the slope of the trend changed after 1998 for incidence or mortality. Changepoints were fit to rates from 1986 to 2007 for both incidence and mortality.

# APPENDIX I: ACTUAL DATA FOR NEW CASES AND DEATHS

The focus of this publication is current year estimates obtained by analyzing actual data and making short-term projections using statistical techniques (see *Appendix II*).

However, summaries of actual incidence and mortality statistics based on the most recently available data are available:

- ◆ Information on cancer incidence is available from the following websites:
  - O Statistics Canada www.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno=82-231-X&lang=eng
  - Public Health Agency of Canada, Chronic Disease Infobase Cubes www.infobase.phac-aspc.gc.ca
- ◆ Information on causes of death—including cancer mortality—is available from Statistics Canada: www.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno=84-208-x&lang=eng
- ◆ The most up-to-date data for individual provinces and territories can be obtained by contacting the provincial or territorial cancer registries (see *For further information*).

#### **DATA SOURCES**

## Incidence data: The Canadian Cancer Registry (CCR)

Actual cancer incidence data used in this publication cover the period of 1983 to 2009 (except for Quebec, for which data in the CCR were available to 2007 in time for this publication). Data for 1992 to 2009 were obtained from the CCR, <sup>20</sup> while data for earlier years were retrieved from its predecessor, the National Cancer Incidence Reporting System (NCIRS). The NCIRS is a fixed, tumour-oriented database containing cases diagnosed as far back as 1969.

- ◆ Incidence data originate with the provincial and territorial cancer registries, which provide data annually to Statistics Canada for inclusion in the CCR.
- ◆ The CCR is a person-oriented database that includes clinical and demographic information about residents of Canada newly diagnosed with cancer.
- ◆ The Health Statistics Division at Statistics Canada maintains the CCR, including linking data internally to track people with tumours diagnosed in more than one province or territory and to identify duplicates. Incidence records are also linked with the mortality data (described below) for the purposes of survival and prevalence analyses.
- Cancer diagnoses are classified according to the *International Classification of Diseases for Oncology, Third Edition* (ICD-O-3).<sup>21</sup>

## Mortality data: the Canadian Vital Statistics - Death Database (CVS: D)

- The actual cancer mortality data cover the period of 1983 to 2007 and were obtained from the CVS: D.<sup>22</sup>
- ◆ Death records originate with the provincial and territorial registrars of vital statistics and are provided regularly to Statistics Canada for inclusion in the CVS: D.
- ◆ The CVS: D includes demographic and cause of death information for all deaths in Canada from 1921 onward.
- Data are also included for Canadian residents who died in some states of the United States. Canada currently receives abstracted death data from approximately 10 states.
- ◆ The Health Statistics Division at Statistics Canada maintains the CVS: D.
- ◆ Cause of death is classified according to the *International Statistical Classification* of Diseases and Related Health Problems, Tenth Revision (ICD-10).<sup>23</sup>
- ◆ Cancer deaths are those for which some form of cancer, as certified by a physician, is the underlying cause of death.

## Population data: The Census of Canada

- Population estimates for Canada and the provinces and territories are based on censuses conducted every five years from 1981 through to 2006.
- ◆ Intercensal estimates prepared by Statistics Canada are used for the years between these censuses, and postcensal estimates are used for 2006 to 2010.³
- ◆ Projected population estimates are used for 2011 and 2012, as prepared by Statistics Canada under assumptions of medium growth (scenario M1).² The

scenario M1 incorporates medium-growth and historical trends (1981–2008) of interprovincial migration.

◆ All population estimates include non-permanent residents and are adjusted for net census under-coverage and Canadians returning from abroad.

#### **Cancer definitions**

- ◆ Cancers are generally defined according to the groupings of ICD-O-3 for incidence and ICD-10 for mortality, as indicated in Table A1.
- ◆ Some definitions have changed slightly over time; changes occurring since the 2004 edition of this publication are outlined in Table A2.

#### **METHODS**

### Incidence and mortality rates

Records from each province or territory were extracted from the relevant incidence or mortality files and then classified by year of diagnosis or death and by sex, five-year age group (0–4, 5–9, ..., 80–84 and 85+ years) and cancer type.

- Rates for each category were calculated by dividing the number of cases or deaths in each category (i.e., province/territory, year, sex, age group, cancer type) by the corresponding provincial or territorial population figure. These formed the basis for calculations of age-standardized rates and for estimates beyond the most recent year of actual data.
- ◆ For the section *Incidence and mortality by age and sex*, age-specific rates were computed for broader age groups (0–19, 20–29, ..., 70–79 and 80+ years) in the same way.
- ◆ Age-standardized incidence rates (ASIRs) and mortality rates (ASMRs) were calculated using the direct method, which involves weighting the age-specific rates for each five-year age group according to the age distribution of the 1991 Canadian population (see *Glossary*).

## Estimation of incidence (new cases) and mortality (deaths) for 2012

Two methods were used to estimate incidence and mortality data: the Nordpred Power5 regression model and five-year averaging.

