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Canadian Cancer Statistics 2010

Special Topic: End-of-Life Care

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This report is also available at www.cancer.ca/statistics

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 included on the distribution mailing list for next year's publication or offer ideas on how the report can be improved please complete the *Evaluation and Order Form* or email stats@cancer.ca.

Additional copies may be requested from Divisions of the Canadian Cancer Society or by calling Cancer Information Service 1 888 939-3333 (see *For Further Information*).

La version française de cette publication est disponible sur demande.

1. Incidence and mortality by cancer type

- An estimated 173,800 new cases of cancer (excluding 75,500 non-melanoma skin cancers) and 76,200 deaths from cancer will occur in Canada in 2010.
- More men than women are diagnosed with cancer, but the gap between the two sexes has narrowed in recent years (51.7% of cancer cases in men vs. 48.3% in women).
- 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 9,100 deaths (11.9% of all cancer deaths).

2. Incidence and mortality by province

- Generally, both incidence and mortality rates are higher in Atlantic Canada and Quebec. They are lowest in British Columbia.
- Lung cancer incidence and mortality rates among males continue to be highest in Quebec and lowest in British Columbia. Among females, Nova Scotia has the highest incidence rate and Quebec the highest mortality rate.
- Colorectal cancer mortality rates are approximately twice as high in Newfoundland and Labrador as they are in British Columbia.
- The prostate cancer mortality rate is highest in Saskatchewan.
- Little variation is seen in breast cancer rates across Canada.

3. Incidence and mortality by age and sex

- The risk of cancer increases with age, with 43% of new cancer cases and 61% of cancer deaths occurring among those 70 years of age and older.
- The 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 1997 and 2006, thyroid cancer incidence rates rose by nearly 7% per year for males and 10% for females. Liver cancer rates in males rose by 3% per year.
- Between 1997 and 2006, incidence rates declined by at least 2% per year for stomach and lung cancers in males and for larynx cancer in both sexes.
- Excluding lung cancer, the overall cancer mortality rate has dropped by nearly 20% in females since 1981.
- Between 1996 and 2005, overall mortality rates declined significantly for both sexes. The rates declined by at least 2% per year for lung, oral, prostate and larynx cancers in males; cervical cancer in females; and stomach cancer and non-Hodgkin lymphoma in both sexes.

HIGHLIGHTS

5. Cancer in depth: Cancer of the esophagus

- Cancer of the esophagus occurs three times more often in males than in females.
- The majority of esophageal cancers are adenocarcinomas (more common in males) and squamous cell carcinomas (more common in females).
- Although the overall incidence rate of esophageal cancer has remained stable since the mid-1980s, adenocarcinomas (particularly in the lower esophagus) have increased and squamous cell carcinomas have decreased.
- Increasing rates of esophageal adenocarcinoma may reflect the rising prevalence of obesity and gastroesophageal reflux disease. Decreases in squamous cell carcinoma may be the result of the declining prevalence of smoking.
- Although the prognosis is generally poor for individuals with esophageal cancer, five-year relative survival has improved slightly since the early 1990s.

6. Cancer in depth: Cancer of the kidney

- Kidney cancer is nearly twice as common in males as in females.
- Renal cell carcinomas, which account for the majority of kidney cancers in adults, have become increasingly common over the past 20 years.
- Increasing rates of kidney cancer may reflect changes in the prevalence of certain risk factors, particularly obesity.
- Despite increasing incidence rates, mortality rates due to kidney cancer have declined and five-year relative survival has improved.

7. Special topic: End-of-life care

- Quality palliative care services provided at the end of life benefit people dying from cancer.
- About 29% of deaths in Canada are related to cancer. Therefore, people with cancer represent an important group of palliative care services users.
- Formal palliative care in Canada is a patchwork of services that varies significantly both within and between provinces.
- Current data suggest that services are inadequate to allow individuals to die at home when that is their preference, palliative care services are being used insufficiently and families bear substantial psychological and financial burdens.
- A lack of uniform definitions and incomplete, inaccessible and incomparable data on end-of-life care make surveillance and comparisons across jurisdictions difficult.

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 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, 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 of the most common types of cancer presented by age, sex, time and province or territory. These data can help stimulate new research as well as assist decision-making and priority-setting at the individual, 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.

New biennial format of the publication

Every year, this publication provides updates on cancer incidence, mortality, survival, prevalence and risk of developing or dying from cancer. Given that some of this information does not change significantly from year to year, we are introducing a new biennial format for this publication.

Starting with the 2010 edition (and every even year thereafter), a new condensed format will alternate with the usual full-length publication. This change will allow the Steering Committee on Cancer Statistics to explore and develop new content for the condensed report on specialized cancer issues beyond the usual statistics. For example, this year's edition includes two new sections:

- Cancer in depth: Cancer of the esophagus
- Cancer in depth: Cancer of the kidney

To make this change, we have temporarily deferred the sections on Five-Year Relative Survival, Prevalence, Probability of Developing or Dying from Cancer, and Incidence, Mortality and Survival in Children. These sections will reappear next year (and every odd year) as part of the full-length report.

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

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

- 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.

ABOUT THIS PUBLICATION

- Cancers included in this report are defined according to the groupings listed in Table A9: Cancer Definitions, unless otherwise noted.
- The following types of tumours are not included:
  - non-melanoma skin cancers (basal and squamous)
  - benign tumours and carcinomas in situ (except for in situ carcinomas of the bladder)

Most provincial and territorial cancer registries do not collect non-melanoma skin cancer incidence 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.

Actual and estimated data (see *Appendix II* for detailed information)

- The information provided in this publication includes both actual and estimated data.
- Actual incidence data are available up to 2006 for all provinces and territories.
- Actual mortality data are available up to 2005 for all provinces and territories.
- Incidence data for 2007–2010 and mortality data for 2006–2010 are estimated from long-term (15–20 year) trends. Therefore, a recent change in the long-term trend may not be reflected in projected estimates.

Review and analysis

- The Chronic Disease Surveillance Division of the Centre for Chronic Disease Prevention and Control (CCDPC), part of the Public Health Agency of Canada (PHAC), conducted the data analysis for most of the sections. The analysts were supported by Dr. Michael Otterstatter, who updated the tables and figures.
- The Health Statistics Division of Statistics Canada also provided analyses.
- 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 A8.1 and A8.2.
- The French translation of this publication was reviewed by Michel Beaupré of the Fichier des tumeurs du Québec and Jean-Marc Daigle of the Institut National de Santé Publique du Québec.

Cancers in depth (kidney and esophagus)

The two new cancer in depth (kidney and esophagus) sections were developed by members of the Steering Committee on Cancer Statistics, with significant contributions from Dr. Michael Otterstatter and the Public Health Agency of Canada.

The Committee would like to thank Dr. James Brierley (Princess Margaret Hospital) for assistance with writing the clinical aspects of the esophagus section and for reviewing the section along with Dr. Morteza Bashash (BC Cancer Agency).

Special topic (end-of-life care)

This special topic was developed by a working group whose names are listed at the beginning of *Section 7: End-of-Life Care*.

- The authors of the special topic would like to acknowledge Julie Lachance of Health Canada and Sharon Baxter of Canadian Hospice Palliative Care Association for their critical review of a final draft of this section.

- For a complete list of previous special topics, see *Appendix III*.

Previous special topics (1988–2009) are available online at www.cancer.ca/statistics or can be obtained in hardcopy by writing to stats@cancer.ca.

Production and distribution

The Canadian Cancer Society supports the production, printing and distribution of this publication with charitable funds. 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

Electronic copies of this publication (English and French), all figures (English only), and some additional tables and figures not included in this publication 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 2010, Canada will continue to see an increase in the number of individuals diagnosed with and dying from cancer. Every hour of every day, an average of 20 people will be diagnosed with some type of cancer and eight 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 cancer burden.

An estimated 173,800 new cases of cancer and 76,200 cancer deaths are expected in Canada in 2010. This represents increases of 1.6% (2,800) in new cases and 1.2% (900) in cancer deaths from 2009.[1] More men than women will be diagnosed with a new cancer (51.7% vs. 48.3%) and will die from cancer (52.5% vs. 47.5%). The gap between incidence in men and women is narrowing from previous years, while the difference in mortality shows little change. In addition, 75,500 new cases and 280 deaths from non-melanoma skin cancers (basal and squamous) are expected in 2010. Although non-melanoma skin cancer represents the most common cancer diagnosed in Canadians, it is reported separately because it accounts for very few deaths and most cancer registries do not routinely collect information on these cases.

In both men and women, lung is the second most common cancer (13.9%) and colorectal is the third most common cancer (12.9%). Prostate cancer remains the most common cancer diagnosed in men, with 24,600 cases expected in 2010. Breast cancer continues to be the most frequently diagnosed cancer in women, with over 23,200 new cases expected. In 2010, four cancers (breast, lung, colorectal and prostate) will account for 54.4% of all cancers diagnosed in Canada. The number of new prostate cancer cases declined by 900 from 2009.[1] Female breast cancer diagnoses increased slightly (by 500) from last year.

Lung cancer remains the leading cause of cancer death in both men (28.0%) and women (26.0%) (Figures 1.1 and 1.2). While prostate cancer is the most common cancer diagnosed in men, it ranks third in terms of mortality, with approximately 4,300 deaths. Breast cancer, which represents 27.6% of cancer cases in women, ranks second for mortality at 14.6%. Colorectal cancer has a significant impact on mortality for men and women combined, with 9,100 deaths expected (11.9% of all deaths).

Every hour of every day, about 20 people will be diagnosed with cancer and eight people will die from cancer across Canada. Of the newly diagnosed cases, about one-half will be lung, colorectal, prostate and breast cancers.

Table 1.1

Estimated New Cases and Age-Standardized Incidence Rates for Cancers by Sex, Canada, 2010

	New Cases 2010 Estimates			Cases per 100,000 2010 Estimates		
	Total*	M	F	Total*	M	F
All Cancers	**173,800**	**90,000**	**83,900**	**403**	**455**	**366**
Prostate	24,600	24,600	—	123	123	—
Lung†	24,200	12,900	11,200	55	66	48
Breast	23,300	180	23,200	53	1	102
Colorectal	22,500	12,400	10,100	51	62	41
Non-Hodgkin Lymphoma	7,500	4,100	3,400	18	21	15
Bladder†	7,100	5,300	1,800	16	27	7
Melanoma	5,300	2,900	2,300	13	15	11
Thyroid	5,200	1,050	4,100	14	6	22
Leukemia	4,800	2,800	2,000	12	15	9
Kidney†	4,800	2,900	1,850	11	15	8
Body of Uterus	4,500	—	4,500	19	—	19
Pancreas	4,000	1,950	2,100	9	10	8
Oral	3,400	2,200	1,150	8	11	5
Stomach	2,900	1,900	1,050	7	10	4
Brain	2,600	1,500	1,150	7	8	6
Ovary†	2,600	—	2,600	11	—	11
Multiple Myeloma	2,300	1,250	1,000	5	6	4
Liver	1,850	1,400	440	4	7	2
Esophagus	1,700	1,250	430	4	6	2
Cervix	1,300	—	1,300	7	—	7
Larynx	1,150	930	220	3	5	1
Testis	930	930	—	6	6	—
Hodgkin Lymphoma	930	510	420	3	3	3
All Other Cancers	14,500	6,900	7,600	33	36	30
Non-melanoma skin	75,500	41,200	34,300	—	—	—

— Not applicable.
* Column totals may not sum to row totals due to rounding.
† Definitions for these cancers have changed, see Table A7.
Note: "All Cancers" excludes the estimated new cases of non-melanoma skin cancer (basal and squamous).
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada
Data sources: Canadian Cancer Registry database at Statistics Canada

Table 1.2

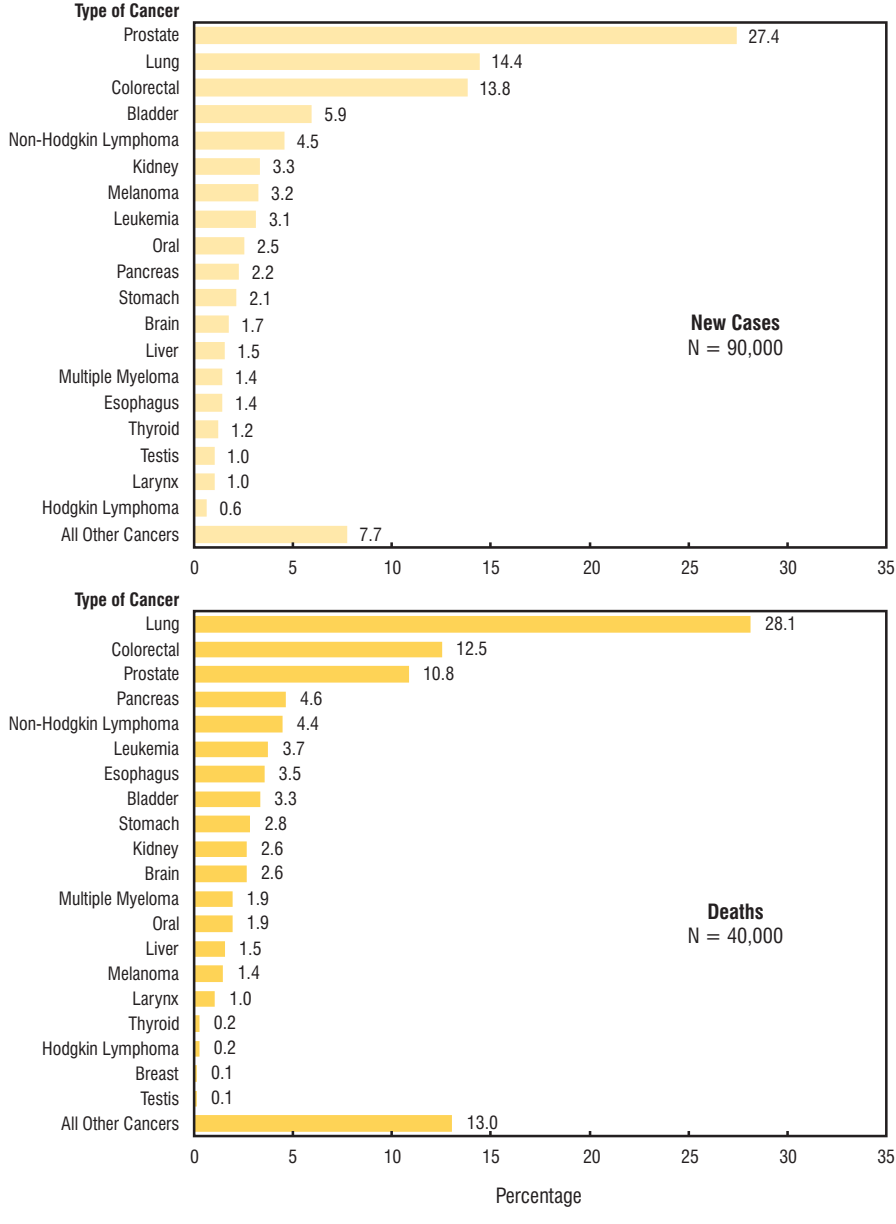
Estimated Deaths and Age-Standardized Mortality Rates for Cancers by Sex, Canada, 2010

	Deaths 2010 Estimates			Deaths per 100,000 2010 Estimates		
	Total*	M	F	Total*	M	F
All Cancers	**76,200**	**40,000**	**36,200**	**170**	**204**	**146**
Lung†	20,600	11,200	9,400	47	57	39
Colorectal	9,100	5,000	4,100	20	25	16
Breast	5,400	50	5,300	12	<0.5	21
Prostate	4,300	4,300	—	22	22	—
Pancreas	3,900	1,850	2,000	9	9	8
Non-Hodgkin Lymphoma	3,200	1,750	1,450	7	9	6
Leukemia†	2,500	1,450	1,000	6	8	4
Bladder	1,850	1,300	550	4	7	2
Stomach	1,850	1,100	720	4	6	3
Esophagus	1,800	1,400	440	4	7	2
Brain	1,750	1,000	750	4	5	3
Ovary†	1,750	—	1,750	7	—	7
Kidney†	1,650	1,050	610	4	5	2
Multiple Myeloma†	1,450	780	650	3	4	3
Oral	1,150	750	390	3	4	2
Melanoma	920	580	350	2	3	1
Body of Uterus	790	—	790	3	—	3
Liver†	750	590	160	2	3	1
Larynx	500	400	95	1	2	<0.5
Cervix	370	—	370	2	—	2
All Other Cancers	10,600	5,400	5,300	23	28	20

— Not applicable.
* Column totals may not sum to row totals due to rounding.
† Definitions for these cancers have changed, see Table A7.
Note: "All Other Cancers" includes 280 deaths from non-melanoma skin cancer.
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada
Data sources: Canadian Vital Statistics Death database at Statistics Canada

Figure 1.1

Percentage Distribution of Estimated New Cases and Deaths for Selected Cancers, Males, Canada, 2010



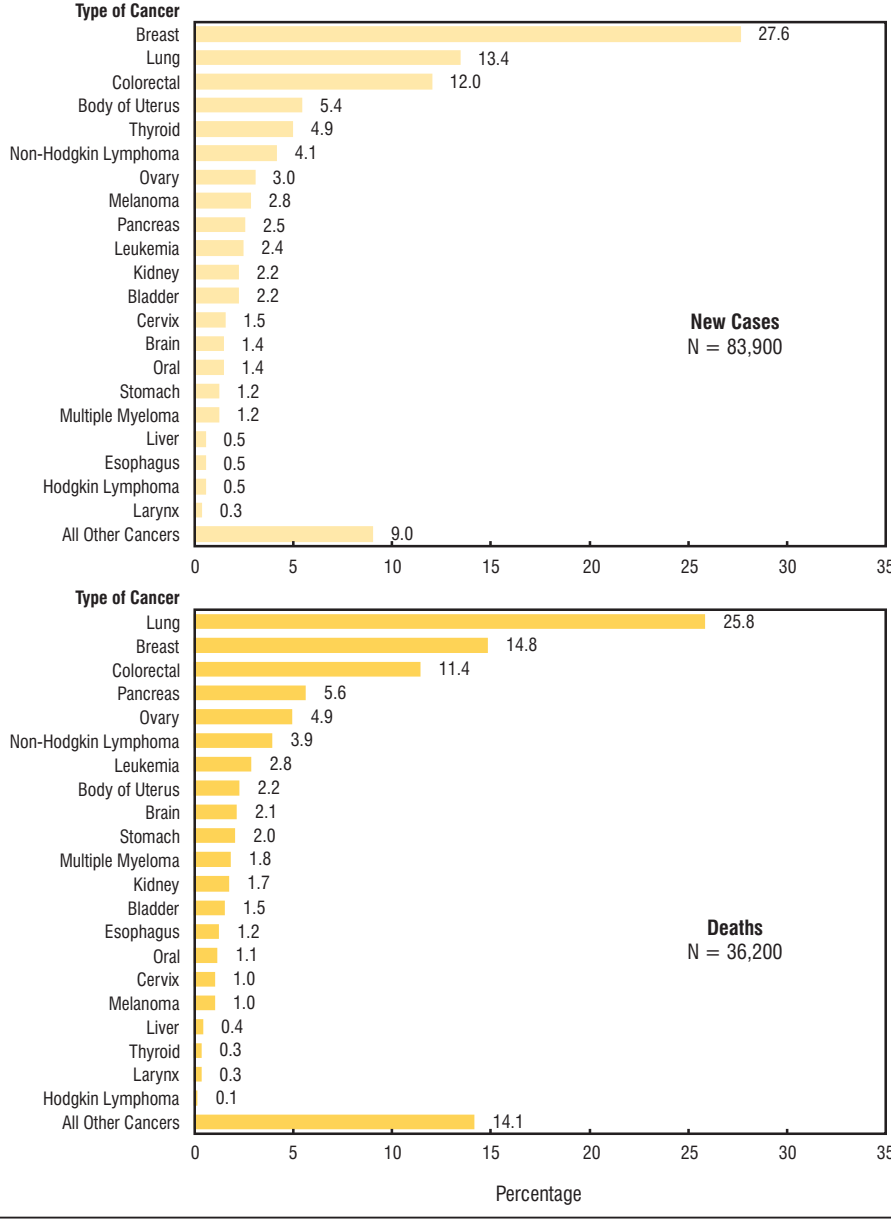
Note: New cases exclude an estimated 41,200 new cases non-melanoma skin cancer (basal and squamous). The number of deaths for "All Other Cancers" include about 160 deaths with underlying cause "other malignant neoplasms" of skin.

Analysis by: Chronic Disease Surveillance 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, 2010



Note: New cases exclude an estimated 34,300 of non-melanoma skin cancer (basal and squamous). Deaths for "All Other Cancers" include about 110 deaths with underlying cause "other malignant neoplasms" of skin.

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

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

2. INCIDENCE AND MORTALITY BY PROVINCE

Table 2.1 presents population projections and estimates of new cases and deaths for all cancers combined by sex and province or territory for 2010. Tables 2.2 and 2.3 present estimates of the number of new cases and the age-standardized incidence rates for each of the most common cancers by sex and province or territory for 2010. The corresponding estimates of the number of deaths and the age-standardized mortality rates are presented in Tables 2.4 and 2.5. Tables A3 to A6 in *Appendix I* provide the most recent actual numbers and rates.

Age-standardization adjusts for differences in age distributions among the provinces and territories, allowing for interprovincial comparisons. The calculation of these rates, using the 1991 Canadian population as the standard, is described in the *Glossary*, and in more detail in *Appendix II*.

Incidence

- Incidence rates for all cancers combined continue to be projected highest for the Maritime Provinces and Quebec, and lowest in British Columbia (Table 2.3). Rates in Newfoundland and Labrador are underestimated because of missing data.
- Prostate cancer incidence rates show large provincial differences, possibly due to diversity in prostate-specific antigen (PSA) testing.
- Lung cancer incidence rates among men are projected to be highest in Quebec and lowest in British Columbia. Nova Scotia is predicted to have the highest rate of lung cancer among women.
- The highest colorectal cancer incidence rate among men is seen in Newfoundland and Labrador. The highest rates among women are seen in Prince Edward Island, Nova Scotia and Newfoundland and Labrador. 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, mortality rates for all cancers continue to be higher in Atlantic Canada and Quebec, and lower in Western Canada (Table 2.5). The pattern is similar for females, although the projected rate is also high in Manitoba.
- Among males, the lung cancer mortality rate is projected highest in Quebec and New Brunswick, and lowest in British Columbia. Among females, the lung cancer mortality rate is projected to be highest in Quebec and lowest in Ontario and Saskatchewan.
- Colorectal cancer mortality rates are approximately twice as high in Newfoundland and Labrador as they are in British Columbia.
- The mortality rate for prostate cancer continues to be projected highest in Saskatchewan.

Interpretation

Canada is one of the few nations in the world with a population-based cancer registry system that allows cancer patterns to be monitored for the entire Canadian population. The provincial, territorial and national cancer registries are important resources that enable the geographic comparison of rates of new cancer cases and deaths. This

results in valuable information that can be used for research and knowledge exchange, along with planning and decision-making at the provincial or territorial level. These data are therefore of interest to researchers, healthcare workers, planners and policy makers.

Interpretation of geographical differences should, however, be approached with caution since there may be a number of explanations. True differences in incidence or mortality rates between provinces or territories may be due to any one of several factors, including:

- variation in the prevalence of cancer risk factors (e.g., higher historic smoking rates in Quebec and Atlantic Canada are the likely cause of higher rates of lung cancer)
- variation in early detection of cancer because of different rates of participation in formal screening programs (e.g., mammographic screening for breast cancer), or in screening procedures that are not programmatic (e.g., PSA testing for prostate cancer), or because of differences in availability of diagnostic services
- variation in treatment access and quality

However, in situations where variation in cancer rates and any of the above factors agree, one cannot assume that the relationship is causal. Such a determination could only be made after more detailed studies, involving individual people, have been conducted. It is also important to note that, for many cancers, there is a long interval between exposure to a risk factor and the occurrence of disease and often the information on the prevalence of risk factors from previous decades is inadequate. Where true differences in cancer risk and causal associations are demonstrated in subsequent epidemiologic studies, these findings can be used in planning cancer control programs that aim to reduce the burden of cancer.

Issues that should be kept in mind when interpreting interprovincial variation:

- When a cancer is rare, or the population is small, the number of cases and rates occurring annually in a given province or territory may be so small that estimates could be unreliable and vary considerably from year to year.
- While the completeness of registration of new cancer cases is generally very good across the country, there are exceptions. For example, 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 falsely lowered the number of newly diagnosed cases for the current projection and actual data (*Appendix I*), mainly among those cancers with a poor prognosis, such as lung and pancreatic cancer (see *Appendix II*). The degree to which death certificate information is actively followed back to hospital records also varies across provinces or territories, and this affects the accuracy of information on 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 have been estimated to be under-reported.[2]
- The method of projection selected by the provincial registries for 2010 estimates (Poisson modelling vs. five-year average) varies across provinces and cancer type (see *Methods, Appendix II*). This may particularly affect variation in 2010 estimates for lung cancer in women (new cases and deaths), where choice of method may be related to recent changes in trend that vary by province.

2. INCIDENCE AND MORTALITY BY PROVINCE

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 a 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, 2010

	Population (in thousands) 2010 Estimates			New Cases 2010 Estimates			Deaths 2010 Estimates		
	Total*	M	F	Total*	M	F	Total*	M	F
CANADA	**33,639**	**16,654**	**16,986**	**173,800**	**90,000**	**83,900**	**76,200**	**40,000**	**36,200**
Newfoundland and Labrador (NL)†	513	251	262	2,700	1,550	1,200	1,400	810	610
Prince Edward Island (PE)	141	69	72	880	490	400	350	180	170
Nova Scotia (NS)	947	464	483	6,200	3,400	2,800	2,700	1,450	1,300
New Brunswick (NB)	756	373	383	4,600	2,500	2,100	2,000	1,100	920
Quebec (QC)†	7,804	3,858	3,946	45,200	22,900	22,300	20,300	10,700	9,600
Ontario (ON)	13,237	6,533	6,705	65,100	33,300	31,800	28,200	14,600	13,600
Manitoba (MB)	1,208	601	607	6,200	3,100	3,000	2,800	1,450	1,350
Saskatchewan (SK)	983	488	495	5,200	2,800	2,400	2,400	1,300	1,100
Alberta (AB)	3,446	1,737	1,709	15,900	8,400	7,600	6,200	3,300	2,900
British Columbia (BC)	4,496	2,226	2,270	21,600	11,400	10,200	9,500	5,000	4,500
Yukon (YT)	31	16	16	120	60	55	65	40	25
Northwest Territories (NT)	46	24	22	140	70	65	60	30	30
Nunavut (NU)	31	16	15	70	35	35	40	20	20

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

† An underestimate of the number of cases for some cancers for the years used to generate the 2010 estimates.

Note: The Canada and provincial totals exclude non-melanoma skin cancer (basal and squamous).

Analysis by: Chronic Disease Surveillance 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.[3]

Table 2.2

Estimated New Cases for Selected Cancers by Sex and Province, Canada, 2010

	New Cases										
	Canada*	NL†	PE	NS	NB	QC†	ON	MB	SK	AB	BC
Males											
All Cancers	**90,000**	**1,550**	**490**	**3,400**	**2,500**	**22,900**	**33,300**	**3,100**	**2,800**	**8,400**	**11,400**
Prostate	24,600	510	150	1,050	690	4,700	10,200	760	890	2,500	3,100
Lung‡	12,900	180	70	510	420	4,400	4,100	430	350	990	1,400
Colorectal	12,400	300	55	460	310	3,300	4,500	450	390	1,050	1,550
Bladder‡	5,300	85	30	230	160	1,750	1,300	210	170	510	800
Non-Hodgkin Lymphoma	4,100	50	20	140	120	930	1,600	150	120	370	590
Melanoma	2,900	50	15	130	90	400	1,300	95	75	300	460
Kidney‡	2,900	50	20	130	110	830	1,000	130	90	280	280
Leukemia	2,800	20	15	75	55	650	1,100	110	100	280	380
Oral	2,200	40	5	85	60	560	870	95	55	180	280
Pancreas	1,950	25	10	65	65	570	630	75	55	170	270
Stomach	1,900	50	5	55	50	500	710	70	50	160	240
Brain	1,500	30	5	45	35	400	560	40	40	140	180
Liver	1,400	15	5	20	10	380	530	40	20	150	220
Esophagus	1,250	20	5	60	35	300	460	40	35	130	180
Multiple Myeloma	1,250	15	10	40	30	340	510	40	35	100	150
Thyroid	1,050	10	—	30	30	250	530	15	15	100	80
Females											
All Cancers	**83,900**	**1,200**	**400**	**2,800**	**2,100**	**22,300**	**31,800**	**3,000**	**2,400**	**7,600**	**10,200**
Breast	23,200	370	100	740	560	6,100	8,900	800	630	2,100	2,800
Lung‡	11,200	160	55	460	310	3,200	3,700	420	310	1,050	1,500
Colorectal	10,100	210	60	400	240	2,600	3,800	370	300	800	1,250
Body of Uterus	4,500	65	20	140	100	1,050	1,850	190	120	430	590
Thyroid	4,100	45	5	75	120	870	2,300	75	60	350	230
Non-Hodgkin Lymphoma	3,400	50	10	110	100	810	1,400	120	100	300	460
Ovary‡	2,600	25	10	65	65	690	1,050	95	70	180	300
Melanoma	2,300	45	20	120	75	340	1,050	60	60	220	330
Pancreas	2,100	10	10	70	70	640	670	75	55	190	280
Leukemia	2,000	10	10	55	40	510	750	90	75	210	260
Kidney‡	1,850	30	10	80	60	520	680	80	55	160	170
Bladder‡	1,800	30	10	70	50	620	470	70	55	180	260
Cervix	1,300	20	10	50	30	280	490	45	35	160	160
Oral	1,150	15	5	35	25	290	440	50	35	95	150
Brain	1,150	15	5	35	30	330	440	40	35	95	140
Stomach	1,050	25	5	30	25	300	380	35	25	95	120
Multiple Myeloma	1,000	10	5	30	25	270	430	35	25	70	110

* 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.

— Fewer than 3 cases.

† An underestimate of the number of cases for some cancers for the years used to generate the 2010 estimates.

‡ Definitions for these cancers have changed, see Table A7.

