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Special Topic:
Cancer in Adolescents and Young Adults

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Steering Committee Members

Lorraine Marrett (Chair), PhD

Population Studies and Surveillance, Cancer Care Ontario, Toronto, Ontario

Prithwish De, PhD

Canadian Cancer Society, Toronto, Ontario

Dagny Dryer, MD, FRCPC

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

Larry Ellison, MSc

Health Statistics Division, Statistics Canada, Ottawa, Ontario

Eva Grunfeld, MD, DPhil, FCFP

Ontario Institute for Cancer Research and Department of Family and Community
Medicine, University of Toronto, Toronto, Ontario

Heather Logan, RN, BScN, MHSc, CHE

Canadian Cancer Society, Toronto, Ontario

Maureen MacIntyre, MHSA

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

Les Mery, MSc

Surveillance Action Group, Canadian Partnership Against Cancer, Ottawa, Ontario

Howard Morrison, PhD

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

Hannah K. Weir, PhD

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

Analytic and Statistical Support

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

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

Robert Semenciw, MSc

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

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The development of this publication over the years has benefited considerably from the comments and suggestions of readers. The Steering Committee appreciates and welcomes such comments. To be 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 171,000 new cases of cancer (excluding 75,100 non-melanoma skin cancers) and 75,300 deaths from cancer will occur in Canada in 2009.
- ◆ Three types of cancer account for the majority of new cases in each sex: prostate, lung and colorectal in males and breast, lung and colorectal in females.
- ◆ Lung cancer remains the leading cause of cancer death for both men and women.
- ◆ Overall, colorectal cancer is the second leading cause of death from cancer.

2. Incidence and mortality by province

- ◆ Generally, both incidence and mortality rates are higher in Atlantic Canada and Quebec and lowest in British Columbia.
- ◆ Lung cancer incidence and mortality rates continue to be highest in Quebec and lowest in British Columbia among males. Nova Scotia is predicted to have the highest rate of lung cancer among females.
- ◆ Colorectal cancer mortality rates are approximately twice as high in Newfoundland and Labrador as they are in British Columbia.
- ◆ Little variation is seen in breast cancer rates across the country.

3. Incidence and mortality by age and sex

- ◆ 43% of new cancer cases and 60% of deaths due to cancer occur among those who are at least 70 years old.
- ◆ 30% of new cancer cases and 17% of cancer deaths will occur in young and middle-aged adults ages 20-59, in their most productive years for employment and raising families.
- ◆ Cancer incidence is rising in young women aged 20-39.
- ◆ 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 cases of cancer, exclusive of non-melanoma skin cancers, is primarily due to a growing and aging population.
- ◆ Between 1996 and 2005, incidence rates rose by more than 6% per year for thyroid cancer in both sexes. Liver cancer in males rose by more than 3% per year in the same timeframe.
- ◆ Between 1996 and 2005, incidence rates declined by at least 2% per year for stomach cancer in males, and larynx cancer in both sexes, and cervical cancer in females.
- ◆ Excluding lung cancer, cancer mortality rates have dropped by nearly 20% in females since 1980.
- ◆ Between 1995 and 2004, mortality rates declined significantly by at least 2% per year for prostate, lung, oral, and larynx cancers in males, stomach cancer and Hodgkin lymphoma in both sexes, and cervical cancer in females.

5. Incidence, mortality and survival in children (0-14 years)

- ◆ Although childhood cancer is rare, it remains of significant public health importance.
- ◆ On average, an estimated 836 children aged 0-14 develop cancer each year, but due to the successful treatment of the most common cancers, the number of deaths is one-sixth the number of cases.
- ◆ While the cancer incidence rate in children has been relatively constant since 1985, the cancer mortality rate continues to decline.
- ◆ In Canada, nearly 80% of children with cancer are either enrolled in a clinical trial or treated according to a registered protocol established by a clinical trial.
- ◆ Improving survival in childhood cancer (now at 82%), has increased the need for long-term follow-up of late effects.

6. Probability of developing or dying from cancer

- ◆ Based on current incidence rates, 40% of Canadian women and 45% of men will develop cancer during their lifetimes.
- ◆ Current mortality rates indicate that 24% of women and 29% of men, or approximately 1 out of every 4 Canadians, will die from cancer.

7. Five-year relative cancer survival

- ◆ Relative survival ratios were highest for thyroid, testicular and prostate cancers, and melanoma.
- ◆ Pancreatic, esophageal, lung and liver cancers had the lowest relative survival ratios.
- ◆ Relative survival for lung cancer tends to decline with increasing age; for breast cancer, survival is significantly worse for those aged 20-39 at diagnosis compared to all other age groups up to 79.
- ◆ Relative survival has improved by 4.5% for all cancers combined between 1992-94 and 2002-04. Improvements were greatest for non-Hodgkin lymphoma and prostate cancer.

8. Prevalence

- ◆ Cancers of the breast, prostate, colorectal and lung, that were diagnosed between 1995 and 2004, were the most prevalent cancers on January 1, 2005 and together accounted for nearly 60% of 10-year prevalent cases.
- ◆ Among women, the most common 10-year prevalent cancers were breast, colorectal, body of uterus, and lung.
- ◆ Among men, the most common 10-year prevalent cancers were prostate, colorectal, bladder, and lung.
- ◆ As the number of Canadians diagnosed with cancer continues to grow and cancer survival increases, cancer prevalence rises. This growing burden will have health resource implications as more Canadians will require ongoing medical treatment, surveillance and supportive care.

9. Cancer in adolescents and young adults (15-29 years)

- ◆ On average, there were 2,075 new cancer cases per year between 1992-2005 and 326 deaths per year between 1991-2004 in this age group.
- ◆ Slightly more young females than young males are diagnosed with cancer.
- ◆ Lymphomas are the most commonly diagnosed cancers in both sexes, while thyroid cancer in females and testicular cancer in males occur with similar frequency in each sex.
- ◆ Leukemia accounts for the most cancer deaths in each sex.
- ◆ Cancer incidence rates rose by 0.8% per year in males and by 1.4% per year in females during 1996-2005, while mortality rates declined in both sexes over a similar period.
- ◆ Little is known about risk factors for many of the leading cancers in this age group, which makes prevention difficult.
- ◆ For all cancers combined, 5-year observed survival increased from 80% in 1992-1995 to 85% in 2001-2004.
- ◆ Treatment and care issues include delays in diagnosis; low participation in clinical trials; lack of age-appropriate care; concerns around social support during cancer treatment; as well as late effects of treatment; second cancers; and long-term psychosocial requirements for cancer survivors.

ABOUT THIS PUBLICATION

Canadian Cancer Statistics is part of an annual series that began in 1987 and has been developed by members of the Canadian Cancer Statistics Steering Committee, 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 representatives of the Canadian Cancer Society, the Public Health Agency of Canada (PHAC), Statistics Canada, the Canadian Council of Cancer Registries, the Canadian Partnership Against Cancer as well as researchers based in universities and provincial/territorial cancer agencies. Information about the development of this publication is noted below.

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 period and province or territory. These data may help stimulate new research as well as assist decision-making and priority-setting at the individual, community, provincial/territorial and national levels. This report can also be used by educators, the media and members of the public who have an interest in cancer.

Data sources (for detailed information see Appendix II)

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

- ◆ Clinical and demographic data on newly diagnosed cancer cases are collected by provincial and territorial cancer registries for people residing in that province/territory. These are reported annually to Statistics Canada and added to the CCR.
- ◆ Demographic and cause of death information are collected by the provincial/territorial registrars of vital statistics for people residing in that province or territory at the time of death. These are reported annually to Statistics Canada and added to the CVS: D.
- ◆ 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 cell and squamous cell carcinomas). Most provincial/territorial cancer registries do not collect non-melanoma skin cancer incidence data. Canada-wide estimates are based on data from 3 provinces and are shown only in Table 1.1.
 - Benign tumours and carcinomas in situ (except for in situ carcinomas of the bladder).

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

- ◆ It is important to emphasize that 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 except for the province of Quebec because the data from this province were not reported to the CCR in time for this publication.

- ◆ Actual mortality data are available to 2004 for all provinces/territories.
- ◆ Incidence data for the period 2007-2009 (as well as 2006 for Quebec) and mortality data for 2005-2009 are estimated from long-term (15-20 year) trends. Thus, a recent change in long-term trend may not be reflected in projected estimates.

Review and analysis

- ◆ The Chronic Disease Surveillance Division, Centre for Chronic Disease Prevention and Control (CCDP), PHAC, conducted the data analysis for most of the sections. The analysts were supported by Maggie Stewart, who updated the tables and figures.
- ◆ Analyses were also provided by the Health Statistics Division of Statistics Canada.
- ◆ Provincial and territorial cancer registries were consulted regarding the cancer incidence and mortality estimates for their own jurisdictions. The final 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.

Special topic

- ◆ This year's Special Topic is Cancer in Adolescents and Young Adults (15-29 years). Comments on final drafts were provided by the following external reviewers:
 - Members of the C17 Council, in particular Dr. Ronald D. Barr and Dr. Paul Rogers.
- ◆ For a complete list of previous Special Topics please refer to *Appendix III*.
- ◆ Previous years' Special Topics are available online (1997 to 2008) or as hard copies 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, and some additional tables/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. However, please refer to the front of this publication for proper citation information.

For additional resources, please refer to the section entitled *For Further Information*.

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Cancer in Children and Youth (0-19 Years) (including Table W2 and Figure W2)

Appendix W1 – Classification of Cancers in Adolescents and Young Adults (15-29 Years) Using International Classification of Childhood Cancer, Third Edition and SEER Site Recodes

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1. INCIDENCE AND MORTALITY BY CANCER TYPE

The importance of different types of cancer can be measured in two ways, as shown in Table 1.1. Incidence is expressed as the number of new cases of a given type of cancer diagnosed each year. Mortality is expressed as the number of deaths attributed to a particular type of cancer during the year.

In 2009, an estimated 171,000 new cases of cancer and 75,300 deaths from cancer will occur in Canada. This represents an increase of 4,600 newly diagnosed cases and 1,500 deaths compared to 2008. More men than women will be diagnosed with a new cancer (52.2% vs. 47.8%) and die from cancer (52.6% vs. 47.4%) (Table 1.1). In addition, 75,100 new cases and 270 deaths from non-melanoma skin cancers (basal cell and squamous cell carcinomas) are expected in 2009. These cancers are reported separately because they represent the most common cancer diagnosed in Canadians, yet account for very few deaths. Most cancer registries do not routinely collect information on these cancers.

Excluding non-melanoma skin cancers, three types of cancer account for over half of the new cases in men (prostate, lung and colorectal) and women (breast, lung and colorectal). Lung cancer remains the leading cause of death in both men (28.3%) and women (26.3%) (Figures 1.1 and 1.2). The total number of lung cancer cases in men and women combined (n=23,400) is less than the number of prostate diagnoses (n=25,500) but is slightly higher than breast cancer cases (n=22,700) in females.

Among Canadian women, breast cancer continues to lead incidence with 22,700 new cases expected in 2009. Lung cancer incidence may be leveling off among women with an estimated 10,700 new cases being diagnosed in 2009 (approximately 600 fewer than in 2008).¹ However, lung cancer continues to be the leading cause of cancer mortality among women with an estimated 9,400 deaths occurring in 2009 (approximately 200 more than in 2008).¹ Breast cancer is the second leading cause of cancer mortality among women.

Canadian men will continue to see prostate cancer as the most commonly diagnosed cancer, with an estimated 25,500 new cases, compared with 12,800 lung cancers. Lung cancer will remain the leading cause of cancer death in Canadian men in 2009; the estimated 11,200 lung cancer deaths far exceed the 4,900 deaths due to colorectal cancer, the second leading cause of cancer death in men. Prostate cancer is third in mortality, causing 4,400 deaths.

Lung cancer is the overall leading cause of cancer mortality in Canadian men and women combined, followed by colorectal cancer.

The number of new cancer cases is expected to approach 171,000 in 2009 which represents approximately 470 Canadians diagnosed each day with some form of cancer.

1. INCIDENCE AND MORTALITY BY CANCER TYPE

Table 1.1

Estimated New Cases and Deaths for Cancers by Sex, Canada, 2009

	New Cases 2009 Estimates			Deaths 2009 Estimates		
	Total*	M	F	Total*	M	F
All Cancers	171,000	89,300	81,700	75,300	39,600	35,700
Prostate	25,500	25,500	–	4,400	4,400	–
Lung†	23,400	12,800	10,700	20,500	11,200	9,400
Breast	22,900	180	22,700	5,400	50	5,400
Colorectal	22,000	12,100	9,900	9,100	4,900	4,200
Non-Hodgkin Lymphoma	7,200	3,900	3,300	3,200	1,750	1,450
Bladder†	6,900	5,100	1,750	1,850	1,300	550
Melanoma	5,000	2,700	2,300	940	580	360
Thyroid	4,700	990	3,700	190	70	120
Leukemia†	4,700	2,700	1,950	2,500	1,450	1,050
Kidney†	4,600	2,800	1,800	1,600	1,000	610
Body of Uterus	4,400	–	4,400	800	–	800
Pancreas	3,900	1,900	2,000	3,900	1,850	2,000
Oral	3,400	2,200	1,150	1,150	770	390
Stomach	2,900	1,850	1,050	1,850	1,150	720
Brain	2,600	1,450	1,150	1,750	1,000	750
Ovary	2,500	–	2,500	1,750	–	1,750
Multiple Myeloma†	2,200	1,250	980	1,400	750	640
Liver†	1,700	1,300	410	700	540	160
Esophagus	1,600	1,200	420	1,800	1,350	440
Cervix	1,300	–	1,300	380	–	380
Larynx	1,150	940	220	510	410	95
Hodgkin Lymphoma	910	500	410	110	65	45
Testis	900	900	–	30	30	–
All Other Cancers	14,500	7,000	7,600	9,400	5,000	4,500
Non-melanoma skin	75,100	41,100	34,000	270	160	100

– 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) but includes the estimated deaths with underlying cause of other malignant neoplasms of skin (ICD-10 code C44).

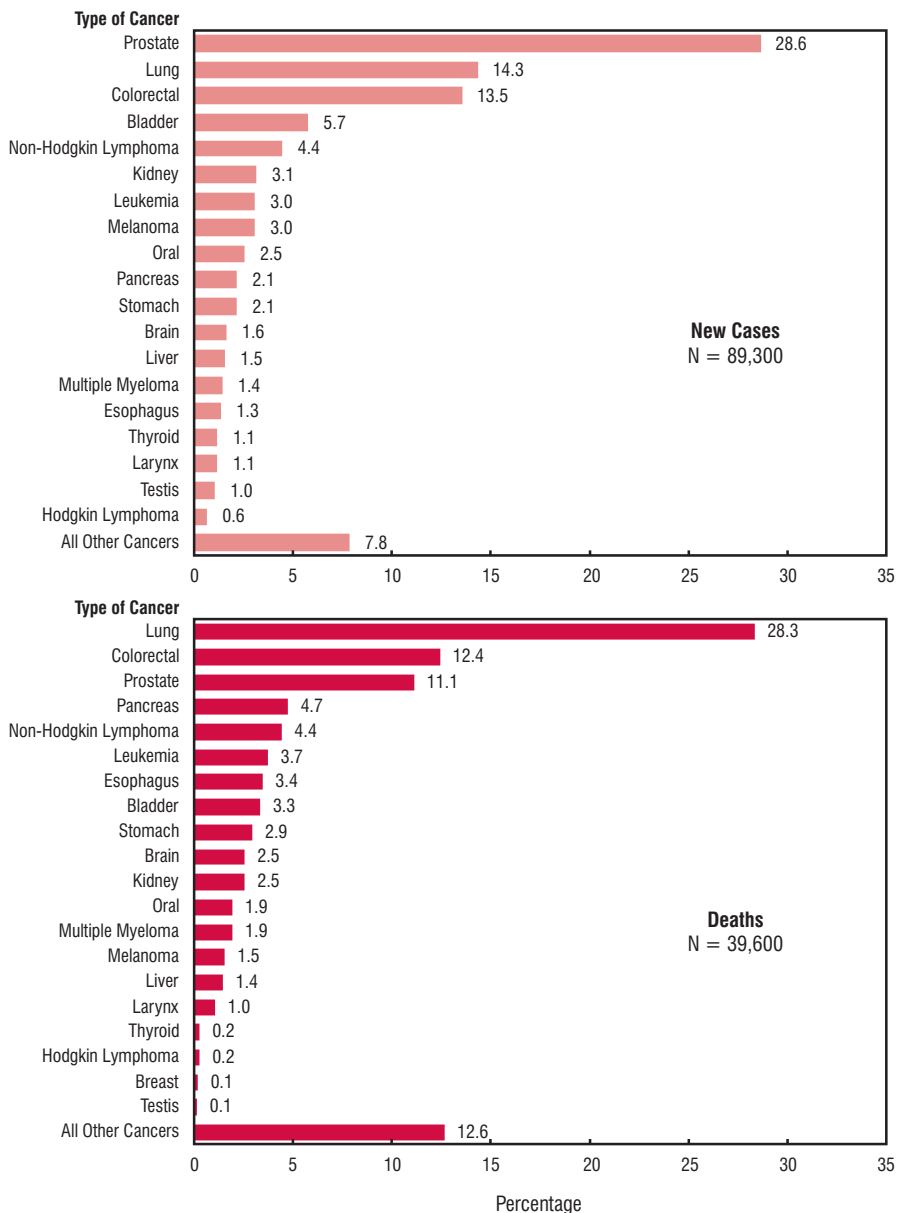
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

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

1. INCIDENCE AND MORTALITY BY CANCER TYPE

Figure 1.1

Percentage Distribution of Estimated New Cases and Deaths for Selected Cancers, Males, Canada, 2009



Note: New cases exclude an estimated 41,100 new cases non-melanoma skin cancer (basal and squamous). Deaths for 'All Other Cancers' include about 160 deaths with underlying cause 'other malignant neoplasms of skin'.

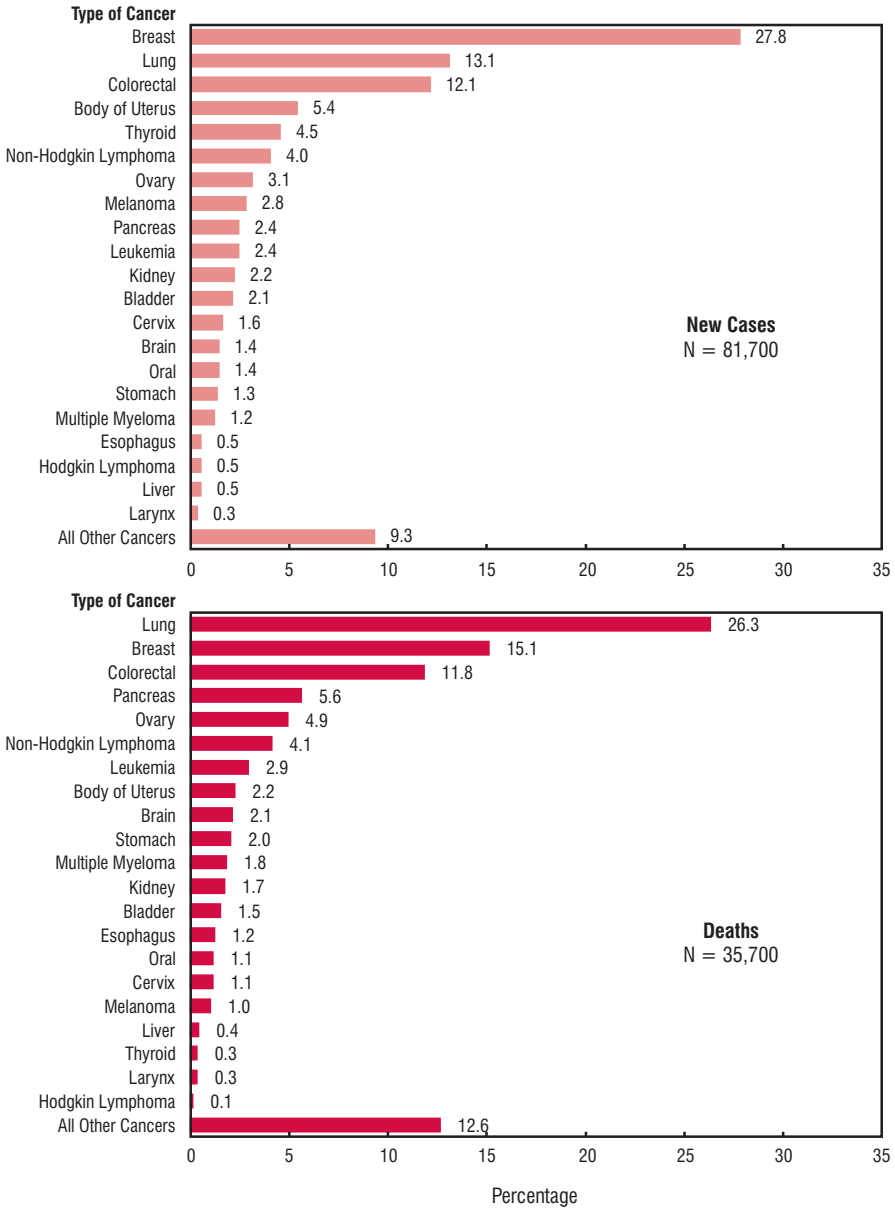
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

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

1. INCIDENCE AND MORTALITY BY CANCER TYPE

Figure 1.2

Percentage Distribution of Estimated New Cases and Deaths for Selected Cancers, Females, Canada, 2009



Note: New cases exclude an estimated 34,000 of non-melanoma skin cancer (basal and squamous). Deaths for 'All Other Cancers' include about 100 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/territory for 2009. 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/territory for 2009. 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.