## **Nordpred Power5 modelling**

The Nordpred Power5 regression model was the primary method for estimating the number of new cases and deaths in 2012 for each cancer type by sex (except new cases of non-melanoma skin cancer; see *Non-melanoma skin cancer incidence* below) reported in Tables 1.1 and 1.2. Nordpred is based on an age-period-cohort Poisson regression model but has enhancements that overcome difficulties in the standard Poisson model and improve projection accuracy.<sup>24</sup> Nordpred was developed into a software package<sup>25</sup> and is now one of the most frequently used methods for cancer projections worldwide.<sup>26-30</sup>

The Nordpred Power5 model was used when the average annual number of cases for a site for the most recent five years was greater than 50. The assumption underlying the Nordpred Power5 regression model is that the annual number of new cases and deaths are independent Poisson random variables with mean values equal to the product of the population size for a particular year and the (true) annual rate.

- ◆ A separate Nordpred Power5 regression model was fit for each province, sex and type of cancer for the period of 1985 to 2009 (1983–2007 for Quebec) for incidence and 1983 to 2007 for mortality.
- ◆ The Power5 model is  $R_{ap} = (A_a + D \cdot p + P_p + C_c)^5$  where a, p and c represent age, period and cohort, respectively, in five-year groups. Input data were aggregated into five-year calendar periods and 18 five-year age groups (described above); cohorts were created synthetically by subtracting age from period.  $R_{ap}$  is the incidence/mortality rate in age group a in calendar period p,  $A_a$  is the age component for age group a, D is the common drift parameter that summarizes the linear component of the trend that cannot be attributed to either period or cohort.  $P_p$  is the nonlinear period component of period p, and  $C_c$  is the nonlinear cohort component of cohort c.
- Nordpred uses a goodness of fit test to choose the number of five-year periods to be included in the dataset used for calculating future values (projection base).
- ◆ The software determines whether the average trend across all observed values, or the slope for the last 10 years of observed values is used for projection, based on a significance, test for departure from linear trend. This approach serves as an approximate way of looking for significant changes in the observed trend. You can also choose between using the average trend or the trend for the last 10 years for your projection by specifying the value for the "recent" option.
- ◆ For each age group, a minimum of five cases in each five-year period was required; for age groups below this limit, the average number of cases in the last two periods is used to calculate future rates.
- ◆ To allow for a damping of the impact of current trends in the future time periods, a "cut-trend" option is used, which is a vector of proportions indicating how much to cut the trend estimate for each five-year projection period. A gradual reduction in the drift parameter of 25% and 50% in the second and third five-year period, respectively, was used as the default in this publication.
- ◆ Age was included in all models as a factor. Age-specific incidence rate trends were then extrapolated to 2012. The predicted numbers of cancer cases in 2012 were calculated by multiplying these extrapolated incidence rates by the sex-, age- and province-specific population projections for the same year.
- ◆ The Nordpred "recent" and "cut-trend" options were modified from the default values for selected sites, including thyroid cancer incidence and prostate cancer mortality, since recent trends are not expected to continue with as large an annual percent change. The values were chosen so that estimates were consistent with the most recent data available to the provincial cancer registries.

## Five-year averaging

New cases and deaths in 2012 for each type of cancer were also estimated based on the average of the five most recent years of data. This method may be more realistic for cancers for which there are recent changes in trend (the Nordpred Power5 model results in poor estimates for these cancers because it is based on a medium or longer term trend) or when frequencies are low and result in unstable estimates using the Nordpred model. The average of rates for the most recent five years was calculated for each sex, five-year age group, cancer type and province. The predicted numbers were

then obtained by multiplying these rates by the corresponding projected population sizes.

The five-year average was used for prostate cancer incidence because of recent agespecific changes in trend.

#### Selection of "best" estimates

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

- ◆ The Nordpred model was preferred except when frequencies were low.
- Five-year average estimates were used when the average annual number of cases during the most recent five years was less than or equal to 50.
- Five-year average estimates were used for the territories and are reported only for "All Cancers" because of small sample sizes.
- ♦ The absolute value of the difference between the age-standardized rates estimated by the two methods was calculated and expressed relative to the five-year average estimate. For example, if the Nordpred Power5 model estimated a rate of 4.0 and the five-year average estimated a rate of 4.5, the relative difference would be  $(4.0-4.5) \div 4.5$ , or 11.1%.
- Provinces closely examined estimates for cancers where the absolute value of the relative difference exceeded 15%. Such situations may be indicative of important deviations from the long-term trend.
- Provinces provided feedback based on the availability of in-house projections, knowledge of local trends or access to more current data, which permitted an assessment of the estimates produced by the two different estimation methods.
- ◆ Estimates for Canada as a whole were computed as the sum of the estimates for the individual provinces and territories.

Tables A3 and A4 indicate the cancer types that were reported according to the fiveyear average method for 2012. In these situations, the age-standardized rates for 2012 reported in this publication were calculated using the most recent five years of actual data.