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

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

Data source: Canadian Cancer Registry database at Statistics Canada

Table 2.3

Estimated Age-Standardized Incidence Rates for Selected Cancers by Sex and Province, Canada, 2010

	Cases per 100,000										
	Canada*	NL†	PE	NS	NB	QC†	ON	MB	SK	AB	BC
Males											
All Cancers	**455**	**444**	**552**	**564**	**532**	**486**	**442**	**453**	**460**	**467**	**417**
Prostate	123	147	167	162	141	98	133	109	148	142	108
Lung‡	66	54	79	84	88	92	55	63	58	57	50
Colorectal	62	88	65	75	64	68	59	65	64	59	54
Bladder‡	27	27	35	37	33	37	18	30	27	29	28
Non-Hodgkin Lymphoma	21	15	20	23	25	20	21	22	21	20	21
Melanoma	15	17	19	22	19	8	17	13	12	17	16
Kidney‡	15	15	21	21	21	17	13	18	15	15	10
Leukemia	15	6	18	13	12	14	15	17	17	16	14
Oral	11	12	8	13	12	11	11	14	9	9	10
Stomach	10	15	7	9	11	10	9	10	8	9	9
Pancreas	10	9	13	10	13	12	8	11	9	10	9
Brain	8	9	7	8	8	9	8	6	7	8	7
Liver	7	4	5	3	3	8	7	6	3	8	7
Esophagus	6	5	8	9	7	6	6	6	5	7	6
Thyroid	6	3	2	5	6	6	7	2	3	5	3
Multiple Myeloma	6	4	10	7	6	7	7	6	5	6	5
Females											
All Cancers	**366**	**318**	**393**	**394**	**377**	**386**	**365**	**374**	**349**	**374**	**323**
Breast	102	96	98	105	100	109	102	102	95	102	90
Lung‡	48	43	51	64	53	54	42	51	45	53	47
Colorectal	41	52	53	52	40	43	40	42	40	38	37
Thyroid	22	13	6	14	27	20	31	12	11	19	9
Body of Uterus	19	17	18	20	17	17	21	23	19	21	18
Non-Hodgkin Lymphoma	15	14	12	16	18	14	16	15	15	15	15
Melanoma	11	13	22	18	15	7	13	9	10	12	12
Ovary‡	11	6	9	9	12	12	12	12	10	9	10
Leukemia	9	4	8	9	8	9	9	11	11	11	8
Pancreas	8	3	8	9	11	10	7	8	7	9	8
Kidney‡	8	8	7	12	11	9	8	10	8	8	6
Cervix	7	7	10	10	7	6	7	7	7	9	6
Bladder‡	7	8	7	9	9	10	5	8	8	9	8
Brain	6	5	6	6	6	7	6	5	6	5	5
Oral	5	4	5	5	4	5	5	6	5	5	5
Stomach	4	6	3	4	4	5	4	4	4	4	3
Multiple Myeloma	4	2	4	4	4	4	5	4	3	3	3

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

† An underestimate of the number of cases for some cancers for the years used to generate the 2010 estimates.

‡ Definitions for these cancers have changed, see Table A7.

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

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

Data source: Canadian Cancer Registry database at Statistics Canada

Table 2.4

Estimated Deaths for Selected Cancers by Sex and Province, Canada, 2010

	Deaths										
	Canada*	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC
Males											
All Cancers	**40,000**	**810**	**180**	**1,450**	**1,100**	**10,700**	**14,600**	**1,450**	**1,300**	**3,300**	**5,000**
Lung†	11,200	240	60	450	370	3,700	3,700	390	320	810	1,250
Colorectal	5,000	140	20	190	120	1,350	1,850	190	170	380	590
Prostate	4,300	85	20	140	140	870	1,650	180	230	440	570
Pancreas	1,850	30	5	75	55	470	660	65	60	150	260
Non-Hodgkin Lymphoma	1,750	20	5	50	50	400	710	80	50	140	230
Leukemia†	1,450	20	5	50	35	310	600	60	55	130	200
Esophagus	1,400	20	5	50	30	260	560	50	45	120	230
Bladder	1,300	25	5	50	35	300	510	50	45	100	190
Stomach	1,100	35	5	35	25	330	420	35	30	75	130
Kidney†	1,050	20	5	40	35	270	360	55	30	100	120
Brain	1,000	20	—	35	25	300	350	30	25	100	130
Multiple Myeloma†	780	10	5	25	20	190	310	30	20	60	110
Oral	750	15	5	35	20	180	280	25	20	55	110
Liver†	590	10	—	15	5	180	250	20	5	45	70
Melanoma	580	10	—	25	10	110	250	20	15	60	80
Females											
All Cancers	**36,200**	**610**	**170**	**1,300**	**920**	**9,600**	**13,600**	**1,350**	**1,100**	**2,900**	**4,500**
Lung†	9,400	170	40	310	220	2,900	3,000	390	240	820	1,250
Breast	5,300	110	30	180	130	1,400	2,100	220	160	420	640
Colorectal	4,100	110	25	160	100	1,150	1,550	160	120	290	500
Pancreas	2,000	30	10	70	60	540	740	70	55	160	280
Ovary†	1,750	30	5	60	45	390	710	65	55	150	240
Non-Hodgkin Lymphoma	1,450	15	5	40	35	350	590	60	45	110	170
Leukemia†	1,000	10	5	30	25	230	410	40	40	90	130
Body of Uterus	790	10	5	25	20	180	350	30	20	60	85
Brain	750	15	5	25	20	210	260	25	20	70	95
Stomach	720	25	—	25	15	210	260	25	20	60	80
Multiple Myeloma†	650	10	5	20	15	170	260	25	20	50	80
Kidney†	610	15	5	25	20	180	200	30	25	50	65
Bladder	550	10	—	15	15	140	220	20	15	40	75
Oral	390	—	—	10	10	100	150	15	10	35	55
Cervix	370	15	5	20	10	65	140	15	10	40	50
Melanoma	350	10	—	15	10	60	150	10	10	30	50

— Fewer than three deaths

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

† Definitions for these cancers have changed, see Table A7.

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

Data source: Canadian Vital Statistics Death database at Statistics Canada

Table 2.5

Estimated Age-Standardized Mortality Rates for Selected Cancers by Sex and Province, Canada, 2010

	Deaths per 100,000										
	Canada*	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC
Males											
All Cancers	**204**	**251**	**212**	**241**	**230**	**228**	**195**	**209**	**208**	**188**	**175**
Lung†	57	73	69	74	77	77	49	56	52	47	44
Colorectal	25	44	25	31	24	29	24	27	26	22	21
Prostate	22	29	26	24	29	20	22	25	34	26	20
Pancreas	9	10	8	12	12	10	9	9	10	9	9
Non-Hodgkin Lymphoma	9	5	8	8	11	8	9	12	8	8	8
Leukemia†	8	6	8	8	7	7	8	9	9	7	7
Esophagus	7	6	8	8	6	5	7	7	7	7	8
Bladder	7	9	6	8	7	7	7	7	7	6	7
Stomach	6	12	5	6	5	7	6	5	5	4	5
Brain	5	6	2	6	5	6	5	5	5	5	5
Kidney†	5	7	7	7	7	6	5	8	5	6	4
Oral	4	4	5	5	4	4	4	4	3	3	4
Multiple Myeloma†	4	4	5	4	4	4	4	4	3	4	4
Melanoma	3	3	3	4	2	2	3	3	2	3	3
Liver†	3	2	1	2	1	4	3	3	1	2	2
Females											
All Cancers	**146**	**152**	**153**	**168**	**150**	**154**	**143**	**154**	**145**	**139**	**131**
Lung†	39	44	40	42	37	50	33	45	33	41	38
Breast	21	27	27	23	20	22	22	24	21	20	19
Colorectal	16	26	23	20	15	17	15	16	15	13	13
Pancreas	8	7	8	9	10	8	8	8	7	8	8
Ovary†	7	7	6	8	7	6	8	8	8	7	7
Non-Hodgkin Lymphoma	6	4	6	6	6	6	6	7	6	5	5
Leukemia†	4	2	4	4	4	4	4	5	5	4	4
Stomach	3	7	1	3	2	3	3	2	2	3	2
Body of Uterus	3	3	3	3	4	3	4	3	3	3	2
Brain	3	4	4	4	4	4	3	3	4	4	3
Multiple Myeloma†	3	3	3	3	3	3	3	3	2	2	2
Oral	2	—	2	1	1	2	2	2	1	2	2
Cervix	2	4	3	3	2	1	2	2	2	2	2
Bladder	2	2	1	2	2	2	2	2	2	2	2
Kidney†	2	4	3	3	4	3	2	3	3	2	2
Melanoma	1	2	1	2	1	1	2	1	1	1	2

— Fewer than three deaths.

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

† Definitions for these cancers have changed, see Table A7.

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

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

Data source: Canadian Vital Statistics Death database at Statistics Canada

3. INCIDENCE AND MORTALITY BY AGE AND SEX

While cancer is primarily a disease that affects Canadians 50 years of age or older (representing 88% of all new cases and 95% of deaths), it impacts all age groups. For both sexes, the median age range is 65–69 years at cancer diagnosis and 70–74 years at death. It is important to note that approximately 12% of new cancer cases and 5% of cancer deaths will occur in people under the age of 50 years. Table 3.1 shows that in 2010:

- Approximately 75,100 new cancer cases (43% of all cases) and 46,200 cancer deaths (61% of all deaths) will occur in Canadians aged 70 years or older.
- An additional 46,900 new cases (27%) and 17,100 deaths (22%) will occur in those aged 60–69 years.
- Compared to older age groups, those aged 50–59 years represent a smaller proportion of all new cases (18%) and deaths (12%).

Figure 3.1 displays age-specific rates of cancer incidence (for 2006) and mortality (in 2005) by five-year age groups. Cancer incidence and mortality rates increase with age in both sexes. The incidence rate for males surpasses that for females around age 55. A similar pattern is observed for mortality rates.

The age and sex distributions for the most common cancers in Canadians are presented in Table 3.2, which shows that:

- More than 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. Twenty-eight percent of breast cancer cases are diagnosed over age 69, while 19% occur in females 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, 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 occur in males 80 years and older. This pattern likely reflects the effect of screening men 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 are shown in Figure 3.2.

- Cancer is more common among males than among females under age 20 and adults over age 60, while higher incidence rates are seen in females than in males between ages 20 and 59. Sex-specific cancers (breast and cervical cancer in particular), as well as lung cancer, melanoma and thyroid cancer, account for the higher cancer incidence in females between ages 20 and 59.
- Breast cancer is the most common cancer in females over the age of 20. But deaths from breast cancer are only more frequent than other common cancers for women 30–39 years of age.

3. INCIDENCE AND MORTALITY BY AGE AND SEX

- 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 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 females up to age 69. But for females, this rate begins to increase from age 70. From 1996–2005, annual mortality rates have dropped significantly in all 10-year age groups, especially in younger age groups (not shown).

The risk of developing cancer increases with age. Notable declines in mortality for all cancers combined have occurred in both sexes and in most age groups.

3. INCIDENCE AND MORTALITY BY AGE AND SEX

Table 3.1

Estimated New Cases and Deaths for All Cancers by Age and Sex, Canada, 2010

Age	Population (in thousands) 2010 Estimates			New Cases 2010 Estimates			Deaths 2010 Estimates		
	Total*	M	F	Total*	M	F	Total*	M	F
All Ages	**33,639**	**16,654**	**16,986**	**173,800**	**90,000**	**83,900**	**76,200**	**40,000**	**36,200**
0–19	7,641	3,914	3,727	1,300	690	590	160	90	75
20–29	4,597	2,334	2,262	2,000	910	1,100	220	120	100
30–39	4,652	2,342	2,310	4,600	1,550	3,000	660	280	390
40–49	5,180	2,601	2,580	12,900	4,500	8,400	2,900	1,250	1,650
50–59	4,865	2,407	2,458	31,100	14,600	16,500	9,000	4,400	4,600
60–69	3,405	1,657	1,748	46,900	27,000	19,900	17,100	9,400	7,700
70–79	2,003	922	1,080	42,900	25,000	17,900	21,800	12,400	9,400
80+	1,296	475	821	32,200	15,800	16,400	24,400	12,100	12,300

* 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 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.[3]

Table 3.2

Estimated New Cases and Deaths for the Most Common Cancers by Age and Sex, Canada, 2010

Age	Lung			Colorectal			Prostate	Breast
	Total	M	F	Total	M	F	M	F
New Cases								
All Ages	**24,200**	**12,900**	**11,200**	**22,500**	**12,400**	**10,100**	**24,600**	**23,200**
0–19	10	5	5	10	5	5	5	5
20–29	25	10	10	55	30	25	—	85
30–39	95	40	55	240	120	110	15	860
40–49	960	360	600	1,050	560	510	440	3,500
50–59	3,400	1,600	1,850	3,400	2,000	1,400	4,100	6,200
60–69	7,200	3,900	3,300	5,900	3,600	2,200	9,400	5,800
70–79	7,600	4,400	3,300	6,300	3,700	2,700	7,000	3,800
80+	4,800	2,700	2,100	5,400	2,400	3,100	3,600	2,800
Deaths								
All Ages	**20,600**	**11,200**	**9,400**	**9,100**	**5,000**	**4,100**	**4,300**	**5,300**
0–19	—	—	—	5	5	—	—	—
20–29	5	—	5	10	5	5	—	5
30–39	55	20	35	50	25	25	—	100
40–49	690	260	430	270	150	120	15	400
50–59	2,500	1,200	1,300	950	560	390	120	920
60–69	5,700	3,100	2,600	1,900	1,200	670	520	1,050
70–79	6,800	3,900	2,900	2,500	1,500	1,000	1,250	1,100
80+	4,900	2,700	2,200	3,500	1,550	1,950	2,400	1,750

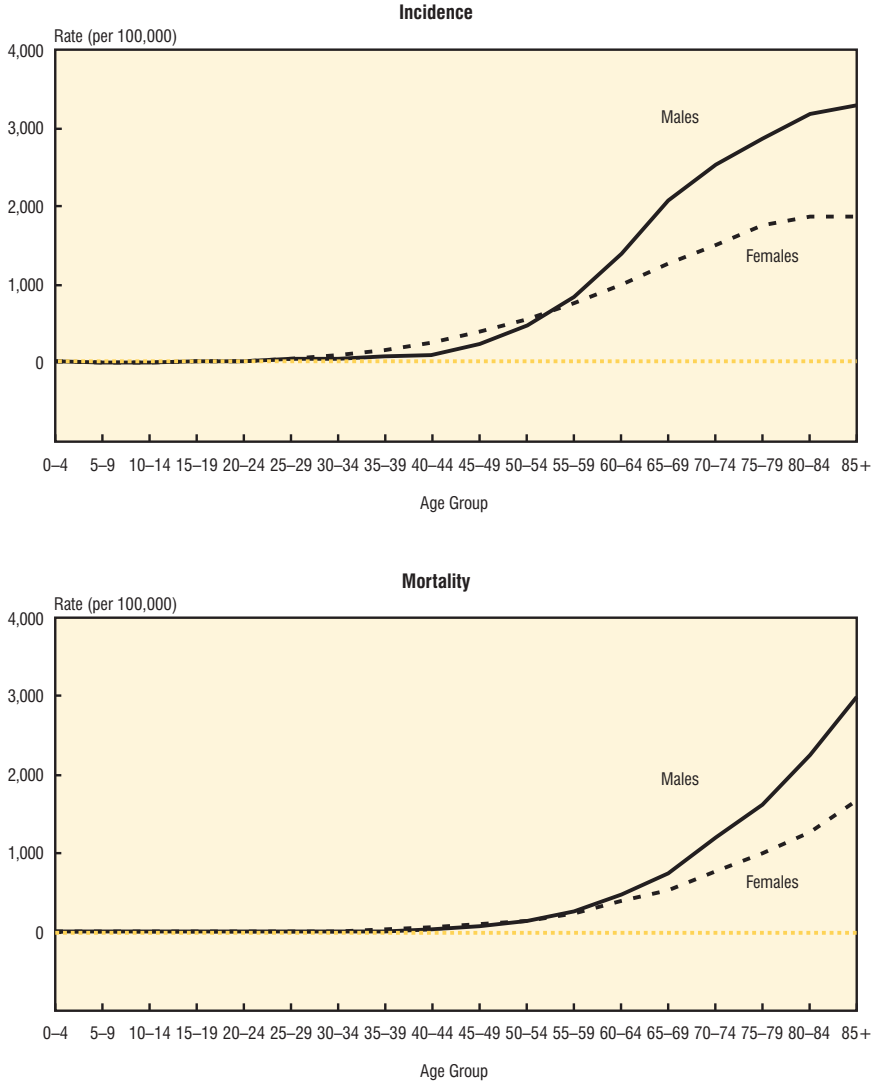
— Fewer than three cases or deaths.

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

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

Figure 3.1

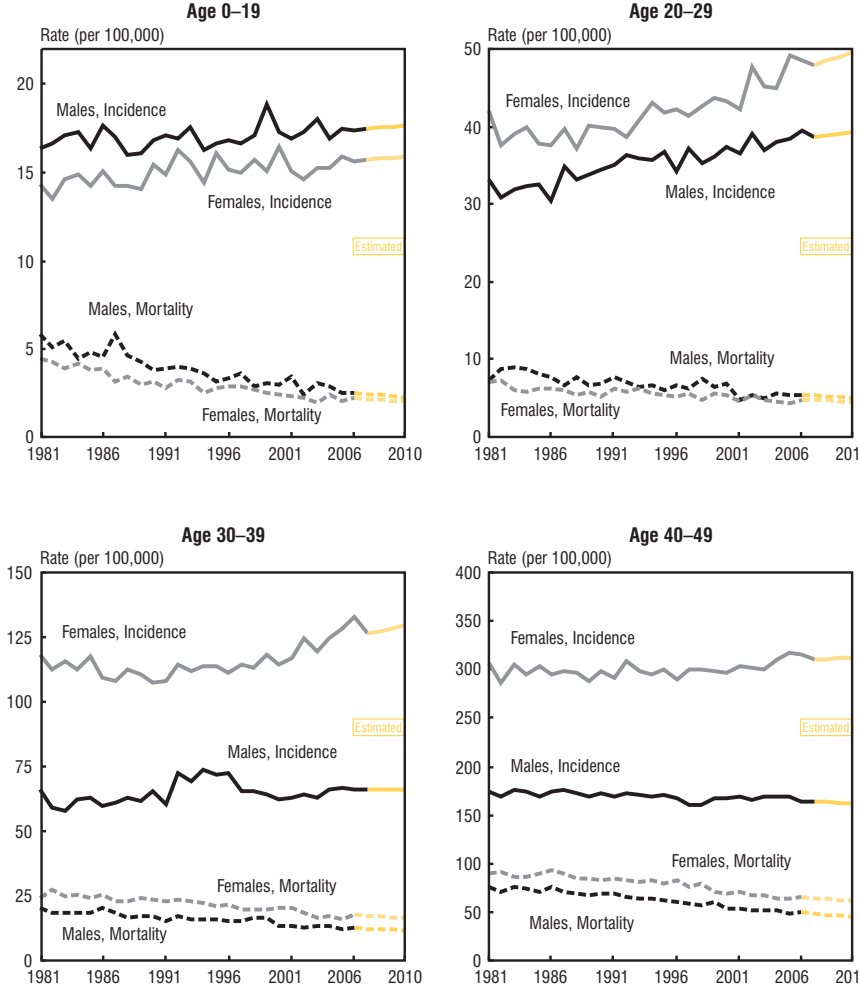
Age-Specific Incidence (2006) and Mortality Rates (2005) for All Cancers by Sex, Canada



Note: Incidence rates exclude non-melanoma skin cancer (basal and squamous).
Analysis by: Chronic Disease Surveillance 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 by Age, All Cancers, Canada, 1981–2010



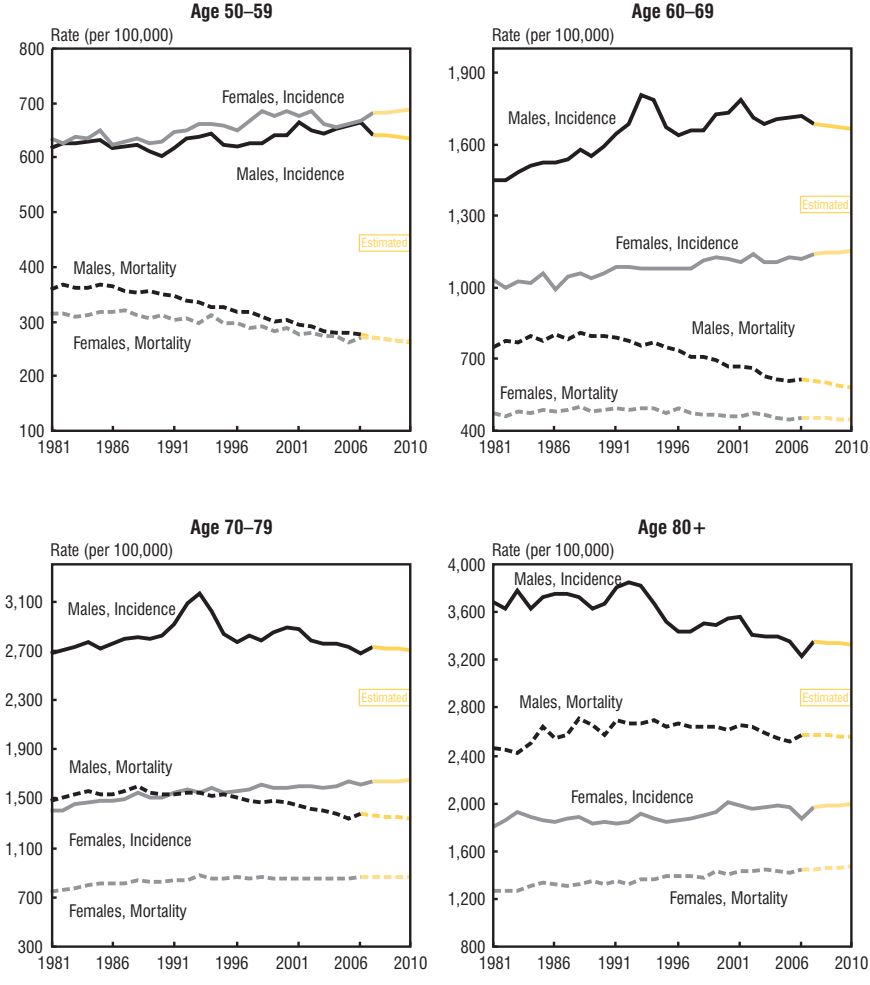
Note: The range of rate scales differ widely between the four age groups. Incidence rates exclude non-melanoma skin cancer (basal and squamous). Actual data for incidence and mortality were available to 2006 and 2005, respectively.

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

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

Figure 3.2 *(continued)*

Age-Standardized Incidence and Mortality Rates by Age, All Cancers, Canada, 1981–2010



Note: The range of rate scales differ widely between the four age groups. Incidence rates exclude non-melanoma skin cancer (basal and squamous). Actual data for incidence and mortality were available to 2006 and 2005, respectively.

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

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

4. TIME TRENDS IN INCIDENCE AND MORTALITY

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 the prevalence of risk or protective factors. They may also indicate changes in diagnostic practices (including screening) and can be directly used to predict how many new people may seek diagnosis, primary treatment and possibly further rounds of treatment in the future. Trends in mortality rates reflect changes in disease incidence, survival or both, and indicate progress in cancer control.

Trends in incidence and mortality are assessed by comparing annual age-standardized rates. Age-standardization results in more meaningful comparisons over place and time because it adjusts for variation in the age distributions of populations.

Trends for all cancers combined

Figures 4.1 and 4.2 present the numbers of new cases and deaths for Canadian males and females, together with the corresponding age-standardized rates for 1981–2006 and estimates to the year 2010. Despite the relative stability in age-standardized rates, the numbers of new cancer cases and deaths continue to rise steadily as the Canadian population grows and ages. In 2010, the number of new cases is estimated to be 173,800 and the number of deaths is estimated to be 76,200. This represents an additional 2,800 new cases and 900 deaths in 2010 over the estimates for the previous year. The new cases include an additional 800 lung, 500 colorectal and 400 breast cancer cases, but 900 fewer prostate cancer cases, than estimated for 2009.

Among males, the overall cancer incidence rate rose in the early 1990s and then declined sharply, followed by a second peak in 2001 and subsequent decline (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. In contrast, the cancer mortality rate, after reaching a peak in 1988, has been declining slowly because of decreases in mortality rates for lung, colorectal, prostate and other cancers (Figure 4.2).

Among females, the overall cancer incidence rate has been increasing slowly since the early 1990s, while the mortality rate has remained relatively stable since 1981 (Figures 4.1 and 4.2). Figures 4.3 and 4.4 show the relative contributions to the changes in the total numbers of new cases and deaths that can be attributed to changes in cancer rates, population size and aging of the population. The figures show that the major contributors to the rising numbers of new cases and deaths from cancer 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 it was in 1981, reflecting the impact of changing risk.
- The middle line represents the number of new cases (or deaths) that would have occurred if the age structure had remained the same as it was in 1981, reflecting the impact of changing 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 the aging of the population.

These figures indicate that the growth 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 commensurate annual increase in the number of new cases and deaths. It is noteworthy that changes in the risks of cancer diagnosis have contributed very little to the growth in new cases, especially in males, while changes in the risk of death have actually resulted in a reduction of deaths among males.

Figure 4.5 demonstrates the impact of changes in lung cancer mortality rates on overall cancer mortality trends. It plots the relative change in age-standardized mortality rates for 1981–2010 for all cancers combined, as well as for all cancers *excluding* lung cancer. The different pattern between males and females illustrates the different state of the lung cancer problem in the two sexes and different mortality trends for other cancers:

- In males, the mortality trend for all cancers largely reflects the trend in lung cancer mortality (the two lines are very close throughout the time period). Thus, the declining overall cancer mortality since 1988 is predominantly due to dropping lung cancer rates.
- In females, however, the lung cancer mortality rate has not yet begun to decline. Thus, the mortality rate for all cancers that has been essentially stable since 1981 conceals the almost 20% decline that has occurred for other types of cancer over the 30-year period.

Trends for selected cancers

Trends in annual rates for selected cancers over the past 30 years are presented in Figures 4.6–4.9, with the data provided in Tables 4.1–4.4. The trends are discussed further below.

The annual percent change (APC) in cancer-specific incidence rates (1997–2006) and mortality rates (1996–2005) are listed in Table 4.5. It should be noted that these short-term trends do not necessarily reflect the longer-term or earlier trends evident in Tables 4.1–4.4 and Figures 4.6–4.9. The descriptions that follow should be interpreted with this in mind.

Of the cancers listed in Table 4.5, statistically significant increases or decreases of 2% or more per year have been observed for the following:

- Increases in incidence:
  - in males, liver cancer (3.1%)
  - thyroid cancer in both males (6.8%) and females (9.5%)
- Decreases in incidence:
  - in males, stomach (–2.1%) and lung cancer (–2.1%)
  - larynx cancer in both males (–3.8%) and females (–4.3%)
- Increases in mortality:
  - in males, liver cancer (2.2%)

- Decreases in mortality:
  - in males, lung cancer (–2.2%), oral cancer (–2.4%), non-Hodgkin lymphoma (–2.6%), prostate cancer (–3.0%), stomach cancer (–3.6%) and larynx cancer (–6.5%)
  - in females, stomach cancer (–2.5%), non-Hodgkin lymphoma (–2.9%) and cervical cancer (–3.8%)

Discussion of selected cancers with significantly changing trends

Liver cancer

- In males, incidence rates increased by 3.1% per year and mortality rates increased by 2.2% per year. Both increases were statistically significant.
- In females, incidence rates also increased by 2.2% per year and mortality rates increased by 1.3% per year. Neither rate was statistically significant.
- The observed increases may be explained by rising immigration of people from world regions where risk factors for liver cancer, such as hepatitis B virus and aflatoxins, are prevalent. Increases in rates of hepatitis C infection and alcohol abuse may also contribute to liver cirrhosis, which can lead to liver cancer.

Thyroid cancer

- Incidence is increasing the most rapidly of all cancers (6.8% per year in males and 9.5% per year in females since 1998). Similar increases have been noted in Europe and parts of the United States.
- More frequent use of medical imaging (ultrasound, needle biopsy, and potentially computed tomography [CT scan] and magnetic resonance imaging) may be improving detection of earlier stage, asymptomatic cancers more frequently than was possible in the past.[4]
- Mortality rates have remained stable, most likely because modern treatment is highly effective in the management of early thyroid cancers.

Stomach cancer

- Incidence rates are declining in both sexes (–2.1% per year in males and –1.6% per year in females). This decline may be due to:
  - better diets (including lower consumption of salted, smoked or preserved foods)
  - decreases in smoking and heavy alcohol use, which can increase the impact of smoking on stomach cancer risk
  - 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 (–3.6% per year in males and –2.5% per year in females).
- Similar downward trends in incidence and mortality have been observed over a long period of time. Rates are now about half of what they were in 1981.

4. TIME TRENDS IN INCIDENCE AND MORTALITY

Lung cancer

- In males, incidence and mortality rates 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 –2.1% per year for incidence and by –2.2% per year for mortality (Table 4.5).
- In females, incidence rate has been increasing since 1980, with a significant upward trend of 1.2% per year between 1997 and 2006. However, longer-term projections suggest that this rate is beginning to level off.
- Males are projected to continue to have higher incidence and mortality rates than females in 2010 (incidence: 65.5 per 100,000 vs. 47.9 per 100,000; mortality: 57.1 per 100,000 vs. 39.4 per 100,000).
- The differences between male and female trends reflect past differences in the patterns of tobacco consumption, particularly the drop that began for males in the mid-1960s and much later—in the mid-1980s—for females.

Larynx cancer

- Incidence rates are significantly decreasing for both males (–3.8% per year) and females (–4.3% per year), while mortality rates for males only show a significant decline of –6.5% since 2001.
- Cancer of the larynx is most strongly associated with smoking and alcohol use. Incidence and mortality rates reflect the decreasing trends in these risk factors.

Non-Hodgkin lymphoma

- In both males and females, incidence rates increased approximately 50% between 1978 and the late 1990s. Since that time, rates have stabilized.
- 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 the human immunodeficiency virus (HIV). Other factors that increase risk are poorly understood, but may include occupational exposures to pesticides and organochlorines, such as phenoxy herbicides and dioxins.
- Mortality rates have shown modest declines. Since 2000, there have been statistically significant declines of –2.6% per year for males and –2.9% per year for females.
- 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 the particularly aggressive forms of non-Hodgkin lymphoma attributable to HIV infection.

Prostate cancer

- The two peaks in incidence that occurred in 1993 and 2001, each followed by a decline, are compatible with two waves of intensified screening activity with the prostate-specific antigen (PSA) test for early prostate cancer detection. The first follows the introduction of PSA as a screening test. The second may be explained

by the publicity around the federal minister of health's diagnosis with prostate cancer in early 2001 as a result of serial PSA tests. The first decline was followed by resumption of the earlier more gradual increase, whereas the second decline is too recent to know whether the increasing trend will return.

- Although the long-term and apparently ongoing increase in incidence may be due to more gradual changes in early detection, changes in the prevalence of risk or protective factors might also be partly responsible. However, little is known about what these factors are for prostate cancer.
- In contrast to incidence, mortality rates rose much more slowly from 1980, and started to decline in the mid-1990s. Mortality declined significantly by –3.0% per year between 1996 and 2005 (Table 4.5), which likely reflects improved treatment. Two large randomized trials of PSA testing and its possible relation to reducing mortality in men over age 55 produced conflicting results.[5,6] Ongoing follow-up of men in these studies may help clarify the role of PSA testing in reducing deaths from prostate cancer.

Oral cancer

- This group of cancers includes cancers of the lip, tongue, salivary gland, mouth, nasopharynx and oropharynx.
- Incidence and mortality rates have declined significantly in males only (–1.4% per year for incidence and –2.4% per year for mortality).
- Declines 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 human papillomavirus (HPV) infection, diet and sun exposure (linked to lip cancer), are unclear.

Cervical cancer

- Incidence and mortality rates have been declining (–1.8% and –3.8% per year, respectively). This is largely due to widespread regular use of Papanicolaou (Pap) test screening, which detects pre-malignant and malignant lesions early so they can be treated.
- Recent announcements by some provinces to institute vaccination of school-aged girls with the vaccine for human papillomavirus (HPV) will 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.

Discussion of trends in other notable cancers

Breast cancer

- Breast cancer incidence rates rose steadily from 1980 through the early 1990s, in part because of increased mammography screening. Reasons for the observed pattern of modest declines and increases observed since then are unclear, but likely relate to factors like 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 age-standardized mortality rate has fallen by more than 30% since peaking in 1986, to 21.4 from 32.0 per 100,000 (Table 4.4). The downward trend has decelerated to –1.8% per year since 1999. This is likely the result of a combination of the increase in mammography screening and the use of more effective adjuvant therapies following breast cancer surgery. The breast cancer death rate is the lowest it has been since 1950. Similar declines have also occurred in the United States, United Kingdom and Australia.