The use of age-standardization adjusts for differences in age distributions among the provinces and territories, allowing for inter-provincial 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 are continuing to be projected higher in 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 rates show large provincial differences, possibly due to diversity in Prostate Specific Antigen (PSA) testing.
- ◆ Lung cancer incidence rates are highest in Quebec and lowest in British Columbia among men. Nova Scotia is predicted to have the highest rate of lung cancer among women.
- ◆ The highest colorectal cancer incidence rates are seen among men in Newfoundland and Labrador and among women in Prince Edward Island, Nova Scotia and Newfoundland; the lowest are in British Columbia for both sexes.
- ◆ Female breast cancer incidence rates appear to be reasonably consistent across the country.

Mortality

- ◆ Mortality rates for males for all cancers combined are higher in Atlantic Canada and Quebec, and are lower in Western Canada (Table 2.5). The pattern is similar for females, although rates are also high in Manitoba.
- ◆ Among males, the lung cancer mortality rate is highest in Quebec and lowest in British Columbia. Among females the lung cancer mortality rate is highest in Quebec and lowest in Saskatchewan and Alberta. The variation in lung cancer mortality across the country is much greater for males than females.
- ◆ Colorectal cancer mortality rates are approximately twice as high in Newfoundland and Labrador as they are in British Columbia.

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, knowledge exchange, along with planning and decision-making at the provincial/territorial level. These data are therefore of interest to researchers, health care workers, planners and policy-makers.

2. INCIDENCE AND MORTALITY BY PROVINCE

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/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 these 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 inter-provincial variation:

- ◆ When a cancer is rare, and/or the population is small the number of cases and rates occurring annually in a given province/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 and this falsely lowers the number of newly diagnosed cases, 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 in different provinces/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 microscopically confirmed prostate, melanoma and bladder cases have been estimated to be seriously underreported.²

The large inter-provincial differences seen in bladder cancer incidence rates are likely due to differences in reporting of in situ cases, particularly in Ontario, where they are not collected.

There continues to be a large variation in reported incidence and mortality from east to west across Canada.

2. INCIDENCE AND MORTALITY BY PROVINCE

Table 2.1

Estimated Population, New Cases and Deaths for All Cancers by Sex and Geographic Region, Canada, 2009

	Population (in thousands) 2009 Estimates			New Cases 2009 Estimates			Deaths 2009 Estimates		
	Total*	M	F	Total*	M	F	Total*	M	F
CANADA	33,368	16,520	16,848	171,000	89,300	81,700	75,300	39,600	35,700
Newfoundland and Labrador (NL) [†]	513	251	262	2,700	1,500	1,150	1,400	790	600
Prince Edward Island (PE)	140	68	72	880	490	390	360	190	170
Nova Scotia (NS)	945	463	482	6,000	3,300	2,700	2,700	1,450	1,250
New Brunswick (NB)	756	373	383	4,500	2,400	2,100	2,000	1,100	900
Quebec (QC) [†]	7,765	3,837	3,928	44,200	22,500	21,700	20,100	10,600	9,400
Ontario (ON)	13,099	6,465	6,634	65,100	33,900	31,200	27,900	14,500	13,400
Manitoba (MB)	1,201	597	604	6,000	3,000	3,000	2,800	1,450	1,350
Saskatchewan (SK)	985	489	496	5,000	2,700	2,300	2,400	1,350	1,100
Alberta (AB)	3,408	1,719	1,689	15,700	8,500	7,300	6,100	3,200	2,900
British Columbia (BC)	4,447	2,202	2,245	20,600	10,900	9,800	9,400	4,900	4,500
Yukon (YT)	31	16	16	110	55	55	65	40	25
Northwest Territories (NT)	45	23	22	110	55	55	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 2009 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

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.

2. INCIDENCE AND MORTALITY BY PROVINCE

Table 2.2

Estimated New Cases for Selected Cancers by Sex and Province, Canada, 2009

	New Cases										
	Canada*	NL†	PE	NS	NB	QC†	ON	MB	SK	AB	BC
Males											
All Cancers	89,300	1,500	490	3,300	2,400	22,500	33,900	3,000	2,700	8,500	10,900
Prostate	25,500	480	170	990	670	4,600	11,200	650	870	2,900	3,000
Lung‡	12,800	190	70	510	410	4,400	4,100	430	350	940	1,350
Colorectal	12,100	290	55	450	300	3,200	4,400	440	380	1,000	1,450
Bladder‡	5,100	85	30	220	160	1,700	1,300	200	160	490	760
Non-Hodgkin Lymphoma	3,900	45	20	120	100	910	1,500	150	120	350	560
Kidney‡	2,800	50	20	120	85	800	980	120	85	260	270
Melanoma	2,700	50	20	120	70	400	1,250	70	70	240	430
Leukemia	2,700	20	15	75	55	650	1,100	110	100	300	340
Oral	2,200	40	5	80	60	560	860	100	55	180	270
Pancreas	1,900	20	10	65	65	560	620	75	55	170	250
Stomach	1,850	50	5	60	50	490	700	70	50	160	230
Brain	1,450	30	5	45	35	400	550	40	40	130	180
Liver	1,300	10	5	20	10	370	500	40	20	130	200
Multiple Myeloma	1,250	15	10	40	30	320	490	40	35	100	140
Esophagus	1,200	20	5	55	35	290	440	40	35	110	180
Females											
All Cancers	81,700	1,150	390	2,700	2,100	21,700	31,200	3,000	2,300	7,300	9,800
Breast	22,700	360	100	730	550	6,000	8,700	790	630	2,000	2,700
Lung‡	10,700	150	50	440	290	3,000	3,700	410	300	850	1,400
Colorectal	9,900	200	55	390	240	2,600	3,700	360	300	780	1,200
Body of Uterus	4,400	65	20	140	95	1,000	1,800	180	120	420	570
Thyroid	3,700	40	5	70	110	770	2,100	70	55	330	210
Non-Hodgkin Lymphoma	3,300	50	10	110	80	790	1,350	120	100	290	430
Ovary‡	2,500	25	10	65	65	670	1,050	95	70	180	290
Melanoma	2,300	45	20	110	60	330	1,050	60	60	220	320
Pancreas	2,000	10	10	70	65	630	670	75	55	190	270
Leukemia	1,950	10	5	55	40	500	740	85	70	200	220
Kidney‡	1,800	30	5	80	60	500	660	75	55	150	170
Bladder‡	1,750	30	10	65	50	590	480	70	55	170	250
Cervix	1,300	20	10	50	35	280	500	45	40	160	150
Oral	1,150	15	5	35	20	280	440	50	35	95	150
Brain	1,150	15	5	35	25	310	440	40	35	95	130
Stomach	1,050	25	5	30	25	300	390	35	30	90	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.

† An underestimate of the number of cases for some cancers for the years used to generate the 2009 estimates.

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

Note: Rates 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

2. INCIDENCE AND MORTALITY BY PROVINCE

Table 2.3

Estimated Age-Standardized Incidence Rates for Selected Cancers by Sex and Province, Canada, 2009

	Cases per 100,000										
	Canada*	NL†	PE	NS	NB	QC†	ON	MB	SK	AB	BC
Males											
All Cancers	462	446	581	560	525	491	460	464	458	491	409
Prostate	129	140	184	159	141	98	149	95	148	161	108
Lung‡	66	56	80	85	88	95	56	64	57	56	49
Colorectal	62	87	65	75	64	69	60	65	63	59	53
Bladder‡	27	27	35	37	33	37	18	30	27	29	27
Non-Hodgkin Lymphoma	20	15	21	20	21	20	21	22	20	20	21
Leukemia	15	6	21	13	13	15	15	16	17	17	13
Kidney‡	14	15	21	21	18	17	13	18	15	15	10
Melanoma	14	15	23	21	15	9	17	11	12	13	16
Oral	11	13	8	14	12	11	11	14	9	10	10
Pancreas	10	7	13	10	13	12	8	11	9	10	9
Stomach	10	15	7	10	11	11	9	10	8	9	8
Brain	8	9	7	8	8	9	8	6	7	8	7
Liver	7	4	7	3	2	8	7	5	3	7	7
Multiple Myeloma	6	4	13	6	6	7	7	6	5	6	5
Esophagus	6	5	8	9	7	6	6	6	5	6	6
Females											
All Cancers	364	317	390	393	371	383	365	373	346	369	318
Breast	102	95	98	105	100	109	102	102	95	103	90
Lung‡	47	41	51	63	52	53	42	51	45	44	45
Colorectal	41	52	53	52	40	43	41	42	40	38	36
Thyroid	20	13	6	13	25	18	29	11	11	18	9
Body of Uterus	19	17	18	20	17	17	21	23	19	21	18
Non-Hodgkin Lymphoma	15	13	12	16	14	14	16	15	15	15	14
Ovary	11	7	9	10	12	12	12	12	10	9	10
Melanoma	11	12	21	18	12	7	13	9	10	12	11
Leukemia	9	4	7	8	8	9	9	11	11	10	8
Pancreas	8	3	8	9	11	10	7	8	7	9	8
Kidney‡	8	8	7	11	11	9	8	10	8	8	6
Bladder‡	7	8	7	9	9	10	5	8	7	8	8
Cervix	7	7	10	10	7	6	7	7	7	9	6
Brain	6	5	6	6	6	6	6	5	6	5	5
Oral	5	4	5	5	4	5	5	6	5	5	5
Stomach	4	6	5	4	4	5	4	4	4	5	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 2009 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

2. INCIDENCE AND MORTALITY BY PROVINCE

Table 2.4

Estimated Deaths for Selected Cancers by Sex and Province, Canada, 2009

	Deaths										
	Canada*	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC
Males											
All Cancers	39,600	790	190	1,450	1,100	10,600	14,500	1,450	1,350	3,200	4,900
Lung [†]	11,200	230	70	440	370	3,700	3,600	360	320	800	1,250
Colorectal	4,900	130	25	190	120	1,350	1,800	200	160	370	580
Prostate	4,400	85	25	140	130	880	1,650	180	230	440	560
Pancreas	1,850	30	5	70	55	530	650	65	60	150	260
Non-Hodgkin Lymphoma	1,750	20	5	55	45	390	720	70	50	130	260
Leukemia [†]	1,450	20	5	50	25	350	590	60	55	120	200
Esophagus	1,350	20	5	50	30	260	560	55	40	120	220
Bladder [†]	1,300	25	5	45	35	300	510	50	45	100	190
Stomach	1,150	35	5	35	25	320	420	35	30	75	130
Brain	1,000	20	–	35	25	300	350	30	25	95	130
Kidney [†]	1,000	20	5	40	30	260	350	45	30	95	120
Oral	770	15	5	35	20	220	280	30	15	55	100
Multiple Myeloma [†]	750	10	5	25	20	190	300	30	25	45	100
Melanoma	580	10	–	20	10	90	290	20	15	45	75
Liver [†]	540	5	–	10	5	170	220	20	5	45	65
Females											
All Cancers	35,700	600	170	1,250	900	9,400	13,400	1,350	1,100	2,900	4,500
Lung [†]	9,400	160	40	290	200	2,800	3,400	300	230	650	1,200
Breast	5,400	110	30	200	130	1,400	2,100	220	150	430	650
Colorectal	4,200	100	25	170	100	1,250	1,500	160	120	290	480
Pancreas	2,000	30	10	70	60	520	730	70	55	180	270
Ovary	1,750	35	5	60	45	380	690	75	55	150	250
Non-Hodgkin Lymphoma	1,450	15	10	50	35	350	590	60	45	100	180
Leukemia [†]	1,050	10	5	35	20	270	410	40	35	100	130
Body of Uterus	800	10	5	25	20	220	320	30	20	70	85
Brain	750	15	5	25	20	220	260	25	20	70	95
Stomach	720	25	–	25	15	210	250	20	20	65	85
Kidney [†]	610	15	5	20	20	170	200	25	25	55	75
Bladder [†]	550	10	–	15	15	140	220	15	10	45	75
Oral	390	–	–	10	10	95	150	15	10	35	60
Cervix	380	15	5	20	15	70	140	15	15	40	50
Melanoma	360	5	–	15	10	60	170	10	10	30	50

– Fewer than 3 deaths

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

† 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

2. INCIDENCE AND MORTALITY BY PROVINCE

Table 2.5

Estimated Age-Standardized Mortality Rates for Selected Cancers by Sex and Province, Canada, 2009

	Deaths per 100,000										
	Canada*	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC
Males											
All Cancers	207	252	227	244	233	233	198	212	216	190	176
Lung†	58	75	79	75	79	80	50	52	53	48	45
Colorectal	26	41	31	33	25	29	24	30	26	22	21
Prostate	23	29	33	25	29	20	23	25	35	28	20
Pancreas	10	10	8	12	11	11	9	9	10	9	9
Non-Hodgkin Lymphoma	9	5	8	9	10	8	10	10	8	8	9
Leukemia†	8	6	8	8	6	8	8	9	9	7	7
Esophagus	7	6	8	8	6	5	8	8	6	7	8
Bladder†	7	9	6	8	7	7	7	7	7	6	7
Stomach	6	11	8	6	6	7	6	5	5	5	5
Brain	5	6	2	6	5	7	5	5	5	5	5
Kidney†	5	7	8	7	6	6	5	6	5	6	4
Multiple Myeloma†	4	4	5	4	4	4	4	4	4	3	4
Oral	4	4	5	5	4	5	4	4	3	3	4
Melanoma	3	3	3	4	2	2	4	3	2	3	3
Liver†	3	2	1	1	1	4	3	3	1	2	2
Females											
All Cancers	147	152	154	169	151	155	145	155	146	143	133
Lung†	40	42	41	41	35	49	38	37	33	33	38
Breast	22	27	27	25	21	23	22	25	21	21	19
Colorectal	16	26	23	21	15	19	15	17	15	14	13
Pancreas	8	7	8	9	10	8	8	8	7	8	8
Ovary	7	9	6	8	7	6	8	9	8	8	8
Non-Hodgkin Lymphoma	6	4	8	7	6	6	6	7	6	5	6
Leukemia†	4	3	4	5	3	4	4	5	5	5	4
Brain	3	4	4	4	4	4	3	3	4	4	3
Body of Uterus	3	3	3	4	4	3	3	3	3	3	3
Stomach	3	7	1	3	2	3	3	2	3	3	2
Kidney†	2	3	3	2	3	3	2	3	3	3	2
Bladder†	2	2	1	2	2	2	2	1	1	2	2
Cervix	2	4	3	3	3	1	2	2	2	2	2
Oral	2	0	2	2	1	2	2	2	1	2	2
Melanoma	2	1	1	2	1	1	2	1	1	1	2

* 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 of Canadians 50 years of age or older (who represent 89% of all new cases), it nevertheless impacts all age groups. Table 3.1 shows that in 2009 it is estimated that:

- ◆ Approximately 73,000 new cases (43% of cases) and 46,000 cancer deaths (60% of deaths) will occur in Canadians aged 70 years or older.
- ◆ An additional 46,000 new cases (27%) and 16,700 deaths (22%) will occur in those aged 60-69.

The median age range at cancer diagnosis is between 65 and 69 years and between 70 and 74 years at death for both sexes. However, it is important to note that approximately 51,000 new cases (30%) and 13,000 deaths (17%) will occur between ages 20 and 59. These are the most productive years for employment and raising families. In addition, an increasing number of people over age 65 are delaying retirement in favour of continued work.⁴ Thus, cancer can have an enormous impact in both younger and older adults as well as on the social fabric and economy of Canada.

Figure 3.1 displays age-specific rates of cancer incidence (through 2005) and mortality (through 2004) by five-year age groups. Cancer incidence and mortality rates increase with age in both sexes. The age and sex distribution 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 cancers will occur among Canadians aged 70 or older.
- ◆ Breast cancer occurs primarily in women between the ages of 50 and 69. Only 29% of breast cancers are diagnosed over age 69, while 20% occur in women under age 50. It is notable that although half of new cases of breast cancer are estimated to occur between age 50 and 69, more deaths from breast cancer will occur in the 80 years and older age group, reflecting the benefits of screening and treatment in middle-aged women.
- ◆ Prostate cancer will be diagnosed most frequently in men aged 60-69, but more prostate cancer deaths occur in the 80 years and older age group. This pattern likely reflects the effect of screening in younger men and the long natural history of the disease.

Trends in age-standardized incidence and mortality rates for all cancers combined are shown in Figure 3.2. Cancer is more common among males compared to females in both youth under age 20 and adults over age 60. However, higher rates are seen in females than in males between the ages of 20 and 59. Sex-specific cancers such as breast and cervical cancer, in particular, as well as lung cancer, melanoma and thyroid cancer in females account for the marked shift in cancer incidence in ages 20-59. More specifically:

- ◆ Breast cancer is the most common cancer and cause of cancer death in females aged 20-59, accounting for 37% of new cancer cases and 22% of deaths.
- ◆ The increasing cancer incidence rate in young women aged 20-39 can be attributed to the increasing incidence of non-Hodgkin lymphoma, thyroid and kidney cancer in this group.⁵
- ◆ While the overall cancer incidence rate in men over age 69 has been dropping, primarily due to a declining rate of lung cancer from decreased tobacco use, the incidence rate in women is only beginning to level off.

3. INCIDENCE AND MORTALITY BY AGE AND SEX

The mortality rate for all cancers combined has been dropping for both males up to age 79 and females up to age 69, but begins to increase thereafter for females (Figure 3.2). From 1995-2004, annual rates of mortality have dropped significantly in all 10-year age groups (data not shown) for:

- ◆ Males aged 30-69 by about 2% per year, aged 70-79 by 1% and aged 80 or older by 0.4%
- ◆ Females aged 0-19 (>3% per year), aged 30-39 by 2.2%, aged 40-49 by 2.5%, aged 50-59 by 1.4%, and aged 60-69 by 0.5%.