#### All cancers combined

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

#### Non-melanoma skin cancer incidence

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

 Pathology laboratories in British Columbia send all diagnostic reports of NMSC to the provincial registry. The age- and sex-specific incidence rates in British

Columbia for 1992 to 1994 and 2003 were projected to 2012 by the British Columbia Cancer Registry and applied to the projected Canadian population estimates to generate an estimate of the number of cases for Canada as a whole.

- ◆ Counts of NMSC for 1989 to 2008 by year, sex and age group were provided by the Manitoba Cancer Registry and by the New Brunswick Cancer Registry. Linear regressions using a logarithmic transformation of the annual rates for each province and age group (0−39, 40−59, 60−79 and 80+ years) were conducted and projected to 2012.
- ◆ The predicted numbers of NMSC cases for all of Canada were calculated by multiplying the projected incidence rates for each of Manitoba and New Brunswick by the sex- and age-specific Canadian population projections for 2012.
- ◆ Reported new cases of NMSC for all of Canada are the average of 2012 estimates from the British Columbia, Manitoba and New Brunswick registries.

## Rounding for reporting

- Estimates of incidence and mortality presented in this publication have been rounded as follows:
  - o numbers between 0 and 99 to the nearest 5
  - o numbers between 100 and 999 to the nearest 10
  - o numbers between 1,000 and 1,999 to the nearest 50
  - o numbers greater or equal to 2,000 to the nearest 100
- ◆ Percentages, age-standardized rates and age-specific rates were rounded to the nearest 10th, except in Tables 1.1, 1.2, 2.3 and 2.5, where space restrictions forced rounding to the nearest whole number.
- ◆ Age-specific and sex-specific numbers or rates were combined before rounding, so it is possible that the totals in the tables do not add up. However, any such discrepancies are within the precision of the rounding units described above.

#### Precision of 2012 estimates

Estimates of precision (standard errors, coefficients of variation and confidence limits) for 2012 counts and rates are available on request from the Chronic Disease Surveillance and Monitoring Division (Centre for Chronic Disease Prevention and Control, Public Health Agency of Canada). The precision of an estimate depends primarily on the number of observed cases and the population size for each combination of cancer type, age, sex and province or territory.

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

The estimated APC was calculated for each cancer type by fitting a piecewise linear regression model, assuming a constant rate of change in the logarithm of the annual ASIR or ASMR in each segment. The models incorporated estimated standard errors of the ASIR or ASMR. The tests of significance used a Monte Carlo Permutation method. The estimated slope from this model was then transformed back to represent an annual percentage increase or decrease in the rate.

- ◆ Changepoint analysis was applied to annual age-standardized rates over the period of 1986 to 2007 (for incidence and mortality) in order to determine years in which the APC changed significantly; such years are referred to as *changepoints*.
- ◆ A minimum of five years of data before and after a changepoint was required for a new trend to be identified. Thus, the most recent possible changepoint is 2003.
- If no changepoint was detected within the period from 1998 to 2007, then the APC was estimated by fitting a model within this time period, in the same way as described above.
- ◆ If a changepoint was detected within this decade, then the APC was estimated from the trend in the last segment. Both the changepoint year and the APC for the years beyond the changepoint are indicated in Table 4.5.

# Contribution of change in cancer rate, population growth and population age structure to incidence and mortality trends

Figures 4.3 and 4.4 display the determinants of increases in incidence and mortality for males and females, respectively. The section on *Time trends in incidence and mortality* provides a description of the three series. The series were calculated as follows:

- Uppermost series: the annual number of Canadian cancer cases or deaths, for males or females
- Next to uppermost series: annual total population multiplied by the annual agestandardized rate, using the 1983 population distribution for males or females as the standard weights
- ♦ Next to baseline series: the 1983 total population multiplied by the annual agestandardized rate, using the 1983 population distribution for males or females as the standard weights
- ◆ Baseline (dotted line): the observed number of Canadian cancer cases or deaths during 1983, for males or females

#### **DATA AND METHODS ISSUES**

#### Incidence

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

- ◆ Benign tumours and carcinomas in situ are not routinely captured or reported except for in situ carcinomas of the bladder; all cancer registries except Ontario report in situ bladder cancers to the CCR.
- ◆ The Newfoundland and Labrador Cancer Registry did not receive information on death certificates that mentioned cancer until very recently. This has led to underestimates of the incidence of some cancers because there were no "death certificate only" (DCO) cases. This could result in death counts or rates exceeding those for incidence in a specific year; this especially affects highly fatal cancers.

- The number of DCO cases for 2008 and 2009 in Newfoundland and Labrador was estimated from 2007 data.
- ◆ In Quebec, cases diagnosed only through death certificates have not generally been reported to the CCR with the exception of the 2000 to 2006 data years. The number of DCO cases in Quebec for 2007 was estimated from the average of 2002 to 2006. In addition, because of the registry's dependence on hospital data, the numbers of cases of some cancers, particularly those for which pathology reports represent the main source of diagnostic information, are underestimated. Prostate cancer, melanoma and bladder cancers are affected in particular.¹
- ◆ The number of DCO cases for 2008 and 2009 in Ontario was estimated from the average of 2003 to 2007 data.
- ◆ The number of DCO cases is less than 2% of total cases.
- ◆ Non-melanoma skin cancers are excluded since most provincial and territorial cancer registries do not collect information on these cases. These cancers are difficult to register completely because they may be diagnosed and treated in a variety of settings and are very numerous. Estimates based on the three registries that include these cancers (see *Non-melanoma skin cancer incidence* above) are therefore likely to be underestimates.