Colorectal cancer

- Trends for colorectal cancer incidence between 1980 and 2006 (the last year of complete data) are complex. In both sexes, incidence rose (or was relatively stable in the case of females) between 1980 and 1985, then declined to the mid-1990s (more strongly in females than in males), then rose through 2000, only to decline significantly thereafter. Colorectal cancer projections to 2010 are based on long-term data (1986–2006), which is the standard methodology for this publication, and therefore may not capture effects of short-term fluctuations. They should be used with caution.
- Mortality rates continue to decline in both sexes: by –1.2% per year in males and by –1.7% in females since 1996 (Table 4.5). This is likely the result of improvements in treatment, such as chemotherapy.
- Screening for colorectal cancer can reduce both incidence and mortality. Some screening has already been occurring in several provinces, which may partly account for the decline in mortality. Several provinces have announced that they are implementing a population-based colorectal cancer screening program, while other provinces are in the process of reviewing such a proposal.

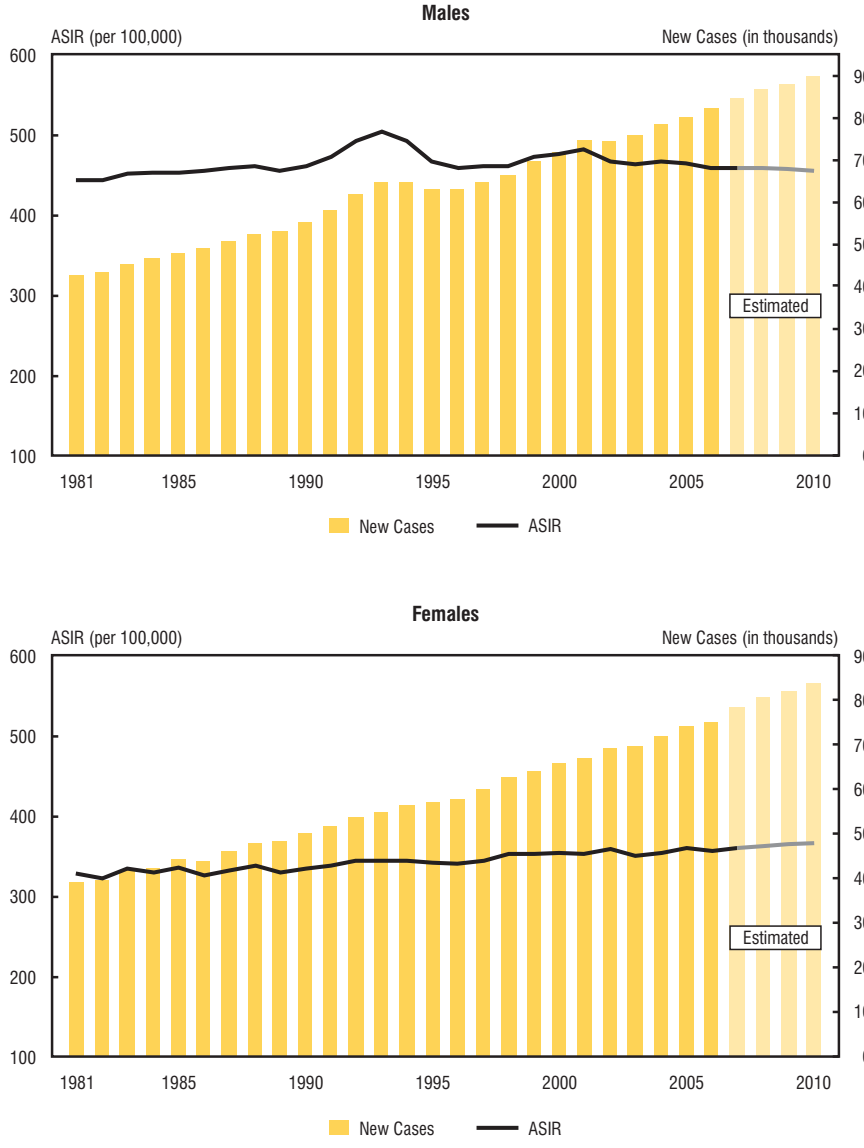
Implications

The strong declines in mortality rates suggest that there has been important progress in cancer control, specifically due to early detection and treatment. However, the increasing or stable trends in incidence rates for many cancers suggest a need for more primary prevention. Furthermore, Figures 4.1 and 4.2 highlight the fact that the rise in new cases and deaths from cancer will place an increasing burden on Canadian society, largely independent of the trend in rates of incidence and mortality. 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, early detection, treatment and health promotion.

Figure 4.1

New Cases and Age-Standardized Incidence Rates (ASIR) for All Cancers, Canada, 1981–2010



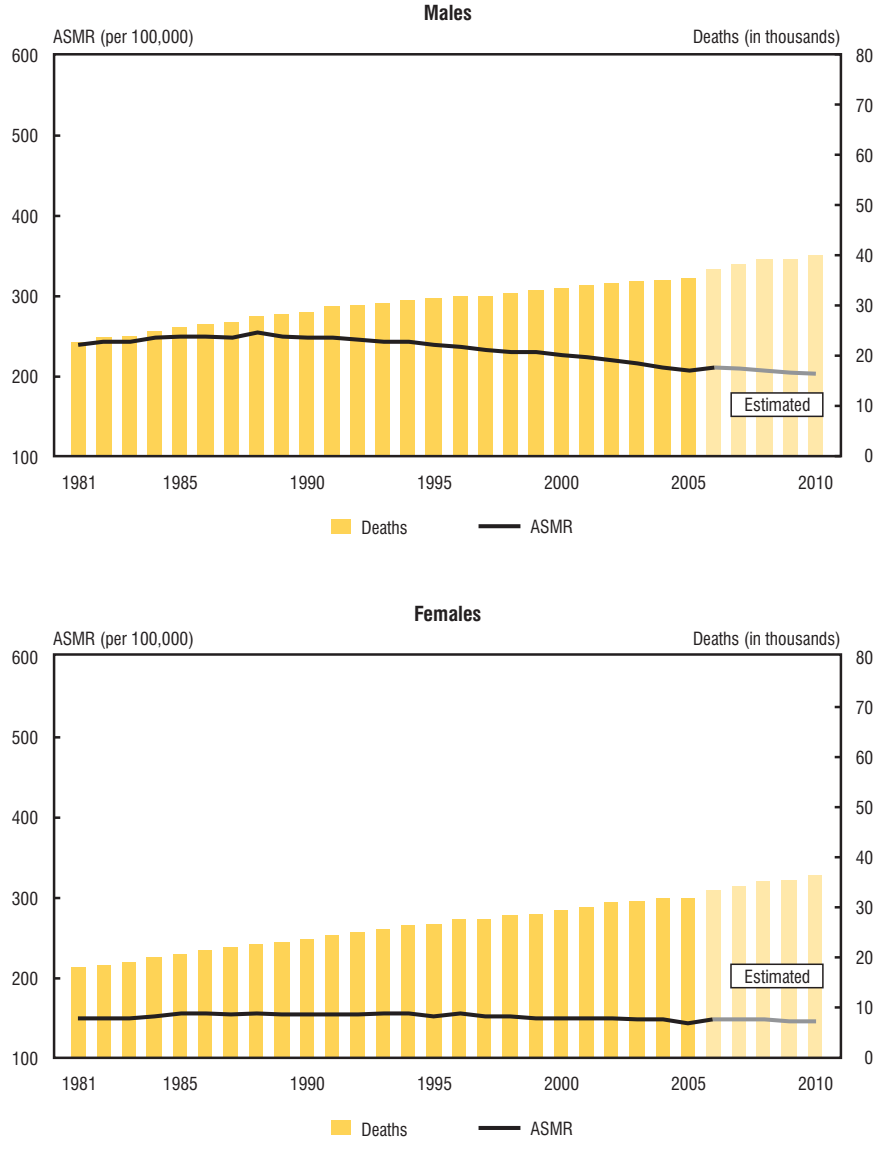
Note: All cancers exclude non-melanoma skin cancer (basal and squamous). Rates are age-standardized to the 1991 Canadian population. Actual data were available to 2006. Please refer to *Appendix II: Methods* for further details.

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

Data source: Canadian Cancer Registry database at Statistics Canada

Figure 4.2

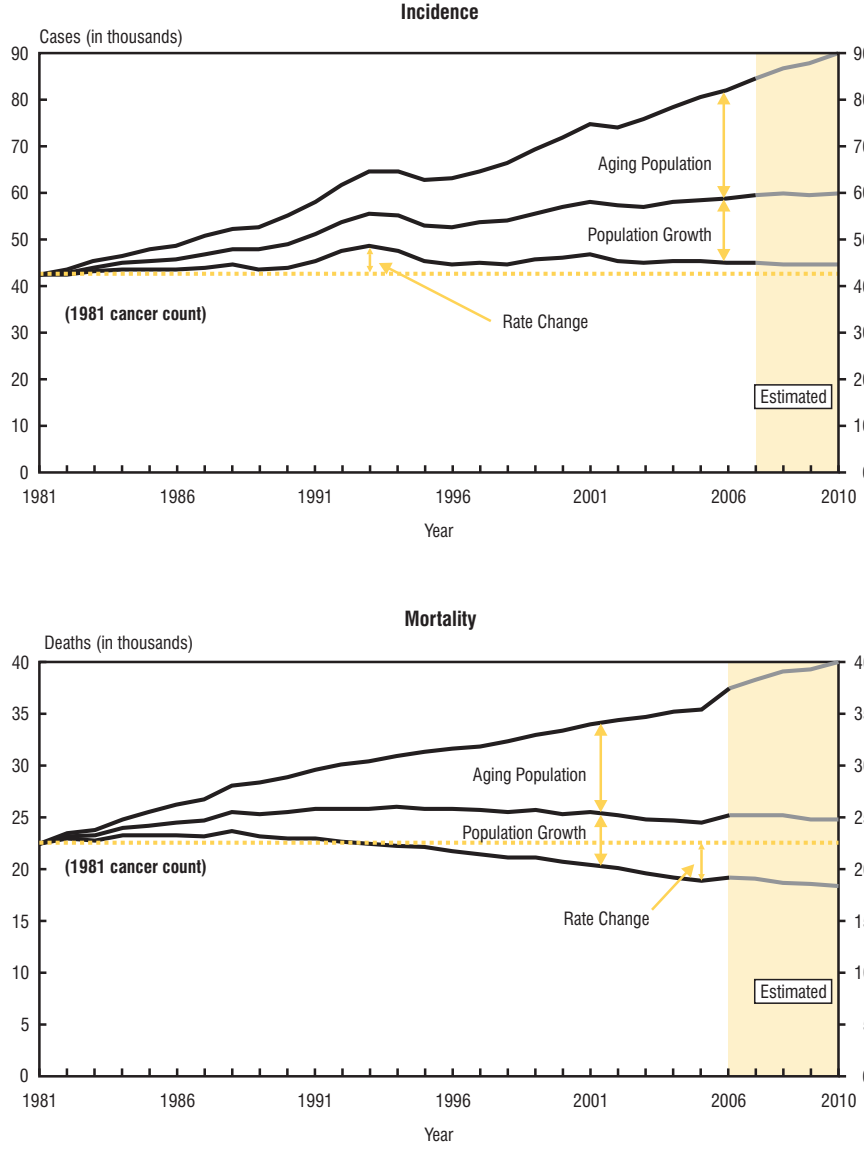
Deaths and Age-Standardized Mortality Rates (ASMR) for All Cancers, Canada, 1981–2010



Note: Rates are age-standardized to the 1991 Canadian population. Actual mortality data were available to 2005.
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada
Data source: Canadian Vital Statistics Death database at Statistics Canada

Figure 4.3

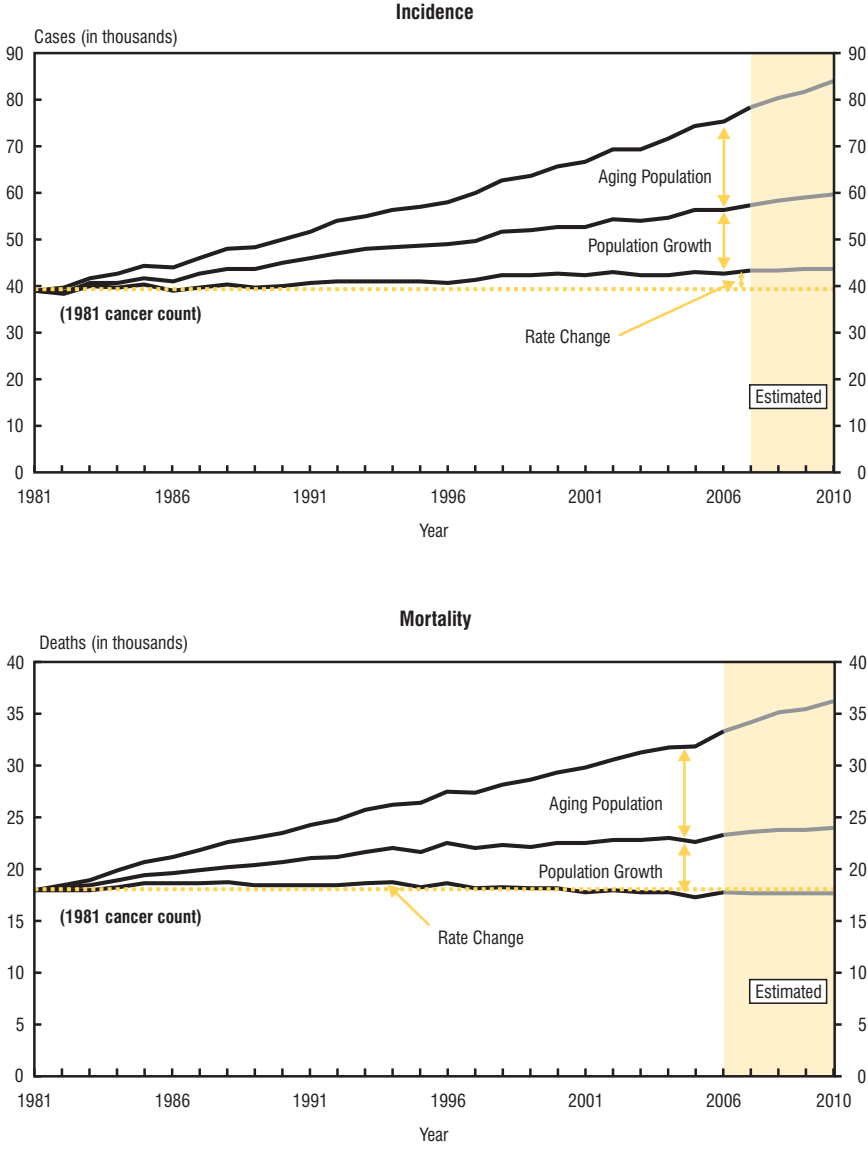
Trends in New Cases and Deaths for All Cancers and Ages, Attributed to Cancer Rate, Population Growth and Aging Population, Males, Canada, 1981–2010



Note: New cases exclude non-melanoma skin cancer (basal and squamous). Actual incidence data were available to 2006 and mortality to 2005. The range of scales differs between figures.
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada
Data source: Canadian Cancer Registry 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, 1981–2010



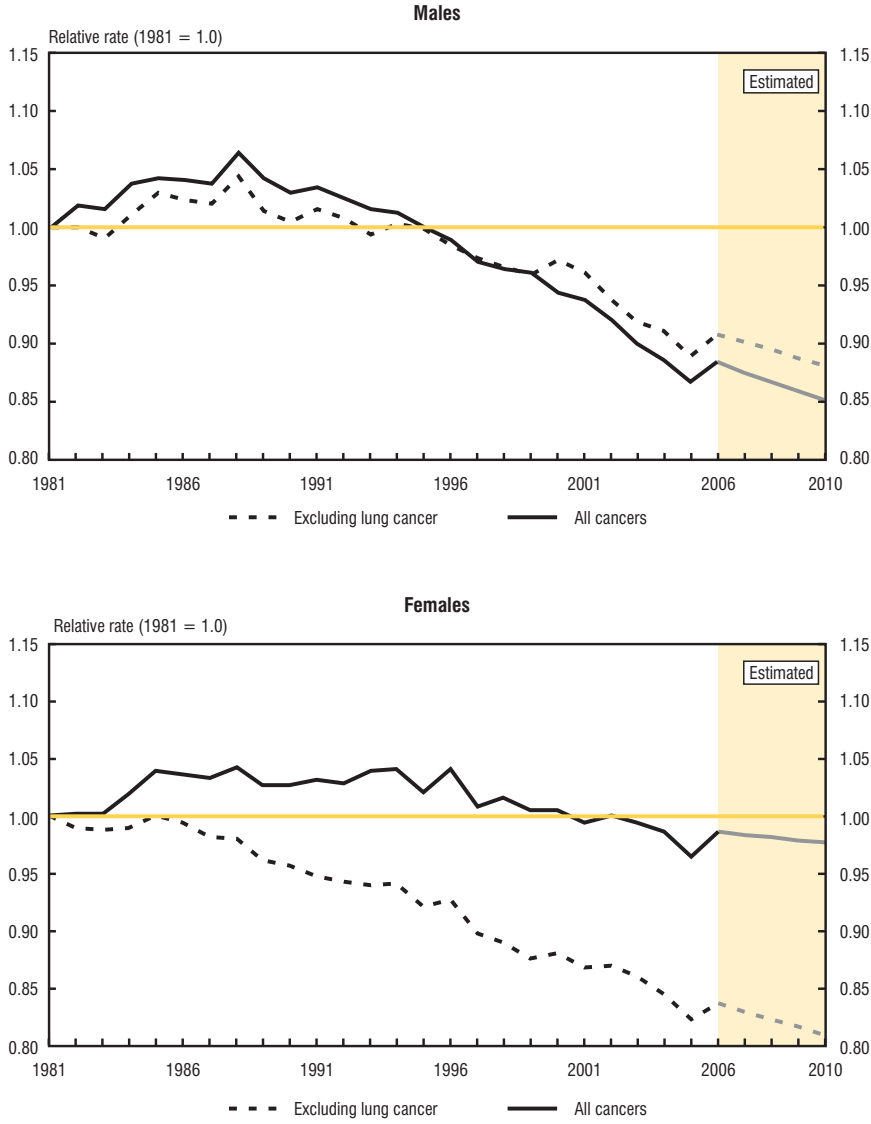
Note: New cases exclude non-melanoma skin cancer (basal and squamous). Actual incidence data were available to 2006 and mortality to 2005. The range of scales differs between figures.

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

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

Figure 4.5

Relative Change* in Age-Standardized Mortality Rates Including and Excluding Lung Cancer, Canada, 1981–2010



* Current year rate divided by 1981 rate.

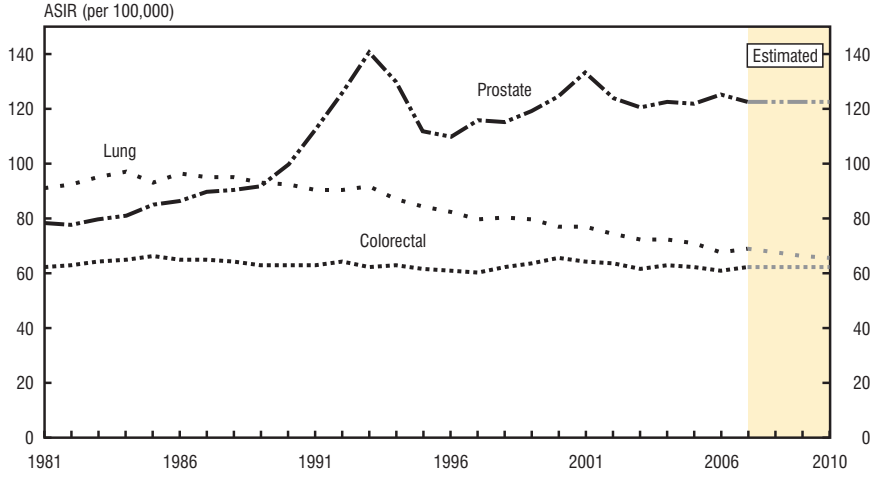
Note: Rates are age-standardized to the 1991 Canadian population. Actual data for mortality were available to 2005.

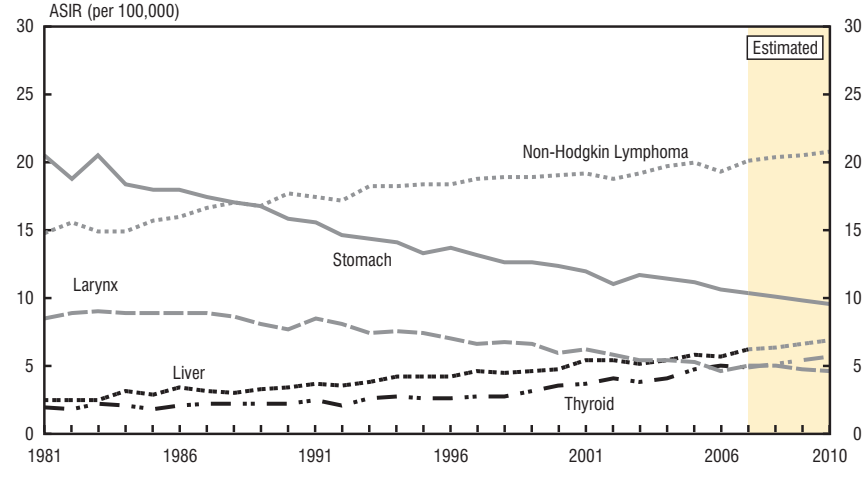
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

Data source: Canadian Vital Statistics Death database at Statistics Canada

Figure 4.6

Age-Standardized Incidence Rates (ASIR) for Selected* Cancers, Males, Canada, 1981–2010





* 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).

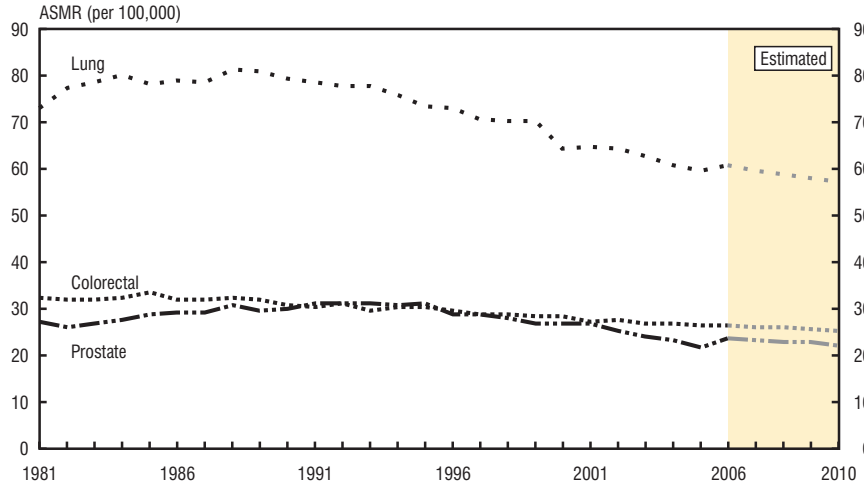
Note: Rates are age-standardized to the 1991 Canadian population. See Table 4.1 for data points. Actual data for incidence were available to 2006. The range of scales differs widely between the figures.

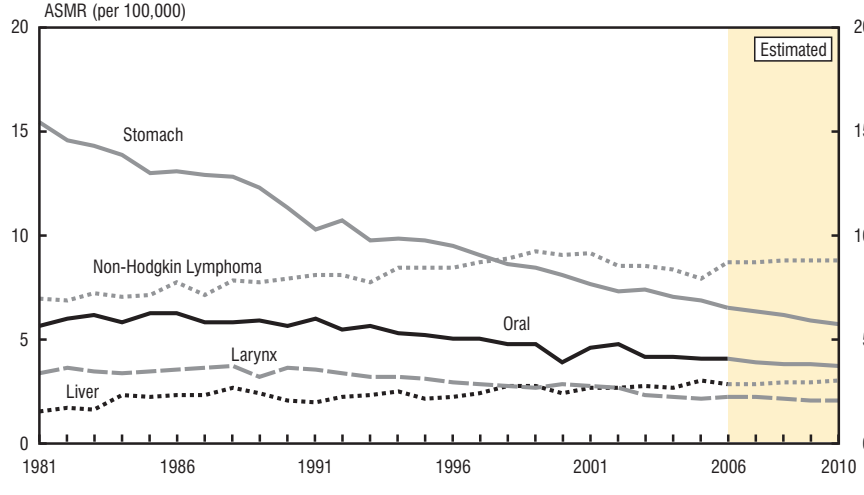
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

Data source: Canadian Cancer Registry database at Statistics Canada

Figure 4.7

Age-Standardized Mortality Rates (ASMR) for Selected* Cancers, Males, Canada, 1981–2010





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

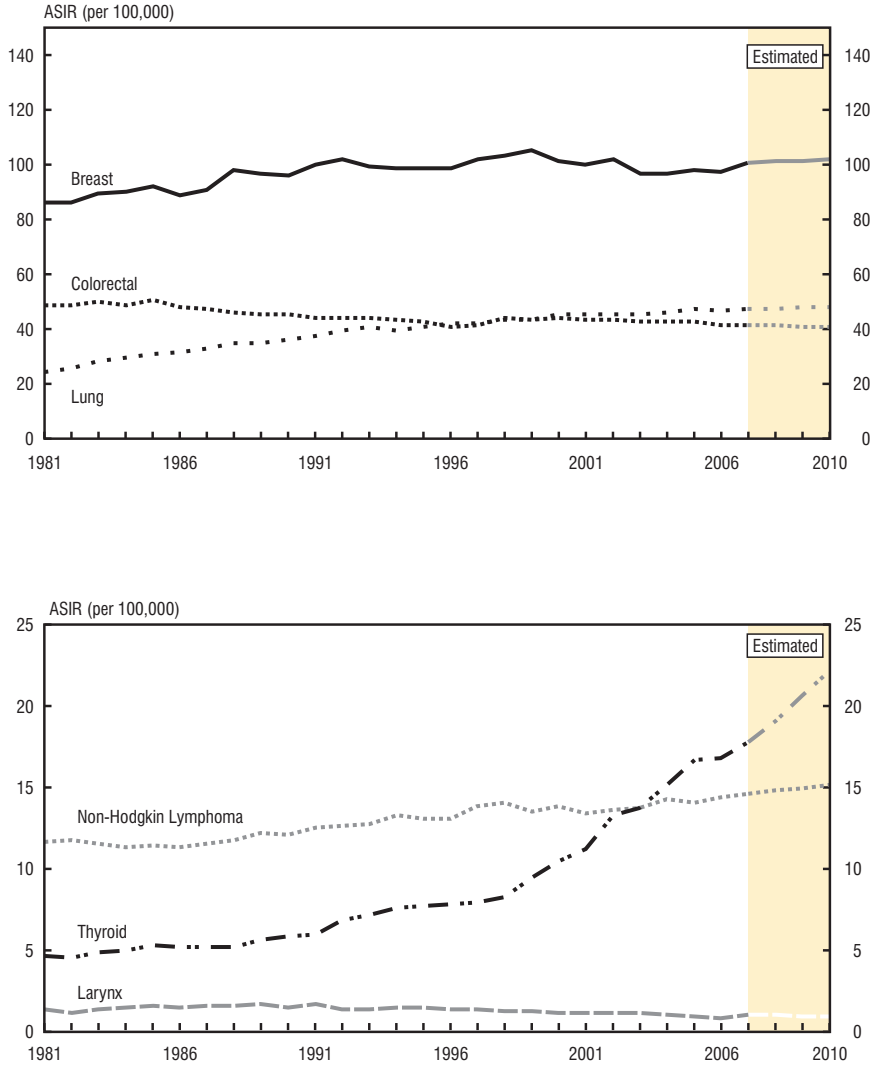
Note: Rates are age-standardized to the 1991 Canadian population. See Table 4.2 for data points. Actual data for mortality were available to 2005. The range of scales differs widely between the figures.

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

Data source: Canadian Vital Statistics Death database at Statistics Canada

Figure 4.8

Age-Standardized Incidence Rates (ASIR) for Selected* Cancers, Females, Canada, 1981–2010



* 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).

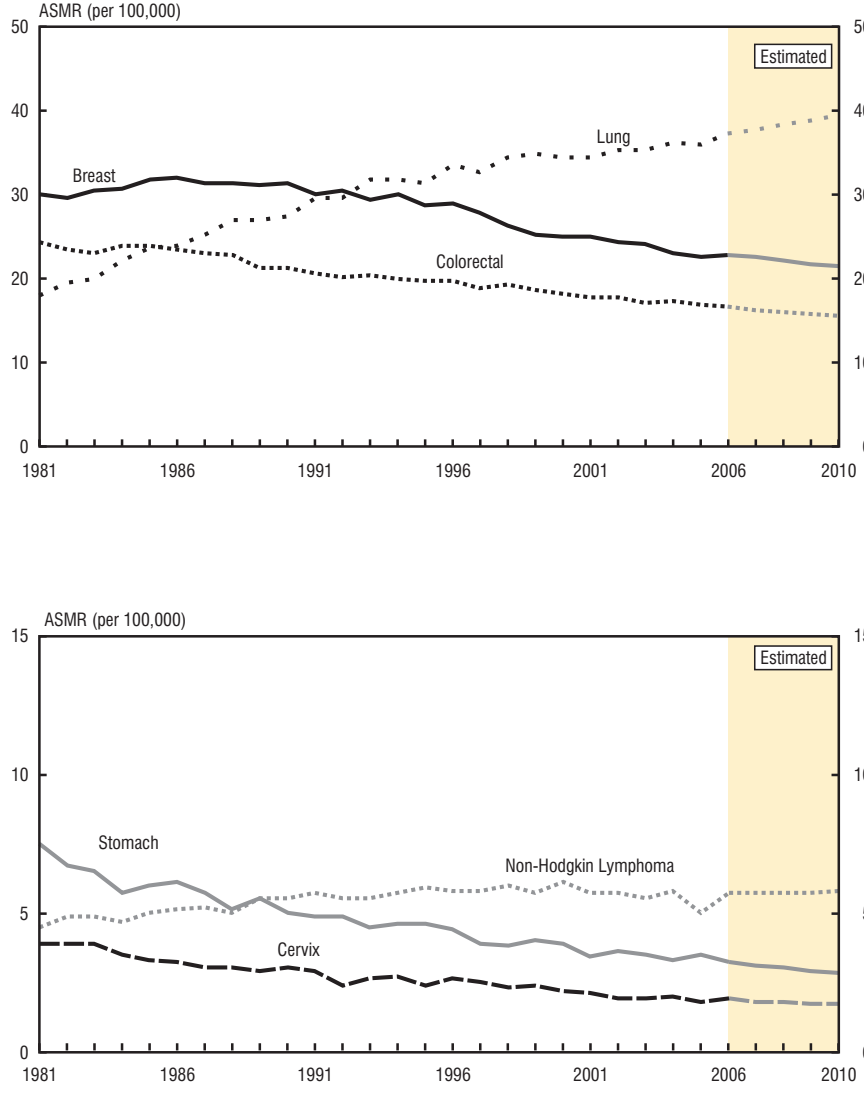
Note: Rates are age-standardized to the 1991 Canadian population. See Table 4.3 for data points. Actual data for incidence were available to 2006. The range of scales differs widely between the figures.

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

Data source: Canadian Cancer Registry database at Statistics Canada

Figure 4.9

Age-Standardized Mortality Rates (ASMR) for Selected* Cancers, Females, Canada, 1981–2010



* Five most frequent cancers (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 2005. The range of scales differs widely between the figures.