The risk of developing cancer increases with age. Cancer rates are expected to rise in younger women aged 20-39 due to the increasing contribution of several specific cancer types. Notable declines in mortality, for all cancers combined, 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 Group and Sex, Canada, 2009

Age Group	Population (in thousands) 2009 Estimates			New Cases 2009 Estimates			Deaths 2009 Estimates		
	Total*	M	F	Total*	M	F	Total*	M	F
All Ages	33,368	16,520	16,848	171,000	89,300	81,700	75,300	39,600	35,700
0-19	7,692	3,940	3,752	1,300	700	600	170	95	80
20-29	4,564	2,318	2,246	1,950	880	1,050	220	120	100
30-39	4,624	2,329	2,295	4,500	1,550	3,000	680	290	400
40-49	5,236	2,627	2,608	13,200	4,700	8,400	3,000	1,300	1,700
50-59	4,750	2,349	2,401	31,300	15,300	16,000	9,000	4,400	4,600
60-69	3,263	1,589	1,674	46,000	26,900	19,100	16,700	9,300	7,500
70-79	1,978	910	1,068	42,100	24,500	17,600	21,800	12,400	9,300
80+	1,260	458	802	30,600	14,800	15,900	23,700	11,700	12,000

* 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

3. INCIDENCE AND MORTALITY BY AGE AND SEX

Table 3.2

Estimated New Cases and Deaths for the Most Common Cancers by Age Group and Sex, Canada, 2009

Age Group	Lung			Colorectal			Prostate	Breast
	Total	M	F	Total	M	F	M	F
New Cases								
All Ages	23,400	12,800	10,700	22,000	12,100	9,900	25,500	22,700
0-19	10	5	5	10	5	5	5	5
20-29	25	10	10	55	30	25	–	85
30-39	100	40	55	220	120	110	10	850
40-49	990	380	610	1,050	560	510	640	3,600
50-59	3,400	1,600	1,800	3,400	2,000	1,400	5,000	6,100
60-69	7,000	3,800	3,200	5,700	3,500	2,100	9,900	5,600
70-79	7,500	4,400	3,100	6,300	3,600	2,700	6,700	3,700
80+	4,500	2,500	1,950	5,300	2,300	3,000	3,100	2,800
Deaths								
All Ages	20,500	11,200	9,400	9,100	4,900	4,200	4,400	5,400
0-19	–	–	–	10	5	5	–	–
20-29	5	5	5	15	10	5	–	5
30-39	60	25	35	55	25	25	–	100
40-49	700	280	420	290	150	140	10	420
50-59	2,500	1,200	1,300	960	550	410	120	940
60-69	5,500	3,000	2,500	1,850	1,200	680	520	1,050
70-79	6,900	4,000	2,900	2,500	1,500	1,050	1,300	1,100
80+	4,900	2,600	2,200	3,400	1,500	1,950	2,400	1,700

– Fewer than 3 cases or deaths.

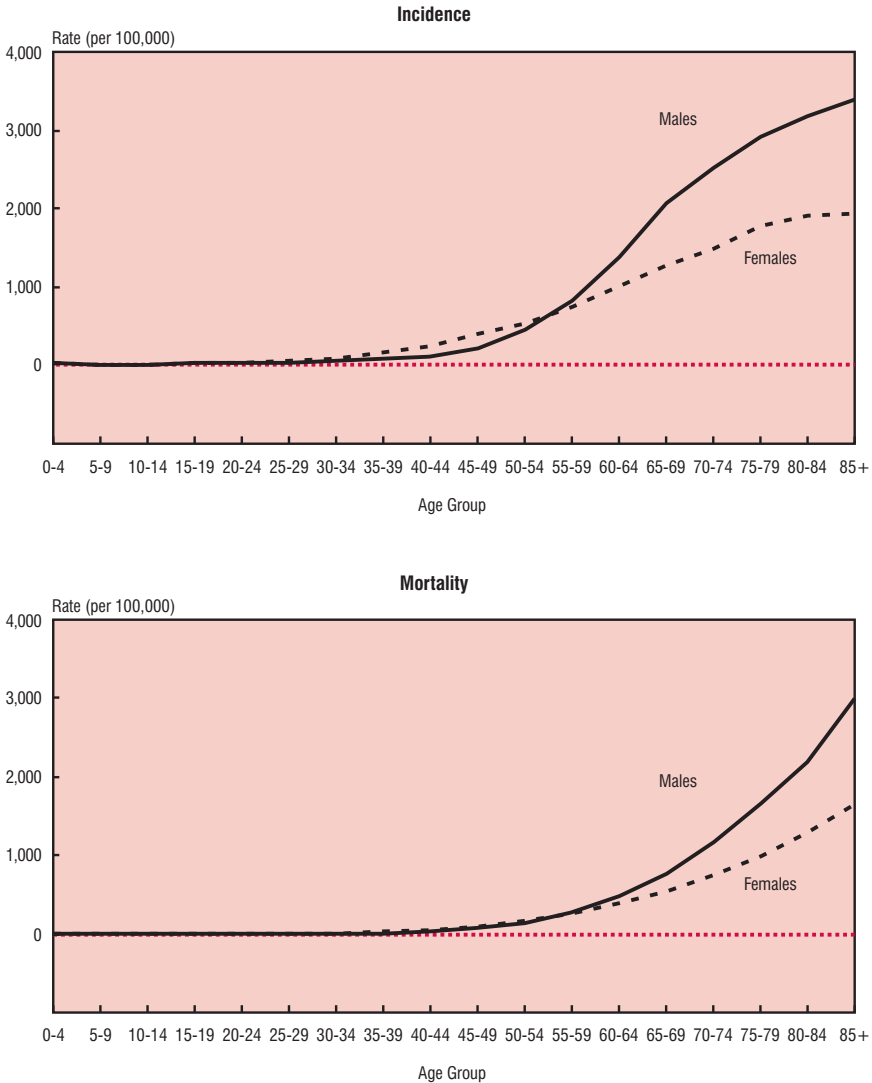
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

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

3. INCIDENCE AND MORTALITY BY AGE AND SEX

Figure 3.1

Age-Specific Incidence (2005) and Mortality Rates (2004) for All Cancers by Sex, Canada



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

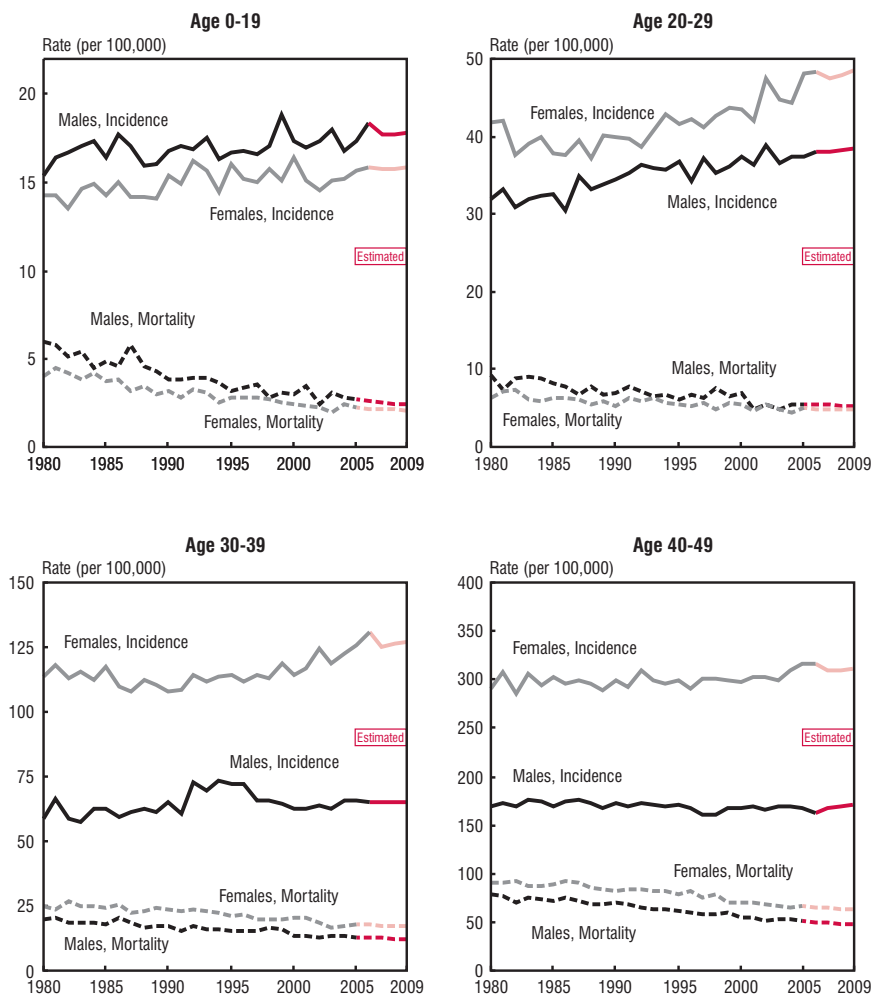
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

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

3. INCIDENCE AND MORTALITY BY AGE AND SEX

Figure 3.2

Age-Standardized Incidence and Mortality Rates by Age Group, All Cancers, Canada, 1980-2009

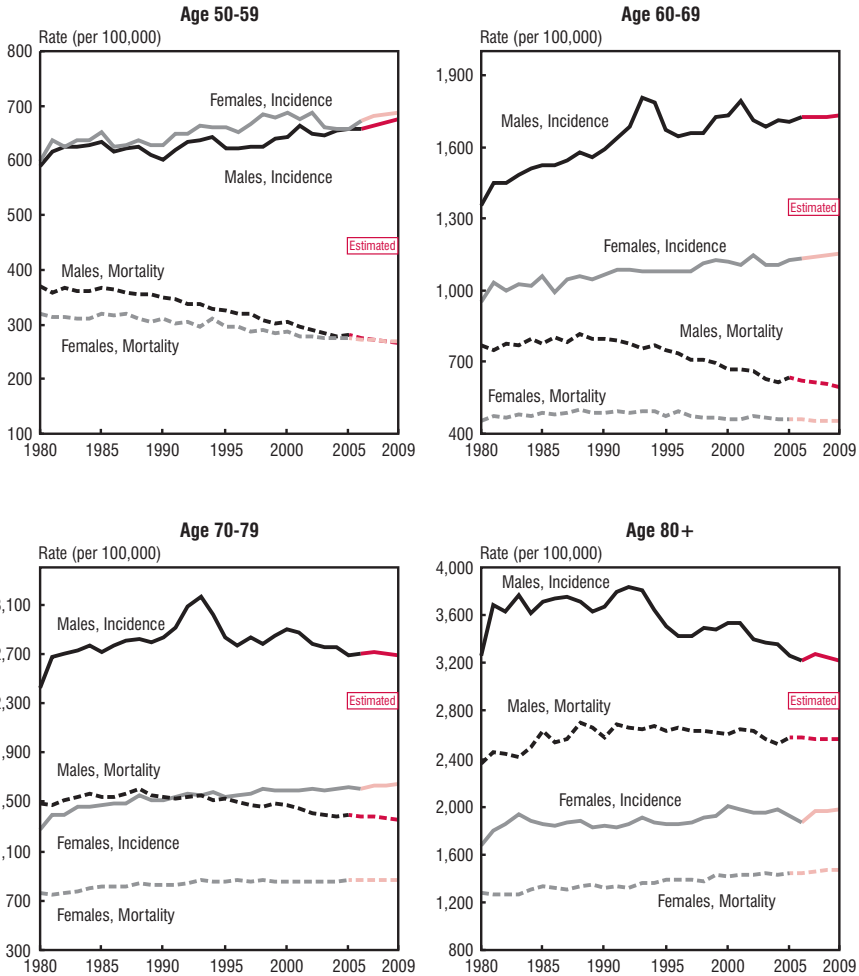


Note: The range of rate scales differs widely between the four age groups. Incidence rates exclude non-melanoma skin cancer (basal and squamous). Actual incidence data were available to 2006 except for Quebec.
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada
Data sources: Canadian Cancer Registry and Canadian Vital Statistics Death databases at Statistics Canada

3. INCIDENCE AND MORTALITY BY AGE AND SEX

Figure 3.2 (continued)

Age-Standardized Incidence and Mortality Rates by Age Group, All Cancers, Canada, 1980-2009



Note: The range of rate scales differs widely between the four age groups. Incidence rates exclude non-melanoma skin cancer (basal and squamous). Actual incidence data were available to 2006 except for Quebec.
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 health care system. Incidence trends can be directly used to predict how many new patients may seek diagnosis, primary treatment, and possibly further rounds of treatment thereafter. The trend in mortality gives an indication of the number of people who succumb to their disease and also reflects changes in incidence and survival.

Trends in incidence and mortality are assessed by comparing annual age-standardized rates. The use of 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 number of new cases and deaths for Canadian males and females, together with the corresponding age-standardized rates from 1980 to 2006 and estimates to the year 2009. Despite the relative stability in age-standardized rates, the number of new cancer cases and deaths continue to rise steadily as the Canadian population grows and ages. In 2009, the number of new cases is estimated to be 171,000 and the number of deaths to be 75,300. This represents an additional 4,600 new cases and 1,500 deaths in 2009 over the estimates for the previous year. The new cases include an additional 800 prostate and 500 colorectal cancer cases and 500 fewer lung cancer cases than estimated for 2008.

The cancer mortality rate among males, after reaching a peak in 1988, is declining slowly as a result of decreases in mortality rates for lung, colorectal and other cancers (Figure 4.2). In contrast, the cancer incidence rate rose in the early 1990s and then declined sharply, followed by a second peak in 2001, followed by a second decline. This pattern reflected a similar trend in prostate cancer incidence during this period. The cancer mortality rate in females has remained relatively stable since 1980.

Figures 4.3 and 4.4 show the relative contribution to the change in the total number 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 the growing and aging 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 1980.
- ◆ 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 1980.
- ◆ The top line represents the number of new cases (or deaths) that actually occurred and thus reflects the combined impact of rate change, population growth and the aging of the population.

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

4. TIME TRENDS IN INCIDENCE AND MORTALITY

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 from 1980 to 2009 for all cancers combined as well as for all cancers *excluding* lung cancer. The different pattern between males and females illustrates partly the different state of the lung cancer problem in the two sexes and partly different mortality trends for other cancers:

- ◆ In males, the all cancer mortality trend largely reflects the trend in lung cancer mortality (the two lines are very close through 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 is still increasing. Thus, the “All Cancer” mortality rate that has been essentially stable since 1980 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 (1996-2005) and mortality rates (1995-2004) are listed in Table 4.5. Of the 23 cancers listed in this table, statistically significant differences (increases or decreases) of 2% or more per year have been observed for the following cancers:

- ◆ Incidence:
 - Increases: thyroid cancer in both males (+6.4%) and females (+10.1%), and liver cancer in males (+3.2%).
 - Decreases: stomach cancer in males (-2.3%), larynx cancer in both males (-3.4%) and females (-3.5%), and cervical cancer (-2.3%) in females.
- ◆ Mortality:
 - Increases: liver cancer in males (+ 2.2%).
 - Decreases: in males, Hodgkin lymphoma (-4.2%), cancer of the stomach (-3.6%), larynx (-3.2%), prostate (-2.9%), oral cancer (-2.5%), and lung cancer (-2.1%); and in females, Hodgkin lymphoma (-3.7%), cervical (-3.3%) and stomach cancers (-3.1%).

It should be noted that short-term trends may not necessarily reflect longer-term trends. As such, the trends highlighted in this section should be interpreted with this caveat in mind.

Trends for specific cancers are as follows:

Prostate cancer

- ◆ Two peaks in incidence occurred in 1993 and in 2001, each followed by a decline. These peaks are compatible with two waves of intensified screening activity with

4. TIME TRENDS IN INCIDENCE AND MORTALITY

the PSA test for early prostate cancer. The first follows the introduction of PSA as a screening test while the second may be explained by the publicity around the then Canadian 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 some of the long-term and apparently ongoing increase in incidence may be due to more gradual changes in early detection, changes in risk or protective factors might also be partly responsible. However, little is known about the causes of prostate cancer, and hence, there is limited information about relevant changes in risk factors or risk behaviours.
- ◆ In contrast to incidence, mortality rates rose much more slowly from 1980, and started to decline in the mid 1990s. Mortality declined significantly by 2.9% per year between 1995 and 2004 (Table 4.5), and likely reflects improved treatment. The role of the widespread adoption of PSA testing in reducing mortality is unclear.

Lung cancer

- ◆ In males, rising incidence and mortality rates began to level off in the mid-1980s and have been declining ever since (Table 4.1 and 4.2). Rates have dropped significantly by 1.8% per year for incidence and by 2.1% per year for mortality (Table 4.5).
- ◆ In females, incidence and mortality rates have been increasing since 1980, however, the incidence rate appears to be leveling off as it had in other jurisdictions.⁶
- ◆ Males are projected to continue to have higher incidence and mortality rates than females in 2009 (66.5 per 100,000 vs. 46.7 per 100,000 and 58.4 per 100,000 vs. 40.3 per 100,000, respectively, Tables 4.1-4.4).
- ◆ These differences between male and female trends reflect the drop in tobacco consumption that began for males in the mid 1960's and much later – in about the mid-1980's – for females.

Breast cancer

- ◆ Breast cancer incidence rates rose steadily from 1980 through the early 1990's, in part as a consequence of the uptake of mammography screening. Reasons for the observed pattern of modest declines and increases observed since then are unclear but may relate in part to factors such as mammography screening, the increasing tendency for delaying childbearing and the large declines in the use of hormone replacement therapy which occurred after 2002.
- ◆ Female breast cancer mortality rates have been declining since the mid-1980s. The age-standardized mortality rate has fallen by more than 30% since 1986 from 32 to 22 per 100,000 (Table 4.4). The downward trend has decelerated to 1.6% per year since 1999. This is likely again the result of a combination of uptake of 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 US, UK and Australia.

4. TIME TRENDS IN INCIDENCE AND MORTALITY

Colorectal cancer

- ◆ Trends for colorectal cancer incidence between 1980 and 2005 (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 2009 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 1.3% per year in males and by 1.7% in females (Table 4.5), and are 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.
- ◆ The Canadian Partnership Against Cancer's Screening Action Group has recently established a colorectal cancer screening network to provide a national forum to review, discuss and take action to enhance and improve colorectal cancer screening in Canada.

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 from 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: a non-statistically significant decline of 2.4% per year since 2000 for males and 0.5% per year since 1996 for females. These declines 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 1990's has resulted in a decline in the proportion of the particularly aggressive forms of non-Hodgkin lymphoma attributable to HIV infection.

Other types of cancer

- ◆ *Melanoma incidence* increased in males and females (by 1.6% and 1.0% per year, respectively) between 1996 and 2005. This is likely related to more leisure time spent in the sun without adequate protection and to improvements in disease detection. Mortality rates were relatively stable in males but decreased in females between 1995 and 2004 (0.8% per year).

4. TIME TRENDS IN INCIDENCE AND MORTALITY

- ◆ *Kidney cancer* incidence rates increased by 0.8% and 1.3% per year in males and females, respectively, between 1996 and 2005. However, mortality rates remained relatively stable. Increasing incidence is partly due to improved detection but may also be related to the rising prevalence of obesity, which is an important risk factor for renal cell carcinoma, the major type of kidney cancer.
- ◆ *Thyroid cancer* incidence is increasing the most rapidly of all cancers (6.4% in males, and 10.1% per year in females since 1997). 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.⁷ Mortality rates have remained stable, most likely because modern treatment is highly effective in the management of early thyroid cancers.
- ◆ *Liver cancer* incidence and mortality rates increased in males by 3.2% and 2.2% per year, respectively, and both were statistically significant. In females, rates also increased by 1.7% per year for both incidence and mortality, but neither rate was statistically significant. These increases may be explained by rising immigration of persons from world regions where risk factors for liver cancer such as hepatitis B virus and aflatoxin are prevalent. Increases in rates of hepatitis C infection and alcohol abuse may also contribute to liver cirrhosis which can lead to liver cancer.
- ◆ *Cervical cancer* incidence and mortality rates have been declining (2.3% and 3.3% per year, respectively), largely due to widespread regular use of Papanicolaou (Pap) test screening whereby malignant as well as pre-malignant lesions can be detected early and 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 health care.
- ◆ *Larynx cancer* incidence rates are significantly decreasing for both males and females (3.4% and 3.5% per year, respectively), while mortality rates for males show a significant decline of 3.2%. Cancer of the larynx is associated with tobacco use and alcohol.
- ◆ *Hodgkin lymphoma* mortality rates are very low and have declined sharply between 1995 and 2004 by 4.2% and 3.7% per year, in males and females respectively.
- ◆ *Testicular cancer* incidence continues to increase at a rate that is now statistically significant (1.5% per year between 1996 and 2005). Testicular cancer incidence has been increasing for several decades for reasons which are not well understood. The decline in testicular cancer mortality (2.4% per year between 1995 and 2004) continues but is no longer statistically significant. Because there are few testicular cancer deaths each year, mortality rates tend to be unstable, which can result in substantial year-to-year variation.