#### **Mortality**

Although procedures for registering and allocating cause of death have been standardized both nationally and internationally, some lack of specificity and uniformity is inevitable. The description of cancer type provided on the death certificate is usually less accurate than that obtained by the cancer registries from hospital and pathology records.

Although there have been numerous small changes in definitions over the years (see Table A2), there is one major earlier change of note:

- ◆ In the versions of this publication published before 2003, mortality due to colorectal cancer was based on the *International Classification of Diseases, Ninth Revision* (ICD-9), codes 153–154, to be consistent with other publications. However, this underestimates colorectal cancer mortality by about 10% because most deaths registered as ICD-9 code 159.0 (intestine not otherwise specified) are cases of colorectal cancer.
- ◆ Commencing with the 2003 edition, these deaths were included in the definition of colorectal cancer. As a consequence, mortality figures for colorectal cancer appearing in this publication cannot be directly compared with those appearing in reports prior to 2003.

# **Table A1 Cancer Definitions**

Cancer	ICD-O-3 Site/Histology Type* (Incidence)	ICD-10 (Mortality)
Oral	C00-C14	C00-C14
Esophagus	C15	C15
Stomach	C16	C16
Colorectal	C18-C20, C26.0	C18-C20, C26.0
Liver	C22.0	C22.0, C22.2-C22.7
Pancreas	C25	C25
Larynx	C32	C32
Lung	C34	C34
Melanoma	C44 (Type 8720-8790)	C43
Breast	C50	C50
Cervix	C53	C53
Body of Uterus	C54-C55	C54-C55
Ovary	C56.9	C56
Prostate	C61.9	C61
Testis	C62	C62
Bladder (including in situ)	C67	C67
Kidney	C64.9, C65.9	C64-C65
Brain	C70-C72	C70-C72
Thyroid	C73.9	C73
Hodgkin Lymphoma*	Type 9650–9667	C81
Non-Hodgkin Lymphoma*	Type 9590–9596,9670–9719, 9727–9729 Type 9823, all sites except C42.0,.1,.4 Type 9827, all sites except C42.0,.1,.4	C82-C85,C96.3
Multiple Myeloma*	Type 9731,9732,9734	C90.0, C90.2
Leukemia*	Type 9733,9742,9800–9801,9805, 9820,9826,9831–9837,9840, 9860–9861,9863,9866–9867, 9870–9876,9891,9895–9897,9910, 9920,9930–9931,9940,9945–9946, 9948,9963–9964 Type 9823 and 9827, sites C42.0,.1,.4	C91–C95,C90.1
All Other Cancers	All sites C00–C80, C97 not listed above	All sites C00–C80, C97 not listed above
All Cancers excluding Lung	C00-C97 excluding C34	C00-C97 excluding C34

## Table A1 (continued)

#### **Cancer Definitions**

Cancer	ICD-O-3 Site/Histology Type* (Incidence)	ICD-10 (Mortality)
All Other and Unspecified Cancers	Type 9140,9740,9741,9750–9758, 9760–9769,9950–9962, 9970–9989 C76.0–C76.8 (type 8000–9589) C80.9 (type 8000–9589) C42.0–C42.4 (type 8000–9589) C77.0–C77.9 (type 8000–9589) C44.0–C44.9 excluding type 8050–8084,8090–8110, 8720–8790,9590–9989	C26.1,C44,C46,C76–C80,C88, C96.0–.2,C96.7–.9,C97
All Cancers	All invasive sites	All invasive sites

<sup>\*</sup> Histology types 9590–9989 (leukemia, lymphoma and multiple myeloma) and 9050–9055 (mesothelioma) are excluded from other specific organ sites.

Note: ICD-O-3 refers to the International Classification of Diseases for Oncology, Third Edition.<sup>21</sup>