Analysis by: Chronic Disease Surveillance 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, 1981–2010†

Year	Cases per 100,000								
	All Cancers	Prostate	Lung	Colorectal	Non-Hodgkin Lymphoma	Thyroid	Stomach	Liver	Larynx
1981	443.0	78.6	90.9	62.6	14.7	1.9	20.5	2.4	8.4
1982	442.2	77.9	92.4	62.7	15.6	1.7	18.7	2.4	8.8
1983	450.6	79.7	95.0	64.0	14.9	2.1	20.5	2.4	9.0
1984	452.4	81.0	96.9	64.8	14.9	2.0	18.4	3.1	8.9
1985	452.3	85.2	93.0	66.3	15.7	1.8	18.0	2.8	8.8
1986	454.0	86.1	96.1	64.7	16.0	2.0	18.0	3.3	8.8
1987	458.5	89.5	94.8	64.7	16.6	2.2	17.4	3.1	8.8
1988	461.0	90.4	95.1	64.5	17.0	2.1	17.0	3.0	8.6
1989	453.8	91.8	93.3	63.0	16.7	2.1	16.7	3.2	8.1
1990	460.2	99.8	92.4	63.0	17.7	2.2	15.8	3.4	7.7
1991	472.4	112.5	90.5	63.0	17.4	2.4	15.6	3.6	8.4
1992	490.6	125.7	90.6	64.3	17.2	2.0	14.6	3.5	8.1
1993	503.3	140.8	91.6	62.0	18.2	2.6	14.3	3.8	7.4
1994	491.5	129.9	86.9	63.2	18.2	2.7	14.1	4.2	7.5
1995	467.1	111.9	84.7	61.6	18.3	2.6	13.3	4.2	7.4
1996	458.2	110.1	82.2	60.7	18.3	2.6	13.6	4.2	6.9
1997	461.1	115.6	79.4	60.3	18.8	2.7	13.1	4.5	6.6
1998	460.6	115.0	80.5	62.5	18.9	2.7	12.6	4.4	6.7
1999	471.7	119.5	79.5	63.5	18.9	3.1	12.6	4.6	6.6
2000	476.3	124.8	77.1	65.6	19.0	3.5	12.3	4.7	5.9
2001	482.1	133.2	77.0	64.4	19.1	3.6	11.9	5.3	6.1
2002	466.4	123.7	74.4	63.8	18.8	4.0	11.0	5.3	5.8
2003	461.9	120.3	72.4	61.5	19.1	3.7	11.7	5.1	5.4
2004	465.6	122.5	72.1	63.0	19.7	4.0	11.4	5.4	5.3
2005	463.8	121.6	70.9	62.4	20.0	4.7	11.1	5.8	5.2
2006	459.3	125.2	67.6	61.1	19.3	5.0	10.6	5.6	4.6
2007‡	459.3	122.6	68.7	62.3	20.1	4.8	10.3	6.1	5.0
2008‡	457.9	122.6	67.7	62.3	20.3	5.1	10.0	6.3	4.9
2009‡	456.2	122.5	66.5	62.2	20.5	5.3	9.8	6.6	4.7
2010‡	454.9	122.6	65.5	62.2	20.7	5.6	9.5	6.8	4.6

* 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).

† Actual data were available to 2006.

‡ Estimated rates for all provinces/territories. These estimates are based on long-term trends and may not reflect recent changes.

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

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

Data source: Canadian Cancer Registry database at Statistics Canada

Table 4.2

Age-Standardized Mortality Rates for Selected* Cancers, Males, Canada, 1981–2010†

Year	Deaths per 100,000								
	All Cancers	Prostate	Lung	Colorectal	Non-Hodgkin Lymphoma	Oral	Stomach	Liver	Larynx
1981	239.3	27.2	73.1	32.2	6.9	5.6	15.4	1.5	3.3
1982	243.6	26.0	77.4	31.9	6.8	6.0	14.6	1.7	3.6
1983	243.1	26.7	78.4	31.8	7.2	6.1	14.3	1.6	3.4
1984	248.1	27.5	80.2	32.5	7.0	5.8	13.9	2.3	3.3
1985	249.2	28.9	78.0	33.4	7.1	6.2	13.0	2.2	3.4
1986	249.1	29.4	78.8	32.0	7.7	6.2	13.1	2.3	3.5
1987	248.1	29.4	78.5	32.0	7.1	5.8	12.9	2.3	3.6
1988	254.7	30.7	81.2	32.4	7.8	5.8	12.8	2.6	3.7
1989	249.5	29.7	81.0	31.9	7.7	5.9	12.3	2.4	3.2
1990	246.4	30.1	79.4	30.9	7.9	5.6	11.3	2.0	3.6
1991	247.5	31.2	78.7	30.4	8.1	6.0	10.3	1.9	3.5
1992	245.2	31.1	77.6	31.2	8.1	5.4	10.7	2.2	3.3
1993	243.2	31.1	77.9	29.7	7.7	5.6	9.7	2.3	3.2
1994	242.3	30.8	75.6	30.3	8.4	5.3	9.8	2.5	3.2
1995	239.3	31.1	73.3	30.2	8.4	5.2	9.7	2.1	3.1
1996	236.6	29.0	72.9	29.5	8.4	5.0	9.5	2.2	2.9
1997	232.3	28.8	70.5	29.0	8.7	5.0	9.0	2.4	2.8
1998	230.8	28.1	70.2	29.0	8.9	4.7	8.6	2.7	2.7
1999	229.8	27.0	70.4	28.6	9.2	4.7	8.4	2.7	2.6
2000	225.8	26.9	64.4	28.5	9.0	3.9	8.1	2.4	2.8
2001	224.3	26.8	64.7	27.2	9.1	4.6	7.6	2.6	2.7
2002	220.3	25.1	64.5	27.8	8.5	4.7	7.3	2.6	2.6
2003	215.4	24.0	62.7	26.8	8.5	4.1	7.4	2.7	2.3
2004	212.1	23.4	60.6	26.8	8.3	4.1	7.0	2.6	2.2
2005	207.7	21.9	59.8	26.5	7.9	4.0	6.8	3.0	2.1
2006‡	211.6	23.8	60.6	26.4	8.7	4.0	6.5	2.8	2.2
2007‡	209.5	23.4	59.7	26.2	8.7	3.9	6.3	2.8	2.2
2008‡	207.6	23.0	58.9	25.9	8.8	3.8	6.1	2.9	2.1
2009‡	205.5	22.7	57.9	25.6	8.8	3.8	5.9	2.9	2.0
2010‡	203.6	22.3	57.1	25.4	8.8	3.7	5.7	3.0	2.0

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

† Actual data were available to 2005.

‡ Estimated rates for all provinces/territories. These estimates are based on long-term trends and may not reflect recent changes.

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

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

Data source: Canadian Vital Statistics Death database at Statistics Canada

Table 4.3

Age-Standardized Incidence Rates for Selected* Cancers, Females, Canada, 1981–2010†

Year	Cases per 100,000						
	All Cancers	Lung	Breast	Colorectal	Non-Hodgkin Lymphoma	Thyroid	Larynx
1981	328.3	24.2	86.5	48.6	11.6	4.6	1.3
1982	321.3	25.8	86.0	48.9	11.7	4.5	1.1
1983	333.1	28.2	89.3	50.2	11.5	4.8	1.3
1984	329.9	29.5	90.3	48.9	11.3	4.9	1.4
1985	336.1	30.8	92.2	50.6	11.4	5.3	1.5
1986	325.5	31.5	88.6	48.2	11.3	5.2	1.4
1987	331.6	33.2	91.1	47.6	11.5	5.2	1.5
1988	336.8	34.6	97.8	46.1	11.7	5.1	1.5
1989	330.6	34.9	96.4	45.3	12.2	5.6	1.6
1990	333.6	36.3	96.0	45.6	12.1	5.8	1.4
1991	338.1	37.6	100.2	44.2	12.5	5.9	1.6
1992	343.8	39.7	101.9	44.3	12.6	6.8	1.3
1993	343.3	40.6	99.1	44.3	12.7	7.1	1.3
1994	343.8	39.8	98.9	43.7	13.3	7.6	1.4
1995	342.0	40.8	98.8	42.6	13.1	7.7	1.4
1996	339.9	42.0	98.6	41.1	13.1	7.8	1.3
1997	344.2	42.0	102.2	41.7	13.8	7.9	1.3
1998	351.7	43.7	103.2	43.9	14.0	8.2	1.2
1999	352.4	43.5	105.1	43.3	13.5	9.4	1.2
2000	354.4	45.1	101.5	44.4	13.8	10.4	1.1
2001	352.2	45.1	100.2	43.6	13.4	11.2	1.1
2002	358.1	45.7	102.0	43.4	13.6	13.3	1.1
2003	350.7	45.6	96.5	42.6	13.7	13.7	1.1
2004	353.4	46.3	96.9	42.9	14.3	15.1	1.0
2005	359.6	47.5	98.0	42.9	14.0	16.7	0.9
2006	356.6	47.0	97.2	41.3	14.4	16.8	0.8
2007‡	361.0	47.2	100.9	41.5	14.6	17.8	1.0
2008‡	362.6	47.4	101.2	41.3	14.8	19.1	1.0
2009‡	364.2	47.7	101.4	41.1	14.9	20.6	0.9
2010‡	365.8	47.9	101.7	40.9	15.1	22.1	0.9

* 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).

† Actual data are available to 2006.

‡ Estimated rates for all provinces/territories. These estimates are based on long-term trends and may not reflect recent changes.

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

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

Data source: Canadian Cancer Registry database at Statistics Canada

Table 4.4

Age-Standardized Mortality Rates for Selected* Cancers, Females, Canada, 1981–2010†

Year	Deaths per 100,000						
	All Cancers	Lung	Breast	Colorectal	Non-Hodgkin Lymphoma	Stomach	Cervix
1981	149.0	17.9	30.1	24.4	4.5	7.5	3.9
1982	149.3	19.5	29.7	23.5	4.9	6.7	3.9
1983	149.4	19.9	30.4	23.1	4.9	6.5	3.9
1984	151.9	22.1	30.7	23.8	4.7	5.7	3.5
1985	154.8	23.7	31.8	23.8	5.0	6.0	3.3
1986	154.4	23.9	32.0	23.5	5.1	6.1	3.2
1987	154.1	25.3	31.3	23.0	5.2	5.7	3.0
1988	155.4	26.9	31.4	22.7	5.0	5.1	3.0
1989	153.0	26.9	31.2	21.3	5.5	5.5	2.9
1990	152.9	27.5	31.3	21.3	5.5	5.0	3.0
1991	153.7	29.5	30.1	20.7	5.7	4.9	2.9
1992	153.2	29.6	30.4	20.2	5.5	4.9	2.4
1993	154.9	31.7	29.4	20.3	5.5	4.5	2.6
1994	155.2	31.9	30.0	19.9	5.7	4.6	2.7
1995	152.1	31.3	28.7	19.8	5.9	4.6	2.4
1996	155.2	33.6	28.9	19.7	5.8	4.4	2.6
1997	150.4	32.6	27.8	18.8	5.8	3.9	2.5
1998	151.3	34.5	26.4	19.3	6.0	3.8	2.3
1999	149.8	34.9	25.2	18.6	5.7	4.0	2.4
2000	149.8	34.4	25.1	18.2	6.1	3.9	2.2
2001	148.2	34.4	25.0	17.8	5.7	3.4	2.1
2002	149.2	35.2	24.4	17.7	5.7	3.6	1.9
2003	148.1	35.3	24.1	17.1	5.5	3.5	1.9
2004	147.0	36.1	23.1	17.3	5.8	3.3	2.0
2005	143.7	35.9	22.6	16.9	5.0	3.5	1.8
2006‡	147.0	37.3	22.9	16.6	5.7	3.2	1.9
2007‡	146.6	37.8	22.5	16.3	5.7	3.1	1.8
2008‡	146.3	38.3	22.1	16.1	5.7	3.0	1.8
2009‡	145.9	38.9	21.8	15.8	5.7	2.9	1.7
2010‡	145.6	39.4	21.4	15.6	5.8	2.8	1.7

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

† Actual data were available to 2005.

‡ Estimated rates for all provinces/territories. These estimates are based on long-term trends and may not reflect recent changes.

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

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

Data source: Canadian Vital Statistics Death database at Statistics Canada

Table 4.5

Annual Percent Change (APC) in Age-Standardized Incidence and Mortality Rates for Selected Cancers, Canada

	Incidence 1997–2006				Mortality 1996–2005			
	Males		Females		Males		Females	
	APC	Change-point†	APC	Change-point†	APC	Change-point†	APC	Change-point†
All Cancers	-0.1		0.3*		-1.9**	2001	-0.6**	
Prostate	0.6		—		-3.0**		—	
Lung	-2.1**	1999	1.2**		-2.2**		0.9**	
Breast	—		-0.9*	1999	—		-1.8**	1999
Colorectal	-1.0**	2000	-1.0*	2000	-1.2**		-1.7**	
Non-Hodgkin Lymphoma	0.5*		1.4*	2001	-2.6*	2000	-2.9*	2000
Bladder	-0.7*		-0.3		-0.8*		0.3	
Melanoma	1.5**		1.2**		0.2		-0.5*	
Thyroid	6.8**		9.5**	1998	—		—	
Leukemia	0.5		0.8**		-0.9*		-1.4**	
Kidney	1.0**		1.4**		-0.4		-0.6	
Body of Uterus	—		0.4*		—		-0.6	
Pancreas	-0.4		0.1		-0.6		-0.2	
Oral	-1.4**		-0.1		-2.4**		-0.4	
Stomach	-2.1**		-1.6**		-3.6**		-2.5**	
Brain	-0.7*		-1.1*		-1.3**		-1.4**	
Ovary	—		0.0		—		-0.5	
Multiple Myeloma	0.3		-0.3		-1.1*		-0.3	
Liver	3.1**		2.3		2.2*		1.3	
Esophagus	0.2		-0.9		0.0		-1.2*	
Cervix	—		-1.8**		—		-3.8**	
Larynx	-3.8**		-4.3**		-6.5**	2001	-0.7	
Hodgkin Lymphoma	0.2		0.4		—		—	
Testis	1.5**		—		—		—	

— Not applicable or small number of deaths

* Significant, $p<0.05$

** Significant, $p<0.01$

† Changepoint indicates the baseline year, if the slope of the trend changed after 1997 for incidence or 1996 for mortality. Changepoints were fit to rates from 1986 to 2006 for incidence and 1986 to 2005 for mortality.

Note: Annual Percent Change 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). See *Appendix II: Methods* for further details.

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

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

Overview

Esophageal cancer, summary statistics

Incidence (2002–2006)	Males	Females
Number of cases:	5,231	1,903
Rate (per 100,000):	6.1	1.7
% of all cancers:	1.4	0.5
Mortality (2001–2005)		
Number of deaths:	5,419	1,834
Rate (per 100,000):	6.6	1.7
% of all cancer deaths:	3.1	1.2

In Canada, esophageal cancer will be responsible for an estimated 1,700 new cancer cases and 1,800 deaths in 2010. It is the 15th most common cancer in males and the 19th most common in females (Table 1.1). Esophageal cancer is the seventh leading cause of cancer deaths nationally for men and the 14th for women (Table 1.2). The vast majority of esophageal cancers develop in epithelial tissue as adenocarcinomas or squamous cell carcinomas. Esophageal adenocarcinoma is more common (70%) in the lower third of the esophagus, while squamous cell carcinoma is more common (50%) in the middle and upper thirds. Overall, most esophageal cancers occur in the lower third (Figure 5.1 and Table 5.1).

Table 5.1 shows that the overall annual incidence rate for esophageal cancer is more than three times greater for males than females (6.1 vs. 1.7 per 100,000, respectively). Among males, esophageal adenocarcinoma is roughly twice as common as squamous cell carcinoma. In females, the reverse is true. As with most epithelial cancers, incidence rates for esophageal cancer increase steeply with age: more than 90% occur among people 50 years of age and older.

Across the Canadian provinces, the average annual incidence rates of esophageal cancer ranged from 3.0 per 100,000 to 4.7 per 100,000 (Figure 5.2). These differences are likely related to the combined effects of variation in risk factor prevalence and cancer registry practices. The highest incidence rate occurred in Nova Scotia, while the lowest rate occurred in Newfoundland and Labrador. It is noteworthy that the incidence of esophageal cancer in British Columbia was greater than the national average, given that this province typically has lower than average rates for most cancers.

Trends in incidence and mortality

The overall annual incidence rate of esophageal cancer in Canada has changed little since the mid-1980s. Figure 5.3 shows that the average incidence rate has increased by 0.3% per year* for males and decreased by 0.5% per year for females. This figure also shows that the annual mortality rates for this cancer have increased slightly among males (0.7% per year), reaching 6.6 per 100,000 by 2005. The annual mortality rates have been stable among females (1.8 per 100,000) throughout 1986–2005.

* Statistically significant time trends are reported in terms of annual percent change, calculated using a log-linear model; unless otherwise noted, time trends refer to the period 1986–2006 (incidence) and 1986–2005 (mortality).

By age

- The overall incidence of esophageal cancer has been stable in males and females for all age groups. The only exception was a decrease (1.3% per year) among females aged 55–64 years.
- Among males, rates of mortality from esophageal cancer have increased for most age groups, with the steepest increases (3.0% per year) among those aged 15–44 years. Among females, mortality has been generally stable, except for a decrease of 1.6% per year among those aged 55–64 years.

By topography and morphology

- Cancers in the lower third of the esophagus have increased (2.5% per year), and now account for roughly 70% of all new cases in a specified location (Figure 5.4a). In contrast, cancer incidence has declined in other regions of the esophagus. In the upper third of the esophagus, incidence has declined by 1.7% per year. In the middle third, it has decreased by 2.1% per year (1992–2006 only). The incidence in other specified and unspecified locations[†] combined has also declined by 1.6% per year.
- Figure 5.4b shows that adenocarcinoma incidence rates increased by an average of 3.9% per year in males and 3.6% per year in females throughout 1986–2006. Incidence rates for squamous cell carcinomas have declined since the early 1990s by 3.3% per year in males (1992–2006) and 3.2% per year in females (1994–2006). These trends were generally consistent across regions of the esophagus, including other specified and unspecified locations, and across age groups.
- Figure 5.4c shows that the most substantial increases in esophageal adenocarcinoma occurred in the lower third of the esophagus (4.9% per year, both sexes combined), although increases occurred elsewhere in the esophagus as well (2.1% per year, other specified and unspecified locations combined). While the rate of increase in lower esophageal adenocarcinoma has been greatest among those under 50 years of age (6.1% per year), the actual number of cases in this age group remains very low (<30 per year, on average).

Five-year relative survival

- Survival from cancer of the esophagus is generally poor. Individuals diagnosed with this cancer in 2003–2005 have a predicted five-year survival that is 14% of that for similar people (e.g., age, sex and province) in the general population (Table 5.2). Five-year relative survival does not differ by sex.
  - Survival from cancers of the upper esophagus (16%) was slightly greater than that for cancers of the lower esophagus (13%). However, it is difficult to precisely estimate survival from cancers of the upper esophagus, due to the relatively small number of cases.
  - The five-year relative survival rate was slightly better for people diagnosed with squamous cell carcinoma (16%) than those with adenocarcinoma (13%). The location of the adenocarcinomas, whether in the lower third of the esophagus or

[†] "Other specified locations" refers to cancers coded as cervical, thoracic or abdominal (ICD-O-3, C15.0–C15.2), or overlapping across subsites (C15.8). "Unspecified locations" refers to cancers coded as "Not Otherwise Specified" (NOS, C15.9).

elsewhere in this organ, did not meaningfully affect the five-year relative survival rate.

- Survival was highest for people diagnosed in the 15–44 year age group (23%) and lowest for those diagnosed at 75–99 years of age (10%).
- The age-standardized five-year relative survival ratio increased by 3.3%, to 13.8% for 2003–2005 from 10.5% for 1992–1994.

Discussion of trends and risk factors

Although cancers of the esophagus are still relatively rare in Canada, the incidence rate for esophageal adenocarcinoma has doubled in the last two decades. Similar increases have been observed in England,[7] New Zealand,[8] Australia,[9] and parts of Europe.[10–13] In the United States, the incidence of esophageal adenocarcinoma has risen six-fold since the 1970s, faster than any other cancer type.[14,15] It appears that such increases are authentic, and not due to changes in cancer screening or classification.[16]

Chronic gastroesophageal reflux disease (GERD), and the associated development of abnormal tissue in the lower esophagus (Barrett's esophagus), is the strongest known risk factor for esophageal adenocarcinomas.[14,17,18] The observed increases in lower esophageal adenocarcinoma may therefore reflect changes in the prevalence of GERD and Barrett's esophagus in Canada. However, it is likely that a combination of factors, rather than a single risk factor, is responsible for the dramatic rise in esophageal adenocarcinomas.[16] Obesity, for example, also increases the risk of esophageal adenocarcinomas.[19,20] The incidence of esophageal adenocarcinoma and the prevalence of obesity appear to be rising in parallel in the Canadian population.[21,22]

It is possible that increases in the incidence of lower esophageal adenocarcinoma could be due in part to increases in adenocarcinomas in the nearby gastroesophageal junction and upper stomach (cardia), if tumours were not classified consistently with respect to location. However, this seems unlikely given that adenocarcinoma in the combined gastroesophageal junction–gastric cardia (current coding practices do not separate these regions) did not increase among males during 1986–2006, and increased only weakly among females (data not shown).

The incidence rate of esophageal squamous cell carcinoma is declining in Canada, which is consistent with trends in the United States.[15,16] In contrast, rates of esophageal squamous cell carcinoma have been relatively stable across much of Europe,[12] and in England and Wales,[7] since the 1970s. Esophageal squamous cell carcinoma is most strongly associated with cigarette smoking and alcohol consumption.[23] Reduced rates of cigarette smoking in Canada[24] may help to explain the declining incidence of esophageal squamous cell carcinoma.

Mortality from esophageal cancer has increased among males, but remained generally stable among females. Five-year survival from esophageal cancer remains low (14%), probably because this cancer tends to be diagnosed at a late stage (see *Staging* below) when treatment is not very effective.[25] In Canada, five-year survival from esophageal cancer appears to be slightly higher than in Europe[26] and slightly lower than in the United States.[27]

5. CANCER IN DEPTH: CANCER OF THE ESOPHAGUS

Staging

Treatment of esophageal cancer depends on tumour stage. Diagnosis is usually by endoscopy, which enables doctors to identify the tumour and its site, and a subsequent biopsy. Occasionally, a barium swallow x-ray is performed first. After biopsy, doctors may perform further investigations, including high-tech imaging (CT or PET scans) of the esophagus.

In Canada, Manitoba's provincial cancer registry is now collecting staging information for esophageal cancer. The Manitoba data show that, for cases of a known stage, half the cases of esophageal cancer were stage IV at diagnosis, while the remaining cases were roughly equally distributed among stages I, II and III (Table 5.3). This pattern was consistent for esophageal adenocarcinomas and squamous cell carcinomas. The survival rate of people diagnosed with stage IV is low, whereas those diagnosed with stages I–III have a good to moderate prognosis.[25]

Treatment

The standard treatment for early esophageal cancer is surgery. However, people with esophageal carcinoma in situ and very early invasive cancer can sometimes be treated with local therapies using an endoscope. More advanced tumours can be treated by surgery or combined chemotherapy and radiation therapy. Cancer specialists are recommending triple modality therapy (usually chemoradiation followed by surgery) more frequently.[28] Unfortunately, many people are diagnosed with cancer that has metastasized and cannot be completely removed. For these people, treatment may include a stent to relieve obstruction, radiotherapy or chemotherapy, or a combination of these treatments.

Esophageal adenocarcinomas are becoming increasingly common in Canada and the prognosis for affected individuals is poor. Prevention programs aimed at the dominant risk factors (gastroesophageal reflux disease and obesity), and better screening techniques for early detection, could substantially improve the control of esophageal cancer in Canada.

Table 5.1

New Cases and Age-Standardized Incidence Rates (ASIR) for Esophageal Cancer by Topography, Morphology, Sex and Age, Canada, 2002–2006

	New Cases			Cases per 100,000		
	Total	Males	Females	Total	Males	Females
All Esophageal Cancers	**7,134**	**5,231**	**1,903**	**3.7**	**6.1**	**1.7**
Topography						
Upper Esophagus	448	282	166	0.2	0.3	0.2
Middle Esophagus	1,183	732	451	0.6	0.9	0.4
Lower Esophagus	3,536	2,825	711	1.9	3.3	0.7
Not Specified as Upper, Middle or Lower*	1,967	1,392	575	1.0	1.6	0.5
Morphology						
Squamous Cell Carcinoma	2,603	1,589	1,014	1.4	1.9	0.9
Adenocarcinoma	3,470	2,935	535	1.8	3.4	0.5
Lower Esophageal Adenocarcinoma	2,473	2,120	353	1.3	2.4	0.3
All Other Adenocarcinoma	997	815	182	0.5	0.9	0.2
Other Specified and Unspecified Types	1,061	707	354	0.5	0.8	0.3
Age†						
15–44	186	150	36	0.2	0.4	0.1
45–54	757	625	132	3.1	5.1	1.1
55–64	1,627	1,327	300	9.8	16.3	3.6
65–74	2,066	1,581	485	18.4	29.8	8.2
75+	2,498	1,548	950	25.8	41.6	15.4

* Includes cancers classified as cervical (134 cases), thoracic (94 cases), abdominal (18 cases), overlapping across subsites (234 cases) or unspecified with respect to location (1,487 cases).

† No new cases observed among individuals <15 years of age.

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

Data source: Canadian Cancer Registry database at Statistics Canada

Table 5.2

Estimated Five-Year Relative Survival Ratio (RSR) and 95% Confidence Interval (CI) for Esophageal Cancer by Sex, Age, Topography and Morphology, Canada (excluding Quebec*), 2003–2005

		95% CI	
	RSR (%)	Low (%)	High (%)
All Esophageal Cancers	**14**	**13**	**15**
Sex			
Males	14	12	15
Females	14	12	17
Topography			
Upper Esophagus	16	11	22
Middle Esophagus	15	12	19
Lower Esophagus	13	11	15
Not Specified as Upper, Middle or Lower†	14	12	17
Morphology			
Adenocarcinoma	13	12	15
Lower Esophageal Adenocarcinoma	13	11	15
All Other Adenocarcinoma	14	11	18
Squamous Cell Carcinoma	16	13	18
Age			
15–44	23	16	31
45–54	16	12	20
55–64	17	15	20
65–74	14	12	17
75–99	10	8	12

* See *Appendix II* for details.

† Includes cancers classified as cervical, thoracic, abdominal, overlapping across subsites or unspecified with respect to location.

Note: The analysis was conducted using the period method (see *Appendix II*).

Analysis by: Health Statistics Division, Statistics Canada

Data source: Canadian Cancer Registry database at Statistics Canada

Table 5.3

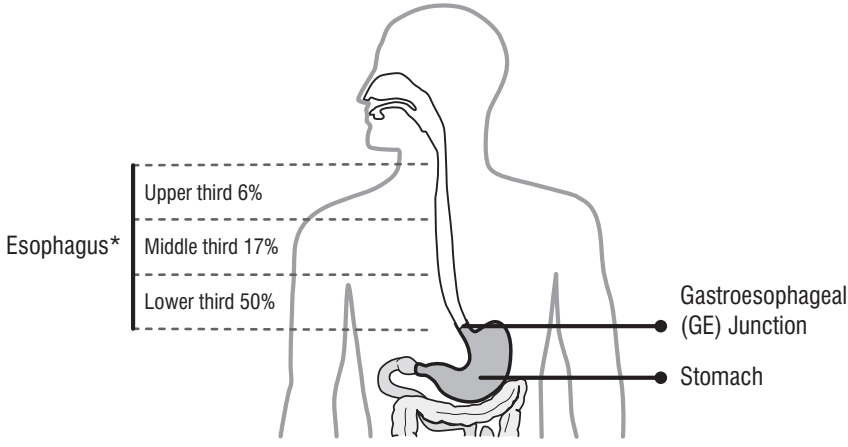
New Cases of Esophageal Cancer by Stage and Morphology, Manitoba, 2005–2007

Stage	New Cases	% of Total
All Esophageal Cancers (known stage)	**128**	**100.0**
I	19	14.8
II	20	15.6
III	25	19.5
IV	64	50.0
Unknown stage	31	—
Adenocarcinomas (known stage)	**74**	**100.0**
I	11	14.9
II	12	16.2
III	16	21.6
IV	35	47.3
Unknown stage	7	—
Squamous Cell Carcinomas (known stage)	**39**	**100.0**
I	7	17.9
II	7	17.9
III	6	15.4
IV	19	48.7
Unknown stage	14	—

Note: Values are for both sexes combined.
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada
Data source: Manitoba Cancer Registry

Figure 5.1

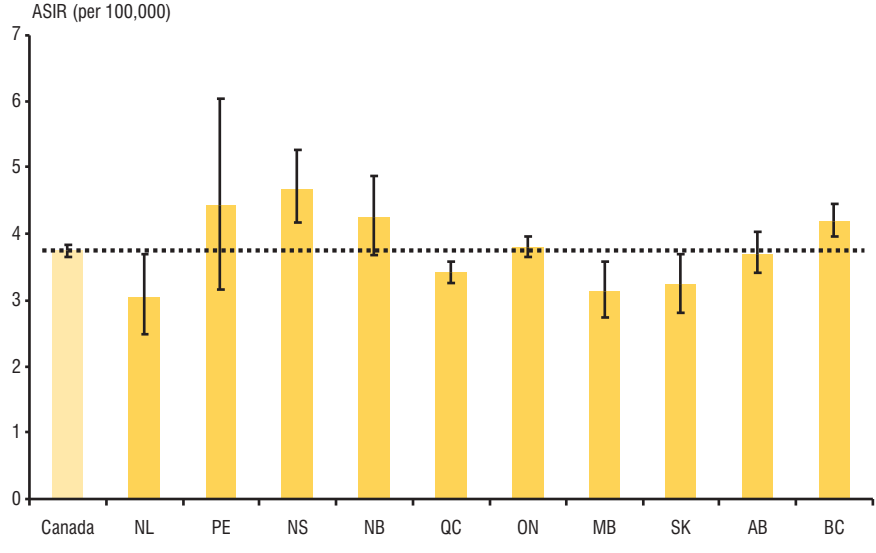
The Esophagus with Percentage of New Cancers Occurring in Each Subsite, Canada, 2002–2006



*27% of esophageal cancers were not specified with respect to location or overlapped across subsites

Figure 5.2

Age-Standardized Incidence Rates (ASIR) for Esophageal Cancer by Province, Canada, 2002–2006



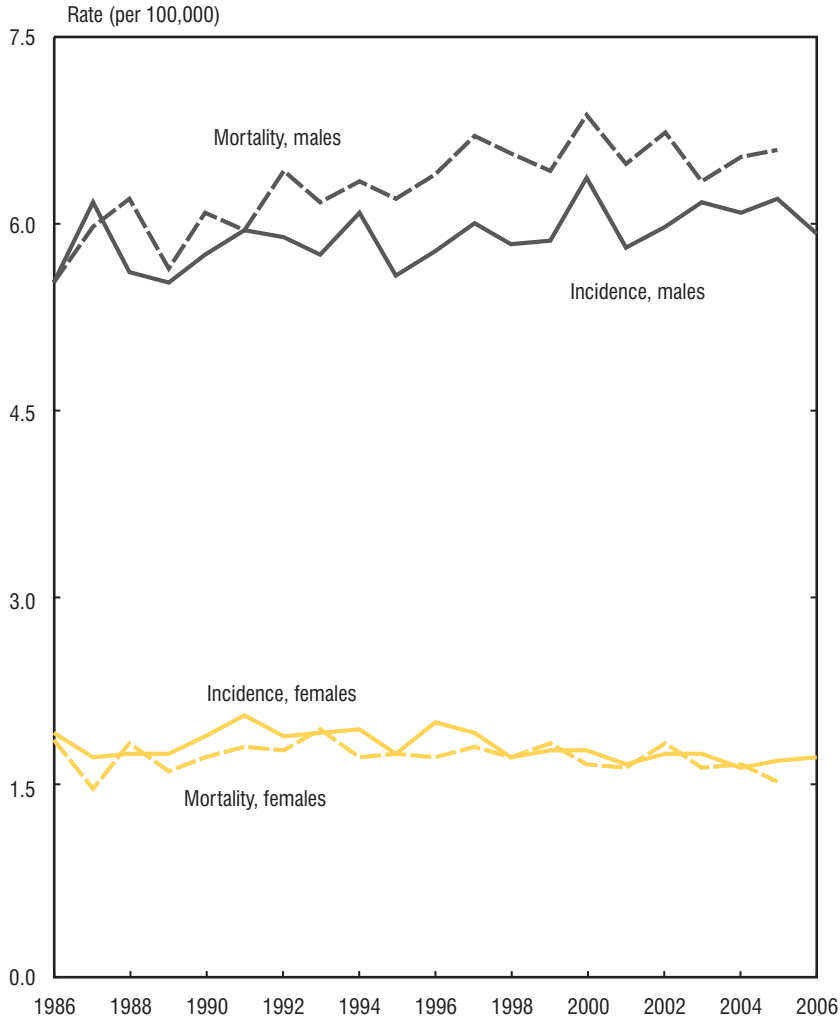
Note: Rates are for both sexes, age-standardized to the 1991 Canadian population. The height of the bar represents the average annual age-standardized rates for a given area for 2002–2006. The whiskers represent the 95% confidence intervals of the mean. The territories are not shown due to small numbers of cases (<5 per year, on average).