4. TIME TRENDS IN INCIDENCE AND MORTALITY

Implications

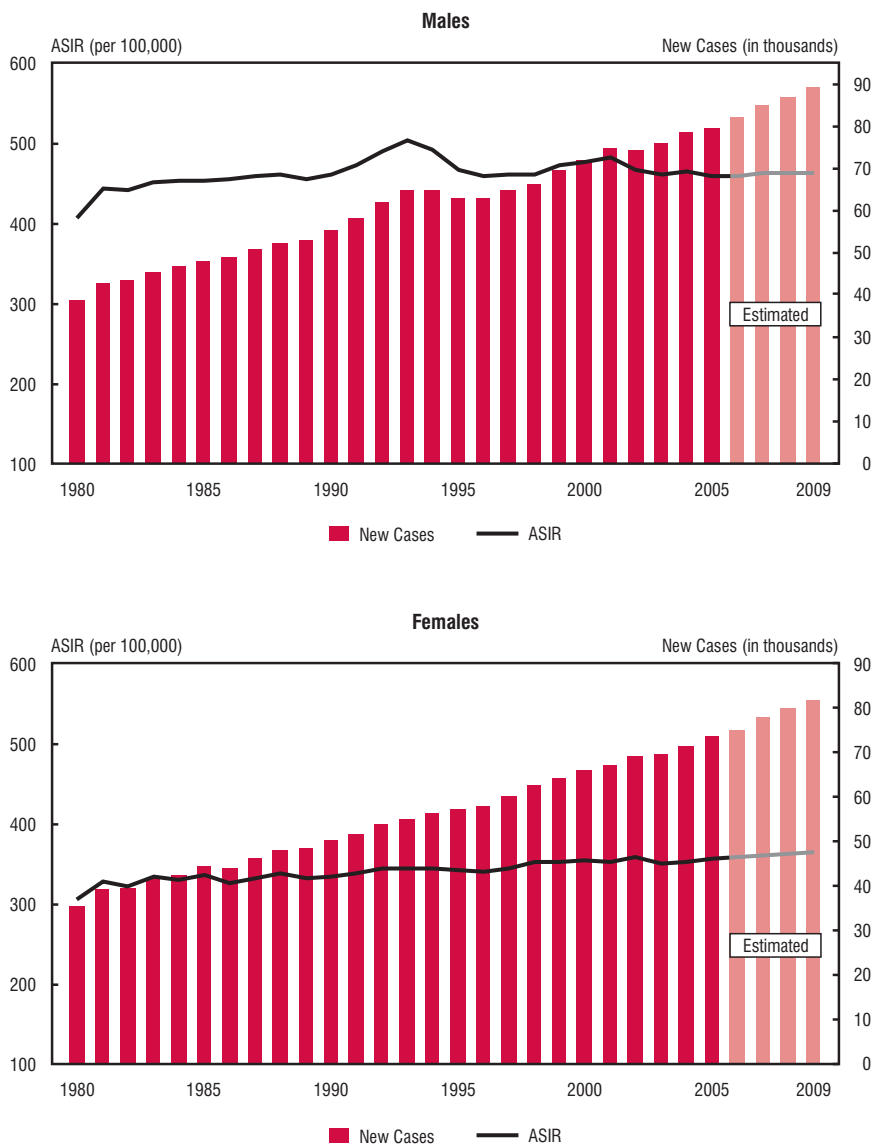
Figures 4.1 and 4.2 highlight the notion that the rise in new cases and deaths from cancer will place an increasing burden on Canadian society, largely independent of the trend in rates of incidence and mortality. This vividly illustrates why cancer prevention and health promotion programs are so vital. Cancer trends also underline the importance of planning for the increasing number of cancer cases in the context of a growing and aging Canadian population. We must enhance capacity for primary prevention, early detection, treatment, health promotion and palliation. In addition, we must do a better job of primary prevention to reduce the number of cases that are avoidable.

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, health promotion and palliation.

4. TIME TRENDS IN INCIDENCE AND MORTALITY

Figure 4.1

New Cases and Age-Standardized Incidence Rates (ASIR) for All Cancers, Canada, 1980-2009



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 except for Quebec. Please refer to *Appendix II: Methods* for further details.

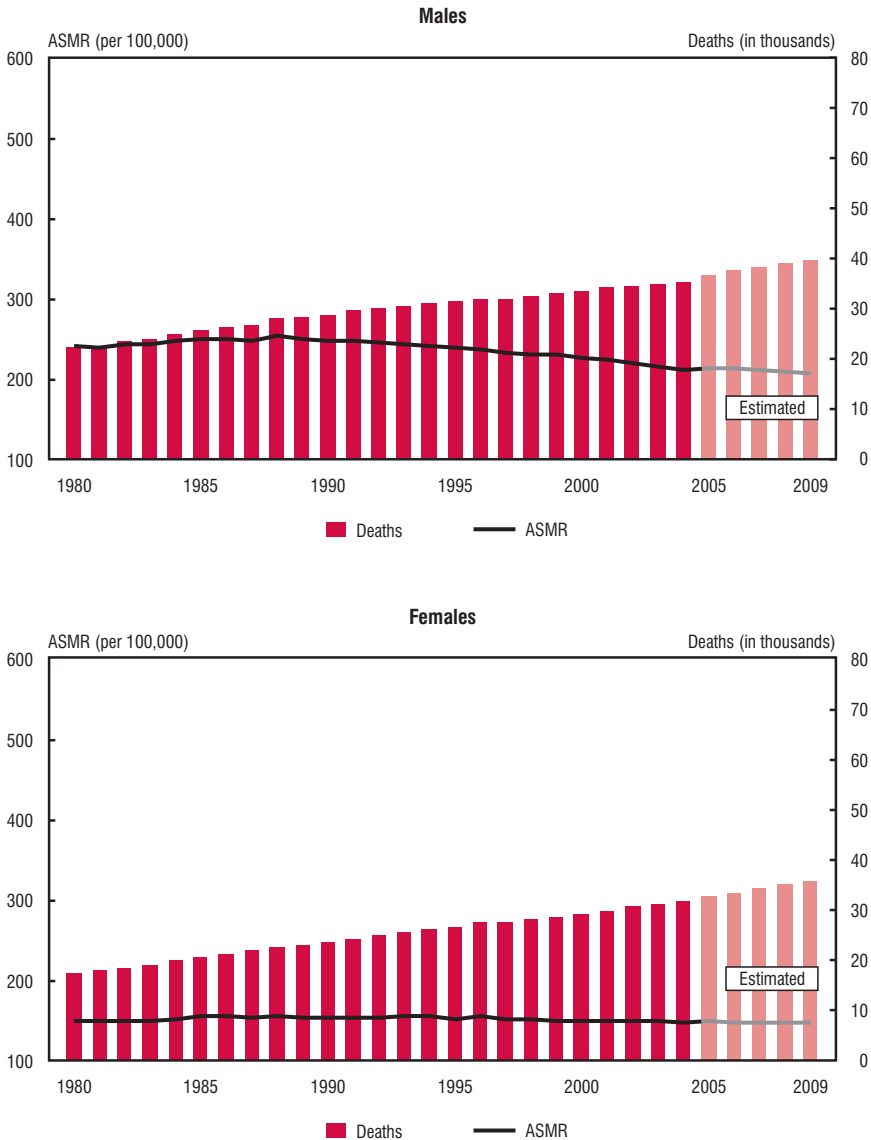
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

Data source: Canadian Cancer Registry database at Statistics Canada

4. TIME TRENDS IN INCIDENCE AND MORTALITY

Figure 4.2

Deaths and Age-Standardized Mortality Rates (ASMR) for All Cancers, Canada, 1980-2009



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

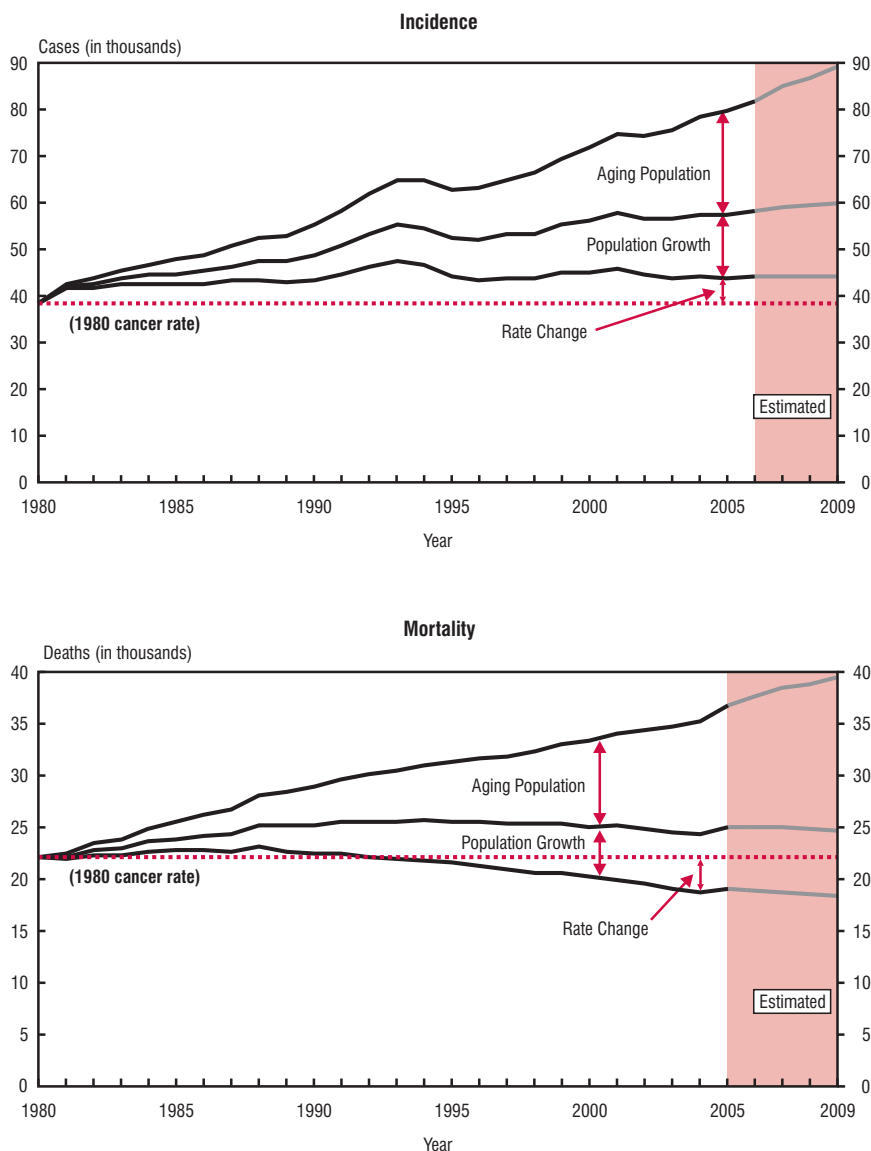
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

Data source: Canadian Vital Statistics Death database at Statistics Canada

4. TIME TRENDS IN INCIDENCE AND MORTALITY

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, 1980-2009



Note: Incidence rates exclude non-melanoma skin cancer (basal and squamous). Actual incidence data were available to 2006 except for Quebec. The range of rate scales differs between figures.

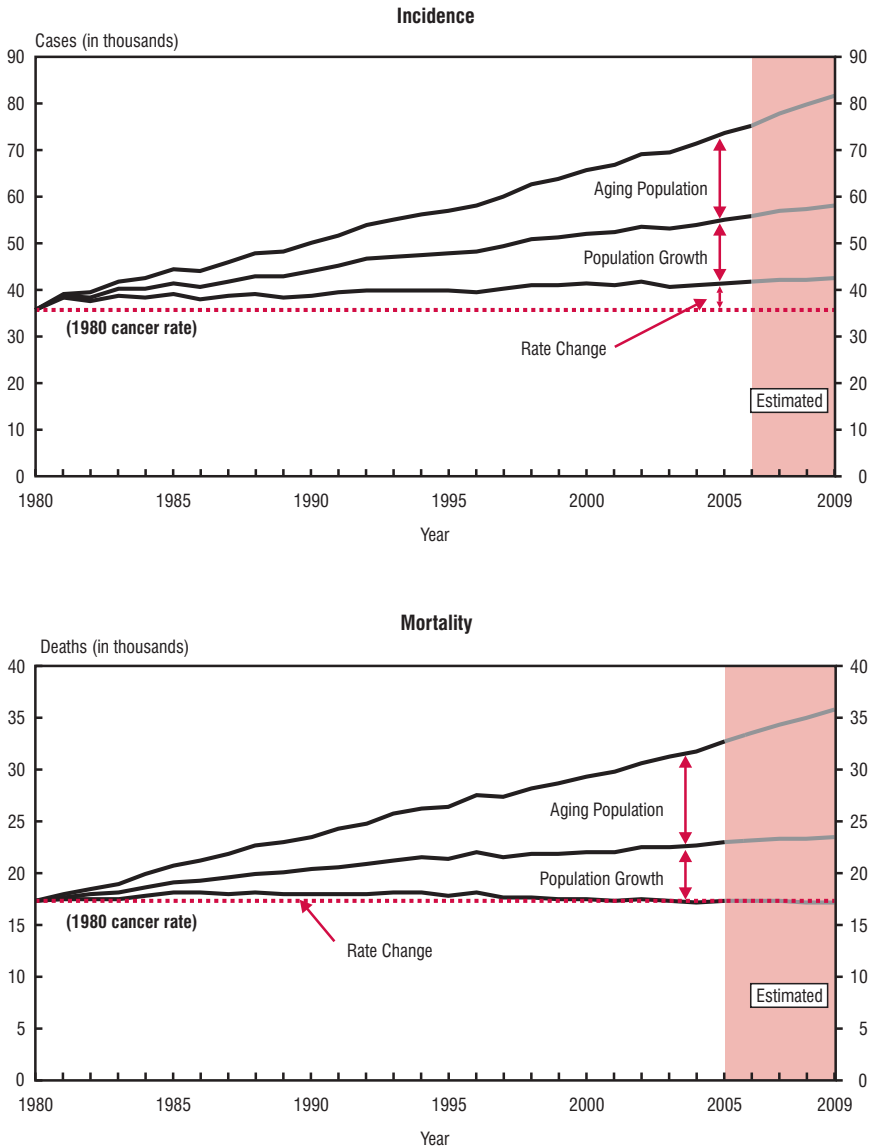
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

Data source: Canadian Vital Statistics Death database at Statistics Canada

4. TIME TRENDS IN INCIDENCE AND MORTALITY

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, 1980-2009



Note: Incidence rates exclude non-melanoma skin cancer (basal and squamous). Actual incidence data were available to 2006 except for Quebec. The range of rate scales differs between figures.

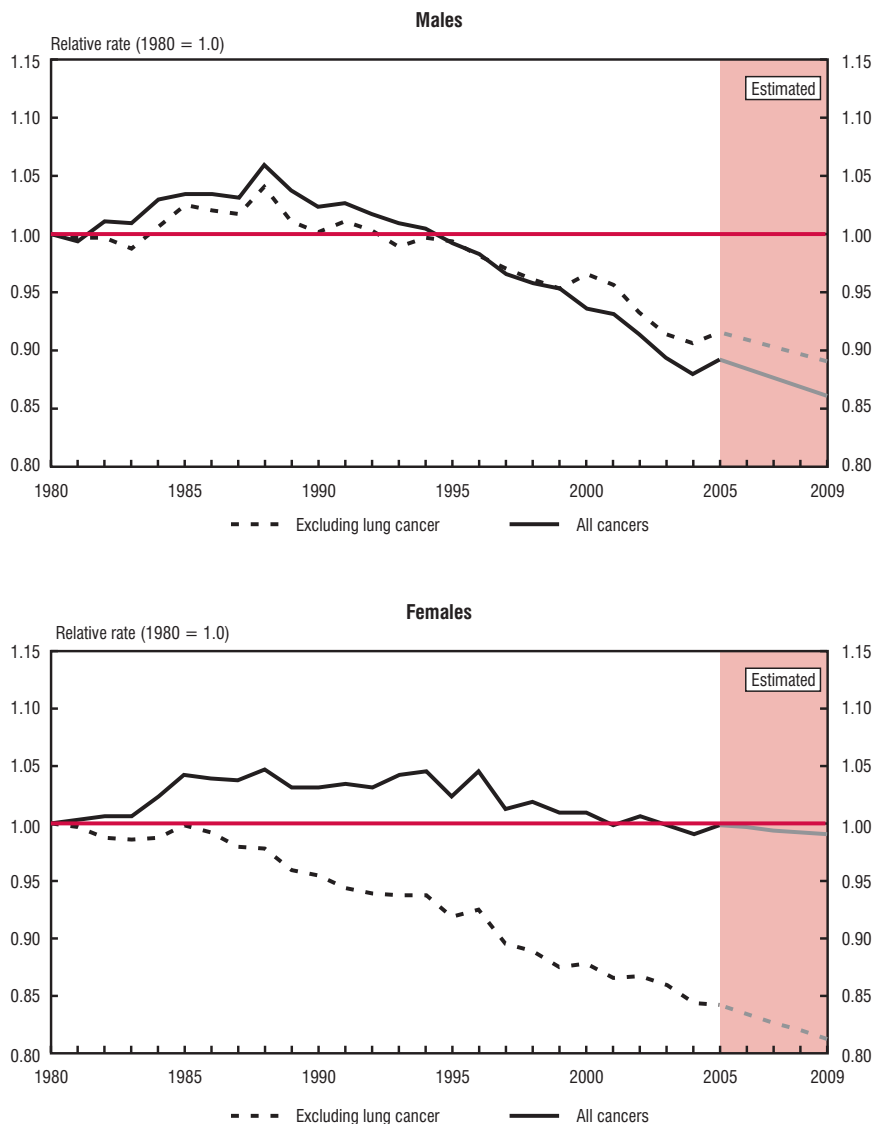
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

Data source: Canadian Vital Statistics Death database at Statistics Canada

4. TIME TRENDS IN INCIDENCE AND MORTALITY

Figure 4.5

Relative Change* in Age-Standardized Mortality Rates Including and Excluding Lung Cancer, Canada, 1980-2009



* Current year rate divided by 1980 rate.

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

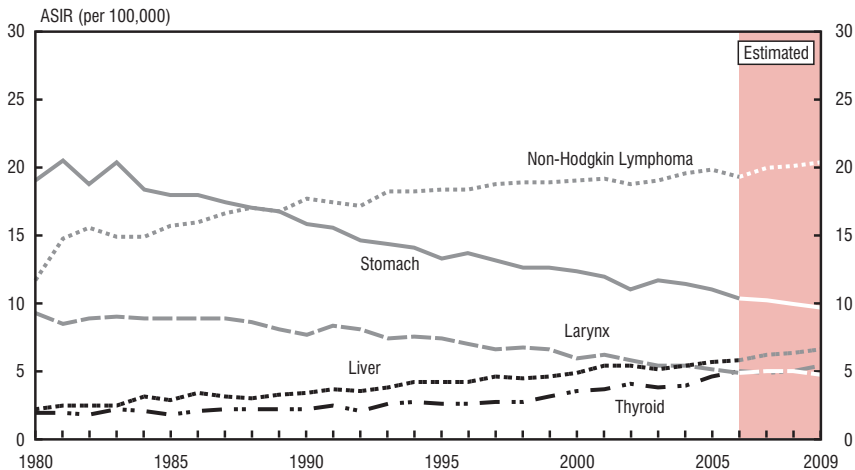
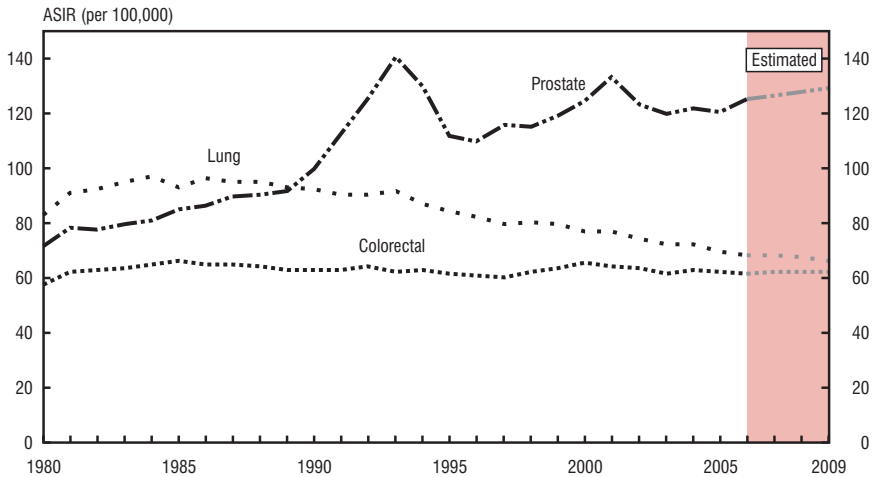
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

Data source: Canadian Vital Statistics Death database at Statistics Canada

4. TIME TRENDS IN INCIDENCE AND MORTALITY

Figure 4.6

Age-Standardized Incidence Rates (ASIR) for Selected* Cancers, Males, Canada, 1980-2009



* 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 were available to 2006 except for Quebec. The range of scales differs widely between the figures.