Table A2
Recent Cancer Definition Changes

	Incid	ence De	finition	Mort	Mortality Definition				
Cancer	New Definition a Year Changed	nd	Old Definition	New Definition as Year Changed	nd	Old Definition			
Bladder	ICD-O-3 C67 (including in situ cancers, except for Ontario since this province does not report in situ bladder cancer)	2006	ICD-O-3, C67 (not including in situ cancers)	_		_			
Colorectal	ICD-O-3 C18-C20, C26.0	2011	ICD-O-3 C18-C21,C26.0	ICD-10 C18-C20, C26.0	2012	ICD-10 C18-C21 C26.0			
Kidney	ICD-O-3 C64-C65	2008	ICD-O-3 C64-C66,C68	ICD-10 C64-C65	2008	ICD-10 C64-C66 C68			
Leukemia	_		_	ICD-10 C91-C95, C90.1	2008	ICD-10 C91-C95			
Liver	_		_	ICD-10 C22.0, C22.2-C22.7	2007	ICD-10 C22 (before 2006) ICD-10 C22.0, C22.2–C22.9 (in 2006)			
Lung	ICD-O-3 C34	2008	ICD-O-3 C33-C34 (before 2006)	ICD-10 C34	2008	ICD-10 C33-C34 (before 2006)			
			ICD-O-3 C34 (in 2006)			ICD-10 C34 (in 2006)			
			ICD-O-3 C33–C34 (in 2007)			ICD-10 C33–C34 (in 2007)			
Multiple myeloma	_		_	ICD-10 C90.0, C90.2	2008	ICD-10 C88, C90 (before 2007)			
						ICD-10 C90 (in 2007)			
Ovary	ICD-O-3 C56	2006	ICD-O-3 C56, C57.0-C57.4	ICD-10 C56	2006	ICD-10 C56, C57.0-C57.4			
All other and unspecified cancers	_		-	ICD-10 C44, C46, C76-C80,C88, C96.0-C96.2, C96.7-C96.9, C97	2007	ICD-10 C44,C46, C76-C80, C96.0-C96.2, C96.7-C96.9, C97			

**Note:** According to the *International Classification of Diseases for Oncology, Third Edition* (ICD-O-3),<sup>21</sup> cancer incidence for bladder, kidney, lung and ovary excludes histology types 9590–9989 (leukemia, lymphoma and multiple myeloma) and 9050–9055 (mesothelioma).

Table A3
Use of Five-Year Average Method\* for Incidence Projection by Cancer Type and Province, 2012

	вс	AB	SK	МВ	ON	QC	NB	NS	PE	NL
All Cancers								F		
Oral			F	F			F	F	M,F	M,F
Esophagus		F	M,F	M,F			M,F	M,F	M,F	M,F
Stomach			F	F			F	F	M,F	F
Pancreas			F						M,F	M,F
Larynx	F	F	M,F	M,F			M,F	M,F	M,F	M,F
Melanoma									M,F	M,F
Breast									F	
Cervix			F	F			F	F	F	F
Body of Uterus									F	
Ovary									F	F
Prostate <sup>†</sup>	М	М	М	М	М	М	М	М	М	М
Testis			М	М			М	М	М	М
Bladder									M,F	F
Brain			M,F	M,F			M,F	M,F	M,F	M,F
Thyroid			M,F	М			М	М	M,F	M,F
Hodgkin Lymphoma	F	F	M,F	M,F			M,F	M,F	M,F	M,F
Non-Hodgkin Lymphoma									M,F	
Liver		F	M,F	M,F			M,F	M,F	M,F	M,F
Colorectal									F	
Lung									F	
Kidney									M,F	F
Multiple Myeloma			M,F	M,F			M,F	M,F	M,F	M,F
Leukemia		М					F		M,F	M,F

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

#### Note:

M = males; F = females.

For territories (not shown), five-year average method was used for "All Cancers" because of small numbers.

<sup>&</sup>lt;sup>†</sup> Five-year average method was used for prostate cancer to better capture the stabilizing trend in incidence observed for this cancer.

Table A4
Use of Five-Year Average Method\* for Mortality Projection by Cancer Type and Province, 2012

	вс	AB	SK	МВ	ON	QC	NB	NS	PE	NL
All Cancers										
Oral		F	M,F	M,F			M,F	M,F	M,F	M,F
Esophagus		F	M,F	M,F			M,F	M,F	M,F	M,F
Stomach		М	M,F	M,F			M,F	M,F	M,F	M,F
Pancreas									M,F	M,F
Larynx	F	M,F	M,F	M,F	F	F	M,F	M,F	M,F	M,F
Melanoma	F	M,F	M,F	M,F			M,F	M,F	M,F	M,F
Breast									F	
Cervix		F	F	F			F	F	F	F
Body of Uterus			F	F			F	F	F	F
Ovary							F		F	F
Prostate									М	
Bladder		F	M,F	M,F			M,F	M,F	M,F	M,F
Brain			M,F	M,F			M,F	M,F	M,F	M,F
Non-Hodgkin Lymphoma			F				M,F	M,F	M,F	M,F
Liver		M,F	M,F	M,F		F	M,F	M,F	M,F	M,F
Colorectal									M,F	
Lung									M,F	
Kidney		F	M,F	M,F			M,F	M,F	M,F	M,F
Multiple Myeloma		F	M,F	M,F			M,F	M,F	M,F	M,F
Leukemia			F	F			M,F	M,F	M,F	M,F

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

#### Note:

M = males; F = females.

For territories (not shown), five-year average method was used for "All Cancers" because of small numbers.

## **APPENDIX III: PREVIOUS SPECIAL TOPICS**

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

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

#### Age

Age-standardized incidence rate (ASIR)

The age of the person with cancer at the time of diagnosis or death.