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

Data source: Canadian Cancer Registry database at Statistics Canada

Figure 5.3

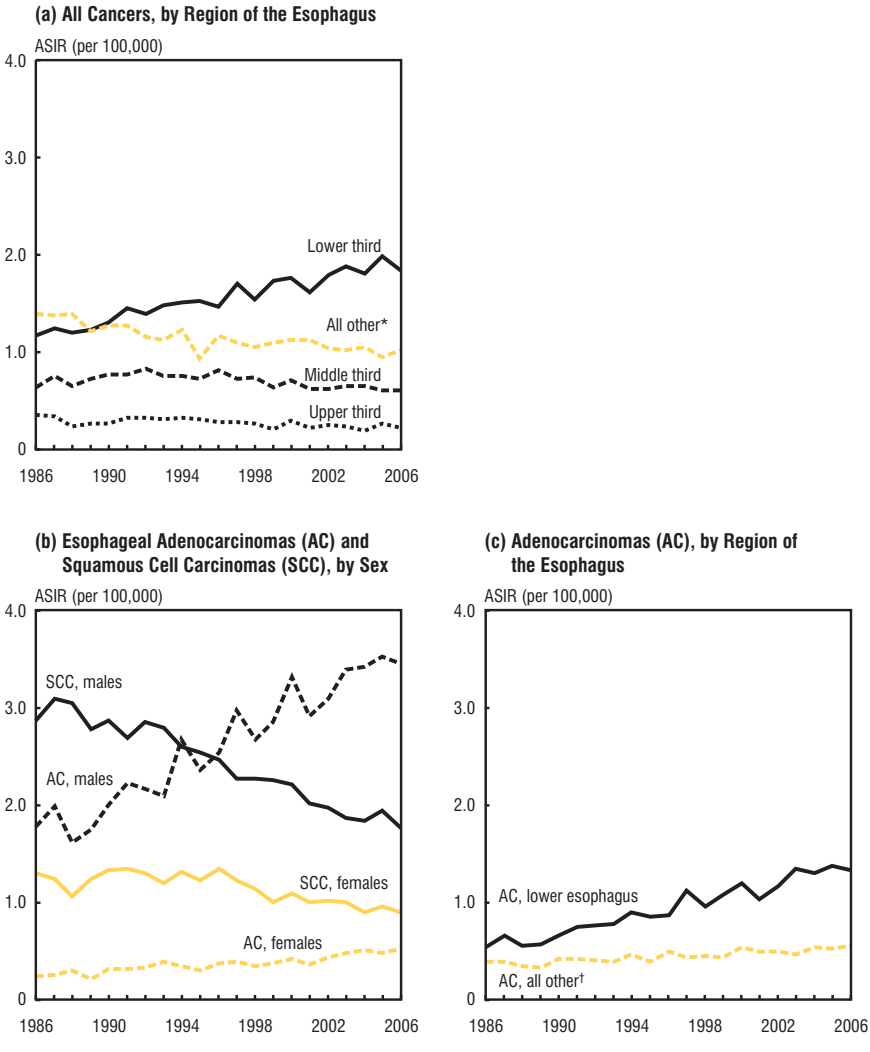
Age-Standardized Incidence Rates (ASIR) 1986–2006, and Mortality Rates (ASMR) 1986–2005, for Esophageal Cancer, Canada



Note: Rates are age-standardized to the 1991 Canadian population.
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada
Data source: Canadian Cancer Registry and Canadian Vital Statistics databases at Statistics Canada

Figure 5.4

Age-Standardized Incidence Rates (ASIR) for Selected Cancers of the Esophagus by Topography and Morphology, Canada, 1986–2006



* includes cervical, thoracic, abdominal, overlapping, and unspecified locations.

† includes cervical, thoracic, upper, middle, overlapping, and unspecified locations.

Notes: Rates are age-standardized to the 1991 Canadian population. Cancer codes appear in Table A10.

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

Data source: Canadian Cancer Registry database at Statistics Canada

Overview

For the purposes of this report, kidney cancer refers to primary invasive tumours of all types that occur in the renal parenchyma of individuals 15 years of age or older (Figure 6.1). Roughly 80% of these cancers are renal cell carcinomas. Historically, cancers of the inner cavity of the kidney (renal pelvis) were grouped with those of the renal parenchyma. However, it is now recognized that the former are essentially urothelial (bladder) cancers. Children younger than 15 years of age are excluded from this report because the predominant type of renal cancer that develops in this group is nephroblastoma (Wilms' tumour).

Kidney cancer, summary statistics

Incidence (2002–2006)	Males	Females
Number of cases:	11,515	7,218
Rate (per 100,000):	16.6	8.9
% of all cancers:	3.0	2.0
Mortality (2001–2005)		
Number of deaths:	4,367	2,624
Rate (per 100,000):	6.7	3.1
% of all cancer deaths:	2.5	1.7

In Canada, kidney cancer will be responsible for an estimated 4,800 new cancer cases and 1,650 deaths in 2010. It is the 10th most common newly diagnosed cancer and the 13th leading cause of cancer death (Tables 1.1 and 1.2). Table 6.1 shows that roughly 90% of all kidney cancers in adults occur in individuals 45 years of age and older. It also reveals that the annual incidence rate was nearly two times higher among males than among females (16.6 vs. 8.9 per 100,000, respectively) during 2002–2006.

Across the Canadian provinces, the average annual incidence of kidney cancer ranged from 8.7 per 100,000 to 17.9 per 100,000 (Figure 6.2). The highest rates occurred in the Maritime provinces, while the lowest rates occurred in British Columbia and Ontario.

Trends in incidence and mortality

The incidence rate of kidney cancer in Canada has increased by roughly 1.3% per year* for both sexes since the late 1990s (Figure 6.3). Prior to that, incidence rates were fairly stable. Overall, mortality rates for this cancer have decreased slightly since the mid-1980s. Among males, mortality rates have declined by 0.3% per year, reaching 6.7 per 100,000 by 2005. For females, mortality rates have decreased by 0.7% per year, reaching 3.0 per 100,000 by 2005.

By age

- Among males, the incidence of kidney cancer has increased over time across age groups, with the strongest increases in the young (1.1% per year among men aged 15–44 years). In contrast, incidence rates have been stable in most age groups for females, except for an increase of 1.8% per year among women aged 75 years and older.
- Mortality due to kidney cancer has generally declined across age groups, with the strongest declines among those aged 15–44 years (males: –2.5% per year; females

* Statistically significant time trends are reported in terms of annual percent change, calculated using a log-linear model; unless otherwise noted, time trends refer to the period 1986–2006 (incidence) and 1986–2005 (mortality).

–3.1% per year). The only exceptions were an increase in mortality among males aged 75 years and older (0.7% per year) and stable mortality rates among females aged 65 years and older (data not shown).

By histology

- Figure 6.4 shows that, for both males and females, the incidence rate of renal cell carcinoma increased by approximately 1.0% per year. By 2006, renal cell carcinoma represented 85% of all kidney cancers.
- Aside from renal cell carcinoma, other specified and unspecified types of kidney cancer declined by 1.5% in males and 0.9% in females during 1986–2006. These cancers represented a relatively small proportion (15%) of all kidney cancers.

Five-year relative survival

- Survival from kidney cancer is fair. Individuals diagnosed with this cancer in 2003–2005 have a predicted five-year survival that is 67% of that of similar people (e.g., age, sex and province) in the general population (Table 6.2). Five-year relative survival did not differ by sex.
- Survival was highest for those in the youngest age group, but decreased with increasing age. Survival decreased to 52% among those aged 75–99 years at diagnosis from 85% among those 15–44 years of age at diagnosis.
- The age-standardized five-year relative survival ratio has increased by 5.4% since 1992–1994.

Discussion of trends and risk factors

In developed countries, kidney cancer represents approximately 2–4% of all new cancers, with incidence rates of 7–22 per 100,000 among males and 4–13 per 100,000 among females.[29,30] In Canada, the rising incidence of kidney cancer is consistent with trends observed in several developed countries since the 1970s.[31–34] The increasing use of high-tech imaging (ultrasonography, computed tomography, magnetic resonance imaging) has probably resulted in greater "incidental" detection of kidney cancer,[35,36] but such technological advancements cannot entirely account for the upward trends.[32] Rates have continued to increase despite the fact that improvements in detection occurred primarily during the late 1980s and early 1990s.

Several risk factors may be contributing to the upward trend in kidney cancer in Canada, including obesity, hypertension and smoking. A positive association between body-mass-index (BMI) and kidney cancer has been reported among Canadians, with the greatest risk in the most obese.[37,38] Moreover, rates of obesity and kidney cancer have been increasing in parallel in Canada over the past 25 years.[21] Hypertension can also increase the risk of kidney cancer independently of obesity.[39]

Cigarette smoking has been implicated as the causal factor in up to 20% of cases of kidney cancer.[40] Among active smokers, the risk of kidney cancer increases with the number of cigarettes smoked per day,[41] and there is evidence that exposure to second-hand smoke also increases risk.[42,43] Although smoking prevalence has been declining in Canada since at least the mid-1980s,[24] smoking rates prior to this time may help to explain some of the current increases in kidney cancer.

Occupational exposures, such as those associated with coke (carbon fuel) production[44,45] and chemical industries,[46,47] may elevate the risk of kidney cancer.

However, it is unclear if such carcinogens contribute substantially to kidney cancer in Canada. Genetic (hereditary) predispositions appear to account for a small fraction of cases of kidney cancer (less than 5%).[31,39]

Despite increasing incidence rates of kidney cancer, mortality rates have generally declined in the Canadian population, as noted previously.[33] Most European countries have experienced similar declines in mortality due to kidney cancer since the early 1990s.[29] In comparison to Canada, five-year relative survival from kidney cancer appears to be somewhat lower across Europe[48] and slightly higher in the United States.[27]

Staging

Staging of cancer is essential for treatment, planning and prognosis. The current standard for staging is the tumour-node-metastasis (TNM) system, although the UCLA integrated staging system (UISS) has been recently devised to incorporate additional prognostic factors. In Canada, Manitoba's provincial cancer registry is now collecting staging information for renal cancer. The Manitoba data (Table 6.3) show that, of the cases of a known stage, half are stage I at diagnosis and almost a quarter are stage IV (metastatic disease). Although stage IV is fatal for the vast majority of people, individuals with stage I are expected to have a good prognosis.[49] Currently, there is no screening method that can detect kidney cancer at an earlier stage and thus help to improve survival.

Treatment

Surgery is the main treatment for kidney cancer and for some of its metastatic sites. Although traditional cytotoxic chemotherapy has had little success against renal cell carcinoma, newer drugs that specifically target cellular pathways show promise and can modestly improve survival in metastatic renal cell carcinoma. Such drugs are being tested in clinical trials as adjuvant therapy to determine if survival after primary surgery can be improved.

Kidney cancer, particularly renal cell carcinoma, is increasing in the Canadian population. However, people diagnosed with this disease have a fair prognosis and survival appears to be improving. Prevention programs focused on obesity and smoking could make substantial progress in fighting kidney cancer, given the strong association between these risk factors and this disease.

6. CANCER IN DEPTH: CANCER OF THE KIDNEY

Table 6.1

New Cases and Age-Standardized Incidence Rates (ASIR), for Kidney Cancer by Sex and Age, Canada, 2002–2006

	New Cases			Cases per 100,000		
	Total	Males	Females	Total	Males	Females
All Kidney Cancers	**18,733**	**11,515**	**7,218**	**12.5**	**16.6**	**8.9**
Age						
15–44	1,407	846	561	1.9	2.2	1.5
45–54	3,078	1,992	1,086	12.6	16.5	8.9
55–64	4,640	3,087	1,553	27.8	37.5	18.3
65–74	4,801	3,014	1,787	43.0	57.1	30.3
75+	4,807	2,576	2,231	49.9	69.4	37.7

Note: Statistics for "All Kidney Cancers" include ages 15+ years.
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada
Data source: Canadian Cancer Registry database at Statistics Canada

Table 6.2

Estimated Five-Year Relative Survival Ratio (RSR) and 95% Confidence Interval (CI) for Kidney Cancer by Sex and Age, Canada (excluding Quebec*), 2003–2005

		95% CI	
	RSR (%)	Low (%)	High (%)
All Kidney Cancers	**67**	**66**	**68**
Sex			
Males	67	65	69
Females	67	65	69
Age			
15–44	85	82	87
45–54	75	73	78
55–64	71	69	73
65–74	64	61	66
75–99	52	49	56

* See *Appendix II* for details.
Note: The analysis was conducted using the period method (see *Appendix II*).
Analysis by: Health Statistics Division, Statistics Canada
Data source: Canadian Cancer Registry database at Statistics Canada

Table 6.3
New Cases of Kidney Cancer by Stage, Manitoba, 2005–2007

Stage	New Cases	% of Total
All Kidney Cancers (known stage)	**577**	**100**
I	286	49.6
II	45	7.8
III	106	18.4
IV	140	24.3
Unknown stage	29	—

Note: Includes all cancers of the kidney and renal pelvis, males and females (all ages) combined.
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada
Data source: Manitoba Cancer Registry

Figure 6.1
Anatomy of the Kidney

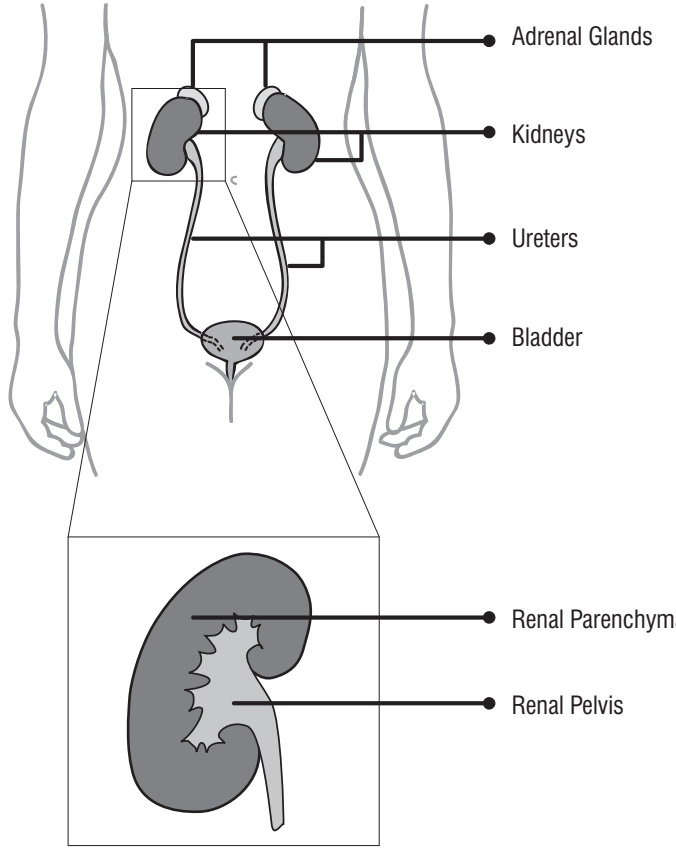
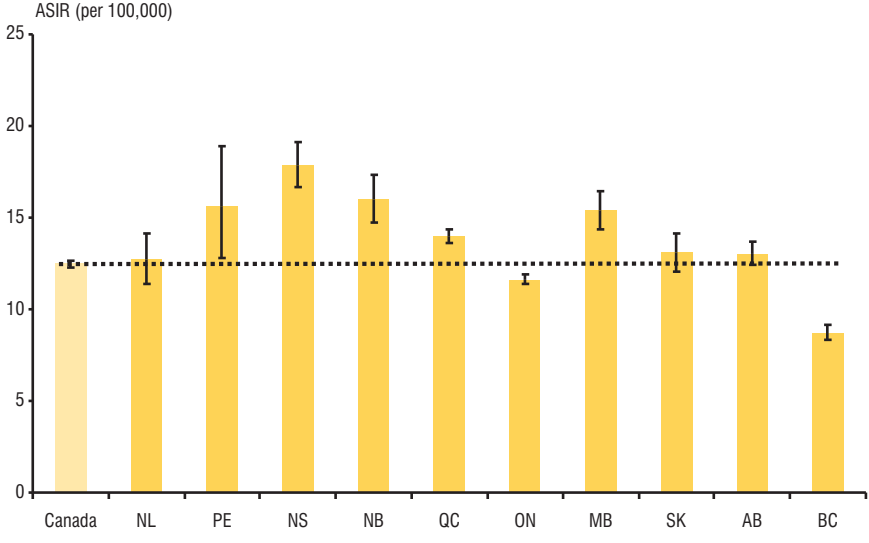


Figure 6.2

Age-Standardized Incidence Rates (ASIR) for Kidney Cancer by Province, Canada, 2002–2006



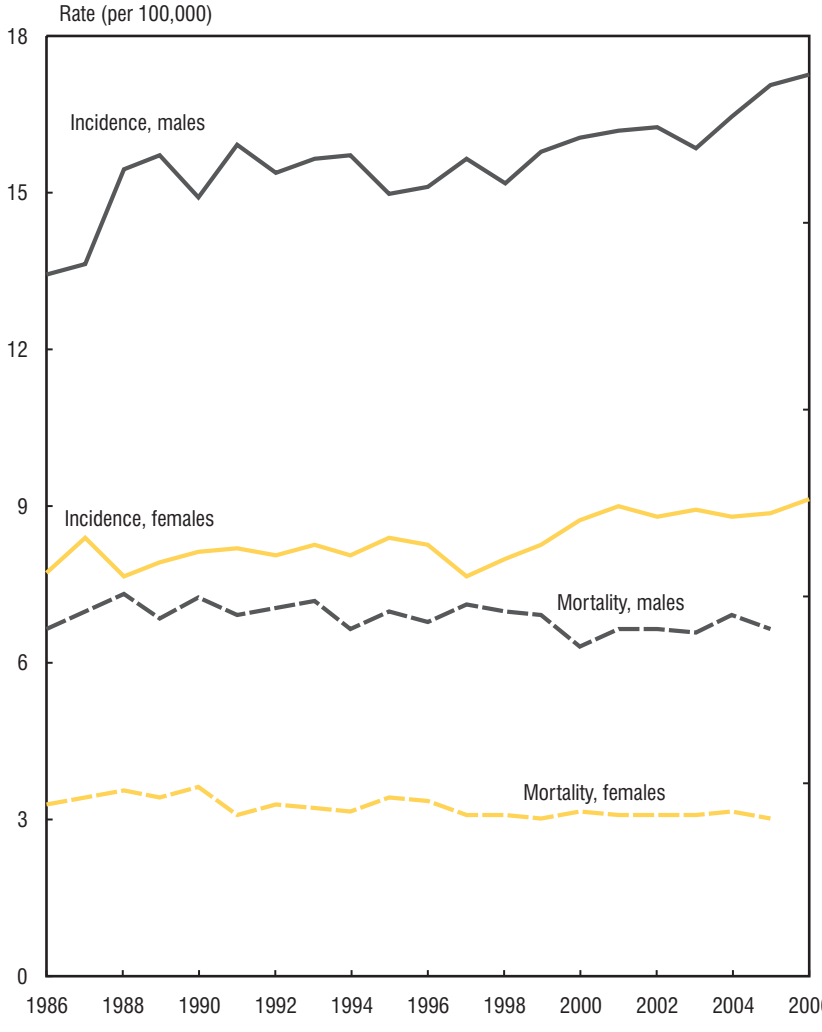
Note: Rates are for both sexes, ages 15+, age-standardized to the 1991 Canadian population. The height of the bar represents the average annual age-standardized rates for a given area for 2002–2006. The whiskers represent the 95% confidence intervals of the mean. The territories are not shown due to small numbers of cases (<5 per year, on average).

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

Data source: Canadian Cancer Registry database at Statistics Canada

Figure 6.3

Age-Standardized Incidence Rates (ASIR) 1986–2006, and Mortality Rates (ASMR) 1986–2005, for Kidney Cancer*, Canada



* Incidence rates are for cancers of the renal parenchyma only, whereas mortality rates include cancers of the renal parenchyma and renal pelvis.

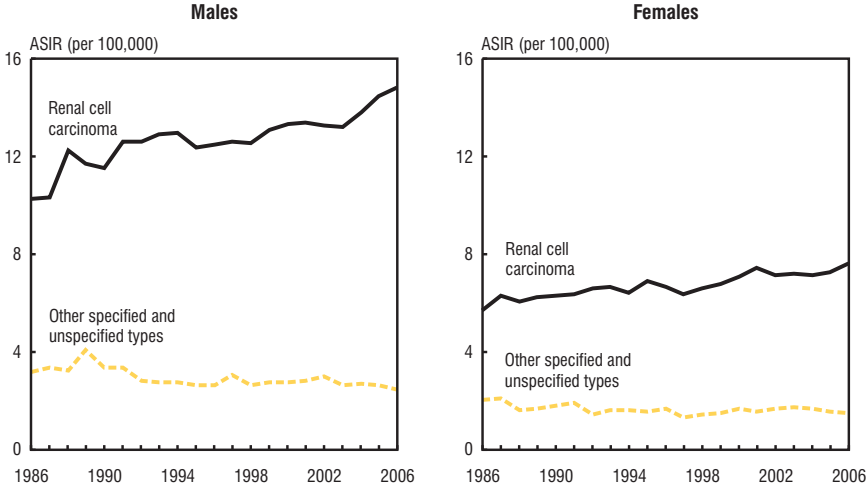
Note: Rates include ages 15+, age-standardized to the 1991 Canadian population.

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

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

Figure 6.4

Age-Standardized Incidence Rates (ASIR) for Selected Cancers of the Kidney by Sex, Canada, 1986–2006



Notes: Rates include ages 15+, age-standardized to the 1991 Canadian population. Cancer codes appear in Table A10.
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada
Data source: Canadian Cancer Registry database at Statistics Canada

Special Topic: End-of-Life Care

Led by members of the Steering Committee on Cancer Statistics with contributions from:

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Dr. Fred Burge, Dalhousie University
Dr. Serge Dumont, Université Laval
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The hand of the photographer's grandmother, Dorothy Ellis, a breast cancer survivor who was diagnosed with leukemia four years ago. Sadly, Dorothy passed away in June 2009.

Photo by Lauren Hammersley ©, PhotoSensitive

7. END-OF-LIFE CARE

Introduction

Palliative care is an approach that aims to improve the quality of life for individuals and their families who are facing a life-threatening illness such as cancer. Improved quality of life is achieved by preventing and relieving suffering.[50] There is no universally agreed point in time after a diagnosis of cancer of when palliative care should begin.[51]

End-of-life cancer care is part of a palliative approach that is provided when a person's healthcare team determines that a cancer can no longer be controlled. At this time, a person with cancer and their healthcare providers agree that the goal of care is to improve quality of life through controlling and alleviating physical symptoms such as pain, constipation, nausea and shortness of breath, while also addressing emotional concerns of a psychological, social and spiritual nature. The definitions of palliative and end-of-life care are not agreed upon. Often these terms are used interchangeably, which adds to the confusion for patients and caregivers.[51]

Palliative and end-of-life cancer care may be delivered by palliative care or cancer specialists, generalist healthcare professionals, family, friends and volunteers. Consequently, palliative care may be provided in a range of settings, including hospital, home, long-term care facilities, hospices or residential facility. Since Canada does not have a national palliative care program, there are differences in the type, quality and access to palliative and end-of-life care services in each province. Surveillance systems can help identify the demand for, supply of and quality of palliative and end-of-life care.

Why this report?

A key question of end-of-life surveillance is whether the end-of-life period differs depending on the cancer type, place of death or type of medical care received. However, surveillance data on end-of-life care are sparse and inconsistently collected across Canada. Several recent provincial reports have attempted to fill this gap in knowledge by examining end-of-life care in their respective provinces. More specifically, a report entitled *Health Care Use at the End of Life in Western Canada* examined end-of-life care issues in British Columbia, Alberta, Saskatchewan and Manitoba.[52] A similar report in Nova Scotia examined important indicators* of care during the end-of-life period.[53] Research studies have also critically examined various aspects of end-of-life care and costs in Alberta, Ontario, Quebec and Nova Scotia.[54–60]

The goal of this report is to use the current literature to examine cancer care at the end of life across selected Canadian provinces (British Columbia, Ontario and Nova Scotia) for which some common descriptors of end-of-life care were obtainable. This report also makes clear the formidable challenge currently faced by palliative and end-of-life researchers regarding the availability and comparability of data across Canada. While such data are necessary to better inform both healthcare policy and provision of care, a number of limitations are acknowledged. First, standard definitions and methods of reporting end-of-life care are lacking. Second, there is no consensus on population markers of when the end-of-life period begins; studies have sometimes

* Quality or performance indicators are tools designed to measure quality of care. They have been defined as a "measurable element of practice performance for which there is evidence or consensus that it can be used to assess quality" and hence change the quality of care provided. (Campbell SM et al. BMJ 2003;326:816-9)

considered the one month, six months or nine months prior to death.[61–63] Finally, there is a lack of data available about the quality of care for people with cancer at the end of life.[64]

Data sources and methods

To describe care at the end of life, provincial data were obtained from the following sources:

i) *Health Care Use at the End of Life in Western Canada*[52] as well as the companion report for British Columbia[65]

ii) *Network for End of Life Studies' Surveillance Report for Nova Scotia*[53]

iii) Ontario's Cancer System Quality Index (CSQI)[66] and published research[54–58]

For Nova Scotia and Ontario, the descriptive analyses presented in this report are based on data obtained by looking back over time for persons who died of cancer in 2005. Data for British Columbia were similarly extracted for 2003–2004. Cancer-related deaths were those identified from death certificates as having cancer as the underlying cause of death. Where possible, such as for the distribution of cancer-related deaths and place of death, provincial data are presented alongside national data, which were obtained from Statistics Canada.

Methods of data collection for each of the provincial reports are described more fully in the respective reports and research studies. Generally, information on the number of cancer-related deaths, place of death and use of health services was obtained from provincial vital statistics databases, along with hospital morbidity and discharge databases. For all provinces, details about place of death are typically identified in death certificates and include categories such as death in hospital, residential facility, home, other place and unknown location. In Ontario, for example, institutional deaths were identified using the discharge disposition variable from the Canadian Institute for Health Information — Discharge Abstract Database, the National Ambulatory Care Reporting System and the Continuing Care Reporting System. Other long-term care facility deaths were identified using a long-term care institution flag available from the Ontario Drug Benefit Database. The Ontario Health Insurance Plan claims identified people with cancer who died at home, based on physician pronouncement. A second source of data for Ontario was an end-of-life cohort study[55], which included adults who died of cancer, whose cancer diagnosis occurred prior to death and who did not die within 30 days of a major post-operative procedure.

The analysis on costs for end-of-life care was obtained by reviewing 14 burden of illness and costing analyses in Canada. Costs are compared and tabulated by type of cancer and trajectory. Some of these costs are further divided into categories such as hospitalization, outpatient care and medication. Because of general inflation, all dollar values are converted to 2009 values using the Canadian consumer price index. The resulting tabulations allow comparisons of recent Canadian cancer costing data over the last decade.

Main findings

I. PROFILE OF CANCER DEATHS IN CANADA AND SELECTED PROVINCES

A total of 230,132 Canadians died in 2005. As shown in Figure 7.1, the leading causes of death were cancer (29%), diseases of the circulatory system (28%) and diseases of

the respiratory system (7%).[67] In 2005, there were approximately 67,300 cancer-related deaths in Canada (Table 7.1). More men than women died from cancer. Over 80% of these deaths were among those 60 years of age and older. The number of cancer deaths in Canada has been increasing in both sexes, largely due to a growing and aging population. For new cases diagnosed in 2002-2004, the overall five-year survival proportion in Canada was 54%.[1] This means that, on average, 46% of people with cancer were expected to die within five years of their cancer diagnosis. Cancers with high numbers of deaths in 2005 include lung (17,900), colorectal (8,500), breast (5,000), prostate (3,600) and pancreas (3,460).

In contrast to the number of deaths, *rates* of cancer death have been declining or have remained stable. The cancer mortality rate for males has been declining slowly after reaching a peak in 1988. The decrease is largely due to declines in lung cancer and, to a lesser extent, decreases in colorectal and other cancers. In females, the mortality rate has remained relatively stable since 1980. The lung cancer death rate continues to increase in spite of declines in other cancer types in females. Mortality rates for all cancers and both sexes combined have generally been on the decline since 1980 for all age groups except for males older than 80 years and females older than 70 years, for whom cancer mortality rates have been increasing.

II. SERVICE UTILIZATION AND QUALITY OF CARE

With the number of deaths from cancer and other chronic diseases expected to increase in the next decade as a result of a growing and aging population, the emphasis on addressing the inevitable need for quality end-of-life care has become increasingly important. The Senate Committee of Canada, which reported on this issue in 1995, found that the "provision of end-of-life care is characterized by uneven access to services".[68] A 2005 follow-up to the Senate report found little progress had been made since that report was published.[69] Thus, information on place of death and access to palliative services are useful indicators of the quality of end-of-life care.

Place of death

Survey data suggest that most terminally ill people would prefer to die at home but more than 55% of deaths occur in a hospital.[52,54,61,70,71] The gap between preference and practice has been attributed to inadequate support for community-based end-of-life care.[72] For individuals who die in hospital, a substantial proportion of deaths occur in special hospital units,[73] often in medical, surgical, transitional or intensive care departments, rather than palliative care beds. The use and frequency of home care is an important factor associated with dying at home.[74] Moreover, living with relatives and the existence of other sources of support (e.g., from family or friends) are also critical for deaths to occur at home. However, the growing trend toward dying in hospital or long-term care facilities could be due to:

- A possible cultural shift, which views dying as a medical event, coupled with the expectation for life-extending or life-enhancing interventions when cared for in an institutional setting.
- Advances in the medical management of distressing symptoms available through hospital-based care.[73,75]

Table 7.2 compares place of death for people dying of cancer in Canada and selected provinces. Overall, close to 60% of all cancer and non-cancer deaths in Canada

occurred in hospitals. In the provinces that were examined, the proportion of hospital deaths ranged from 53% to 71%. Among hospital deaths in Ontario, 51.4% of deaths were in acute-care settings and 2% in emergency rooms (data not shown).[56,66] In all provinces, long-term care, nursing homes and private homes comprise the next largest categories for location of death. Nova Scotia had nearly 8% of people die in nursing homes or long-term care facilities, while in Ontario 23.7% of people died in long-term care facilities or complex continuing care.[†] In both Nova Scotia and Ontario, approximately 20% of people died in a private home or in an unspecified place. Comparable statistics on location of death, whether in hospital, at home or elsewhere, are somewhat complicated by the fact that there are differences across provinces in coding the location of death on death certificates.