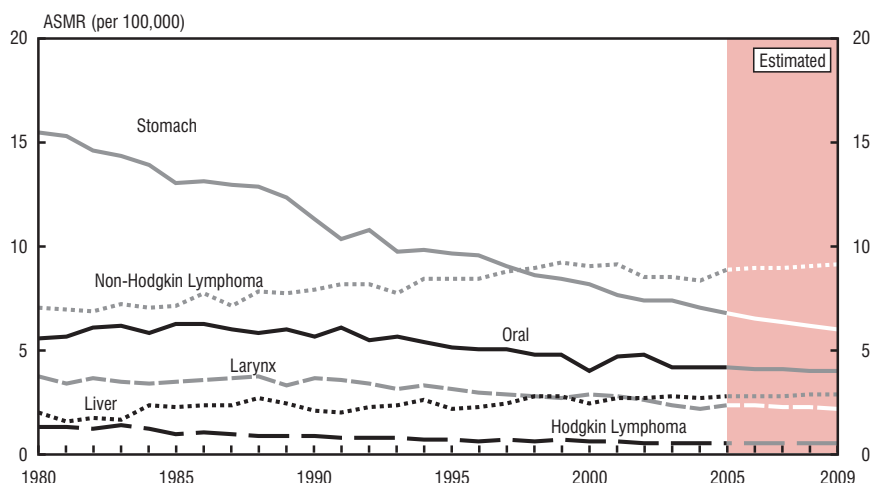
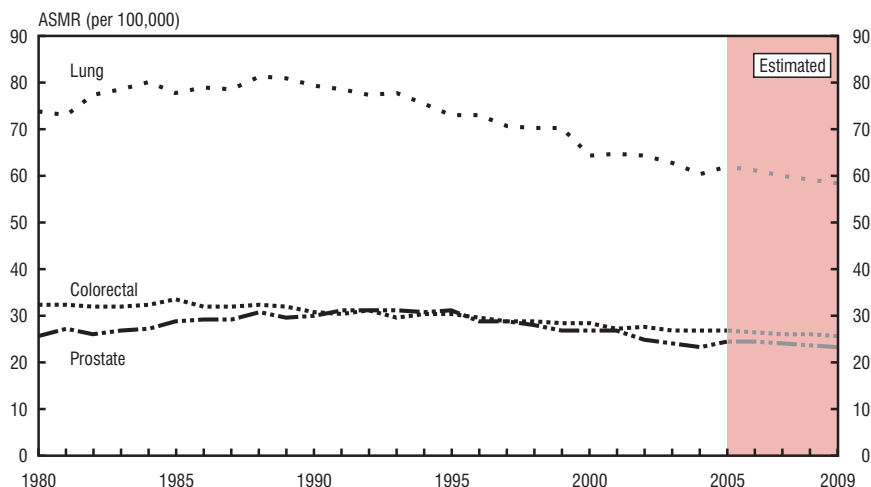
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

Data source: Canadian Vital Statistics Death database at Statistics Canada

4. TIME TRENDS IN INCIDENCE AND MORTALITY

Figure 4.7

Age-Standardized Mortality Rates (ASMR) for Selected* Cancers, Males, Canada, 1980-2009



* 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. The range of scales differs widely between the figures.

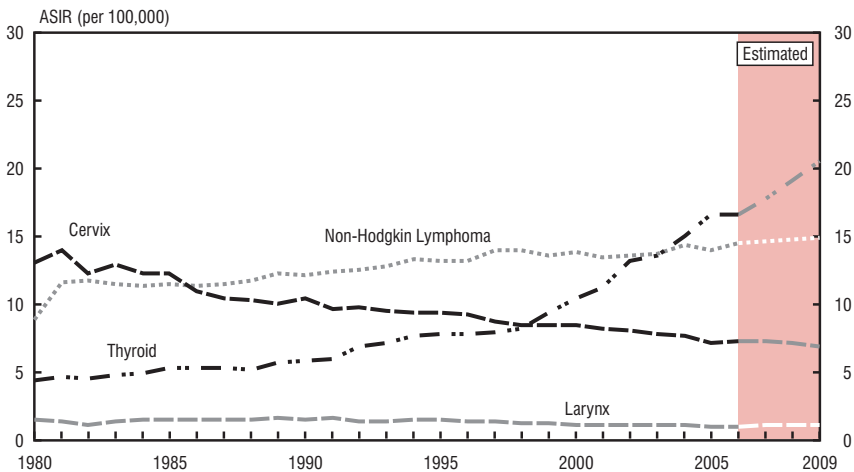
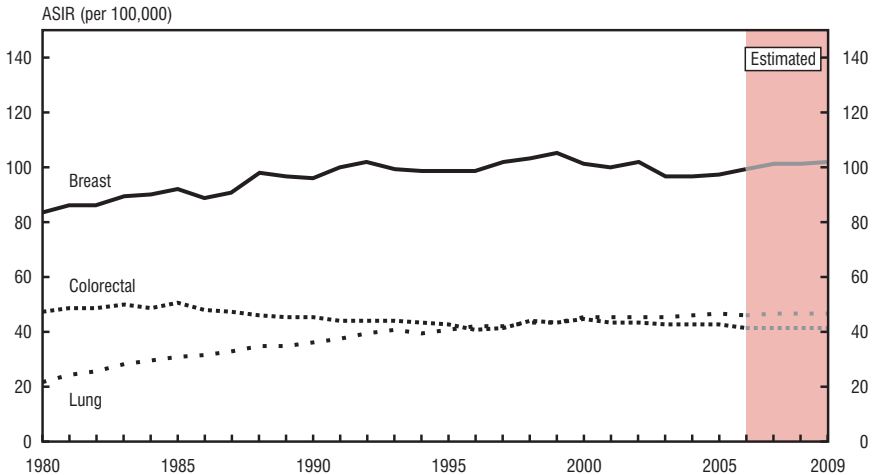
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

Data source: Canadian Vital Statistics Death database at Statistics Canada

4. TIME TRENDS IN INCIDENCE AND MORTALITY

Figure 4.8

Age-Standardized Incidence Rates (ASIR) for Selected* Cancers, Females, Canada, 1980-2009



* 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 were available to 2006 except for Quebec. The range of scales differs widely between the figures.

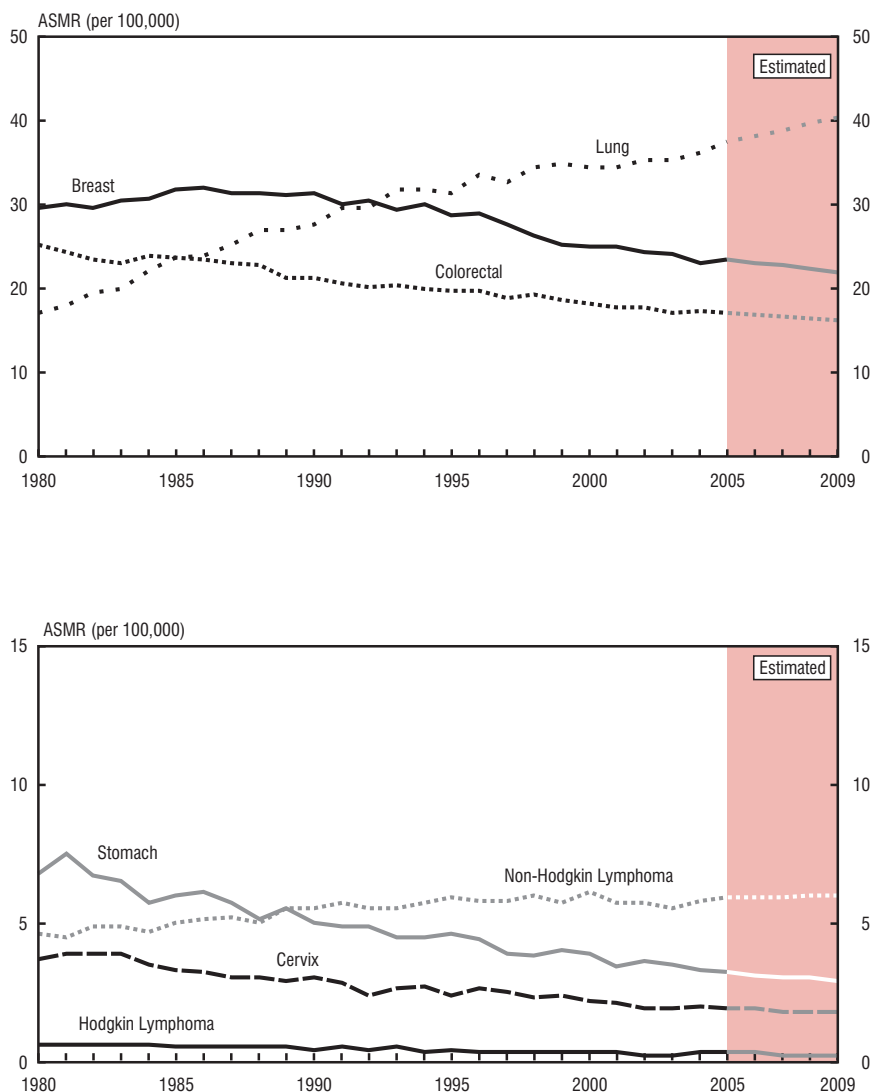
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

Data source: Canadian Vital Statistics Death database at Statistics Canada

4. TIME TRENDS IN INCIDENCE AND MORTALITY

Figure 4.9

Age-Standardized Mortality Rates (ASMR) for Selected* Cancers, Females, Canada, 1980-2009



* 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. 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

4. TIME TRENDS IN INCIDENCE AND MORTALITY

Table 4.1

Age-Standardized Incidence Rates for Selected* Cancers, Males, Canada, 1980-2009

Year	Cases per 100,000								
	All Cancers	Prostate	Lung	Colorectal	Non-Hodgkin Lymphoma	Thyroid	Stomach	Liver	Larynx
1980	407.1	71.4	82.9	57.9	11.6	1.9	19.0	2.2	9.3
1981	442.9	78.5	90.8	62.6	14.7	1.9	20.5	2.4	8.4
1982	442.0	77.8	92.3	62.7	15.6	1.7	18.7	2.4	8.8
1983	450.3	79.6	95.0	63.9	14.9	2.1	20.4	2.4	9.0
1984	451.9	80.9	96.8	64.7	14.9	2.0	18.4	3.1	8.9
1985	451.9	85.1	93.0	66.2	15.7	1.8	18.0	2.8	8.8
1986	453.9	86.1	96.1	64.7	16.0	2.0	18.0	3.3	8.8
1987	458.7	89.6	94.9	64.7	16.6	2.2	17.4	3.1	8.8
1988	461.2	90.4	95.2	64.6	17.0	2.1	17.0	3.0	8.6
1989	454.0	91.9	93.4	63.1	16.7	2.1	16.8	3.2	8.1
1990	460.4	99.9	92.5	63.0	17.7	2.2	15.8	3.4	7.7
1991	472.0	112.3	90.5	62.9	17.4	2.4	15.6	3.6	8.3
1992	490.1	125.5	90.5	64.2	17.2	2.0	14.6	3.5	8.1
1993	502.8	140.6	91.5	62.0	18.2	2.6	14.3	3.8	7.4
1994	490.9	129.7	86.8	63.1	18.2	2.7	14.1	4.2	7.5
1995	466.8	111.7	84.7	61.6	18.3	2.6	13.3	4.2	7.4
1996	458.3	110.1	82.3	60.7	18.3	2.6	13.6	4.2	6.9
1997	461.3	115.7	79.5	60.3	18.8	2.7	13.1	4.5	6.6
1998	460.5	114.9	80.5	62.5	18.9	2.7	12.6	4.4	6.7
1999	471.3	119.4	79.5	63.4	18.9	3.1	12.6	4.6	6.6
2000	475.9	124.7	77.1	65.6	19.0	3.5	12.3	4.8	5.9
2001	481.9	133.1	77.1	64.4	19.1	3.6	11.9	5.3	6.1
2002	465.9	123.5	74.4	63.7	18.8	4.0	11.0	5.3	5.8
2003	461.0	120.1	72.2	61.4	19.0	3.7	11.6	5.1	5.4
2004	464.1	122.1	72.0	62.8	19.6	3.9	11.4	5.4	5.3
2005	458.8	120.8	69.7	62.0	19.8	4.6	11.0	5.6	5.1
2006 [†]	458.9	125.3	68.4	61.4	19.3	4.9	10.3	5.7	4.8
2007 [‡]	462.2	126.5	68.6	62.2	20.0	4.8	10.2	6.1	5.0
2008 [‡]	462.1	127.9	67.5	62.2	20.1	5.0	9.9	6.3	4.9
2009 [‡]	462.2	129.5	66.5	62.2	20.3	5.3	9.7	6.6	4.7

* 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 except for Quebec.

[‡] Estimated rates for all provinces/territories.

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

4. TIME TRENDS IN INCIDENCE AND MORTALITY

Table 4.2

Age-Standardized Mortality Rates for Selected* Cancers, Males, Canada, 1980-2009

Year	Deaths per 100,000									
	All Cancers	Prostate	Lung	Colorectal	Non-Hodgkin Lymphoma	Oral	Stomach	Liver	Larynx	Hodgkin Lymphoma
1980	240.7	25.8	73.9	32.3	7.0	5.5	15.5	1.9	3.7	1.2
1981	239.2	27.1	73.1	32.2	6.9	5.6	15.3	1.5	3.3	1.2
1982	243.5	26.0	77.3	31.9	6.8	6.0	14.6	1.7	3.6	1.1
1983	242.9	26.7	78.4	31.8	7.2	6.1	14.3	1.6	3.4	1.3
1984	247.9	27.4	80.1	32.4	7.0	5.8	13.9	2.3	3.3	1.1
1985	249.0	28.9	77.9	33.4	7.1	6.2	13.0	2.2	3.4	0.9
1986	249.0	29.4	78.8	32.0	7.7	6.2	13.1	2.3	3.5	1.0
1987	248.2	29.4	78.5	32.0	7.1	5.9	12.9	2.3	3.6	0.9
1988	254.8	30.7	81.2	32.4	7.8	5.8	12.8	2.6	3.7	0.8
1989	249.6	29.7	81.0	31.9	7.7	5.9	12.3	2.4	3.2	0.8
1990	246.5	30.1	79.4	30.9	7.9	5.6	11.3	2.0	3.6	0.8
1991	247.2	31.2	78.7	30.4	8.1	6.0	10.3	1.9	3.5	0.7
1992	244.7	31.0	77.5	31.1	8.1	5.4	10.7	2.2	3.3	0.7
1993	242.8	31.1	77.8	29.7	7.7	5.6	9.7	2.3	3.1	0.7
1994	241.8	30.7	75.5	30.3	8.4	5.3	9.8	2.5	3.2	0.6
1995	239.0	31.0	73.2	30.2	8.4	5.1	9.6	2.1	3.1	0.6
1996	236.5	29.0	72.9	29.5	8.4	5.0	9.5	2.2	2.9	0.5
1997	232.3	28.7	70.5	29.0	8.7	5.0	9.0	2.4	2.8	0.6
1998	230.5	28.0	70.2	28.9	8.9	4.7	8.6	2.7	2.7	0.5
1999	229.4	26.9	70.4	28.5	9.2	4.7	8.4	2.7	2.6	0.6
2000	225.4	26.8	64.3	28.5	9.0	3.9	8.1	2.4	2.8	0.5
2001	224.0	26.7	64.6	27.1	9.1	4.6	7.6	2.6	2.7	0.5
2002	219.9	25.0	64.4	27.7	8.5	4.7	7.3	2.6	2.5	0.4
2003	215.0	23.9	62.6	26.8	8.5	4.1	7.3	2.7	2.3	0.4
2004	211.6	23.3	60.5	26.8	8.3	4.1	7.0	2.6	2.1	0.4
2005†	214.7	24.6	61.8	26.7	8.8	4.1	6.7	2.7	2.3	0.4
2006†	212.7	24.3	61.0	26.4	8.9	4.0	6.5	2.7	2.3	0.4
2007†	210.8	23.9	60.1	26.2	8.9	4.0	6.3	2.7	2.2	0.4
2008†	208.9	23.6	59.2	25.9	9.0	3.9	6.1	2.8	2.2	0.4
2009†	207.1	23.3	58.4	25.7	9.1	3.9	5.9	2.8	2.1	0.4

* 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).

† Estimated rates for all provinces/territories.

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

4. TIME TRENDS IN INCIDENCE AND MORTALITY

Table 4.3

Age-Standardized Incidence Rates for Selected* Cancers, Females, Canada, 1980-2009

Year	Cases per 100,000							
	All Cancers	Lung	Breast	Colorectal	Non-Hodgkin Lymphoma	Thyroid	Cervix	Larynx
1980	305.8	21.6	83.3	47.4	8.8	4.4	13.0	1.4
1981	328.3	24.2	86.5	48.6	11.6	4.6	13.9	1.3
1982	321.3	25.8	86.0	48.9	11.7	4.5	12.3	1.1
1983	333.2	28.2	89.3	50.2	11.5	4.8	12.9	1.3
1984	329.9	29.5	90.4	48.9	11.3	4.9	12.2	1.4
1985	336.1	30.8	92.2	50.6	11.4	5.3	12.3	1.5
1986	325.5	31.5	88.6	48.2	11.3	5.2	10.9	1.4
1987	331.4	33.2	91.1	47.6	11.5	5.2	10.4	1.5
1988	336.8	34.6	97.8	46.1	11.7	5.1	10.2	1.5
1989	330.7	34.9	96.4	45.3	12.2	5.6	10.0	1.6
1990	333.9	36.3	96.0	45.7	12.1	5.8	10.4	1.4
1991	337.7	37.5	100.1	44.1	12.4	5.9	9.6	1.6
1992	343.8	39.7	101.9	44.3	12.5	6.9	9.7	1.3
1993	343.2	40.6	99.1	44.3	12.7	7.1	9.5	1.3
1994	343.8	39.8	99.0	43.7	13.3	7.6	9.4	1.4
1995	342.0	40.8	98.9	42.5	13.1	7.7	9.3	1.4
1996	340.0	42.0	98.7	41.1	13.1	7.8	9.2	1.3
1997	344.2	41.9	102.2	41.7	13.9	7.9	8.7	1.3
1998	351.8	43.7	103.2	43.9	14.0	8.2	8.4	1.2
1999	352.5	43.5	105.1	43.3	13.5	9.4	8.4	1.2
2000	354.6	45.1	101.6	44.5	13.8	10.4	8.4	1.1
2001	352.3	45.1	100.3	43.6	13.4	11.2	8.2	1.1
2002	358.1	45.7	102.2	43.5	13.6	13.2	8.0	1.1
2003	350.2	45.6	96.5	42.6	13.7	13.6	7.8	1.1
2004	353.0	46.3	96.9	42.9	14.3	15.0	7.6	1.0
2005	356.5	47.0	97.3	42.7	13.9	16.6	7.1	0.9
2006 [†]	357.6	46.2	99.5	41.5	14.5	16.6	7.2	0.9
2007 [‡]	360.6	46.5	101.3	41.6	14.6	17.7	7.2	1.0
2008 [‡]	362.1	46.6	101.6	41.4	14.7	19.1	7.1	1.0
2009 [‡]	363.6	46.7	101.9	41.2	14.9	20.5	6.9	1.0

* 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 except for Quebec.

[‡] Estimated rates for all provinces/territories.