The incidence rate that would have occurred if the age distribution in the population of interest was the same as that of the standard population. It is generally expressed per 100,000 population at risk per year. It can be calculated for all ages combined or for specific broad age groups (generally age groupings of greater than 10 years). It is calculated as a weighted average of the actual age-specific rates, where the weights are the proportions of persons in the corresponding age groups of a standard population. In Canada, we use the 1991 Canadian population (males and females combined) as the standard. The potential confounding effect of age is reduced when comparing age-standardized rates computed using the same standard population.

# Age-standardized mortality rate (ASMR)

The mortality rate that would have occurred if the age distribution in the population of interest was the same as that of the standard population. It is generally expressed per 100,000 population at risk per year. It can be calculated for all ages combined or for specific broad age groups (generally age groupings of greater than 10 years). It is calculated as a weighted average of the actual age-specific rates, where the weights are the proportions of persons in the corresponding age groups of a standard population. In Canada, we use the 1991 Canadian population (males and females combined) as standard. The potential confounding effect of age is reduced when comparing age-standardized rates computed using the same standard population.

# Annual percent change (APC)

The estimated change in the rate of new cases (incidence) or deaths (mortality) from one year to the next over some period of time, reported as a percentage. It is estimated by fitting a linear model to logarithmically transformed annual rates, assuming that the rate is changing over the modelled period of time as a constant percentage of the rate of the previous year.

#### **ICD-10**

International Statistical Classification of Diseases and Related Health Problems, Tenth Revision.<sup>23</sup> This is a general system for classifying diseases and causes of death, including cancer.

#### **ICD-0-3**

International Classification of Diseases for Oncology, Third Edition.<sup>21</sup> This is the most current system specifically designed for classifying tumours. It is based on ICD-10 but encompasses both the body organ where the tumour arose and the tumour's morphologic type.<sup>23</sup>

# Incidence (new cases)

The total number of new cases of cancer diagnosed in a given population during a specific period of time. This counts the cancers, not the number of people; a person can have more than one cancer.

#### Incidence rate

The number of new cancer cases (of all types or of a specific site or type) occurring in a given population during a year, usually expressed as the number of cancers per 100,000 population at risk. It is calculated as the number of new cases divided by the population size, then multiplied by 100,000. It can be calculated for all ages combined or for specific age groups, when it is referred to as an age-specific rate.

#### **Mortality (deaths)**

The number of deaths due to cancer in a given population during a specific period of time, regardless of when the diagnosis of cancer was made (e.g., during or prior to the period of interest, or at the time of death).

#### **GLOSSARY**

#### **Mortality rate**

The number of cancer deaths (of all types or of a specific site or type) occurring in a given population during a year, usually expressed as the number of cancer deaths per 100,000 population at risk. It is calculated as the number of deaths divided by the population size, then multiplied by 100,000. It can be calculated for all ages combined or for specific age groups, when it is referred to as an age-specific rate.

#### Province/territory

The province or territory of the person's permanent residence at the time of cancer diagnosis or death. This may not be the same location as where the new case of cancer or the cancer death was registered, or where treatment was delivered.

#### Standard population

The Canadian population distribution is based on the final postcensal estimates of the July 1, 1991, Canadian population, adjusted for census under-coverage. The age distribution of the population has been weighted and normalized. Data were obtained from the Census and Demographics Branch, Statistics Canada.

## 1991 Canadian Standard Population

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

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Data contained in this publication and additional information are available from the following:

- Canadian Cancer Society www.cancer.ca
- Public Health Agency of Canada www.phac-aspc.gc.ca (select surveillance)
- ◆ Statistics Canada www.statcan.gc.ca (search "cancer")

Additional information related to this publication can be found in other print sources, including the following:

- reports from provincial and territorial cancer registries
- Cancer Incidence in Canada, 20 Cancer Survival Statistics 32 and Health Reports, published by Statistics Canada
- Chronic Diseases and Injuries in Canada, published by Health Canada/Public Health Agency of Canada
- a collaborative monograph entitled Cancer in North America: 2004–2008, published by the North American Association of Central Cancer Registries and available at www.naaccr.org/ DataandPublications/CINAPubs.aspx
- Cancer Incidence in Five Continents, published by the International Agency for Research on Cancer in 2007 and available at: http://www.iarc.fr/en/publications/pdfs-online/epi/sp160/ index.php.

#### **Information from the Canadian Cancer Society**

For general information about cancer statistics or any other aspect of cancer (such as cancer prevention, screening, diagnosis, treatment or care), contact the Canadian Cancer Society's *Cancer Information Service* at 1 888 939-3333. Contact information for the Canadian Cancer Society, National, and the divisions is provided on page 66. Your local Canadian Cancer Society office is listed in the white pages of the telephone directory.

For information about cancer research funded by the **Canadian Cancer Society Research Institute**, contact the Canadian Cancer Society, National, at the address provided on page 66.

#### Information from the Public Health Agency of Canada

More detailed information on methodology is available from the Chronic Disease Surveillance and Monitoring Division, CCDPC, Public Health Agency of Canada, 785 Carling Avenue, Ottawa, Ontario, K1A 0K9. Tel: (613) 952-5176, Fax: (613) 941-2057.