In the United States, Europe and Australia, the proportions of hospital deaths range from 30–50%.[76–79] The smaller proportion of hospital deaths in other countries compared to Canada may be due to their better-developed systems of institutional and home-based palliative care. Hospitalization prior to death may also be linked to particular cancer type and the need for specialized care. According to studies from the United Kingdom and Australia, people with prostate, breast and hematological cancer are more likely to die in hospital than those with other cancer types.[78,80]

Access to end-of-life care, referral to palliative care and use of palliative drugs

An optimal approach to end-of-life care ultimately depends on the existence of an adequate infrastructure for the provision of care, including the right combination of personnel, facilities, and drugs, as well as modes of care delivery. In turn, the availability of end-of-life care depends on where a person lives, while their specific situation determines the type of services and type of health care providers who will be involved in their care. As such, health planners are interested in identifying the type of care received at the end of life and the extent to which it is coordinated and appropriate.

Because it is often difficult to anticipate death, healthcare providers may not know or be able to judge when people with cancer should begin receiving care that is focused on palliative needs rather than disease treatment. As a result, some individuals with uncertain prognoses continue to die in acute-care hospital settings and may receive interventions with a focus on treating the disease until death. In other cases, late enrolment to palliative care can deprive a person with cancer the opportunity to benefit from care specifically focused on the needs of the dying. Regardless of the situation, there is no current way to track where care occurred prior to death since most death certificates do not distinguish between palliative and acute-care hospital locations. This has a direct impact when determining the time to enrolment in palliative services as well as the proportion of people receiving end-of-life care within a specified period of time prior to death.

BRITISH COLUMBIA AND OTHER WESTERN PROVINCES

In the western Canadian provinces (Manitoba, Saskatchewan, Alberta and British Columbia), 37% of dying people were hospitalized at least once in the 30 days before

[†] Complex continuing care (CCC) provides continuing, medically complex and specialized services. CCC is provided in hospitals for people who have long-term illnesses when they need skills or services not available at home or in long-term care facilities. (Ontario Ministry of Health and Long-Term Care. Available at: http://www.health.gov.on.ca/english/public/pub/chronic/chronic.html)

death. This figure was 57% in the last six months of life. In British Columbia, people spent an average of 4.5 days in hospital in the last 30 days of life. When the hospital discharge abstracts of people who died were examined, it was possible to distinguish those who received palliative care while hospitalized. Table 7.3 indicates that among all deaths, 14.8% (9,438) received hospital-based palliative care during their last hospitalization. Of the 29,456 people who died in 2005 in British Columbia, 8,171 were identified as requiring palliative care services (data not shown). Of these people receiving palliative care, 4,036 used an acute-care palliative service, hospice service or received Palliative Care Drug Plan benefits in the last two years of life.

Drugs that control symptoms commonly experienced by people with cancer at the end of life (e.g., to control pain, nausea and vomiting, or respiratory distress) are crucially important to meet the palliative care goals of improving quality of life. Most provinces have introduced palliative drug programs, but they vary somewhat in terms of the extent of coverage in drugs and supplies. The proportion of people with cancer who died and who were registered with the provincial palliative drug program at their time of death in 2003–2004 was examined in the western Canadian provinces.[52] Of the 45,869 deaths in the four provinces with available data, the palliative drug plan enrolment rates were at 47.6% in British Columbia (44.7% were people with cancer), 53.2% in Saskatchewan and 27.6% in Manitoba. In addition to the palliative drug plan coverage being different in each province, some individuals were not included in these analyses, such as those in long-term care facilities or extended-care hospitals. People dying of a terminal illness such as cancer had the highest use of prescription drugs compared to other death trajectories (frailty, organ failure, sudden death, other), particularly within the last 30 days of life.

NOVA SCOTIA

In Nova Scotia's two largest urban districts (Halifax and Cape Breton County), which represent half of the population of the province, 81% of the adults dying of cancer in 2005 were enrolled in a palliative care program. In Cape Breton County, 44% of the referrals to the palliative care program were for persons who were living at home with terminal cancer, 52% in hospital and 4% in a nursing home at the time of the referral. Nearly 24% of those enrolled in a palliative care program were enrolled within the last two weeks of life (Table 7.3). As part of their end-of-life care, approximately 1% of people in the province also received medical oncology consultations in the last two weeks of life, and 11% received these consultations in the last six months of life. In addition, 23.5% of people who died of cancer in the province received palliative radiation in the last nine months of life. The province also reports home care access rates of approximately 70% in 2003 by people with cancer who were within six months of death. Home care is the array of government funded (in whole or in part) services that are provided in the home and community setting, including nursing and personal-care worker services.

Data on time to palliative care program referral are also available through the ACCESS prospective study.[‡] ACCESS reports on a colorectal cancer cohort in Nova Scotia diagnosed between 2001 and 2005, of which 367 people had stage IV colorectal cancer at the time of diagnosis and lived in one of the districts that had accessible

[‡] Grunfeld E (Principal Investigator). CIHR/CCNS Team: ACCESS. Access to colorectal cancer services in Nova Scotia.

palliative care program data. The study subjects were limited to those who had died by 2008 and who lived in either the Capital Health or the Cape Breton District Health Authority. The time from diagnosis to referral to a palliative care program is shown in Table 7.4. Referral within three days of death was considered an indication of poor quality of care since it suggests insufficient time for the palliative care program to address end-of-life concerns with the patient and family.[81] The study found that median wait times to referral are lowest among the oldest members of the cohort (those aged 70 years or older vs. 50–59 year olds) and for females compared to males. The rate of enrolment to a palliative care program in the last two weeks of life was 21.5% (Table 7.5), which was comparable to the Nova Scotia palliative care program enrolment rate for all cancers in 2005 of 23.8% (Table 7.3). Similarly, the age and sex pattern of the 268 (73%) study subjects enrolled in a palliative care program was similar to the distribution for comparable Nova Scotia data.

ONTARIO

There is no comprehensive provincial palliative care program in Ontario. General home care services (nursing, personal-support worker and other services like physiotherapy or social work) are available province-wide. Physician palliative care specialists work either as consultants for hospitalized people or in ambulatory settings in cancer clinics, while some may also perform house calls. House calls may also be provided by family physicians. The availability of palliative specialists or other physicians who perform house calls varies by area. Ideally, these physicians function as part of a home care team. However, palliative care services in Ontario are considered fragmented and poorly coordinated.[82]

As shown in Table 7.3, nearly 18% of people with cancer in 2005 also had at least one ambulatory palliative care assessment in the last two weeks of life, 3.8% had chemotherapy within the last two weeks of life and 26.7% had an in-patient palliative care assessment. These categories are not mutually exclusive and people may have received more than one of each of these services. In 2005, people with cancer spent a median of 14 days in hospital during their last six months of life.

The province reports home care access rates of approximately 70% in 2005 for people who are within six months of death (Table 7.3). Data also indicate a median time of 111 days between the date of home care enrolment and death. Twenty one percent of people had at least one house call in the last two weeks of life (data not shown).

III. POPULATION QUALITY INDICATORS

Population quality indicators of end-of-life cancer care in Nova Scotia and Ontario

Surveillance data have the potential of being used to measure quality of care at the end of life. A series of indicators of quality of care for people with cancer at the end of life have been proposed.[81] Their application to the Canadian setting has been tested using retrospective data for cohorts of breast cancer decedents from Ontario and Nova Scotia.[57,58] These studies examined indicators for both good and poor quality of care (Table 7.6). For example, intensive care admissions or emergency room visits during the last days of life suggest that symptoms are poorly controlled or that there are insufficient resources for home-based care.

These performance indicators are derived from population-level data using administrative health databases and, as such, are not direct measures of clinical care. However, the value of performance indicators lies in enabling comparisons between jurisdictions and identifying if some jurisdictions are performing significantly and consistently differently from others. Awareness of this variation can allow for further examination of what factors may cause some jurisdictions to perform better or worse. Such surveillance methods are valuable tools for benchmarking — they enable us to compare care across institutions or regions and over time.

IV. COSTS FOR END-OF-LIFE CARE

Cancer costs at the end of life refer to the dollar value of healthcare resources used by individuals with cancer. Costing data are obtained to answer a wide variety of questions. For example, the data may be used for pricing, budgeting or to help inform resource allocation decisions. Costs can be categorized as direct medical, direct non-medical (primarily out-of-pocket and travel), indirect (time-related) and intangible costs. Sources of costing data can be obtained from national statistical databases; provincial, regional or institutional administrative databases; surveys or expert opinion. The vast majority of studies, however, are limited to direct medical costs such as hospitalizations, ambulatory care, physician billings, home care, nursing home care and outpatient medications. Consequently, studies that report costs are not easily compared to one another.

Costs over the course of the end-of-life period

Continuing care at home and in long-term care settings is financed through a mix of public and private funding. The last few months or year of a person's life are associated with an increased need for and use of health services, resulting in substantial healthcare costs. This is demonstrated by the average per person costs estimated by numerous studies, as shown in Table 7.7. Although these costs are labeled as end-of-life, they may include resources used for active treatment, rehabilitation and palliative care. Costing can be associated with an event such as referral to palliative care or for a fixed period (such as total costs over the last year of life). Some studies even go as far as including resources used since the cancer diagnosis. In Canada, only one study, Health Canada's Economic Burden of Illness in Canada[83] has managed to generate and synthesize cancer costing data for all of Canada across cost categories and over time.

Costs associated with place of death and type of care

Health Canada estimates that nearly three-quarters of total expenditures in people with cancer are mortality-related, particularly since people with cancer experience a greater chance of dying at all ages.[83] In fact, cancer accounts for 29% of all deaths in Canada (Figure 7.1) and for 32% of all mortality costs. Differences in expenditures across provinces, periods of follow-up and trajectory of illness prevent further comparisons from being made between most of the studies. Hospitalization and direct medical costs account for over half of the costs, which is consistent with the Health Canada report.[83] Substantial variation exists for all other categories, such as hospitalization, outpatient care and medication. While the number of categories account for some of this variation, data sources and methods account for the remainder.

Costs by cancer type

Several studies provide Canadian cost estimates by the type of cancer and age group (Table 7.8). Two studies provide comparable cost estimates for breast cancer (~$33,000 vs. $35,000),[84,85] while other studies provide very different costs for lung cancer (ranging from $18,000 to $50,000)[85,86] and prostate cancer (ranging from $25,000 to $39,000).[85,87] Some estimates are lifetime and include all costs while others are specific to a period before death. However, almost all of these estimates are restricted to direct medical costs.

Costs by cancer trajectory

Costs vary by disease trajectory. Based on the three included studies,[88–90] the data support the notion that cancer care is most expensive following diagnosis and immediately preceding death. This is shown by the trend in total costs during the two years leading up to death (Figure 7.2), whereby disease severity and changes in the type of care over time determine the costs.

Cost of family caregiving at the end of life

Some people choose to stay at home for as long as they can when faced with a life-limiting cancer diagnosis. In such cases, family members or friends take the role of primary caregivers, with support from a healthcare team. Communities will sometimes have supports and services in place to help patients and families provide care at home. The family of a person with cancer assumes most of the costs and other burdens of home care. The breakdown of costs by various categories is shown in Figure 7.3. Family caregiver costs include purchasing prescription and non-prescription medications, nutritional supplements (e.g., Boost, Ensure), special meals, vitamins, natural products and homeopathic products; diapers, hygienic products, dressings and other supplies; adapted devices such as beds, armchairs or furniture and toilet seats; transportation and parking.

Based on data from a survey carried out among a cohort of 248 Canadian families from five provinces (Nova Scotia, Quebec, Manitoba, Alberta and British Columbia), government and families incur approximately 71.3% and 26.6% of the mean cost per patient, respectively. A large proportion of the family financial burden is attributable to the caregiving time. Such commitment represents, for the main caregivers only, an average of 2.6 hours per day.[60]

One approach to value such a commitment is the "replacement cost" proposed by Statistics Canada, which consists of assigning a value to household work.[91] Using this perspective, the caregiver's financial burden represents a mean cost of $36 per day, according to a 2005–2006 estimate. This calculation excludes the lost income related to absence from work in order to provide care or assistance to the terminally-ill loved one. These costs become additionally challenging if they force Canadian families below the poverty threshold or if the financial burden is identified as an independent determinant of the caregiver's distress.[92]

Conclusion

End-of-life care aims to address the physical as well as the psychological, social and spiritual needs of a person's last stages of their cancer journey. Currently, end-of-life care in Canada is a patchwork of services, with significant variation both within and between provinces. There are differences in the type and quality of palliative services for individuals at the end of life, as well as variations in the uptake of such services.

7. END-OF-LIFE CARE

Thus, the goal should be uniform high-quality support for any person dying of cancer no matter where they live.

The current research on end-of-life care for people with cancer is limited; however, findings show that:

- there are inadequate services to allow people to die at home when this is their preference
- there is insufficient use of palliative care services or they are used too late because of inadequate or late referral to such services
- families caring for dying people experience significant psychosocial and financial burdens

Limitations in our understanding of the quality, timeliness and comprehensiveness of care for people with cancer at the end of life are due to available data being:

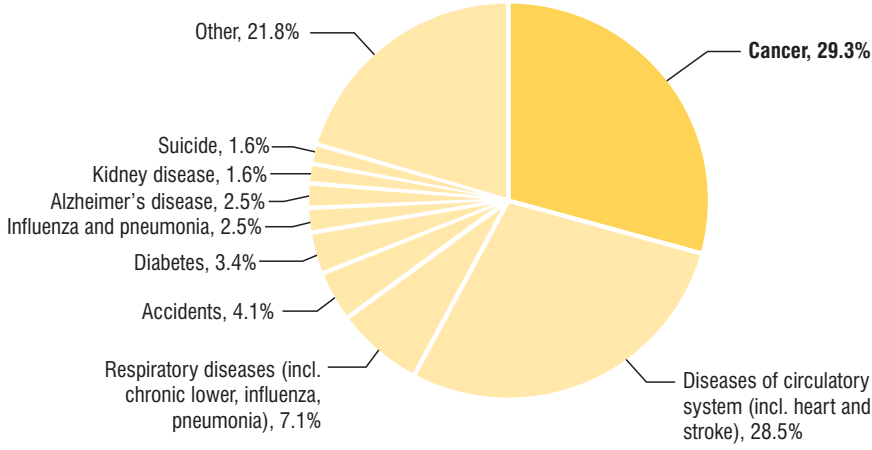
- incomplete and not easily available because of inconsistent collection of data or a lack of common definitions for the types of data that would be informative
- incomparable across jurisdictions because of an inability to easily link data from different sources or to compare similar variables across jurisdictions

Recommendations:

- Improving surveillance on end-of-life care would help define the needs and allow better planning for the end-of-life care for people with cancer.
- Definitions and methods of reporting end-of-life care need to be standardized so that surveillance data are more comparable across jurisdictions, which could allow researchers, policy-makers and healthcare planners to more easily identify gaps in care.

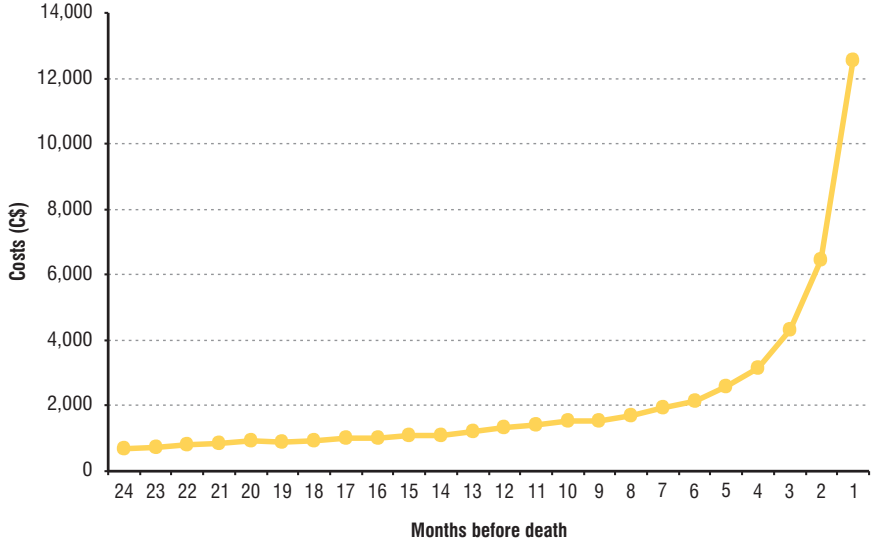
The number of cancer deaths is projected to increase in the future, so it will be increasingly important to ensure there are high quality palliative care services in place to meet the growing need. Our current understanding of the quality, comprehensiveness and accessibility of end-of-life care within and across Canadian jurisdictions is limited. Better surveillance is a vital step to plan for the end-of-life care needs of people with cancer and to lessen the impact on families and caregivers.

Figure 7.1
Proportion of Deaths Due to Cancer and Other Causes, Canada, 2005



Adapted from: Ten leading causes of death, Canada, 2004 and 2005, Statistics Canada.[67]

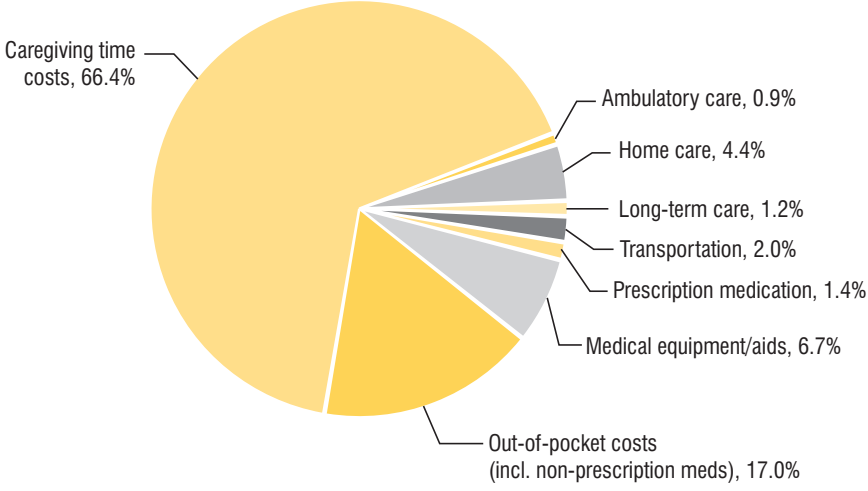
Figure 7.2
Trend in Average Total Public Cost per Person During the Two Years Prior to Death from Cancer, Canada, 2001–2002



Adapted from: Fassbender et al.[88]

Figure 7.3

Proportion of Total Costs per Person with Cancer Incurred by Family Caregivers, by Resource Category, 2005–2006



Adapted from: Dumont et al.[60]

Table 7.1
Profile of Cancer Deaths in Canada and Selected Provinces, 2005

	Canada (N=67,341)		British Columbia (N=8,407)		Nova Scotia (N=2,415)		Ontario (N=24,967)	
	n	%	n	%	n	%	n	%
Sex								
Males	35,479	52.7	4,519	53.8	1,309	54.8	12,859	51.5
Females	31,862	47.3	3,888	46.2	1,080	45.2	12,108	48.5
Age Group (years)								
0–19	182	0.3	15	0.2	2	0.1	73	0.3
20–29	215	0.3	31	0.4	8	0.3	74	0.3
30–39	655	1.0	66	0.8	27	1.1	288	1.2
40–49	3,151	4.7	346	4.1	100	4.1	1,168	4.7
50–59	8,357	12.4	1,062	12.6	305	12.6	3,064	12.3
60–69	14,030	20.8	1,703	20.3	534	22.1	5,035	20.2
70–79	20,629	30.6	2,557	30.4	706	29.3	7,722	30.9
80+	20,122	29.9	2,626	31.2	731	30.3	7,543	30.2
Five Most Common Cancer Causes of Death								
Lung	17,906	26.6	2,173	25.8	702	29.1	6,136	24.6
Colorectal	8,504	12.6	1,054	12.5	312	12.9	3,204	12.8
Breast	5,045	7.5	569	6.8	148	6.1	1,993	8.0
Prostate	3,586	5.3	504	6.0	131	5.4	1,295	5.2
Pancreas	3,459	5.1	461	5.5	137	5.7	1,252	5.0
Other	28,841	42.8	3,646	43.4	985	40.8	11,087	44.4

Data source: Canadian Vital Statistics Death database at Statistics Canada

Table 7.2

Place of Death for Cancer Deaths in Canada and Selected Provinces, 2003–2004 and 2005

	Canada* (all deaths including cancer) (N=230,132)		British Columbia† (N=8,171)		Nova Scotia‡ (N=2,389)		Ontario§ (N=21,419)	
	n	%	n	%	n	%	n	%
Hospital	137,308	59.7	4,934	61.1	1,693	70.9	12,419	53.4
Long-term Care or Nursing Home	62,483	27.2	1,436	17.8	191	8	5,506	23.7
Home			1,645	20.4	505	21.1	2,148	9.2
Unknown	30,341	13.2	156	1.9			3,173	13.7

* data are for 2005; categories for national data are hospital, non-hospital, unknown

† data are for 2003–2004

‡ data are for 2005 and exclude death certificate only cases which represent approximately 5% of cancer deaths; categories for Nova Scotia are hospital acute care, nursing home, other

§ data are for 2005

Data sources: Statistics Canada[70], Canadian Institute for Health Information[65], Surveillance and Epidemiology Unit, Cancer Care Nova Scotia (Jun Gao, personal communication August 2009), and CSQI Ontario[66]

Table 7.3

Use of Health Services by People with Cancer at the End of Life in Selected Provinces, 2003–2004 and 2005

	British Columbia*		Nova Scotia†		Ontario‡	
	n	%	n	%	n	%
Palliative care assessment as in-patient in last 2 weeks of life	9,438§	14.8	569	23.8	5,450	26.7
Palliative care assessment as ambulatory setting in last 2 weeks of life	—	—	—	—	3,474	17.9
Home care in last 6 months of life	—	—	1,785	70.6	16,246	69.9
Chemotherapy or medical oncology visits in last 2 weeks of life	—	—	26	1.1	886	3.8
Medical oncology consultation in last 6 months of life	—	—	260	10.9	—	—
Palliative radiation in last 9 months of life	—	—	561	23.5	—	—

— indicates that comparable data were unavailable

* data are for 2003–2004

† data are for 2005, except for "home care in the last 6 months of life" which is from 2003

‡ data are for 2005

§ includes all palliative care cases (cancer and non-cancer)

Data sources: Canadian Institute for Health Information[65], Surveillance and Epidemiology Unit, Cancer Care Nova Scotia (Jun Gao, personal communication) and Department of Family Medicine, Dalhousie University (Beverly Lawson, personal communication), CSQI Ontario[66]

Table 7.4

Median Wait Time from Date of Diagnosis of Stage IV Colorectal Cancer (2001–2005)* to Date of Referral to Palliative Care, by Sex and Age, Nova Scotia ACCESS Study

	n	%	Median Wait Time (days)
Sex			
Females	114	42.5	75
Males	154	57.5	158.5
Age			
<50	18	6.7	211
50–59	44	16.4	263
60–69	86	32.1	170
70+	120	44.8	53.5
Total	268		112.5

* Includes patients diagnosed with Stage IV cancer who were residents of Capital District Health Authority or Cape Breton District Health Authority, since Palliative Care Program data were available for these two districts only.

Table 7.5

Referrals to Palliative Care, by Sex and Time Before Death for Stage IV Colorectal Cancer Cases (2001–2005)*, Nova Scotia ACCESS Study

	Died before being referred to palliative care (n=334)		Enrolled in palliative care and died (n=261)		Referred to palliative care within 2 weeks of death (n=56)		Referred to palliative care within 3 days of death (n=13)	
	n	%	n	%	n	%	n	%
Females	150	44.9	111	42.5	24	42.9	6	46.2
Males	184	55.1	150	57.5	32	57.1	7	53.8

* Includes patients diagnosed with Stage IV cancer who were residents of Capital District Health Authority or Cape Breton District Health Authority, since Palliative Care Program data were available for these two districts only.

Table 7.6

Quality of End-of-Life Care Indicators for Breast Cancer Deaths, Nova Scotia and Ontario, 1998–2002

		Proportion of cancer deaths	
Quality Indicator	Indicator Description	Nova Scotia	Ontario
Interval between last chemotherapy and death	Any chemotherapy in the last 14 days	9.3%	15.7%
Place of death	Died in the hospital	63.4%	52.9%
Frequency of emergency room (ER) visits	a) More than one ER visit in the last month	5.6%	6.9%
	b) Average number of ER visits in the last month	0.41%	0.44%
	c) Average number of ER visits per available day in the last month	0.02%	0.02%
Hospital days near the end of life (includes any in-patient days)	More than one hospital admission in the last month	11.7%	15.6%
Hospital days near the end of life (includes ICU days only)	Percentage with at least one ICU admission in the last month	2.1%	4.1%
Adverse events	Bedsore, infection, fall or injury	9.3%	12.6%

Adapted from: Grunfeld et al. [57]

Table 7.7

Average per Person Cost for End-of-Life Cancer Care for Different Periods Before Death, Canada

Resource Category	Average cost (C$) per person				
	Last Year of Life[89]	Last Year of Life[59]	Average Annual[85]	Last Several Months of Life[60]	Last Several Months of Life[93]
In-patient Hospital Care	21,135	23,338	—	6,125	625
Physician	2,712	3,356	—	—	—
Ambulatory Care	—	—	—	1,466	296
Home Care	2,186	2,054	—	3,456	5,046
Long-term Care	5,781	2,151	—	703	—
Hospice	—	2,610	—	—	—
Transportation	—	—	—	291	28
Prescription Medication	1,867	1,028	—	1,197	235
Medical Equipment and Aids	—	—	—	1,115	144
Direct	—	—	22,153	—	—
Out-of-Pocket Costs	—	—	5,191	842	683
Caregiving Time Costs	—	—	2,906	3,251	17,316
Cash Transfer	—	—	9,048	—	—
Total	**33,680**	**34,538**	**39,299**	**18,446**	**24,358**

Table 7.8
Estimated Costs Per Person Associated with Cancer Care

Cancer Type	Cost (C$)	Time frame	Reference
Adults (20 years and older)			
Lung	50,305	Average annual	Butler et al.[85]
Diffuse Large B-Cell Lymphoma	45,796	Lifetime	Lee et al.[94]
Rectal	43,263	Lifetime	Maroun et al.[95]
Prostate	39,061	Average annual	Butler et al.
Colon	36,530	Lifetime	Maroun et al.
Breast	35,632	Average annual	Butler et al.
Breast	33,562	Lifetime	Will et al.[84]
Prostate	25,132	Lifetime	Grover et al.[87]
Small Cell Lung Cancer	22,428	Lifetime	Demeter et al.[86]
Non–small Cell Lung Cancer	18,469	Lifetime	Demeter et al.
Average	39,299	Average annual	Butler et al.
Adolescents (15–19 years)			
Leukemia	266,907	Total for 3 years since diagnosis	Luo et al.[90]
Soft-tissue Sarcoma	121,315	Total for 3 years since diagnosis	Luo et al.
Bone	119,819	Total for 3 years since diagnosis	Luo et al.
Lymphoma	89,650	Total for 3 years since diagnosis	Luo et al.
Central Nervous System	24,796	Total for 3 years since diagnosis	Luo et al.
Other	24,705	Total for 3 years since diagnosis	Luo et al.
Average	105,814	Total for 3 years since diagnosis	Luo et al.
Children (0–14 years)			
Sympathetic Nervous System	128,935	Total for 3 years since diagnosis	Luo et al.
Leukemia	115,829	Total for 3 years since diagnosis	Luo et al.
Bone	99,317	Total for 3 years since diagnosis	Luo et al.
Central Nervous System	96,493	Total for 3 years since diagnosis	Luo et al.
Wilms' Tumour	95,504	Total for 3 years since diagnosis	Luo et al.
Lymphoma	85,202	Total for 3 years since diagnosis	Luo et al.
Soft-Tissue Sarcoma	50,138	Total for 3 years since diagnosis	Luo et al.
Carcinomas	20,842	Total for 3 years since diagnosis	Luo et al.
Other	120,529	Total for 3 years since diagnosis	Luo et al.
Average	97,547	Total for 3 years since diagnosis	Luo et al.

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*). For readers who require *actual data* rather than current year *estimates*, the tables in this appendix provide a summary of actual incidence and mortality statistics based on the most recently available data. Table A1 lists the actual number of new cases (2006) that occurred in Canada and specifies the ICDO-3 codes used to define each diagnostic group. Table A2 lists the actual number of deaths (2005) and specifies the ICD-10 codes used to define each diagnostic group. Given the reliability of these actual counts, it is possible to examine the frequency of additional cancer types, and Tables A1 and A2 list a larger number of cancer types than the previous tables. Tables A3–A6 list actual values for incidence and mortality counts and rates for major cancer types by province and territory.

In addition to the explanations and discussion provided earlier in the report, several other points are helpful to note. As noted in Tables A3–A6, because of the small populations of the territories, only summaries (five-year average) are given for the most common cancers. Furthermore, the data sources are dynamic files that are routinely updated as new data become available. Users who require more current actual data for Canada may contact the Centre for Chronic Disease Prevention and Control at the Public Health Agency of Canada, or the Health Statistics Division at Statistics Canada. 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*).

APPENDIX I: ACTUAL DATA FOR NEW CASES AND DEATHS

Table A1

Actual Data for New Cases of Cancer, Canada, 2006

Cancer	ICDO-3 Site/Histology Type*	Total	Males	Females
All Cancers	**All invasive sites**	**157,194**	**82,133**	**75,061**
Oral (Buccal Cavity and Pharynx)	**C00–C14**	**3,306**	**2,216**	**1,090**
Lip	C00	333	244	89
Tongue	C01–C02	860	581	279
Salivary Gland	C07–C08	358	201	157
Mouth	C03–C06	676	382	294
Nasopharynx	C11	207	132	75
Oropharynx	C10	99	84	15
Other and Unspecified	C09,C12–C14	773	592	181
Digestive Organs	**C15–C26,C48**	**32,258**	**18,005**	**14,253**
Esophagus	C15	1,492	1,092	400
Stomach	C16	2,977	1,910	1,067
Small Intestine	C17	622	330	292
Large Intestine	C18,C26.0	13,226	6,754	6,472
Rectum and Anus	C19–C21	6,968	4,220	2,748
Liver	C22.0	1,423	1,048	375
Gallbladder	C23	407	128	279
Pancreas	C25	3,572	1,763	1,809
Other and Unspecified	C22.1,C24,C26.8–.9,C48	1,571	760	811
Respiratory System	**C30–C34,C38.1–.9,C39**	**23,436**	**13,111**	**10,325**
Larynx	C32	1,009	843	166
Lung	C34	22,085	12,053	10,032
Other and Unspecified	C30–31,C33,C38.1–.9,C39	342	215	127
Bone	**C40–C41**	**301**	**161**	**140**
Soft Tissue (including Heart)	**C38.0,C47,C49**	**1,050**	**610**	**440**
Skin (Melanoma)	**C44 Type 8720–8790**	**4,549**	**2,433**	**2,116**
Breast	**C50**	**20,484**	**147**	**20,337**
Genital Organs	**C51–C63**	**32,145**	**23,500**	**8,645**
Cervix	C53	1,314	—	1,314
Body of Uterus	C54	4,095	—	4,095
Uterus, Part Unspecified	C55	132	—	132
Ovary	C56	2,405	—	2,405
Prostate	C61	22,480	22,480	—
Testis	C62	844	844	—
Other and Unspecified	C51–52,C57,C58,C60,C63	875	176	699
Urinary Organs	**C64–C68**	**11,339**	**7,842**	**3,497**
Bladder	C67	6,534	4,862	1,672
Kidney	C64–C65	4,379	2,710	1,669
Other Urinary	C66,C68	426	270	156
Eye	**C69**	**258**	**152**	**106**
Brain and Central Nervous System	**C70–C72**	**2,413**	**1,369**	**1,044**
Endocrine Glands	**C37,C73–C75**	**4,148**	**1,021**	**3,127**
Thyroid	C73	3,879	882	2,997
Other Endocrine	C37,C74–C75	269	139	130
Hodgkin Lymphoma*	**Type 9650–9667**	**877**	**481**	**396**
Non-Hodgkin Lymphoma*	**See Glossary**	**6,492**	**3,470**	**3,022**
Multiple Myeloma*	**Type 9731,9732,9734**	**2,000**	**1,109**	**891**
Leukemia*	**See Glossary**	**4,441**	**2,529**	**1,912**
Mesothelioma*	**Type 9050–9055**	**461**	**389**	**72**
All Other and Unspecified Cancers	**See Glossary**	**7,236**	**3,588**	**3,648**

— Not applicable

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

Note: ICDO-3 refers to the third edition of the International Classification of Diseases for Oncology.[96] Numbers are for invasive cancers and in situ bladder but exclude non-melanoma skin cancer.