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

4. TIME TRENDS IN INCIDENCE AND MORTALITY

Table 4.4

Age-Standardized Mortality Rates for Selected* Cancers, Females, Canada, 1980-2009

Year	Deaths per 100,000							
	All Cancers	Lung	Breast	Colorectal	Non-Hodgkin Lymphoma	Stomach	Cervix	Hodgkin Lymphoma
1980	148.5	17.0	29.7	25.3	4.6	6.8	3.7	0.6
1981	149.0	17.9	30.1	24.4	4.5	7.5	3.9	0.6
1982	149.3	19.5	29.7	23.5	4.9	6.7	3.9	0.6
1983	149.4	19.9	30.4	23.1	4.9	6.5	3.9	0.6
1984	151.9	22.2	30.7	23.8	4.7	5.7	3.5	0.6
1985	154.8	23.7	31.8	23.7	5.0	6.0	3.3	0.5
1986	154.4	23.9	32.0	23.5	5.1	6.1	3.2	0.5
1987	154.0	25.3	31.3	23.0	5.2	5.7	3.0	0.5
1988	155.4	26.9	31.4	22.7	5.0	5.1	3.0	0.5
1989	153.1	27.0	31.2	21.3	5.5	5.5	2.9	0.5
1990	153.1	27.6	31.3	21.3	5.5	5.0	3.0	0.4
1991	153.5	29.5	30.1	20.7	5.7	4.9	2.8	0.5
1992	153.1	29.6	30.4	20.2	5.5	4.9	2.4	0.4
1993	154.8	31.7	29.4	20.3	5.5	4.5	2.6	0.5
1994	155.1	31.9	30.0	19.9	5.7	4.5	2.7	0.3
1995	152.0	31.3	28.7	19.8	5.9	4.6	2.4	0.4
1996	155.2	33.6	28.9	19.7	5.8	4.4	2.6	0.3
1997	150.3	32.6	27.7	18.8	5.8	3.9	2.5	0.3
1998	151.3	34.5	26.4	19.3	6.0	3.8	2.3	0.3
1999	149.8	34.9	25.2	18.6	5.7	4.0	2.4	0.3
2000	149.8	34.4	25.1	18.2	6.1	3.9	2.2	0.3
2001	148.2	34.4	25.0	17.8	5.7	3.4	2.1	0.3
2002	149.3	35.3	24.4	17.7	5.7	3.6	1.9	0.2
2003	148.2	35.4	24.1	17.1	5.5	3.5	1.9	0.2
2004	147.1	36.1	23.1	17.3	5.8	3.3	2.0	0.3
2005 [†]	148.2	37.5	23.5	17.0	5.9	3.2	1.9	0.3
2006 [†]	147.9	38.2	23.1	16.8	5.9	3.1	1.9	0.3
2007 [†]	147.6	38.9	22.7	16.6	5.9	3.0	1.8	0.2
2008 [†]	147.3	39.6	22.3	16.5	6.0	3.0	1.8	0.2
2009 [†]	147.0	40.3	22.0	16.3	6.0	2.9	1.8	0.2

* 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).

[†] Estimated rates for all provinces/territories.

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

4. TIME TRENDS IN INCIDENCE AND MORTALITY

Table 4.5

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

	Incidence 1996-2005				Mortality 1995-2004			
	Males		Females		Males		Females	
	APC	Change-point†	APC	Change-point†	APC	Change-point†	APC	Change-point†
All Cancers	0.0		0.4*		-1.3**		-0.4**	
Prostate	1.0		–		-2.9**		–	
Lung	-1.8**		1.3**		-2.1**		1.2**	
Breast	–		-1.1*	1999	–		-1.6**	1999
Colorectal	-1.1*	2000	-0.8	2000	-1.3**		-1.7**	
Non-Hodgkin Lymphoma	0.6**		0.2	1997	-2.4	2000	-0.5	1996
Bladder	-0.5		0.0		-0.4		0.4	
Melanoma	1.6*		1.0**		0.5		-0.8*	
Leukemia	0.5		0.5*		-0.8*		-1.0	
Kidney	0.8**		1.3**		-0.5		-0.8	
Thyroid	6.4**	1997	10.1**	1997	0.7		-1.5	
Body of Uterus	–		0.4*		–		-0.4	
Pancreas	-0.2		0.3		-0.5		0.0	
Oral	-1.4**	1997	0.0		-2.5**		-0.6	
Stomach	-2.3**		-1.9**		-3.6**		-3.1**	
Brain	-0.8**		-0.9		-1.0**		-0.7	
Ovary	–		0.0		–		-0.3	
Multiple Myeloma	0.6		0.4		-1.5*		-0.3	
Esophagus	0.5		-1.6**		0.3		-0.6	
Liver	3.2**		1.7		2.2*		1.7	
Cervix	–		-2.3**		–		-3.3**	
Larynx	-3.4**		-3.5**		-3.2**		-1.8	
Hodgkin Lymphoma	0.1		0.2		-4.2*		-3.7*	
Testis	1.5**		–		-2.4		–	

– Not applicable

* Significant, $p < 0.05$

** Significant, $p < 0.01$

† Change-point indicates the baseline year, if the slope of the trend changed after 1996 for incidence or 1995 for mortality. Change-points were fit to rates from 1986 to 2005 for incidence and 1986 to 2004 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

5. INCIDENCE, MORTALITY AND SURVIVAL IN CHILDREN (0-14 YEARS)

Cancer is a rare occurrence among Canadian children. Between 2001 and 2005, 4,181 children aged 0-14 years were diagnosed with cancer in Canada, and between 2000 and 2004, 676 died from their disease (Table 5.1). Although childhood cancers account for just over one-half of one percent of all cancers diagnosed in Canada, they are of significant public health importance. Cancer in children creates a disproportionate impact on health, economic and social welfare systems, as well as placing a tremendous burden on the family of a child affected by cancer. An estimated two-thirds of survivors have at least one chronic or late-occurring effect from their cancer therapy, and up to one-third of these late effects are considered major, serious or life threatening.⁸ As more children survive a cancer diagnosis, the need for long-term monitoring and follow-up care will continue to grow.

Incidence

- ◆ There has been little change in the age-standardized incidence rate for all childhood cancers combined since 1985 (Figure 5.1).
- ◆ Between 2001 and 2005, the most commonly diagnosed childhood cancer was leukemia, which accounted for 32% of all newly diagnosed cases. Cancers of the central nervous system (CNS) and lymphomas were the next most common cancers at 20% and 12%, respectively.
 - Lymphoid leukemias accounted for nearly 80% of the 1,345 leukemias while just over 12% were acute myeloid leukemia.
 - Of the 838 CNS cancers, astrocytomas accounted for 43%, intracranial and intraspinal embryonal tumours represented 24% and diagnoses of ependymoma were responsible for just under 10%.
 - Among the 504 diagnosed lymphoma cases, 38% were Hodgkin lymphomas, 16% were Burkitt lymphomas, and 29% were the result of other non-Hodgkin lymphomas.

Mortality

- ◆ For all childhood cancer combined the age-standardized mortality rate has declined substantially, from a high of 41.2 per 1,000,000 in 1985 to an estimated 20.6 per 1,000,000 in 2009 (Figure 5.1).
- ◆ Nearly 70% of the deaths caused by childhood cancer from 2000 to 2004 were either CNS cancers (30%), leukemias (27%) or neuroblastomas (12%).

Survival

Observed survival proportions (OSP) were derived for 2000 to 2004 using period analysis (see *Appendix II*).

- ◆ For all childhood cancer combined, the five-year OSP was estimated to be 82%.
- ◆ Within specific diagnostic groups, the highest five-year OSPs were observed for retinoblastoma at 99%, followed by renal tumours, lymphomas, germ cell tumours, and other malignant epithelial tumours at 88% each. The lowest five-year OSPs were seen in malignant bone tumours (66%) and in neuroblastomas (72%).

5. INCIDENCE, MORTALITY AND SURVIVAL IN CHILDREN (0-14 YEARS)

- Survival of those diagnosed with acute myeloid leukemia (five-year OSP 67%) was considerably less than for those diagnosed with a lymphoid leukemia (five-year OSP 91%).
- The outlook for those diagnosed with Hodgkin lymphoma (94% five-year OSP) was better than those diagnosed with non-Hodgkin lymphoma (84% five-year OSP).
- The five-year prognosis for certain types of brain cancers such as astrocytoma (86%) was found to be higher than for intracranial and intraspinal embryonal tumours (64%).

Additional information about cancer in children aged 0-14 years is available in the 2008 Special Topic of the Canadian Cancer Statistics available at www.cancer.ca/statistics. Similarly, a section on Cancer in Children (0-19 years) can be found at www.cancer.ca/statistics (web only content).

Although childhood cancer is rare, it remains of significant public health importance.

5. INCIDENCE, MORTALITY AND SURVIVAL IN CHILDREN (0-14 YEARS)

Table 5.1

New Cases and Deaths, Average Annual Age-Standardized Cancer Incidence and Mortality Rates, and Five-Year Observed Survival Proportions (OSP) Estimates (%) and 95% Confidence Intervals (CI), by Diagnostic Group in Children (0-14 Years), Canada*

Diagnostic Group (Subgroup)	New cases (2001-2005)	ASIR (per 1,000,000 per year)	Deaths (2000-2004)	ASMR (per 1,000,000 per year)	5-Year Survival (2000-2004) OSP (95% CI)
Total† (5 years)	4,181	148.7	676	23.3	82 (81-83)
Average Per Year	836	–	135	–	–
I. Leukemia	1,345	48.6	184	6.4	86 (84-88)
a. Lymphoid	1,065	38.5	71	2.4	91 (88-92)
b. Acute Myeloid	167	6.0	51	1.8	67 (59-73)
III. Central Nervous System	838	29.4	201	6.9	75 (72-78)
a. Ependymoma	82	3.0	19	0.7	72 (60-80)
b. Astrocytoma	361	12.5	41	1.4	86 (81-89)
c. Intracranial & Intraspinal Embryonal	204	7.3	57	2.0	64 (56-70)
II. Lymphoma	504	16.8	32	1.1	88 (85-91)
a. Hodgkin Lymphoma	191	6.1	4	0.1	94 (88-96)
b. Non-Hodgkin Lymphoma	147	5.0	10	0.3	84 (76-89)
c. Burkitt Lymphoma	80	2.7	8	0.3	88 (78-94)
IV. Neuroblastoma & Other PNC	311	12.2	82	2.9	72 (66-78)
a. Neuroblastoma	307	12.0	82	2.9	72 (66-77)
IX. Soft Tissue	250	8.7	45	1.5	77 (70-82)
a. Rhabdomyosarcoma	119	4.2	28	1.0	80 (71-87)
VI. Renal Tumours	215	8.1	34	1.2	88 (82-92)
a. Nephroblastoma	199	7.5	27	0.9	89 (83-92)
VIII. Malignant Bone	181	5.9	47	1.5	66 (59-73)
a. Osteosarcoma	84	2.7	16	0.5	63 (52-73)
c. Ewing's Sarcoma	80	2.6	28	0.9	66 (53-75)
XI. Other Malignant Epithelial	178	5.9	9	0.3	88 (80-92)
b. Thyroid	66	2.1	0	0.0	98 (86-100)
d. Malignant Melanoma	41	1.4	1	0.0	96 (78-99)
X. Germ Cell and Other Gonadal	135	4.7	10	0.3	88 (81-93)
c. Gonadal Germ Cell Tumours	52	1.8	2	0.1	93 (81-97)
V. Retinoblastoma	87	3.4	2	0.1	99 (93-100)
VII. Hepatic Tumours	66	2.5	12	0.4	80 (67-88)
XII. Other and Unspecified Cancers	65	2.3	9	0.3	89 (77-95)

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

† Total includes 6 malignant new cases and 9 deaths which were unclassifiable.

Note: Rates are age-standardized to the 1991 Canadian population and are expressed per million per year due to disease rarity. Cases were classified according to the third edition of the International Classification of Childhood Cancer.³ Diagnostic groups are listed according to disease occurrence. Only selected subgroups within each diagnostic group are listed. PNC denotes peripheral nervous cell tumours.

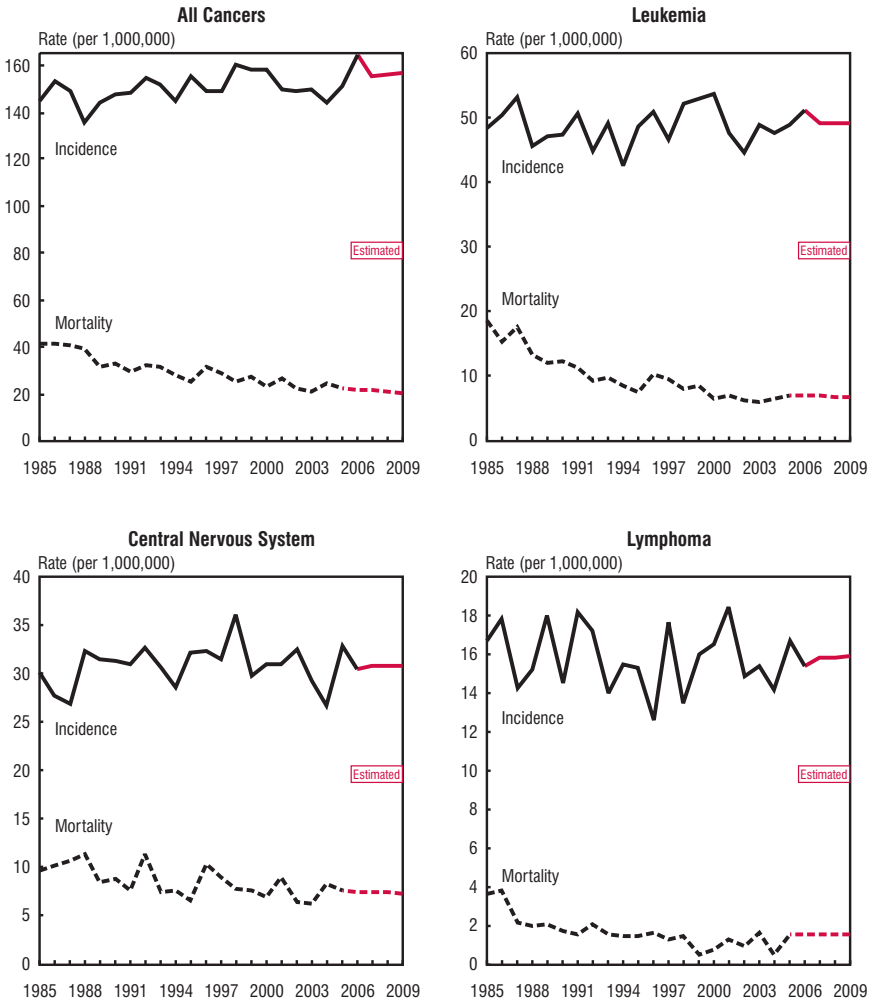
Analysis by: Health Statistics Division, Statistics Canada

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

5. INCIDENCE, MORTALITY AND SURVIVAL IN CHILDREN (0-14 YEARS)

Figure 5.1

Age-Standardized Incidence and Mortality Rates for Selected Cancers in Children (0-14 Years), Canada, 1985-2009



Note: The range of scales differs widely between the figures. Incidence figures exclude non-melanoma skin cancer (basal and squamous). Actual data were available to 2006 except for Quebec.

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

6. PROBABILITY OF DEVELOPING OR DYING FROM CANCER

Table 6.1 presents the probability of Canadians developing the more common cancers within specific 10-year age periods, as well as the lifetime probability of developing or dying from one of these cancers.

Data for the lifetime probability of developing or dying from cancer is presented both as a percentage and as a ratio. Men have a lifetime probability of about 45% for developing cancer or a ratio of 1 in 2.2. This means that nearly one of every two men is expected to develop cancer during his life. Similarly, women have a nearly 40% chance of developing cancer in their lifetime, or slightly more than 1 in 2.5 ratio. One in 3.5 men and 1 in 4.2 women, or approximately 1 in 4 of all Canadians, will die of cancer.

During his lifetime, 1 in 7.4 men will be diagnosed with prostate cancer, and 1 in 27 will die from it. For men, the likelihood of dying from cancer is greatest for lung cancer, at approximately 1 in 13.

During her lifetime, 1 in 9 women is expected to develop breast cancer and 1 in 28 women is expected to die from it. For women, the likelihood of dying from cancer is greatest for lung cancer, at 1 in 18.

The probability of developing cancer within the next 10 years gives a useful indication of short-term cancer risk. Although the lifetime risk of developing breast cancer is 11% (1 in 9) and risk increases with age, the chance of a 60 year old woman developing breast cancer before age 70 is only 2.9% (1 in 34); this figure may be more meaningful than the lifetime probability statistic for a 60-year-old woman contemplating her risk of breast cancer. Table 6.1 shows how steeply the risk of developing prostate cancer rises with age. A man has a low probability of being diagnosed with prostate cancer before age 50. However, a 70-year-old man has a 6.1% (1 in 16) chance of being diagnosed with prostate cancer by age 80; this percentage represents the highest risk for either men or women of developing a specific cancer in any decade of life.

The lifetime risk of being diagnosed for the first time with non-melanoma skin cancer (basal or squamous cell carcinoma) has been estimated in a study of Manitoba residents.¹⁰ The lifetime risk increased from approximately 5% in the 1960s to a high of nearly 16% in the 1990s.

*Approximately one in four Canadians
will die of cancer, the risk being slightly
greater among men than women.*

6. PROBABILITY OF DEVELOPING OR DYING FROM CANCER

Table 6.1

Lifetime Probability of Developing or Dying from Cancer and the Probability of Developing Cancer by Age, Canada

	Lifetime Probability of				Probability (%) of Developing Cancer in next 10 years by age					
	Developing		Dying		30-39	40-49	50-59	60-69	70-79	80-89
	%	One in:	%	One in:						
Males										
All Cancers	44.9	2.2	28.5	3.5	0.7	1.7	6.1	15.2	21.8	21.0
Prostate	13.6	7.4	3.7	26.9	–	0.2	1.7	5.3	6.1	5.0
Lung	8.8	11.4	8.0	12.6	–	0.2	0.8	2.5	4.4	3.8
Colorectal	7.4	13.5	3.7	27.1	0.1	0.2	0.8	2.1	3.4	3.3
Bladder	3.6	28.0	1.1	95.0	–	0.1	0.3	0.9	1.6	1.9
Non-Hodgkin Lymphoma	2.2	45.9	1.1	93.4	0.1	0.1	0.3	0.6	0.9	0.8
Leukemia	1.7	58.0	1.1	92.7	–	0.1	0.2	0.4	0.6	0.8
Kidney*	1.6	64.1	0.7	137.5	–	0.1	0.3	0.5	0.6	0.5
Stomach	1.4	71.7	0.9	106.1	–	–	0.1	0.4	0.6	0.7
Oral	1.4	72.1	0.5	197.9	–	0.1	0.3	0.4	0.4	0.4
Melanoma	1.4	73.7	0.4	284.4	0.1	0.1	0.2	0.3	0.5	0.5
Pancreas	1.3	78.0	1.3	74.4	–	–	0.2	0.4	0.5	0.6
Multiple Myeloma	0.8	131.1	0.5	194.4	–	–	0.1	0.2	0.3	0.4
Brain	0.8	131.8	0.6	171.2	–	0.1	0.1	0.2	0.2	0.2
Esophagus	0.7	136.4	0.8	121.5	–	–	0.1	0.2	0.3	0.3
Liver	0.6	162.8	0.3	307.3	–	–	0.1	0.2	0.2	0.2
Larynx	0.6	162.8	0.3	357.6	–	–	0.1	0.2	0.3	0.2

– Value less than 0.05

* The decrease in the lifetime probability of developing kidney cancer as compared with previous years reflects the decision to exclude ureter and other and unspecified urinary organs from this grouping as of the 2008 edition of *Canadian Cancer Statistics*.