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

#### **Information from Statistics Canada**

Detailed standard tables are available on the Statistics Canada website (www.statcan.gc.ca). Custom tabulations are available on a cost recovery basis upon request from the Health Statistics Division, Statistics Canada, National Contact Centre: (613) 951-8116 or toll-free 1 800 263-1136; infostats@statcan.gc.ca. Analytical articles appear regularly in *Health Reports*, Statistics Canada, Catalogue no. 82-003 (www.statcan.gc.ca/bsolc/olc-cel/olc-cel? catno=82-003-x&lang=eng).

#### Information from the provincial or territorial cancer registries

Cancer incidence data are supplied to Statistics Canada by provincial and territorial cancer registries. Detailed information regarding the statistics for each province or territory is available from the relevant registry (see pages 64-65 for contact information).

## **Canadian Council of Cancer Registries**

# NEWFOUNDLAND AND LABRADOR

Ms. Sharon Smith Director, Cancer Care Program Eastern Health Dr. H. Bliss Murphy Cancer Centre 300 Prince Philip Drive St. John's, NL A1B 3V6 Tel: (709) 777-6521 Fax: (709) 753-0927

www.easternhealth.ca

## PRINCE EDWARD ISLAND

Ms. Kim Vriends Director, PEI Cancer Registry PEI Cancer Treatment Centre Riverside Drive Charlottetown, PE C1A 8T5

Tel: (902) 894-2167 Fax: (902) 894-2187

#### **NOVA SCOTIA**

Ms. Maureen MacIntyre
Director
Surveillance and Epidemiology Unit
Cancer Care Nova Scotia
1276 South Park Street
Bethune Building, Room 569
Halifax, NS
B3H 2Y9

Tel: (902) 473-6084 Fax: (902) 473-4425 www.cancercare.ns.ca

#### **NEW BRUNSWICK**

Dr. Eshwar Kumar and
Dr. Réjean Savoie
Co-Chief Executive Officers
New Brunswick Cancer Network
Department of Health
PO Box 5100
Fredericton, NB
E3B 5G8

Tel: (506) 453-5521 Fax: (506) 453-5522

www.gnb.ca/0051/cancer/index-e.asp

#### **QUEBEC**

Madamme Rabiâ Louchini
Pilote d'orientation du Registre
québécois du cancer
Direction de la santé publique
Ministère de la Santé et Services sociaux
1075, Chemin Ste-Foy, 12° étage
Québec, QC
G1S 2M1
Tal: (418) 266 6713

Tel: (418) 266-6713 Fax: (418) 266-6779

http://msssa4.msss.gouv.qc.ca/santpub/

tumeurs.nsf/cat?OpenView

#### **ONTARIO**

Ms. Mary Jane King Manager, Corporate Data Quality, Informatics Center of Excellence Cancer Care Ontario 620 University Avenue Toronto, ON M5G 2L7

Tel: (416) 217-1242 Fax: (416) 971-6888 www.cancercare.on.ca

#### **MANITOBA**

Ms. Gail Noonan

Manager

Manitoba Cancer Registry

CancerCare Manitoba

675 McDermot Avenue, Room ON4025

Winnipeg, MB R3E 0V9

Tel: (204) 787-2573 Fax: (204) 786-0629 www.cancercare.mb.ca

#### **SASKATCHEWAN**

Ms. Heather Stuart-Panko

Provincial Leader Cancer Registry

Saskatchewan Cancer Agency

Parliament Place

400-2631 28th Avenue

Regina, SK S4S 6X3

Tel: (306) 359-5883 Fax: (306) 359-5604 www.saskcancer.ca

#### **ALBERTA**

Ms. Carol Russell

Director, Alberta Cancer Registry

Cross Cancer Institute 11560 University Avenue

Edmonton, AB T6G 1Z2

Tel: (780) 432-8781 Fax: (780) 432-8659

www.albertahealthservices.ca

#### YUKON

Mr. Paul Gudaitis

Director of Insured Health Services

Yukon Cancer Registry Health Services Branch Yukon Government Box 2703 (H-2)

Whitehorse, YK

Y1A 2C6

Tel: (867) 667-5202 Fax: (867) 393-6486

#### **BRITISH COLUMBIA**

Ms. Sharon Tamaro

Scientific Director, BC Cancer Registry

BC Cancer Agency

Cancer Control Research Unit

#2-116-675 West 10th Avenue

Vancouver, BC

V5Z 1L3

Tel: (604) 675-8070 Fax: (604) 675-8180 www.bccancer.bc.ca

#### NUNAVUT

Dr. Geraldine Osborne

Nunavut Cancer Registry

Department of Health and Social

Services

Box 1000, Station 1000

Iqaluit, NU X0A 0H0

Tel: (867) 975-5774 or 5700 Fax: (867) 975-5755 or 5780

#### **NORTHWEST TERRITORIES**

Ms. Maria Santos

Territorial Epidemiologist

Population Health

Government of the NWT

Box 1320, 5022 49th Street

Centre Square Tower, 6th Floor

Yellowknife, NT

X1A 2L9

Tel: (867) 920-3241

Fax: (867) 873-0122

www.gov.nt.ca

#### **STATISTICS CANADA**

Mr. Jeff Latimer

Director, Health Statistics Division

Main Building, Room 2200

Tunney's Pasture

Ottawa, ON

K1A 0T6

Tel: (613) 951-7030

Fax: (613) 951-0792

## **Canadian Cancer Society Division Offices**

#### **National**

55 St. Clair Avenue West, Suite 300

Toronto, ON M4V 2Y7 Tel: (416) 961-7223 Fax: (416) 961-4189 E-mail: ccs@cancer.ca