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

Data source: Canadian Cancer Registry database at Statistics Canada

Table A2

Actual Data for Cancer Deaths, Canada, 2005

Cancer	ICD-10	Total	Males	Females
All Cancers	**C00–C97**	**67,343**	**35,481**	**31,862**
Oral (Buccal Cavity and Pharynx)	**C00–C14**	**1,053**	**702**	**351**
Lip	C00	14	8	6
Tongue	C01–C02	258	166	92
Salivary Gland	C07–C08	108	66	42
Mouth	C03–C06	185	104	81
Nasopharynx	C11	105	68	37
Oropharynx	C10	93	67	26
Other and Unspecified	C09,C12–C14	290	223	67
Digestive Organs	**C15–C25,C26.0,C26.8–.9,C48**	**18,136**	**10,066**	**8,070**
Esophagus	C15	1,518	1,159	359
Stomach	C16	1,967	1,167	800
Small Intestine	C17	173	90	83
Large Intestine	C18,C26.0	6,824	3,541	3,283
Rectum and Anus	C19–C21	1,680	995	685
Liver	C22.0,C22.2–.7	687	527	160
Gallbladder	C23	292	102	190
Pancreas	C25	3,459	1,697	1,762
Other and Unspecified	C22.1,C22.9,C24,C26.8–.9,C48	1,536	788	748
Respiratory System	**C30–C34,C38.1–.9,C39**	**18,469**	**10,706**	**7,763**
Larynx	C32	446	359	87
Lung	C34	17,906	10,282	7,624
Other and Unspecified	C30–31,C33,C38.1–.9,C39	117	65	52
Bone	**C40–C41**	**146**	**83**	**63**
Soft Tissue (including Heart)	**C38.0,C47,C49**	**374**	**182**	**192**
Skin (Melanoma)	**C43**	**771**	**461**	**310**
Breast	**C50**	**5,045**	**55**	**4,990**
Genital Organs	**C51–C63**	**6,511**	**3,659**	**2,852**
Cervix	C53	369	—	369
Body of Uterus	C54	332	—	332
Uterus, Part Unspecified	C55	346	—	346
Ovary	C56	1,577	—	1,577
Prostate	C61	3,586	3,586	—
Testis	C62	43	43	—
Other and Unspecified	C51–52,C57,C58,C60,C63	258	30	228
Urinary Organs	**C64–C68**	**3,188**	**2,107**	**1,081**
Bladder	C67	1,626	1,125	501
Kidney	C64–C65	1,470	925	545
Other Urinary	C66,C68	92	57	35
Eye	**C69**	**38**	**20**	**18**
Brain and Central Nervous System	**C70–C72**	**1,571**	**898**	**673**
Endocrine Glands	**C37,C73–C75**	**251**	**124**	**127**
Thyroid	C73	146	73	73
Other Endocrine	C37,C74–C75	105	51	54
Hodgkin Lymphoma	**C81**	**137**	**80**	**57**
Non-Hodgkin Lymphoma	**C82–C85,C96.3**	**2,492**	**1,360**	**1,132**
Multiple Myeloma	**C90.0, C90.2**	**1,202**	**644**	**558**
Leukemia	**C91–C95, C90.1**	**2,269**	**1,313**	**956**
Mesothelioma	**C45**	**384**	**319**	**65**
All Other and Unspecified Cancers	**See Glossary**	**5,306**	**2,702**	**2,604**

— Not applicable

Note: ICD-10 refers to the tenth revision of the International Statistical Classification of Diseases and Related Health Problems.[97]

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

Data source: Canadian Vital Statistics Death database at Statistics Canada

APPENDIX I: ACTUAL DATA FOR NEW CASES AND DEATHS

Table A3

Actual Data for New Cases for the Most Common Cancers by Sex and Geographic Region, Canada, 2006*

	New Cases													
	Canada†	NL‡	PE	NS	NB	QC‡	ON	MB	SK	AB	BC	YT	NT	NU
Males														
All Cancers	**82,100**	**1,450**	**450**	**3,100**	**2,300**	**20,100**	**31,700**	**2,800**	**2,500**	**7,200**	**10,400**	**50**	**55**	**30**
Prostate	22,500	420	150	910	730	4,200	9,600	660	720	2,100	3,000	10	10	—
Lung§	12,100	200	55	480	370	3,800	4,100	400	340	930	1,300	5	5	10
Colorectal	11,000	260	45	410	290	2,800	4,200	400	340	910	1,350	10	15	5
Bladder§	4,900	95	30	210	150	1,550	1,250	200	140	500	710	5	—	—
Non-Hodgkin Lymphoma	3,500	45	10	110	100	820	1,350	120	110	300	510	—	5	—
Kidney§	2,700	50	20	130	80	740	960	120	75	260	260	—	—	—
Leukemia	2,500	15	5	75	50	560	1,050	90	95	240	360	—	—	—
Melanoma	2,400	35	25	110	70	270	1,150	70	70	240	370	—	—	—
Oral	2,200	45	5	65	55	540	900	100	65	200	240	—	5	—
Stomach	1,900	50	—	60	55	530	700	65	50	160	240	—	—	—
Pancreas	1,750	25	5	55	50	480	610	75	50	150	250	—	—	—
Brain	1,350	20	10	40	30	380	560	35	40	110	140	—	—	—
Multiple Myeloma	1,100	15	15	45	25	300	460	30	35	80	120	—	—	—
Esophagus	1,100	20	5	50	30	250	410	30	30	110	160	—	—	—
Liver	1,050	15	5	30	20	260	410	35	15	100	160	—	—	—
Thyroid	880	10	5	30	30	200	410	20	10	90	70	—	—	—
Females														
All Cancers	**75,100**	**1,100**	**320**	**2,600**	**1,950**	**19,100**	**29,400**	**2,700**	**2,300**	**6,400**	**9,100**	**50**	**50**	**30**
Breast	20,300	280	75	710	490	5,100	8,000	730	610	1,750	2,600	15	15	5
Lung§	10,000	140	55	370	320	2,900	3,500	370	330	800	1,250	5	5	10
Colorectal	9,200	190	50	390	220	2,300	3,500	360	290	740	1,150	5	5	5
Body of Uterus	4,200	60	20	120	120	960	1,750	160	120	380	550	5	—	—
Non-Hodgkin Lymphoma	3,000	65	10	100	85	700	1,200	120	110	250	400	—	—	—
Thyroid	3,000	30	5	80	85	660	1,600	65	50	250	190	—	—	—
Ovary§	2,400	25	10	60	60	600	1,000	90	80	160	310	—	—	—
Melanoma	2,100	30	5	95	75	270	1,000	60	45	220	310	—	—	—
Leukemia	1,900	10	5	60	30	440	740	65	75	200	270	—	—	—
Pancreas	1,800	10	10	70	60	520	590	70	55	180	250	—	—	—
Bladder§	1,650	30	10	55	45	560	470	60	50	140	240	—	—	—
Kidney§	1,650	25	10	80	55	460	610	60	60	150	150	—	—	—
Cervix	1,300	25	5	50	25	310	520	40	35	160	140	—	—	—
Oral	1,100	15	5	25	25	250	440	55	45	90	140	—	—	—
Stomach	1,050	25	5	35	35	290	410	35	35	85	110	—	—	—
Brain	1,050	15	5	35	40	300	390	30	35	80	120	—	—	—
Multiple Myeloma	890	5	—	25	20	220	410	30	25	65	90	—	—	—

— Fewer than three cases

* 2002–2006 average for Yukon, Northwest Territories, Nunavut.

† Canada totals include provincial and territorial estimates.

‡ An underestimate of the number of cases for some cancers for the years used to generate the 2010 estimates.

§ Definitions for these cancers have changed, see Table A7. Ontario does not report in situ bladder cases. It is estimated that including in situ cases for Ontario would result in 1,900 bladder cancer cases among men and 800 among women.

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

Table A4

Actual Age-Standardized Incidence Rates for Selected Cancers by Sex and Geographic Region, Canada, 2006*

	Cases per 100,000													
	Canada[†]	NL[‡]	PE	NS	NB	QC[‡]	ON	MB	SK	AB	BC	YT	NT	NU
Males														
All Cancers	**459**	**463**	**544**	**558**	**524**	**465**	**468**	**427**	**427**	**454**	**413**	**395**	**442**	**550**
Prostate	125	132	173	160	162	95	141	103	125	134	120	98	95	—
Lung[§]	68	65	69	85	85	88	61	62	57	60	52	58	68	248
Colorectal	61	83	54	73	64	64	61	61	57	57	53	65	111	97
Bladder[§]	27	33	39	38	35	36	19	30	24	32	28	25	—	—
Non-Hodgkin Lymphoma	19	16	15	18	22	19	20	19	19	18	20	—	21	—
Kidney[§]	15	15	21	22	18	16	14	19	13	15	10	—	—	—
Leukemia	15	6	10	14	12	14	16	14	16	15	15	—	—	—
Melanoma	13	12	27	21	16	6	17	10	12	15	15	—	—	—
Oral	12	14	7	10	12	12	13	15	11	11	9	—	24	—
Stomach	11	16	—	10	13	12	10	10	9	10	9	—	—	—
Pancreas	10	8	9	10	12	11	9	11	9	10	10	—	—	—
Brain	8	6	10	7	7	9	8	6	7	6	6	—	—	—
Multiple Myeloma	6	5	19	8	6	7	7	4	6	5	5	—	—	—
Esophagus	6	6	9	9	6	6	6	5	5	6	6	—	—	—
Liver	6	4	6	6	5	6	6	5	3	6	6	—	—	—
Thyroid	5	2	6	5	8	5	6	4	2	5	3	—	—	—
Females														
All Cancers	**357**	**315**	**331**	**395**	**367**	**362**	**367**	**350**	**348**	**348**	**321**	**339**	**354**	**574**
Breast	97	80	81	107	92	98	100	96	96	95	91	105	106	63
Lung[§]	47	41	55	56	59	53	43	47	50	45	43	44	65	267
Colorectal	41	55	53	55	38	42	41	43	39	39	37	46	56	89
Body of Uterus	20	17	19	18	21	18	22	22	19	20	19	22	—	—
Thyroid	17	10	4	15	21	15	23	10	9	14	8	—	—	—
Non-Hodgkin Lymphoma	14	19	12	15	17	13	15	16	16	14	14	—	—	—
Ovary[§]	11	8	9	9	11	11	13	12	12	8	11	—	—	—
Melanoma	11	10	7	16	15	6	14	8	8	12	12	—	—	—
Leukemia	9	4	8	8	6	9	9	9	11	12	10	—	—	—
Pancreas	8	3	7	10	10	9	7	8	7	9	8	—	—	—
Kidney[§]	8	7	11	12	10	9	8	7	9	8	5	—	—	—
Bladder[§]	7	9	9	8	9	10	5	7	8	7	8	—	—	—
Cervix	7	10	6	10	6	7	7	6	7	9	6	—	—	—
Brain	5	5	6	7	9	6	5	5	7	4	5	—	—	—
Oral	5	5	6	3	5	5	5	7	7	5	5	—	—	—
Stomach	5	8	7	5	6	5	5	4	5	5	4	—	—	—
Multiple Myeloma	4	2	—	3	4	4	5	3	4	3	3	—	—	—

— Age-standardized incidence rate is based on less than three cases per year.

* 2002–2006 average for Yukon, Northwest Territories, Nunavut.

† Canada totals include provincial and territorial estimates.

‡ An underestimate of the number of cases for some cancers for the years used to generate the 2010 estimates.

§ Definitions for these cancers have changed, see Table A7. Ontario does not report in situ bladder cases. It is estimated that including in situ cases for Ontario would result in a rate per 100,000 of 28 among men and 9 among women.

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

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

Data source: Canadian Cancer Registry database at Statistics Canada

Table A5

Actual Data for Deaths for Selected Cancers by Sex and Geographic Region, Canada, 2005*

	Deaths													
	Canada†	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC	YT	NT	NU
Males														
All Cancers	**35,500**	**710**	**140**	**1,300**	**970**	**9,500**	**12,900**	**1,350**	**1,200**	**2,900**	**4,500**	**30**	**25**	**15**
Lung‡	10,300	200	50	410	320	3,200	3,500	370	300	720	1,200	10	5	10
Colorectal	4,500	120	15	170	100	1,200	1,750	160	140	350	550	5	5	5
Prostate	3,600	60	15	130	110	760	1,300	190	190	340	500	—	—	—
Pancreas	1,700	25	10	70	55	430	610	65	50	150	230	—	—	—
Non-Hodgkin Lymphoma	1,350	15	5	40	35	310	530	60	50	120	200	—	—	—
Leukemia‡	1,300	25	5	50	35	290	520	50	60	120	150	—	—	—
Stomach	1,150	45	—	45	25	360	420	40	30	70	120	—	—	—
Esophagus	1,150	15	5	55	35	240	440	50	25	100	190	—	—	—
Bladder	1,150	20	5	45	30	260	420	50	45	85	170	—	—	—
Kidney‡	930	20	5	45	40	240	320	40	30	80	110	—	—	—
Brain	900	15	—	30	30	250	320	20	25	85	120	—	—	—
Oral	700	10	—	30	15	180	280	20	15	50	110	—	—	—
Multiple Myeloma‡	640	10	—	20	15	150	250	25	15	65	85	—	—	—
Liver‡	530	5	—	15	-	140	230	15	5	45	70	—	—	—
Melanoma	460	5	5	20	10	90	190	5	15	50	75	—	—	—
Females														
All Cancers	**31,900**	**550**	**160**	**1,100**	**820**	**8,500**	**12,100**	**1,250**	**1,050**	**2,400**	**3,900**	**20**	**20**	**15**
Lung‡	7,600	120	40	290	230	2,100	2,700	300	250	580	990	5	5	5
Breast	5,000	95	25	150	120	1,300	1,950	190	160	390	560	5	5	—
Colorectal	4,000	85	30	150	95	1,100	1,450	150	130	260	510	5	—	—
Pancreas	1,750	25	5	70	50	480	650	55	70	140	230	—	—	—
Ovary‡	1,600	25	5	50	40	350	670	55	50	120	200	—	—	—
Non-Hodgkin Lymphoma	1,150	10	10	50	20	280	450	55	45	85	120	—	—	—
Leukemia‡	960	10	—	30	30	230	380	45	55	65	120	—	—	—
Stomach	800	25	—	35	20	250	290	35	20	50	75	—	—	—
Body of Uterus	680	10	—	10	20	160	310	20	20	50	75	—	—	—
Brain	670	15	5	20	15	180	250	30	25	45	85	—	—	—
Multiple Myeloma‡	560	5	—	20	15	130	210	25	20	60	70	—	—	—
Kidney‡	550	15	5	25	15	160	200	25	20	30	45	—	—	—
Bladder	500	5	—	15	10	140	210	25	15	25	65	—	—	—
Cervix	370	5	—	20	5	65	160	15	10	45	45	—	—	—
Oral	350	5	—	5	5	75	150	10	10	30	50	—	—	—
Melanoma	310	10	—	10	10	60	130	10	5	35	40	—	—	—

— Fewer than three deaths

* 2001–2005 average for Yukon, Northwest Territories, Nunavut.

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

‡ Definitions for these cancers have changed, see Table A7.

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

Table A6

Actual Age-Standardized Mortality Rates for Selected Cancers by Sex and Geographic Region, Canada, 2005*

	Deaths per 100,000													
	Canada†	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC	YT	NT	NU
Males														
All Cancers	**208**	**250**	**181**	**245**	**229**	**232**	**199**	**212**	**196**	**195**	**184**	**275**	**229**	**359**
Lung‡	60	68	66	76	75	77	53	58	51	49	48	103	60	185
Colorectal	27	42	18	31	24	29	27	24	23	24	22	40	47	62
Prostate	22	23	16	25	26	20	21	28	29	25	21	—	—	—
Pancreas	10	9	10	13	14	10	9	10	8	10	9	—	—	—
Non-Hodgkin Lymphoma	8	6	9	8	9	8	8	9	8	8	8	—	—	—
Leukemia‡	8	9	8	10	9	7	8	8	10	8	6	—	—	—
Stomach	7	16	—	9	6	9	6	6	5	5	5	—	—	—
Bladder	7	7	7	8	7	7	7	8	7	6	7	—	—	—
Esophagus	7	5	5	10	8	6	7	8	4	6	8	—	—	—
Kidney‡	5	7	5	8	8	6	5	6	5	5	5	—	—	—
Brain	5	5	—	5	7	6	5	3	5	5	5	—	—	—
Oral	4	4	—	5	3	4	4	3	3	3	4	—	—	—
Multiple Myeloma‡	4	3	—	4	4	4	4	4	3	5	4	—	—	—
Liver‡	3	2	—	3	—	3	3	2	1	3	3	—	—	—
Melanoma	3	2	4	4	2	2	3	1	3	3	3	—	—	—
Females														
All Cancers	**144**	**156**	**153**	**154**	**145**	**153**	**143**	**148**	**140**	**133**	**130**	**178**	**193**	**386**
Lung‡	36	34	42	44	43	40	33	37	36	33	34	45	59	219
Breast	23	27	24	21	21	24	24	22	21	21	19	22	29	—
Colorectal	17	23	26	19	15	19	17	17	15	14	16	26	—	—
Pancreas	8	7	5	10	9	8	7	7	9	8	8	—	—	—
Ovary‡	7	8	7	7	7	7	8	7	7	7	7	—	—	—
Non-Hodgkin Lymphoma	5	3	8	7	4	5	5	6	6	4	4	—	—	—
Leukemia‡	4	2	—	4	5	4	4	5	7	4	4	—	—	—
Stomach	3	8	—	4	3	4	3	4	2	3	2	—	—	—
Brain	3	5	4	4	3	4	3	4	4	3	3	—	—	—
Body of Uterus	3	2	—	2	3	3	4	2	2	3	2	—	—	—
Multiple Myeloma‡	2	1	—	3	2	2	3	3	2	4	2	—	—	—
Kidney‡	2	4	6	3	3	3	2	3	3	2	1	—	—	—
Bladder	2	2	—	2	1	2	2	3	2	1	2	—	—	—
Cervix	2	2	—	3	1	1	2	2	1	2	2	—	—	—
Oral	2	2	—	1	1	1	2	1	1	2	2	—	—	—
Melanoma	1	3	—	1	2	1	2	1	1	2	1	—	—	—

— Rate is based on less than three cases per year.

* 2001–2005 average for Yukon, Northwest Territories, Nunavut.

† Canada totals include provincial and territorial estimates.

‡ Definitions for these cancers have changed, see Table A7.

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

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

Data source: Canadian Vital Statistics Death database at Statistics Canada

APPENDIX II: DATA SOURCES AND METHODS

DATA SOURCES AND DEFINITIONS

Incidence data: the Canadian Cancer Registry (CCR)

Actual cancer incidence data used in this report cover the period of 1981–2006. Data were obtained from the CCR (1992–2006),[98] 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.
- 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 (ICDO-3).[96]

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

The actual cancer mortality data cover the period of 1981–2005 and were obtained from the CVS: D.[99]

- Death records originate with the provincial and territorial registrars of vital statistics and are provided regularly to Statistics Canada for inclusion in the CVS: D.
- The CVS: D includes demographic and cause of death information for all residents who died in Canada between 1950 and 2005.
- Data are also included for Canadian residents who died in some states of the US, as Canada currently receives abstracted death data from approximately 10 states.
- The Health Statistics Division at Statistics Canada maintains the CVS: D.
- Cause of death is classified according to the International Statistical Classification of Diseases and Related Health Problems, 10th revision (ICD-10).[97]
- Cancer deaths are those attributed by the certifying physician to some form of cancer as the underlying cause of death.

Population data: the Census of Canada

Population estimates for Canada, the provinces and the territories are based on quinquennial censuses conducted 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 2006–2008.[100]
- Projected population estimates are used for 2009 and 2010, as prepared by Statistics Canada under assumptions of medium growth (scenario 3).[3] These incorporate expected natural increase, immigration and internal migration. The

medium growth scenario combines assumptions of fertility and immigration similar to recent years and moderate growth in life expectancy.

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

Life tables

Life tables are required to estimate relative survival. Sex-specific provincial life tables are produced by Statistics Canada.

- Data from the 1990–1992 life tables[101] were used for case follow-up in 1992 and 1993. Data from 1995–1997 life tables[102] were used for follow-up from 1994–1998. Data from the 2000–2002 life tables[103] were used for follow-up from 1999–2005. As complete life tables were not available for Prince Edward Island nor for the territories, expected survival proportions for these areas were derived from abridged life tables for Canada, Prince Edward Island and the territories, using a method suggested by Dickman et al.[104] Where this was not possible (i.e., territories 1990–1992), complete Canadian life table values were used. The aforementioned method of Dickman et al. was also used to extend, by single year of age, the 1990–1992 set of provincial life tables for ages 85–99.

Cancer definitions

- Cancers are generally defined according to the groupings of ICDO-3[96] for incidence and ICD-10[97] for mortality, as indicated in Table A9.
- Some definitions have changed slightly over time; changes occurring since the 2004 issue of this publication are outlined in Table A7.
- More specific subgroups, based on ICDO-3 site (topography) and morphology codes, were used for the in depth sections on specific cancers (esophageal and kidney), as indicated in Table A10.

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, sex, five-year age group (0–4, 5–9, …, 80–84 and 85+ years) and cancer type.

- Rates for each category are calculated by dividing the number of cases or deaths in each category (i.e., province, year, sex, age group, cancer type) by the corresponding provincial or territorial population figure. These form 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 are computed for broader age groups (0–19, 20–29, 30–39, 40–49, 50–59, 60–69, 70–79 and 80+ years) in the same way.
- Age-standardized incidence (ASIR) and mortality rates (ASMR) are 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*).

APPENDIX II: DATA SOURCES AND METHODS

Estimation of incidence (new cases) and mortality (deaths) for 2010

Two methods are used to estimate incidence and mortality data: Poisson modelling and five-year averaging.

Poisson modelling

Poisson regression modelling is the primary method for estimating the number of new cases and deaths in 2010 for each cancer type by sex (except new cases of non-melanoma skin cancer; see below) reported in Tables 1.1 and 1.2. The assumption underlying Poisson modelling 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 Poisson model is fit for each province, sex and type of cancer for the period of 1986–2006 for incidence and 1986–2005 for mortality.
- For prostate cancer incidence, Poisson modelling starts in 1991 rather than 1986. This is because the "spike" in incidence rates for this cancer associated with the introduction of the PSA test for detection of early disease in the late 1980s means that longer-term trends result in poor estimates.
- Age is included in all models as a factor with 18 levels (representing the 18 different five-year age groupings described above). Terms for time trends are evaluated by a stepwise selection algorithm available in S-Plus 2000 (MathSoft Inc., 1999). Age-specific incidence rate trends are then extrapolated to 2010. The predicted numbers of cancer cases in 2010 were calculated by multiplying these extrapolated incidence rates by the sex-, age- and province-specific population projections for the same year.

Five-year averaging

New cases and deaths in 2010 for each type of cancer are 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 (Poisson modelling results in poor estimates for these cancers because it is based on a longer-term trend) or when frequencies are low and result in unstable estimates using the Poisson model. The average of rates for the most recent five years is calculated for each sex, five-year age group, cancer type and province. The predicted numbers were then obtained by multiplying these rates by the corresponding projected population sizes.

Selection of "best" estimates

Estimates from the two methods are 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 Poisson-based estimate was generally preferred, especially for cancers where there was a pre-existing long-term trend. Such trends were identified for stomach, larynx, liver, cervix, testicle and thyroid cancers.
  - 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 Poisson 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) ÷ 4.5, or 11.1%.
- Provinces closely examine estimates for cancers where the absolute value of the relative difference exceeded 10%. Such situations may be indicative of important deviations from the long-term trend.
- Provinces were asked to recommend their choice of estimation method, along with a rationale. The rationale was usually the availability of in-house projections, knowledge of local trends or access to more current data, which permitted an assessment of the estimates produced by the two different estimation methods.
- Estimates for Canada as a whole were computed as sums of the estimates for the individual provinces and territories.

Tables A8.1 and A8.2 indicate the cancer types that were reported according to the five-year average method for 2010. In these situations, the age-standardized rates for 2010 reported in this publication are calculated using the most recent five years of actual data.

All cancers combined

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

For incidence and mortality in females and mortality in males, provincial estimates for "All Cancers" are those based on Poisson modelling of all cancers combined. For the territories, "All Cancers" estimates are based on five-year averages in all situations.

Non-melanoma skin cancer incidence

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

- Pathology laboratories in British Columbia send all diagnostic reports of NMSC to the provincial registry. The age- and sex-specific incidence rates in British Columbia for 1992–1994 and 2003 were projected to 2010 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 1986–2007 by year, sex and age group were provided by the Manitoba Cancer Registry and for 1989–2007 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 2010.
- 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 2010.

- Reported new cases of NMSC for all of Canada are the average of 2010 estimates from British Columbia, Manitoba and New Brunswick registries.

Rounding for reporting

- Estimates of incidence and mortality presented in this report have been rounded as follows:
  - numbers between 0 and 99 to the nearest 5
  - numbers between 100 and 999 to the nearest 10
  - numbers between 1,000 and 1,999 to the nearest 50
  - numbers greater or equal to 2,000 to the nearest 100
- Percentages, age-standardized and age-specific rates were rounded to the nearest 10th except in Tables 1.1, 1.2, 2.3 and 2.5 and Appendix Tables A4 and A6, where space restrictions forced rounding to the nearest whole number.
- Age- and sex-specific numbers or rates are 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 2010 estimates

Estimates of precision (standard errors, coefficients of variation and confidence limits) for 2010 counts and rates are available on request from the Chronic Disease Surveillance 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 linear model, assuming a constant rate of change in the logarithm of the annual ASIR or ASMR. 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 1986–2006 (for incidence) and 1986–2005 (for 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 2002 for incidence and 2001 for mortality.
- If no changepoint was detected within the periods 1997–2006 (for incidence) or 1996–2005 (for mortality), then the APC was estimated by fitting a model within these time periods, in the same way as described above.
- If a changepoint is detected within these decades, then a linear model is fitted for years from the changepoint to the final year of data. Both the changepoint year and the APC for the years beyond the changepoint are indicated in Table 4.5.

Statistically significant APC values, but not the changepoints, are reported in the in-depth sections on specific cancers (esophageal and kidney).

Contribution to incidence and mortality trend of change in cancer rate, population growth and population age-structure

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 age-standardized rate, using the 1981 population distribution for males or females as the standard weights
- Next to baseline series: the 1981 total population multiplied by the annual age-standardized rate, using the 1981 population distribution for males or females as the standard weights
- Baseline: the observed number of Canadian cancer cases or deaths during 1981, for males or females

Relative survival

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

- Deaths of people diagnosed with cancer are identified through record linkage of the CCR to the CVS: D, and from information reported by provincial or territorial cancer registries. For deaths reported by a registry but not confirmed by record linkage, it was assumed that the individual died on the date submitted by the reporting province or territory. At the time of the analysis, registration of new cases and follow-up for vital status were complete through December 31, 2005.
- Only survival following diagnosis of the first primary tumour is estimated. In order to identify persons in the CCR who had been diagnosed with cancer prior to 1992, the CCR was linked with its predecessor, the NCIRS. Supplementary information available on the CCR for residents of Ontario was also used.
- Analyses were based on those individuals aged 15–99 years at diagnosis.
- Persons whose diagnosis was established through death certificate only or autopsy only were excluded.
- Analyses were based on an algorithm written by Dickman[105] with some minor adaptations. Expected survival proportions were derived, using the Ederer II approach,[106] from sex-specific provincial life tables produced by Statistics Canada.
- Survival analyses were conducted using both period (2003–2005) and cohort analysis methods.[107] The period approach to survival analysis provides up-to-date predictions of cancer survival.[108] With this method, follow-up data do not relate to a fixed cohort of people with cancer. Rather, estimates of period survival are based

on the assumption that persons diagnosed in the period of interest will experience the most recently observed conditional probabilities of survival. When survival is generally improving, a period estimate tends to be a conservative prediction of the survival that is eventually observed.

- As an indication of the level of statistical uncertainty in the survival estimates, confidence intervals formed from standard errors estimated using Greenwood's method[109] are provided. To avoid implausible lower limits less than zero or upper limits greater than one for observed survival estimates, asymmetric confidence intervals based on the log (–log) transformation were constructed. Relative survival ratio confidence limits were derived by dividing the observed survival limits by the corresponding expected survival proportion.
- Age-standardized estimates were calculated using the direct method by weighting age-specific estimates for a given cancer to the age distribution of persons diagnosed with that cancer during 1992–2001. Confidence intervals for age-standardized relative survival ratios were formed by multiplying the corresponding age-standardized observed upper and lower limits by the ratio of the age-standardized relative survival point estimate to the age-standardized observed survival point estimate.

DATA AND METHODS USED

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.
- In Quebec, cases diagnosed only through death certificates have not generally been reported to the CCR with the exception of the 2000–2005 data years. In addition, because of the registry's dependence on hospital data, the numbers of cases of some cancers, particularly those where pathology reports represent the main source of diagnostic information, are underestimated. Prostate cancer, melanoma and bladder cancers are affected in particular.[2]
- Non-melanoma skin cancers are excluded since most provincial or territorial cancer registries do not collect information about these. Though common, they 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 section on estimating "Non-melanoma skin cancer incidence") 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 A7), there is one major earlier change of note:
  - In the versions of this report published before 2003, mortality due to colorectal cancer was based on the International Classification of Diseases, ninth revision (ICD-9),[110] 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 report cannot be directly compared with those appearing in reports prior to 2003.

Survival

Cases diagnosed in the province of Quebec were excluded from survival analyses, in part because the method of ascertaining the date of diagnosis of cancer cases in this province clearly differed from that of the other provincial cancer registries[111] and because of issues in correctly ascertaining the vital status of cases.