Note: The probability of developing cancer is calculated based on age- and sex-specific cancer incidence and mortality rates for Canada in 2004 and on life tables based on 2002-2004 all-cause mortality rates. The probability of dying from cancer represents the proportion of Canadians dying from cancer in a cohort subjected to the mortality conditions prevailing in the population at large in 2004. See *Appendix II* 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

6. PROBABILITY OF DEVELOPING OR DYING FROM CANCER

Table 6.1 (continued)

Lifetime Probability of Developing or Dying from Cancer and the Probability of Developing Cancer by Age, Canada

	Lifetime Probability of				Probability (%) of Developing Cancer in next 10 years by age					
	Developing		Dying		30-39	40-49	50-59	60-69	70-79	80-89
	%	One in:	%	One in:						
Females										
All Cancers	39.8	2.5	24.1	4.2	1.2	3.1	6.2	10.3	14.0	14.3
Breast	11.1	9.0	3.6	28.0	0.4	1.3	2.3	2.9	3.1	2.6
Colorectal	6.5	15.4	3.3	30.7	–	0.2	0.6	1.3	2.4	2.8
Lung	6.4	15.7	5.4	18.4	–	0.2	0.7	1.9	2.5	1.9
Body of Uterus	2.4	41.8	0.6	174.5	–	0.1	0.5	0.8	0.7	0.5
Non-Hodgkin Lymphoma	1.9	51.9	1.0	103.6	0.1	0.1	0.2	0.4	0.6	0.7
Ovary	1.4	70.9	1.1	87.0	–	0.1	0.2	0.3	0.4	0.4
Pancreas	1.4	72.2	1.5	68.2	–	–	0.1	0.3	0.5	0.7
Thyroid	1.2	80.9	0.1	1,160.1	0.2	0.3	0.2	0.2	0.1	0.1
Leukemia	1.2	81.2	0.7	134.5	–	0.1	0.1	0.2	0.4	0.5
Bladder	1.2	82.6	0.4	229.6	–	–	0.1	0.2	0.4	0.5
Melanoma	1.1	89.8	0.2	485.7	0.1	0.1	0.2	0.2	0.3	0.3
Kidney*	1.0	97.3	0.4	233.6	–	0.1	0.2	0.2	0.3	0.3
Stomach	0.8	123.4	0.6	165.6	–	–	0.1	0.1	0.3	0.4
Cervix	0.7	148.1	0.2	422.6	0.1	0.1	0.1	0.1	0.1	0.1
Oral	0.7	148.6	0.3	358.3	–	–	0.1	0.1	0.2	0.2
Multiple Myeloma	0.6	159.4	0.4	229.4	–	–	0.1	0.1	0.2	0.3
Brain	0.6	172.3	0.5	220.2	–	–	0.1	0.1	0.2	0.1

– Value less than 0.05

* The decrease in the lifetime probability of developing kidney cancer as compared with previous years reflects the decision to exclude ureter and other and unspecified urinary organs from this grouping as of the 2008 edition of *Canadian Cancer Statistics*.

Note: The probability of developing cancer is calculated based on age- and sex-specific cancer incidence and mortality rates for Canada in 2004 and on life tables based on 2002-2004 all-cause mortality rates. The probability of dying from cancer represents the proportion of Canadians dying from cancer in a cohort subjected to the mortality conditions prevailing in the population at large in 2004. See *Appendix II* 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

7. FIVE-YEAR RELATIVE SURVIVAL

Relevance of examining cancer survival

Like incidence and mortality rates, population-based survival is an indicator of the burden of cancer. Its unique contribution is as a measure of disease severity: the average person diagnosed with a cancer with a poor five-year relative survival ratio (RSR), such as lung cancer, has a small probability of living until the fifth anniversary of his/her diagnosis. Examined across cancer types and regions, survival estimates can be used to establish priority areas for improving prognosis.¹¹ Examined over time, and in conjunction with incidence and mortality trends, they represent an important indicator of progress in cancer control.¹² While a population-based survival estimate is a useful “average” indicator¹³, it does not necessarily reflect a specific person’s chances of surviving for a given time (e.g., five years) after diagnosis. This is because it is based on the experiences of a group of people with a heterogeneous mix of disease characteristics. Likewise, the confidence intervals around survival estimates do not represent the range of possible prognoses for individual patients, but rather statistical variation.

Determinants of survival

The prognosis of a cancer patient may be influenced by host factors (e.g., age, sex, comorbid conditions, socio-economic status and lifestyle factors), tumour-related factors (e.g., stage of disease, histological subtype) and system factors related to cancer control (e.g., availability and quality of early detection, diagnostic and treatment services). Stage of disease at diagnosis is a very important prognostic indicator but is not yet routinely available for analysis in all cancer registry datasets. Significant activities are underway in most provincial/territorial cancer registries to expand the collection of stage data.

Interpretation of the relative survival ratio (see *Glossary* for details)

The RSR is the preferred measure for assessing population-based cancer survival. It is defined as the ratio of the observed survival for a group of persons diagnosed with cancer to the survival expected for people in the same general population.¹⁴ A five-year relative survival ratio of 80% for a particular cancer means people with that cancer had 80% likelihood of living for 5 years after diagnosis compared to similar people in the general population.

Estimated relative survival ratios, 2002-2004

Canadian five-year relative RSRs for the 2002 to 2004 period are shown in Table 7.1. The data are presented for all invasive cancers combined and for selected cancers in descending order of survival for both sexes combined.

The five-year RSR for all cancers combined was 62%. This implies that those diagnosed with cancer from 2002 to 2004 were estimated to be 62% as likely to live for another five years as comparable members of the general population. The corresponding five-year observed survival (i.e., the proportion of patients actually alive five years after their diagnosis) was 54% (data not shown). Relative survival was better among women (63%) than men (61%).

Five-year RSRs were highest for thyroid (98%) and testicular (96%) cancer. Among men, prostate cancer also had a very favourable prognosis (95% RSR) as did melanoma among women (93% RSR) (Table 7.1). The lowest RSRs were observed among those diagnosed with pancreatic cancer (6%) followed by cancers of the

esophagus (14%), lung (males 13%, females 17%). For most of the cancers examined, survival was higher among women or similar between the sexes.

Variation by province

Provincial, age-standardized RSRs for prostate, breast, colorectal and lung cancers (i.e., the most commonly diagnosed cancer types) are provided in Table 7.2. Survival ratios for Newfoundland and Labrador are not shown as they are artefactually high. Territorial estimates are not presented because there were too few cases to calculate reliable age-standardized estimates. While there was little provincial variation for breast cancer, age-standardized RSRs for prostate cancer ranged from a low of 87% in Saskatchewan to a high of 97% in Nova Scotia. The highest provincial age-standardized RSRs for colorectal cancer were observed in Ontario (63%) and in British Columbia (62%); the lowest were in Prince Edward Island (53%) and Nova Scotia (56%). The highest provincial age-standardized RSR for lung cancer was in Manitoba (19%) and the lowest occurred in Prince Edward Island (11%). Due to the relatively small number of cases from Prince Edward Island available for analysis, RSR estimates for this province are less precise than for other provinces.

There are a number of possible explanations for the observed variation between provinces, including: differential patterns of use and diffusion of screening and early detection tests; varying patterns of diagnosis; availability and access to specialized cancer treatments; and differences in population attributes. Without data on stage of disease at diagnosis and treatment details, it is difficult to assess which of these might be important.

Variation by age at diagnosis

Five-year relative survival for both breast and prostate cancer was quite favourable for all age groups examined, though reduced somewhat among those diagnosed at very young or very old ages (Table 7.3). The best prognosis for breast cancer was observed among those diagnosed between the ages of 40 and 79 (89%); for prostate cancer, men aged 50 to 79 fared best at 97%. It is uncertain whether the underlying reasons for the poorer survival among those diagnosed with prostate cancer before the age of 50 are biologically or socially/behaviourally based.¹⁵ For lung cancer, relative survival was highest in the youngest age group, and then generally decreased with increasing age from 37% among those 20 to 39 years at diagnosis to 8% among those aged 80 to 99 at diagnosis. With the exception of those in the oldest group, survival was consistent across age groups for colorectal cancer (64%). Relative survival is generally poorer among those diagnosed with cancer at an older age because they may receive less therapy due to the presence of other diseases or conditions which reduce the body's ability to tolerate and respond to cancer treatments (referred to as 'comorbidity'); and they may receive less aggressive treatment independent of comorbidity.^{16,17}

Estimated relative survival ratios, 2002-2004 vs. 1992-1994

Figure 7.1 compares age-standardized five-year RSRs estimated for common cancers for the period from 2002 to 2004 with those for persons diagnosed between 1992 and 1994. Over this time period, RSRs have risen for all cancers combined by 4.5% (expressed as the absolute difference in RSRs between the two time periods) and for most of the leading cancers. The largest increases were observed among those

7. FIVE-YEAR RELATIVE SURVIVAL

diagnosed with non-Hodgkin lymphoma (9.4%) and prostate cancer (6.8%). Increases of approximately 5% were observed for colorectal and breast cancer as well as for leukemia. For cancers of the pancreas, bladder, body of uterus and lung, little change in relative survival (i.e., < 1.0%) was seen.

Examination of survival estimates can help identify gaps and establish priorities for systemic change to improve survival. It is critical to continue to expand collection of data on stage of disease for all newly diagnosed cancer cases to enhance interpretation of survival differences.

7. FIVE-YEAR RELATIVE SURVIVAL

Table 7.1

Estimated Five-Year Relative Survival Ratio (%) (95% Confidence Interval) for Selected Cancers by Sex, Canada (Excluding Quebec*), 2002-2004

	Relative Survival Ratio (%) (95% Confidence Interval)		
	Both Sexes	Males	Females
All Cancers	62 (62-62)	61 (61-61)	63 (62-63)
Thyroid	98 (97-98)	94 (92-96)	99 (98-99)
Testis	–	96 (94-97)	–
Prostate	–	95 (95-96)	–
Melanoma	89 (88-90)	86 (85-87)	93 (91-94)
Breast	87 (87-88)	84 (78-90)	87 (87-88)
Hodgkin Lymphoma	86 (84-88)	85 (83-87)	87 (85-90)
Body of Uterus	–	–	85 (84-86)
Bladder†	77 (76-78)	78 (76-79)	75 (72-77)
Cervix	–	–	75 (73-76)
Kidney	66 (64-67)	65 (63-67)	67 (65-69)
Larynx	65 (63-68)	66 (63-69)	61 (56-67)
Oral	63 (62-65)	62 (60-64)	66 (63-68)
Colorectal	62 (61-62)	61 (61-62)	62 (62-63)
Non-Hodgkin Lymphoma	61 (60-62)	60 (58-61)	63 (62-65)
Leukemia	51 (50-52)	51 (50-53)	51 (49-53)
Ovary	–	–	40 (39-42)
Multiple Myeloma	34 (32-36)	34 (32-36)	34 (31-36)
Stomach	23 (21-24)	22 (20-23)	24 (22-26)
Brain	22 (21-24)	22 (20-23)	24 (22-26)
Liver	18 (16-19)	18 (16-20)	16 (13-19)
Lung	15 (15-15)	13 (12-13)	17 (17-18)
Esophagus	14 (12-15)	14 (12-15)	13 (11-16)
Pancreas	6 (5-6)	6 (5-7)	6 (5-7)

– Not applicable

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

† Excludes data from Ontario which does not currently report in situ bladder cases.

Note: Body of uterus does not include 'uterus not otherwise stated'; colorectal does not include 'anus'; and brain does not include 'other nervous system'.

Analysis by: Health Statistics Division, Statistics Canada

Data source: Canadian Cancer Registry database at Statistics Canada

7. FIVE-YEAR RELATIVE SURVIVAL

Table 7.2

Estimated Age-Standardized Five-Year Relative Survival Ratio (%) (95% Confidence Interval), Both Sexes Combined by Province for the Most Common Cancers, 2002-2004

	Relative Survival Ratio (%) (95% Confidence Interval)			
	Prostate	Breast	Colorectal	Lung
Canada*	94 (94-95)	87 (87-88)	62 (61-63)	15 (15-15)
PE	88 (81-93)	84 (79-89)	53 (46-60)	11 (8-15)
NS	97 (95-99)	84 (82-86)	56 (54-59)	14 (12-15)
NB	96 (93-98)	86 (84-88)	60 (57-64)	15 (13-17)
ON	96 (95-97)	88 (87-88)	63 (63-64)	16 (16-17)
MB	93 (91-95)	86 (84-88)	58 (56-61)	19 (17-21)
SK	87 (85-89)	87 (85-89)	61 (58-63)	14 (13-16)
AB	91 (90-93)	88 (86-89)	60 (58-61)	12 (11-13)
BC	95 (94-96)	87 (86-88)	62 (61-64)	13 (12-14)

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

Note: Colorectal cancer does not include cancer of the anus.

Analysis by: Health Statistics Division, Statistics Canada

Data source: Canadian Cancer Registry database at Statistics Canada

Table 7.3

Estimated Five-Year Relative Survival Ratio (95% Confidence Interval) by Age Group for the Most Common Cancers, Canada (Excluding Quebec*), 2002-2004

	Relative Survival Ratio (%) (95% Confidence Interval)					
	Age Group					
	20-39	40-49	50-59	60-69	70-79	80-99
Prostate	–	94 (92-96)	97 (96-97)	98 (98-99)	96 (95-97)	82 (79-84)
Breast	82 (80-83)	89 (88-89)	89 (88-90)	90 (89-90)	87 (86-89)	80 (77-82)
Colorectal	63 (59-66)	64 (62-66)	65 (64-67)	64 (63-65)	63 (62-64)	56 (54-58)
Lung	37 (31-42)	22 (20-24)	19 (18-20)	17 (16-17)	13 (12-14)	8 (7-9)

– Estimate unavailable due to small number of cases.

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

Note: Colorectal cancer does not include cancer of the anus.

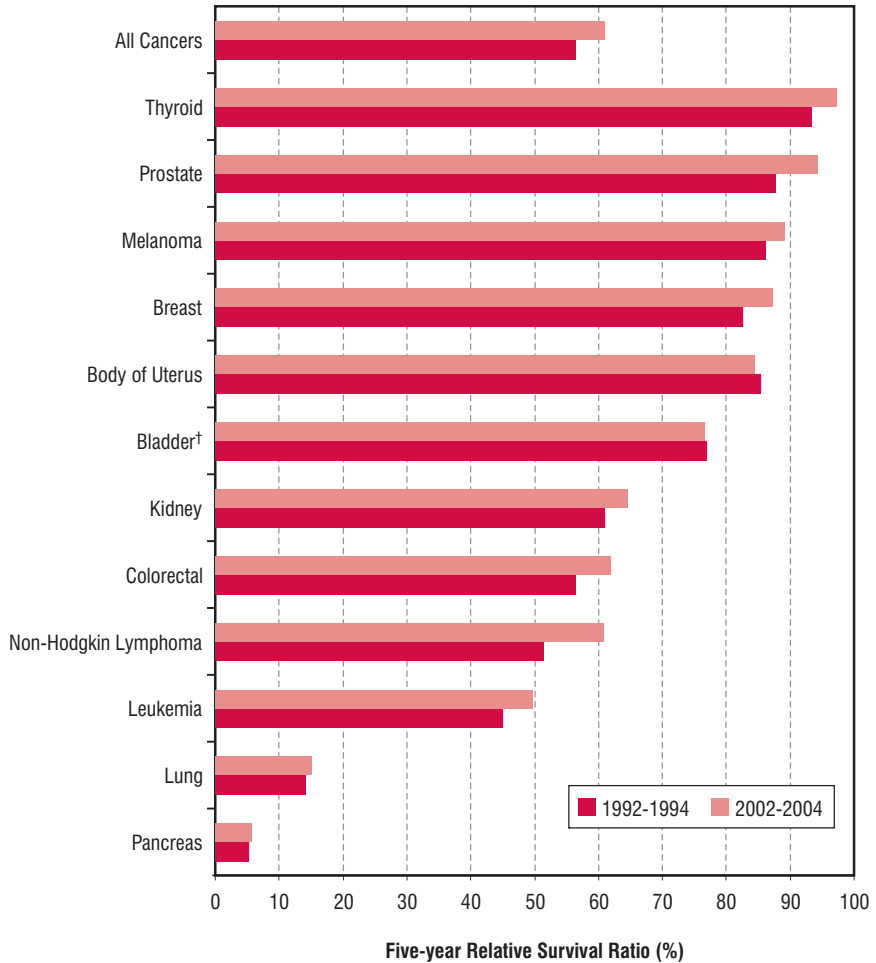
Analysis by: Health Statistics Division, Statistics Canada

Data source: Canadian Cancer Registry database at Statistics Canada

7. FIVE-YEAR RELATIVE SURVIVAL

Figure 7.1

Estimated Age-Standardized Five-Year Relative Survival Ratio (%) for Selected Cancers, Both Sexes Combined, Canada (Excluding Quebec*), 2002-2004 versus 1992-1994



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

† Excludes data from Ontario which did not report in situ bladder cases.

Note: Body of uterus does not include 'uterus not otherwise stated' and colorectal does not include 'anus'.

Analysis by: Health Statistics Division, Statistics Canada

Data source: Canadian Cancer Registry database at Statistics Canada

8. PREVALENCE

Cancer prevalence can be defined as the number of previously diagnosed cases of cancer in a given population, among people alive on a specified date (index date). Alternatively, the unit of interest may be the number of people previously diagnosed with cancer. It is influenced by both the incidence of and survival from cancer. Total prevalence refers to prevalent cases diagnosed at any previous time while limited-duration prevalence refers to prevalent cases diagnosed within a specified number of years. Only prevalent cancers/individuals diagnosed within a recent span of 10 years are considered herein.

Person-based prevalence estimates the **number of individuals** living with cancer on a specified date.

Tumour-based prevalence estimates the **number of primary cancers** diagnosed among individuals living with cancer on a specified date.

Since the person-based approach counts the number of individuals with cancer rather than the number of diagnosed tumours, it can underestimate the true burden of cancer on the Canadian healthcare system, individuals and their families. For this reason the estimates of prevalence presented herein focus on tumour-based prevalence.

Relevance of prevalence

Prevalence is a useful indicator of cancer burden, both at the personal and healthcare system levels. Categorizing cancer prevalence estimates according to time since diagnosis is a useful means of providing more precise indications of health care needs.¹⁸ Cases diagnosed within 10 years represent the major demand for cancer care services; more specifically, different health care services are required by cases diagnosed 2 or fewer, 2-5 and 5-10 years ago.^{18,19}

Although many individuals who survive cancer continue to live productive and rewarding lives, the cancer experience is difficult and presents many physical, emotional and spiritual challenges. These challenges may persist beyond the point of physical recovery from the cancer itself, often requiring extensive use of rehabilitation and supportive care resources. The growing demand and increased complexity of survivors' health needs must be considered in the planning and development of interdisciplinary health services.

Calculation of prevalence

For the first time, this publication uses individual information on vital status to provide direct estimates of Canadian prevalence (see *Appendix II*). Previous issues reported indirect, 15-year prevalence estimates determined by applying survival rates derived from Saskatchewan Cancer Registry data to national cancer incidence counts. New to this issue as well, estimates are provided by time since diagnosis and age group for a greatly extended list of cancers.

The data presented are a summary of more detailed prevalence analyses published recently by Ellison & Wilkins.²⁰

Tumour-based prevalence

Among persons alive on January 1, 2005 in Canada, almost 723,000 primary cancer cases had been diagnosed in the previous 10 years (Table 8.1).

- ◆ By cancer type
 - Nearly 40% were either breast (20.5%, or 148,542 cases) or prostate (18.7%, or 135,065 cases), followed by colorectal cancer (13%, or 93,489 cases), cancer of the lung (5%, or 37,168 cases), bladder cancer (5%, or 35,807 cases), non-Hodgkin lymphoma (4%, or 29,619 cases), and melanoma (4%, or 29,602 cases).
 - Despite the higher incidence of cancer of the lung during the period of study²¹, the number of prevalent colorectal cancer cases (10-year) was over 2.5 times greater which reflects the poor prognosis for those diagnosed with lung cancer.
- ◆ By sex
 - In women, the most prevalent cancers were breast (40%, or 147,595 cases), colorectal (12%, or 43,886 cases), body of uterus (7%, or 26,467 cases), and lung (4.9%, or 18,116 cases). Together, these cancers constituted 64% of all prevalent cases in women.
 - Among men, the most common prevalent cancers were prostate cancer (38%), colorectal cancer (14%, or 49,603 cases), bladder (8%, or 26,625 cases), and lung (5%, or 19,052 cases). Together, these cancers accounted for nearly two in every three prevalent cases in men.
- ◆ By age
 - Five-year prevalence proportions (per 100,000) peaked in the 80 to 84 year age group in both males (9,170) and females (5,179), and in older ages dipped to approximately the level at ages 70 to 74 (Figure 8.1).
 - In females, five-year prevalence exceeded that in males until just under the age of 60 at which point the proportions crossed over and prevalence increased much more rapidly in males than in females.