For more information about cancer:

info@cis.cancer.ca 1 888 939-3333

#### Alberta/NWT

325 Manning Road NE, Suite 200

Calgary, AB T2E 2P5
Toll-free: 1 800 661 2262
Tel: (403) 205-3966
Fax: (403) 205-3979
E-mail: info@cancer.ab.ca

#### **British Columbia & Yukon**

565 West 10th Avenue Vancouver, BC V5Z 4J4 Toll-free: 1 800 663 2524 Tel: (604) 872-4400 Fax: (604) 872-4113

E-mail: inquiries@bc.cancer.ca

#### Manitoba

193 Sherbrook Street Winnipeg, MB R3C 2B7 Toll-free: 1 800 532 6982 Tel: (204) 774-7483 Fax: (204) 774-7500

E-mail: info@mb.cancer.ca

#### **New Brunswick**

PO Box 2089 133 Prince William Street, Suite 201 Saint John, NB E2L 3T5

Toll-free: 1 800 455 9090 Tel: (506) 634-6272 Fax: (506) 634-3808

E-mail: ccsnb@nb.cancer.ca

#### **Newfoundland & Labrador**

PO Box 8921 Daffodil Place 70 Ropewalk Lane St. John's, NL A1B 3R9 Toll-free: 1 888 753 6520 Tel: (709) 753-6520 Fax: (709) 753-9314 E-mail: ccs@nl.cancer.ca

#### **Nova Scotia**

5826 South Street, Suite 1 Halifax, NS B3H 1S6 Toll-free: 1 800 639 0222 Tel: (902) 423-6183 Fax: (902) 429-6563

E-mail: ccs.ns@ns.cancer.ca

#### **Ontario**

55 St. Clair Avenue West, Suite 500

Toronto, ON M4V 2Y7 Toll-free: 1 800 268 8874 Tel: (416) 488-5400 Fax: (416) 488-2872

E-mail: ontdiv@ontario.cancer.ca

#### **Prince Edward Island**

1 Rochford Street, Suite 1 Charlottetown, PE C1A 9L2 Toll-free: 1 866 566 4007 Tel: (902) 566-4007 Fax: (902) 628-8281

E-mail: info@pei.cancer.ca

#### Quebec

5151 de l'Assomption Blvd. Montreal, QC H1T 4A9 Tel: (514) 255-5151 Fax: (514) 255-2808 E-mail: info@sic.cancer.ca

## Saskatchewan

1910 McIntyre Street Regina, SK S4P 2R3 Toll-free: 1 877 977 4673 Tel: (306) 790-5822 Fax: (306) 569-2133 E-mail: ccssk@sk.cancer.ca

#### Tim Catterall

In November 2004, Tim Catterall, a firefighter for the Burlington, Ontario Fire Department, was diagnosed with chronic lymphocytic leukemia. He took a stand and created Firefighters Against Cancer's Existence. Photography: Caitlin den Boer

#### Deanne

After being diagnosed with Hodgkin's disease at age 26, Deanne was determined to survive. She would joke, "I have to keep living: I haven't found the perfect shade of purple nail polish yet!" Photography: Sheilagh O'Leary

#### Eddie

Photographer Larry Frank was Eddie's peer support volunteer. They met through Cancer Connection, a division of the Canadian Cancer Society. The two spoke regularly during the two years following Eddie's cancer diagnosis, while he underwent surgery and radiation. Eddie is now well and looking forward to a healthy life with his wife Tara and young daughter. Photography: Larry Frank

#### Dan Blackburn

The photographer took this image of her Uncle Dan, who has a passion for cooking, sitting peacefully in his kitchen in December 2007. He was receiving chemotherapy, having been diagnosed with colon cancer four months earlier. Sadly, he passed away in March 2008. Photography: Kendra Vamplew

#### Evan Pickard

Throughout his battle with cancer, Evan Pickard's heart was continuously open to others, making everyone around him laugh. He died in April 2007, leaving behind endless hearts touched by his sincere generosity. Photography: Jennifer Globush

#### Francilla Charles

Francilla Charles has been diagnosed twice with pancreatic cancer and survived for 10 years and counting. She now lives with diabetes and continues to inspire and amaze her daughter, photographer Michele Clarke. Photography: Michele Clarke

## Questions about cancer?

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

1 888 939-3333

Monday to Friday, 9 a.m. – 6 p.m.

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