Table A7
Cancer Definition Changes Since 2004

Cancer Incidence	Cancer Mortality	Definition in 2004	Changes since 2004
Bladder		ICDO–3, C67 not including in situ cancers	2006: C67 including in situ cancers except for Ontario since Ontario does not report in situ bladder cancer
Kidney	Kidney	ICDO–3/ICD–10 C64–C66, C68	2008: C64–C65
Lung	Lung	ICDO–3/ICD–10 C33–C34	2006: C34 2007: C33–C34 2008: C34
Ovary	Ovary	ICDO–3/ICD–10 C56, C57.0–C57.4	2006: C56
	Leukemia	ICD–10 C91–C95	2008: C91–C95, C90.1
	Liver	ICD–10 C22	2006: C22.0, C22.2–C22.9 2007: C22.0, C22.2–C22.7
	Multiple Myeloma	ICD–10 C88, C90	2007: C90 2008: C90.0, C90.2
	All other and unspecified cancers	ICD–10 C44, C46, C76–C80, C96.0–C96.2, C96.7–C96.9, C97	2007: C88 added.

Note: Under ICDO-3, cancer incidence for bladder, kidney, lung and ovary excludes histology types 9590–9989 (leukemia, lymphoma and multiple myeloma) and histology 9050–9055 (mesothelioma).

Table A8.1

Use of Five-Year Average Method for Incidence Projection by Cancer Type and Geographic Region, 2010

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

M — Males, F — Females

Note:

- Poisson estimate is the default.
- Poisson modelling was strongly recommended for “All Cancers”, Stomach, Larynx, Cervix, Testis, Thyroid and Liver cancer.
- The territories are not shown, because five-year average method is used for all cancers combined due to small numbers.

Table A8.2

Use of Five-Year Average Method for Mortality Projection by Cancer Type and Geographic Region, 2010

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

M — Males, F — Females

Note:

- Poisson estimate is the default.
- Poisson modeling was strongly recommended for “All Cancers”, Stomach, Larynx, Cervix, Testis, Thyroid and Liver cancer.
- The territories are not shown, because five-year average method is used for all cancers combined due to small numbers.

Table A9
Cancer Definitions

Cancer	ICDO-3 Site/Histology Type* (Incidence)	ICD-10 (Mortality)
Oral	C00–C14	C00–C14
Esophagus	C15	C15
Stomach	C16	C16
Colorectal	C18–C21,C26.0	C18–C21,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 A9 *(continued)*
Cancer Definitions

Cancer	ICDO-3 Site/Histology Type* (Incidence)	ICD-10 (Mortality)
All Other and Unspecified Cancers (grouping used only in Tables A1 and A2)	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

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

Note: ICDO-3 refers to the third edition of the International Classification of Diseases for Oncology (2000).[96] Figures are for invasive sites including in situ bladder and excluding non-melanoma skin cancer.

Table A10
Definitions for Cancers in Depth

Cancer	ICDO-3 Site	ICDO-3 Morphology
Esophagus, All Types*	C15.0–C15.9	Type 8000–9049, 9060–9139, 9141–9589, 9990–9999
Upper Esophagus	C15.3	Type 8000–9049, 9060–9139, 9141–9589, 9990–9999
Middle Esophagus	C15.4	Type 8000–9049, 9060–9139, 9141–9589, 9990–9999
Lower Esophagus	C15.5	Type 8000–9049, 9060–9139, 9141–9589, 9990–9999
Not Specified as Upper, Middle or Lower	C15.0, C15.1–C15.2, C15.8–C15.9	Type 8000–9049, 9060–9139, 9141–9589, 9990–9999
Adenocarcinoma, All	C15.0–C15.9	Type 8140–8141, 8143–8145, 8190–8231, 8260–8263, 8310, 8401, 8480–8490, 8550–8551, 8570–8574, 8576
Adenocarcinoma, Lower Esophagus	C15.2, C15.5	Type 8140–8141, 8143–8145, 8190–8231, 8260–8263, 8310, 8401, 8480–8490, 8550–8551, 8570–8574, 8576
Adenocarcinoma, All Other	C15.0–C15.1, C15.3–C15.4, C15.6–C15.9	Type 8140–8141, 8143–8145, 8190–8231, 8260–8263, 8310, 8401, 8480–8490, 8550–8551, 8570–8574, 8576
Squamous Cell Carcinoma	C15.0–C15.9	Type 8050–8078, 8083–8084
Kidney (Renal Parenchyma), All Types*	C64.9	Type 8000–9049, 9060–9139, 9141–9589, 9990–9999
Renal Cell Carcinoma	C64.9	Type 8050, 8140, 8260, 8270, 8280–8312, 8316–8320, 8340–8344
Other specified and unspecified types	C64.9	Type 8000–8005, 8006–8009, 8010–8035, 8036–8049, 8085–8119, 8123–8129, 8132–8139, 8141–8259, 8261–8269, 8271–8279, 8313–8315, 8321–8339, 8345–8576, 8577–9049, 9060–9139, 9141–9589, 9990–9999

* Excluding hematological malignancies (lymphomas, leukemias and myelomas; ICDO-3 morphology 9590–9989)
Note: ICDO-3 refers to the third edition of the International Classification of Diseases for Oncology (2000).[96]

APPENDIX III: PREVIOUS SPECIAL TOPICS

In past years, other special topics (available at: www.cancer.ca/statistics) included:

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

Province/Territory — The province or territory of the individual'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.

ICD-10 — International Statistical Classification of Diseases and Related Health Problems, 10th revision.[97] This is a general system for classifying diseases and causes of death, including cancer.

ICDO-3 — International Classification of Diseases for Oncology, third edition.[96] This is the most current system specifically designed for classifying tumours. It is based on ICD-10, but encompasses both body organ where the tumour arose and its morphologic type.

ICCC-3 — International Classification of Childhood Cancer, third edition.[112] This system accounts for the important differences between types of cancer common during childhood and those of adulthood, and is more appropriate and informative than the ICDO-3 for reporting of childhood cancers.

INCIDENCE AND MORTALITY

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.

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).

Incidence rate — The number of new cancer cases (of all types or of a specific site or type) occurring in a specified 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 rate — As for incidence rate, but based on number of deaths rather than new cases.

Age-standardized incidence or mortality rate (ASIR, ASMR) — The incidence or mortality rate that would have occurred if the age distribution in the population of interest was the same as that of the standard. 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.

GLOSSARY

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.

SURVIVAL

Observed survival proportion (OSP)

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

Relative survival ratio (RSR)

A measure of the impact of cancer on life expectancy. Estimated by the ratio of the observed survival for a group of persons diagnosed with cancer to the survival that would be expected for members of the general population, assumed to be practically free of the cancer of interest, who have the same main non-tumour characteristics affecting survival (e.g., sex, age, areas of residence) as those with cancer. Estimates of the relative survival ratio greater than 100% are possible and indicate that the observed survival of the people with cancer is better than that expected for the general population.

Age-standardized relative survival ratio

The all-ages survival estimate that would have occurred if the age distribution of the cancer group under study had been the same as that of the standard population (i.e., all persons who were diagnosed with that cancer in Canada between 1992 and 2001). Age-standardization permits RSRs to be compared across jurisdictions or over time, independent of differences in age distributions of cancer cases.

OTHER MEASURES

Prevalence (limited duration)

The number of new or pre-existing cancer cases or people with cancer in a given population alive on a specific date (index date). Limited duration represents the number of cases or people alive on a certain day with a cancer diagnosis within the past *x* (e.g., 10) years.

Tumour-based prevalence counts the number of cancers among people who are alive on the index date. Person-based prevalence counts the number of people with a prior diagnosis of cancer who are alive on the index date.

Probability of developing or dying from cancer

The chance a person has of developing or dying from cancer over some period of life. It can be calculated as lifetime probability or can be age- and duration-specific (e.g., the probability at age 30 of developing cancer within the next 10 years). It is generally expressed as either a percentage or as a "one in *x* chance."

It is calculated by applying current cancer incidence and mortality rates to a hypothetical cohort of persons free of disease at the beginning of the age range of interest.

Potential years of life lost (PYLL)

The estimated number of years of life "lost" when a person dies "prematurely" from cancer. PYLL can be based on the number of years left before a fixed age or the age at which death occurs. In this publication, a life expectancy approach is used. It is calculated by multiplying the number of deaths in each age group by the expected years of life remaining in that age group. Deaths at young ages count more than deaths at older ages because of longer life expectancy.

1991 Canadian Standard Population

Age Group	Population (per 100,000)
<1	1,428.7
1–4	5,517.7
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

Note: The Canadian population distribution is based on the final postcensal estimates of the July 1, 1991, Canadian population, adjusted for census undercoverage. The age distribution of the population has been weighted and normalized.

Source: Census and Demographics Branch, Statistics Canada

REFERENCES

1. Canadian Cancer Society's Steering Committee: *Canadian Cancer Statistics 2009*, Toronto, Canadian Cancer Society, 2009.
2. Brisson J, Major D, Pelletier E. *Évaluation de l'exhaustivité du fichier des tumeurs du Québec*. Institut national de la santé publique du Québec, 2003.
3. Statistics Canada. 2005. *Population Projections for Canada, Provinces and Territories*. (Statistics Canada Catalogue no. 91-520-XIE-2005001). Ottawa: Minister of Industry. (Available at: http://www.statcan.gc.ca/pub/91-520-x/91-520-x2005001-eng.htm).
4. Kent WD, Hall SF, Isotalo PA, Houlden RL, George RL, Groome PA. *Increased incidence of differentiated thyroid carcinoma and detection of subclinical disease*. CMAJ 2007;177:1357–1361.
5. Andriole GL, Crawford ED, Grubb RL 3rd, Buys SS, Chia D, Church TR et al. *Mortality results from a randomized prostate-cancer screening trial.* N Engl J Med. 2009;360(13):1310–1319.
6. Schröder FH, Hugosson J, Roobol MJ, Tammela TL, Ciatto S, Nelen V et al.. *Screening and prostate-cancer mortality in a randomized European study.* N Engl J Med. 2009;360(13):1320–1328.
7. Powell J, McConkey CC, Gillison EW, Spychal RT. *Continuing rising trend in oesophageal adenocarcinoma.* Int J Cancer 2002;102(4):422–427.
8. Armstrong RW, Borman B. *Trends in incidence rates of adenocarcinoma of the oesophagus and gastric cardia in New Zealand, 1978–1992.* Int J Epidemiol 1996;25(5):941–947.
9. Lord RV, Law MG, Ward RL, Giles GG, Thomas RJ, Thursfield V. *Rising incidence of oesophageal adenocarcinoma in men in Australia.* J Gastroenterol Hepatol 1998;13(4):356–362.
10. Hansen S, Wiig JN, Giercksky KE, Tretli S. *Esophageal and gastric carcinoma in Norway 1958–1992: Incidence time trend variability according to morphological subtypes and organ subsites*. Int J Cancer 1997;71(3):340–344.
11. Sihvo EI, Salminen JT, Ramo OJ, Salo JA. *The epidemiology of oesophageal adenocarcinoma: Has the cancer of gastric cardia an influence on the rising ncidence of oesophageal adenocarcinoma?* Scand J Gastroenterol 2000;35(10):1082–1086.
12. Vizcaino AP, Moreno V, Lambert R, Parkin DM. *Time trends incidence of both major histologic types of esophageal carcinomas in selected countries, 1973–1995*. Intl J Cancer 2002;99(6):860–868.
13. Tuyns AJ. Oesophageal cancer in France and Switzerland: recent time trends. Eur J Cancer Prev 1992;1:275–278.
14. Falk GW. *Risk factors for esophageal cancer development*. Surg Oncol Clin N Am 2009;18(3):469–485.
15. Trivers KF, Sabatino SA, Stewart SL. *Trends in esophageal cancer incidence by histology, United States, 1998–2003*. Int J Cancer 2008;123(6):1422–1428.
16. Pohl H, Welch HG. T*he role of overdiagnosis and reclassification in the marked increase of esophageal adenocarcinoma incidence*. J Natl Cancer Inst 2005;97(2):142–146.

17. Lagergren J. *Adenocarcinoma of oesophagus: What exactly is the size of the problem and who is at risk?* Gut 2005;54:I1–I5.

18. Zhang HY, Spechler SJ, Souza RF. *Esophageal adenocarcinoma arising in Barrett esophagus*. Cancer Lett 2009;275(2):170–177.

19. Smith KJ, O'Brien SM, Green AC, Webb PM, Whiteman DC. *Current and past smoking significantly increase risk for Barrett's esophagus*. Clin GastroenterolHepatol 2009;7(8):840–848.

20. Devesa SS, Blot WJ, Fraumeni JF. *Changing patterns in the incidence of esophageal and gastric carcinoma in the United States*. Cancer 1998;83(10):2049–2053.

21. Tjepkema M. *Adult obesity in Canada: Measured height and weight.* Nutrition: Findings from the Canadian Community Health Survey, No. 1. Ottawa: Statistics Canada; 2006.

22. Veugelers PJ, Porter GA, Guernsey DL, Casson AG. *Obesity and lifestyle risk factors for gastroesophageal reflux disease, Barrett esophagus and esophageal adenocarcinoma.* Dis Esophagus 2006;19(5):321–328.

23. Engel LS, Chow WH, Vaughan TL et al. *Population attributable risks of esophageal and gastric cancers*. J Natl Cancer Inst 2003;95(18):1404–1413.

24. Gilmore J. *Report on smoking in Canada*. Statistics Canada, 2002. (Catalogue no. 82F0077XIE).

25. Daly JM, Fry WA, Little AG et al. *Esophageal cancer: Results of American College of Surgeons patient care evaluation study*. J Am Coll Surg 2000;190(5):562–573.

26. Brenner H, Francisci S, de Angelis R et al. *Long-term survival expectations of cancer patients in Europe in 2000–2002*. Eur J Cancer 2009;45(6):1028–1041.

27. SEER Cancer Statistics Review, 1975–2006, National Cancer Institute. Horner MJ, Ries LAG, Krapcho M. (eds.) [based on November 2008 SEER data submission, posted to the SEER website, 2009]. 2009. Bethesda, MD.

28. Wong RKS, Malthaner RA, Zuraw L et al. *Combined modality radiotherapy and chemotherapy in nonsurgical management of localized carcinoma of the esophagus: A practice guideline.* Int J Radiat Oncol Biol Phys 2003;55(4):930–942.

29. Levi F, Ferlay J, Galeone C et al. *The changing pattern of kidney cancer incidence and mortality in Europe*. BJU Int 2008;101(8):949–958.

30. Jemal A, Siegel R, Ward E, Hao YP, Xu JQ, Thun MJ. *Cancer Statistics, 2009*. CA-Cancer J Clin 2009;59(4):225–249.

31. Chow WH, Devesa SS. *Contemporary epidemiology of renal cell cancer*. Cancer J 2008;14(5):288–301.

32. Chow WH, Devesa SS, Warren JL, Fraumeni JF. *Rising incidence of renal cell cancer in the United States*. JAMA 1999;281(17):1628–1631.

33. Liu SL, Semenciw R, Morrison H, Schanzer D, Mao Y. *Kidney cancer in Canada: The rapidly increasing incidence of adenocarcinoma in adults and seniors*. Can J Pub Hlth 1997;88(2):99–104.

34. Mathew A, Devesa SS, Fraumeni JF, Chow WH. *Global increases in kidney cancer incidence, 1973–1992*. Eur J Cancer Prev 2002;11(2):171–178.

35. Murai M, Oya M. *Renal cell carcinoma: Etiology, incidence and epidemiology*. Curr Opin Urol 2004;14(4):229–233.

REFERENCES

36. Patard JJ. *Incidental renal tumours*. Curr Opin Urol 2009;19(5):454–458.

37. Hu J, Mao Y, White K. *Overweight and obesity in adults and risk of renal cell carcinoma in Canada.* Soz Praventiv Med 2003;48(3):178–185.

38. Pan SY, DesMeules M, Morrison H, Wen SW. *Obesity, high energy intake, lack of physical activity, and the risk of kidney cancer*. Cancer Epidemiol Biomarkers Prev 2006;15(12):2453–2460.

39. Curado FJA, Hernandez PC, Castro RP et al. *New epidemiologic patterns and risk factors in renal cancer*. Actas Urol Esp 2009;33(5):459–467.

40. Lipworth L, Tarone RE, McLaughlin JK. *The epidemiology of renal cell carcinoma*. J Urol 2006;176(6):2353–2358.

41. Hunt JD, van der Hel OL, McMillan GP, Boffetta P, Brennan P. *Renal cell carcinoma in relation to cigarette smoking: Meta-analysis of 24 studies*. Int J Cancer 2005;114(1):101–108.

42. Kreiger N, Marrett LD, Dodds L, Hilditch S, Darlington GA. *Risk factors for renal cell carcinoma: Results of a population-based case-control study*. Cancer Causes Control 1993;4(2):101–110.

43. Theis RP, Grieb SMD, Burr D, Siddiqui T, Asal NR. *Smoking, environmental tobacco smoke, and risk of renal cell cancer: a population-based case-control study*. BMC Cancer 2008;8:387.

44. IARC. *Overall evaluations of carcinogenicity: An updating of IARC Monographs Volumes 1 to 42.* International Agency for Research on Cancer (World Health Organization), 1987.

45. Siemiatycki J, Richardson L, Straif K et al. *Listing occupational carcinogens*. Environ Health Perspect 2004;112(15):1447–1459.

46. Hu J, Mao Y, White K. *Renal cell carcinoma and occupational exposure to chemicals in Canada*. Occup Med 2002;52(3):157–164.

47. Pesch B, Haerting J, Ranft U, Klimpel A, Oelschlagel B, Schill W. *Occupational risk factors for renal cell carcinoma: Agent-specific results from it case-control study in Germany.* Int J Epidemiol 2000;29(6):1014–1024.

48. Brenner H, Francisci S, de Angelis R et al. *Long-term survival expectations of cancer patients in Europe in 2000–2002.* Eur J Cancer 2009;45(6):1028–1041.

49. Pantuck AJ, Zisman A, Belldegrun AS. *The changing natural history of renal cell carcinoma*. J Urol 2001;166(5):1611–1623.

50. Higginson IJ, Davies E, Tsouros AD. *The end of life: Unknown and unplanned?* Eur J Public Health 2007;17:331–2.

51. Doyle D, Hawk C, Macdonald N (eds.). *Oxford Textbook of Palliative Medicine*. New York, NY: Oxford University Press, 1998.

52. Canadian Institute for Health Information. *Health Care Use at the End of Life in Western Canada*. Ottawa: CIHI, 2007.

53. NELS ICE. *End of Life Care in Nova Scotia Surveillance Report*. Network for End of Life Studies (NELS) Interdisciplinary Capacity Enhancement (ICE), Dalhousie University, Halifax, Nova Scotia, Canada. 2008.

54. Barbera L, Sussman J, Viola R, et al. *Factors associated with the end of life health service use in patients dying of cancer*. Healthcare Policy;(in press).

55. Barbera L, Paszat L, Chartier C. *Indicators of poor quality end-of-life cancer care in Ontario*. J Palliat Care 2006;22:12–7.

56. Barbera L, Paszat L, Chartier C. *Death in hospital for cancer patients: An indicator of quality of end-of-life care*. Palliat Med 2005;19:435–6.

57. Grunfeld E, Lethbridge L, Dewar R, et al. *Towards using administrative databases to measure population-based indicators of quality of end-of-life care: Testing the methodology*. Palliat Med 2006;20:769–77.

58. Grunfeld E, Urquhart R, Mykhalovskiy E, et al. *Toward population-based indicators of quality end-of-life care: Testing stakeholder agreement*. Cancer 2008;112:2301–8.

59. Fassbender K, Fainsinger R, Brenneis C, et al. *Utilization and costs of the introduction of system-wide palliative care in Alberta, 1993–2000*. Palliat Med 2005;19:513–520.

60. Dumont S, Jacobs P, Fassbender K, et al. *Costs associated with resource utilization during the palliative phase of care: A Canadian perspective*. Palliat Med 2009; 23(8):708–717.

61. Burge F, Lawson B, Johnston G, et al. *Primary care continuity and location of death for those with cancer.* J Palliat Med 2003;6:911–918.

62. Johnston GM, Burge FI, Boyd CJ, et al. *End-of-life population study methods.* Can J Public Health 2001;92:385–386.

63. Johnston GM, Gibbons L, Burge FI, et al. *Identifying potential need for cancer palliation in Nova Scotia*. CMAJ 1998;158:1691–1698.

64. Smith TJ, Hillner BE. *Ensuring quality cancer care by the use of clinical practice guidelines and critical pathways*. J Clin Oncol 2001;19:2886–97.

65. Canadian Institute for Health Information. *Health Care Use at the End of Life in British Columbia*. Ottawa: CIHI, 2008.

66. Cancer Care Ontario, Cancer Quality Council of Ontario. *Cancer System Quality Index (CSQI) 2009.* (Available at: http://csqi.cancercare.on.ca/). Accessed September 9, 2009.

67. Statistics Canada. *Ten leading causes of death, Canada, 2004 and 2005*. CANSIM Table 102–0561.

68. Special Senate Committee on Euthanasia and Assisted Suicide. Of Life and Death — Final Report. Ottawa: Supply and Services Canada [cat no YC2-351/1-OIE], 1995.

69. Carstairs S. *Still Not There — Quality End-of-Life Care: A Progress Report*. Ottawa: Health Canada Secretariat on Palliative and End-of-Life Care, 2005.

70. Statistics Canada. Deaths in hospital and elsewhere, Canada, provinces and territories, annual, CANSIM (Table 102-0509).

71. Burge F, Lawson B, Johnston G. *Trends in the place of death of cancer patients, 1992–1997*. CMAJ 2003;168:265–70.

72. World Health Organization (WHO) Regional Office for Europe. *Better palliative care for older people*. In: Davies E, Higginson I (eds.). Copenhagen 2004.

73. Heyland DK, Lavery JV, Tranmer JE, et al. *Dying in Canada: Is it an institutionalized, technologically supported experience?* J Palliat Care 2000;16 Suppl:S10–16.

REFERENCES

74. Gomes B, Higginson IJ. *Factors influencing death at home in terminally ill patients with cancer: systematic review.* BMJ 2006;332:515–21.

75. Wilson DM, Northcott HC, Truman CD, et al. *Location of death in Canada. A comparison of 20th-century hospital and nonhospital locations of death and corresponding population trends*. Eval Health Prof 2001;24:385–403.

76. Bruera E, Russell N, Sweeney C, et al. *Place of death and its predictors for local patients registered at a comprehensive cancer center.* J Clin Oncol 2002;20:2127–2133.

77. Gallo WT, Baker MJ, Bradley EH. *Factors associated with home versus institutional death among cancer patients in Connecticut*. J Am Geriatr Soc 2001;49:771–777.

78. Higginson IJ, Jarman B, Astin P, et al. *Do social factors affect where patients die: An analysis of 10 years of cancer deaths in England*. J Public Health Med 1999;21:22–28.

79. Costantini M, Camoirano E, Madeddu L, et al. *Palliative home care and place of death among cancer patients: A population-based study*. Palliat Med 1993;7:323–331.

80. Hunt R, McCaul K. *A population-based study of the coverage of cancer patients by hospice services.* Palliat Med 1996;10:5–12.

81. Earle CC, Park ER, Lai B, et al. *Identifying potential indicators of the quality of end-of-life cancer care from administrative data.* J Clin Oncol 2003;21:1133–1138.

82. Cancer Care Ontario. *Improving the Quality of Palliative Care Services for Cancer Patients in Ontario*. Toronto, October 2006.

83. Health Canada. *Economic Burden of Illness in Canada*. Ottawa, 1998.

84. Will BP, Berthelot JM, Le Petit C, et al. *Estimates of the lifetime costs of breast cancer treatment in Canada*. Eur J Cancer 2000;36:724–735.

85. Butler L, Downe-Wamboldt B, Melanson P, et al. *Prevalence, correlates, and costs of patients with poor adjustment to mixed cancers.* Cancer Nursing 2006;29:9–16.

86. Demeter SJ, Jacobs P, Chmielowiec C, et al. *The cost of lung cancer in Alberta*. Can Respir J 2007;14:81–86.

87. Grover SA, Coupal L, Zowall H, et al. *The economic burden of prostate cancer in Canada: Forecasts from the Montreal Prostate Cancer Model.* CMAJ 2000;162:987–992.

88. Fassbender K, Fainsinger RL, Carson M, et al. *Cost trajectories at the end of life: the Canadian experience.* J Pain Symptom Manage 2009;38:75–80.

89. Hollander MJ. *Costs of end-of-life care: Findings from the province of Saskatchewan*. Health Q 2009;12:50–58.

90. Luo W, Lane R, Stobart K, et al. *The medical care cost of childhood and adolescent cancer in Manitoba, 1990–1995*. Chronic Dis Can 2002;23:83–90.

91. Chandler B. *The value of household work in Canada, 1992*. Ottawa: Statistics Canada, Catalogue 13–604, no. 27, 1994.

92. Dumont S, Turgeon J, Allard P, et al. *Caring for a loved one with advanced cancer: determinants of psychological distress in family caregivers*. J Palliat Med 2006;9:912–921.

93. Guerriere DN, Zagorski B, Fassbender K, et al. *Cost Variations in Ambulatory and Home-Based Palliative Care*. Palliat Med 2010 (e-pub. April 1st).

94. Lee RC, Zou D, Demetrick DJ, et al. *Costs associated with diffuse large B-cell lymphoma patient treatment in a Canadian integrated cancer care center*. Value Health 2008;11:221–230.

95. Maroun J, Ng E, Berthelot JM, et al. *Lifetime costs of colon and rectal cancer management in Canada.* Chronic Dis Can 2003;24:91–101.

96. Fritz A, Jack A, Parkin DM, et al (eds.). *International Classification of Diseases for Oncology. Third Edition.* Geneva, World Health Organization, 2000.

97. World Health Organization. *International statistical classification of diseases and related health problems*, 10th revision, Volumes 1 to 3. Geneva 1992.

98. Statistics Canada. 2009. *Cancer Incidence in Canada*. Statistics Canada Catalogue no. 82-231-X. Ottawa: Minister of Industry. (Available at: http://www.statcan.gc.ca/pub/82-231-x/82-231-x2008002-eng.htm)

99. Statistics Canada. 2009. *Causes of Death*. (Statistics Canada Catalogue no. 84-208-XIE). Ottawa.(Available at: http://www.statcan.gc.ca/pub/84-208-x/84-208-x2009001-eng.htm).

100. Statistics Canada. 2009. Demographic Estimates Compendium 2008. CANSIM table 051-0001.

101. Millar WJ, David P. *Life tables, Canada and the provinces, 1990–1992*. (Statistics Canada Catalogue no. 84-537). Ottawa: Minister of Industry, 1995.

102. Duchesne D, Tully P, Thomas B, Bourbeau R. *Life Tables, Canada, Provinces and Territories, 1995/1997*. (Statistics Canada Catalogue 84-537). Ottawa: Minister of Industry, 2002.

103. *Life Tables, Canada, Provinces and Territories, 2000/2002* (Statistics Canada Catalogue 84-537). Ottawa: Minister of Industry, 2006.

104. Dickman PW, Auvinen A, Voutilainen ET, Hakulinen T. *Measuring social class differences in cancer patient survival: Is it necessary to control for social class differences in general population mortality?* A Finnish population-based study. J Epidemiol Community Health 1998;52:727–734.

105. Dickman PW. *Population-based cancer survival analysis*. (Available at: http://www.pauldickman.com/rsmodel/sas_colon/. Accessed January, 2009).

106. Ederer F, Heise H. *The effect of eliminating deaths from cancer on general population survival rates, methodological note 11, End Results Evaluation section*, National Cancer Institute, August 1959.

107. Ellison LF, Gibbons L. *Survival from cancer — up-to-date predictions using period analysis.* Health Reports 2006; 17:19–30.

108. Ellison LF. *An empirical evaluation of period survival analysis using data from the Canadian Cancer Registry*. Ann Epidemiol 2006; 16:191–196.

109. Greenwood M. *The Errors of Sampling of the Survivorship Table, Volume 33 of Reports on Public Health and Medical Subjects.* London: Her Majesty's Stationery Office, 1926.

110. World Health Organization. *International classification of diseases*. 9th revision. Volumes 1 and 2, Geneva, 1977.

REFERENCES

111. Ellison LF, Gibbons L, and the Canadian Cancer Survival Analysis Group. *Five-year relative survival from prostate, breast, colorectal and lung cancer.* Health Reports 2001;13:23–24.

112. Steliarova-Foucher E, Stiller CA, Lacour B, Kaatsch P. *International classification of childhood cancer, third edition*. Cancer 2005; 103:1457–1467

113. Statistics Canada. 2009. *Cancer Survival Statistics*. (Statistics Canada Catalogue no. 82-226-XIE-2009001). Ottawa: Minister of Industry. (Available at: http://www.statcan.gc.ca/pub/82-226-x/82-226-x2009001-eng.htm).

114. Le ND, Marrett LD, Robson DL, Semenciw RM, Turner D, Walter SD. *Canadian cancer incidence atlas*. Ottawa: Minister of Supply and Services Canada. Catalogue H49-6/1-1996, 1995.

115. Copeland G, Lake A, Firth R et al. (eds.). *Cancer in North America, 2002–2006.* Volume one: Incidence; Volume two: Mortality. Springfield, IL: North American Association of Central Cancer Registries, Inc. June 2009.

116. Curado MP, Edwards B, Shin HR, Ferlay J, Heanue M et al. *Cancer Incidence in Five Continents, Volume IX.* Lyon: IARC Scientific Publication No. 160, International Agency for Research on Cancer, 2007.

FOR FURTHER INFORMATION

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

- reports from provincial and territorial cancer registries
- *Cancer Incidence in Canada*,[98] *Cancer Survival Statistics*[113] and *Health Reports*, published by Statistics Canada
- *Chronic Diseases in Canada* and the *Canadian Cancer Incidence Atlas,*[114] published by Health Canada/Public Health Agency of Canada
- a collaborative monograph entitled *Cancer in North America, 2000–2004,*[115] published by the North American Association of Central Cancer Registries
- *Cancer Incidence in Five Continents,*[116] published by the International Agency for Research on Cancer.

For information from Canadian Cancer Society
For general information about cancer statistics or any other aspect of cancer (such as cancer prevention, screening, diagnosis, treatment and care), contact the **Canadian Cancer Society's Cancer Information Service at 1 888 939-3333**. A list of the Canadian Cancer Society's offices is provided on page 122. 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's Research Institute**, contact the National Office of the Canadian Cancer Society at the address provided on page 122.

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

Cancer Surveillance On-Line is an interactive online tool for easy access to cancer surveillance data (see the Public Health Agency of Canada website noted below). It allows you to generate tables, chart and maps according to a choice of parameters, such as cancer type, geographic area and time.

For information from Statistics Canada
Detailed statistical tables are available on the Statistics Canada website listed below. Custom tabulations are available on a cost recovery basis upon request from the Health Statistics Division, Statistics Canada, National Enquiries Line: 1-800-263-1136 or the Health Statistics Division: (613) 951-1746.

For 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 cancer statistics for each province or territory is available from the relevant registry (see pages 120-121 for contact information).

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

- Canadian Cancer Society
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- Public Health Agency of Canada
  www.phac-aspc.gc.ca (select surveillance)
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4. What special topic would you suggest for future editions?

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EVALUATION AND ORDER FORM

5. Do you have any additional suggestions to make this publication more useful to you?

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❑ **YES!** **Please send me the next edition of this report (hardcopy of the year 2011 edition). Please Print.**

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Front cover image:
The Boleys lost their first daughter, Jodi, to cancer at the age of seven. Although this was a devastating experience, it seemed to only strengthen the family. This photo was taken the day they all shaved their heads for *Cops for Cancer*.

Photographed by John Fearnall ©, PhotoSensitive

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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