Person-based prevalence

- ◆ 695,049 persons (approximately 1 in 46 or 2.2% of the Canadian population) had been diagnosed with one or more primary invasive cancers in the previous 10 years and were alive on January 1, 2005 (Table 8.2). One in every 111 females alive on January 1, 2005 had been diagnosed with breast cancer in the previous 10 years; the corresponding figure for prostate cancer was 1 in every 118 males.

The relative burden

The relative contribution of both breast and prostate cancer decreased when shorter prevalence periods were considered — each comprised about 17% of the 2-year prevalent cancer cases (Table 8.1). The opposite pattern was observed for lung cancer; the relative contribution increased with decreasing prevalence-duration (6% for 5-year; 8% for 2-year).

- ◆ Of the estimated 722,833 10-year prevalent cancer cases on January 1, 2005, 217,089 had been diagnosed within the past two years (2003-2004), and these individuals were likely at a stage of their disease requiring primary treatment or recovering from its effects.

8. PREVALENCE

- ◆ Another 237,060 prevalent cases were in the third to fifth year after diagnosis (diagnosed in 2000-2002)—a period that typically requires close clinical follow-up for recurrence and supportive care.

The number of newly diagnosed cancer cases in Canada continues to rise²¹ while survival from cancer is also increasing.^{17,22} The combined result is an increase in the number of people currently living with or having a history of cancer. This growing burden will have health resource implications as more Canadians will require ongoing medical treatment, surveillance and supportive care.

A large number of Canadians live with the effects of cancer, require repeated active treatment and have a continuing need for cancer care resources and support services.

Table 8.1**Number of Prevalent Cases for Selected Cancer Types by Prevalence-Duration and Sex, Canada, January 1, 2005**

	2-year			5-year			10-year		
	Total	Males	Females	Total	Males	Females	Total	Males	Females
All Cancers	217,089	110,595	106,494	454,149	228,318	225,831	722,833	353,508	369,325
Prostate	37,583	37,583	–	85,956	85,956	–	135,065	135,065	–
Lung	17,620	9,189	8,431	27,642	14,122	13,520	37,168	19,052	18,116
Breast	37,391	306	37,085	86,552	598	85,954	148,542	947	147,595
Colorectal	29,554	16,048	13,506	60,700	32,736	27,964	93,489	49,603	43,886
Non-Hodgkin Lymphoma	9,253	4,930	4,323	18,991	10,015	8,976	29,619	15,316	14,303
Bladder	10,532	7,946	2,586	21,887	16,448	5,439	35,807	26,625	9,182
Melanoma	7,722	4,078	3,644	17,459	8,961	8,498	29,602	14,697	14,905
Thyroid	6,001	1,220	4,781	13,091	2,804	10,287	20,529	4,430	16,099
Leukemia	5,794	3,426	2,368	11,511	6,720	4,791	17,684	10,170	7,514
Kidney	6,045	3,624	2,421	12,838	7,670	5,168	20,553	12,205	8,348
Body of Uterus	6,894	–	6,894	15,373	–	15,373	26,467	–	26,467
Pancreas	1,825	883	942	2,444	1,197	1,247	3,037	1,464	1,573
Oral	5,198	3,524	1,674	10,819	7,235	3,584	17,383	11,648	5,735
Stomach	2,890	1,911	979	4,791	3,056	1,735	6,875	4,229	2,646
Brain	2,121	1,229	892	3,841	2,175	1,666	6,015	3,355	2,660
Ovary	3,282	–	3,282	6,265	–	6,265	9,355	–	9,355
Multiple Myeloma	2,537	1,362	1,175	4,564	2,428	2,136	5,902	3,126	2,776
Liver	942	712	230	1,553	1,178	375	1,967	1,473	494
Esophagus	1,215	900	315	1,767	1,319	448	2,266	1,644	622
Cervix	2,346	–	2,346	5,433	–	5,433	9,995	–	9,995
Larynx	1,861	1,521	340	3,908	3,215	693	6,701	5,479	1,222
Hodgkin Lymphoma	1,618	883	735	3,751	2,079	1,672	6,906	3,806	3,100
Testis	1,557	1,557	–	3,817	3,817	–	7,091	7,091	–

– Not applicable

Source: Ellison LF, Wilkins K. Cancer prevalence in the Canadian population. Health Reports 2009; 20(1).²⁰

8. PREVALENCE

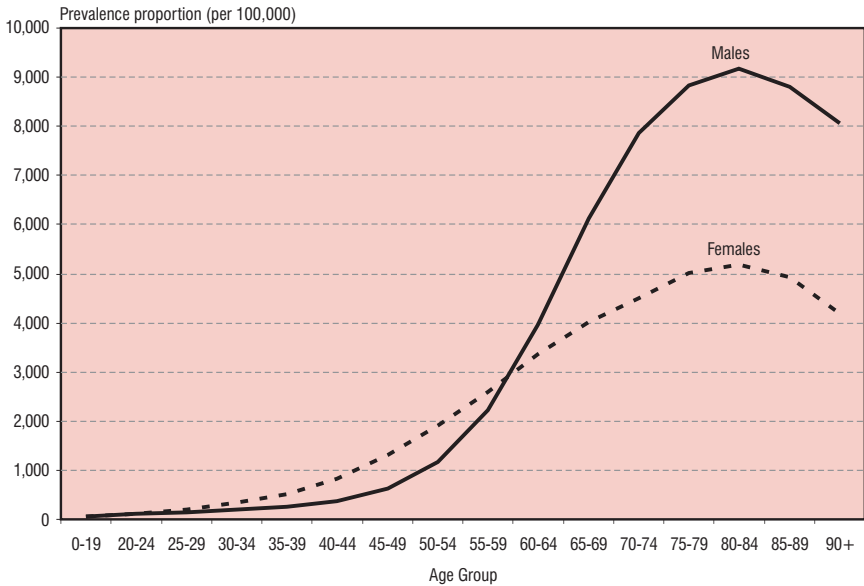
Table 8.2

Ten-Year Person-Based Prevalence for the Most Common Cancers by Sex, Canada, January 1, 2005

	Number of Persons			Percentage of Canadian Population			One in:		
	Both	Males	Females	Both	Males	Females	Both	Males	Females
All Cancers	695,049	338,912	356,137	2.2	2.1	2.2	46	47	46
Female Breast	–	–	145,692	–	–	0.9	–	–	111
Prostate	–	135,061	–	–	0.8	–	–	118	–
Colorectal	91,934	48,725	43,209	0.3	0.3	0.3	350	327	376
Lung	36,875	18,915	17,960	0.1	0.1	0.1	872	842	904

– Not applicable

Source: Ellison LF, Wilkins K. Cancer prevalence in the Canadian population. Health Reports 2009; 20(1).²⁰

Figure 8.1**Age-Specific Five-Year Tumour-Based Prevalence Proportions for All Cancers Combined by Sex, Canada, January 1, 2005**

Source: Ellison LF, Wilkins K. Cancer prevalence in the Canadian population. Health Reports 2009; 20(1).²⁰

9. CANCER IN ADOLESCENTS AND YOUNG ADULTS (15-29 YEARS)

Adolescents and young adults (AYAs) aged 15-29 years are a largely understudied population with regard to cancer. On average, there were 2,075 new cancer cases per year between 1992-2005 and 326 deaths per year between 1991-2004 in this age group. Because cancer occurs relatively infrequently in AYAs, awareness of cancer in this age group is less than in older adults. Moreover, AYAs often do not benefit from the specialized care available to children below 15 years of age.

More recently, AYAs are increasingly recognized as a group with distinct needs. Their unique requirements for psychosocial support are not often addressed in pediatric or adult oncology centres. In addition, their cancers may have biologically distinct behaviours, responding differently to chemotherapy and other treatment for the same cancers in different age groups.²³ Cancers in AYAs may also be detected later in their course because young people may delay seeking medical help upon experiencing symptoms or may not have access to routine medical care.

The small number of cancers in this age group does not appropriately represent the personal and societal costs of cancer in this population, as reflected in the potential years of life lost (Table 9.1). Young adulthood, in particular, is a stage of development involving many life-related changes, including decisions about employment, education, relationships and family that can be severely impacted by a cancer diagnosis.

Epidemiology and surveillance

Between 1992 and 2005, slightly more young females than young males were diagnosed with cancer – 15,043 females and 14,005 males (Table 9.2) – although more young males died from cancer over a similar time period (Table 9.3). A comparison of Tables 9.2 and 9.3 reveals that the most common causes of cancer death differ somewhat from the most commonly diagnosed cancers in AYAs.

Cancers in the AYA population represent a transition between non-epithelial types (especially acute leukemias and embryonal tumours) that are common during childhood and epithelial types (carcinomas) that comprise most cancers of older adults (Figure 9.1). Therefore, the incidence classification system of cancer types in AYAs is a blend of those used for childhood and adult cancers.^{24,25} Epithelial cancers are those that arise in cells lining the inside or outside of the body's organs. As shown in Figure 9.1, about two-thirds of the cancers diagnosed in AYAs during 1992-2005 were non-epithelial (85% in males, 53% in females).

Common cancers

- ◆ Lymphomas (Hodgkin and non-Hodgkin combined) represent the most commonly diagnosed non-epithelial cancer in each sex (Figure 9.1). The male lymphoma rate is nearly 20% higher compared to females, because of higher incidence for non-Hodgkin lymphoma in males.
- ◆ Thyroid cancer, an epithelial type, is the most common cancer overall in young females, representing about 19% of diagnoses per year between 1992 and 2005, followed by Hodgkin lymphoma and melanoma (Figure 9.1). Both thyroid cancer and melanoma are considerably more common in AYA females compared to males.

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- ◆ Germ cell testis cancer, a non-epithelial type, occurs with the highest frequency and accounts for approximately 24% of cancer diagnoses per year in male AYAs between 1992 and 2005 (Figure 9.1). It is followed by Hodgkin lymphoma (14%) and non-Hodgkin lymphoma (10%).
- ◆ Leukemias account for the most cancer deaths in each sex (21% in males and 17% in females), followed by cancer of the brain and other parts of the central nervous system, hereafter called brain. The third most common cancer cause of death is non-Hodgkin lymphoma in males and cancers of the genital organs (mostly cervix or ovary) in females (Table 9.3).

Trends over time

For all cancers combined, the incidence rate rose during the period 1992-2005. Increases are almost entirely due to the rising incidence of epithelial cancers, particularly in females (Figure 9.2). Overall, cancer mortality rates declined between 1992 and 2004 (Figure 9.2). Average annual declines over the most recent 10 years of observed data are estimated to be 2.9% in males (statistically significant) and 1.4% in females (non-significant).

Figure 9.3 shows trends in incidence and mortality rates for the top ten cancers during 1992-2005. The annual percent change (APC) was estimated over the most recent decade (1996-2005) of available data on incidence rates (Table 9.4). Trends for cancers with increases or decreases were as follows:

- ◆ *Germ cell testis cancer* incidence rate has risen significantly by 2.7% per year. Since the risk factors for testis cancer are not well understood, apart from undescended testicle, there is no accepted explanation for the increasing trend. Similar increases have been noted in most countries with largely European populations.²⁶ The mortality rate is very low.
- ◆ *Non-Hodgkin lymphoma* incidence rates are considerably higher in males compared to females. Rates have declined significantly by 2.4% per year in young females and non-significantly by 1.2% per year in males. However, this summary measure hides more complex trends: the incidence rate declined rapidly in males up to 2002 after which the trend stabilized, while it was increasing in females up to about 1998, and was followed by a decline. Trends in mortality rates roughly parallel those for incidence. Immunosuppression is the clearest risk factor for non-Hodgkin lymphoma, particularly apparent by the rise in incidence for this cancer in young males in the 1980s and 1990s as a result of the AIDS epidemic (acquired immune deficiency syndrome).⁵
- ◆ *Soft tissue sarcoma* incidence rate has risen in young males since 2001, following a long, steep decline. The rate has been stable in females.
- ◆ *Thyroid cancer* incidence rate is more than four times higher in young females compared to young males. Although rates have increased in both sexes, the upward trend is much stronger among females (6.5% per year, statistically significant). This increase is driving the rise in incidence of epithelial cancers, particularly in females, since thyroid cancer accounts for nearly 20% of their new cancer diagnoses. Rising thyroid incidence is likely related to changes in diagnostic practices and imaging techniques, resulting in improved detection of earlier stage, asymptomatic cancers.⁷ Thyroid cancer remains a rare cause of death in this age group.

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- ◆ *Cervical cancer* incidence rate has declined by about 2% per year between 1996 and 2005. This continues a long-term drop, most likely related to the uptake of and improvements in Papanicolaou smear (Pap) screening among young females. The incidence of cervical cancer is anticipated to continue declining with the recent introduction of the human papillomavirus (HPV) vaccine for young girls in Canada.

Prevention and screening

Little is known about risk factors for many of the leading cancers in AYAs. Certain congenital anomalies (e.g., undescended testicle) or a family history of cancer appears to increase the risk for certain cancers (e.g., testis, breast, colorectal), while exposure to infectious agents such as HPV, human immunodeficiency virus (HIV), and Epstein-Barr virus may increase the risk for other cancers such as cervical cancer, Kaposi sarcoma, Hodgkin and non-Hodgkin lymphoma.²⁷ In addition, there is growing evidence that exposure to ultraviolet radiation through the use of tanning beds and sunlamps, may increase skin cancer risk, including malignant melanoma, especially if exposure begins in adolescence or young adulthood.²⁸ However, most cancers in AYAs do not appear to be due to environmental carcinogens since individuals in this age group have not had enough time to accrue the mutations that lead to cancer. When a malignancy in AYAs has been linked to a specific cause, that cause is usually exposure before birth or during childhood to known carcinogens or is a second cancer in patients who were treated with chemotherapy and/or radiotherapy for a prior malignancy.²⁷

The lack of identifiable causes of cancer means there is limited opportunity for primary prevention in this age group. Organized cancer screening in AYAs is largely inefficient due to the rarity of cancers, their short latency period, and aggressive growth. One exception is cervical cancer which can, for the most part, be avoided or easily treated if detected early. The Pap test is effective in identifying both invasive cervical cancer and its precursor lesions. Population screening with the Pap test has been shown to effectively reduce rates of cervical cancer incidence and mortality. Screening for cervical cancer is recommended for sexually active women of all ages. The Public Health Agency of Canada is working with the Canadian provincial and territorial health ministries to help with their ongoing efforts to improve the quality of cervical cancer screening programs across the country with the aim of reaching high-risk women, standardize screening practices, assess new technologies, monitor results and provide appropriate follow-up procedures. The Canadian Immunization Committee recommends use of the HPV vaccine in Canada for females aged 9-26 years.²⁹ HPV vaccination campaigns have recently been rolled out in several provinces in conjunction with intensified Pap screening efforts. Together, these two strategies offer the potential to reduce new cases and deaths from cervical cancer. In other cases, genetic testing and diagnostic imaging can be made available to individuals with a strong family history of cancer such as breast and colorectal cancer.

Because behaviours and lifestyles adopted in adolescence and young adulthood are thought to impact cancer risk later in life, cancer prevention and control strategies targeting risky sexual activity, alcohol and drug abuse, poor diet and lack of physical activity should be addressed as early as possible.

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Diagnosis and treatment

The signs and symptoms of cancer in AYAs may be different from those of younger and older patients, reflecting the specific patterns of cancer in this age group. Common symptoms are lumps in the neck, breast, abdomen, and testicle as well as abnormal, pigmented skin lesions. Others include headache, neurologic deficits, lethargy, and isolated limb pain or masses.

Unfortunately, there may be a delay in diagnosis due to a number of possible factors. Young people are more likely to think of themselves as invincible and may present late for medical care because of concerns about time away from school or work, or due to a lack of knowledge about how to navigate through the healthcare system to find appropriate help. They may be less likely to be receiving routine medical care and may pursue medical help less aggressively. Compliance in both the diagnostic workup and treatment may be less frequent in AYAs because of a lack of oversight by parents or the patient's spouse; financial burden related to loss of work, transportation, and medication; altered body image including hair loss, acne, or weight gain; and reduced sexuality. Treatment delays may occur as a result of physicians being less familiar with cancer signs and symptoms in AYAs. Symptoms may be attributed to fatigue, stress, or other causes, and clinical investigations may be slower. Delays in diagnosis and treatment can be reduced by seeking regular and prompt medical care, especially if AYAs are aware of unusual changes to their skin, breasts, or testes.

AYAs with cancer are often faced with several challenges related to their care and treatment. First, the treatment setting, whether a pediatric oncology centre or a cancer setting for older adults, may not always be the most age-appropriate venue. Because cancers affecting young adults are rare, specialist care for young adults is not always available. Based on data for 1997-2001 from the Pediatric Oncology Group of Ontario and the Ontario Cancer Registry, only 32% of adolescents 15-19 years of age with cancer were treated in a pediatric oncology centre in Canada. In addition, because AYAs with cancer are a relatively small population, many such patients may feel isolated and unable to find peers for emotional support.

Second, while pediatric treatment regimens have often improved outcomes in AYAs, those treated in adult cancer centres may not have access to the most appropriate therapies.³⁰ Adult oncologists are more familiar with epithelial cancers and use drug regimens and doses tested and used in older adults. Unlike older adults, young people are less likely to have co-morbid conditions that could interfere with treatment and are physiologically capable of tolerating more intensive treatment. Compared to other age groups, AYAs may also respond differently to treatment because of their different rate of drug metabolism.²³

Finally, the AYA population is the least likely to participate in clinical trials which, in children, have contributed to improved treatment outcomes and faster gains in survival.³¹ The Canadian Childhood Cancer Surveillance and Control Program estimates that only 10% to 20% of adolescents with cancer participate in clinical trials, which may explain why survival among adolescents is improving at a slower rate than in children.³⁰ The participation rate of young adults in the US is even lower at less than 2%, compared with 60% in children, and 3-5% in older adults.³¹ In adult care centres, referral of adolescents for treatment is on average twice as long as it is in a

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pediatric centre.³⁰ Even when treated in a pediatric centre, adolescents are enrolled in trials far less frequently than children under the age of 15 years. In addition to the minimal advances in treatment outcomes, there has been little progress in developing treatment and monitoring guidelines for AYAs.³¹

Survival

Observed survival proportions estimated for AYAs diagnosed from 1997-2004 are presented in Table 9.5. These estimates were derived using period analysis and exclude data from the province of Quebec (see *Appendix II*). For all AYA cancers combined, the five-year OSP was estimated to be 83%. The corresponding one- and three-year survival proportions were 93% and 86%, respectively. Among common cancers in this age group, the highest five-year survival proportions were observed for thyroid (99%), testis (96%), Hodgkin lymphoma (94%), and melanoma (92%) while the lowest were seen in leukemias (61%) and brain tumours (66%).

Five-year survival among females was similar to, or higher than, among males for each of the most common AYA cancers (Table 9.6). Sex-specific differences in survival were largest for non-Hodgkin lymphoma, soft tissue and other extraosseous sarcoma, and melanoma. Overall, survival among females was 6% higher (expressed as a difference in percentages). While no overall pattern was observed between age at diagnosis and survival, the prognosis for a number of individual cancers (e.g., soft tissue and other extraosseous sarcoma, melanoma, and breast) appeared to be poorer at older ages.

A comparison of five-year survival proportions observed for those diagnosed in the early to mid-1990s and those estimated for persons more recently diagnosed revealed that progress has been made among AYAs (Table 9.7). For all cancers combined, survival for the period 2001-2004 was 5% greater than it was for 1992-1995 (85% vs. 80%). The largest increases during this period were observed for non-Hodgkin lymphoma (78% vs. 66%), leukemia (67% vs. 57%), and soft tissue and other extraosseous sarcoma (72% vs. 63%). No changes were seen in patients with common cancers for which the survival was already relatively high.

Survivorship

Survivorship is the phase of the cancer control continuum that follows the completion of primary treatment. During the post-treatment phase, immediate treatment-related adverse events diminish and surveillance, psychosocial adjustment, and long-term health care concerns predominate. The long-term health care needs of survivors of AYA cancers involve the management of late-effects of treatment, the elevated risk of second primary cancers associated with the initial cancer or its treatment, and general medical and preventive health care.³² The frequency of follow-up visits and testing of cancer survivors varies according to cancer type. Concurrent educational, vocational, lifestyle, and psychosocial needs during this formative stage of life add to the complexity of survivorship needs in AYAs.^{33,34} Currently, few Canadian cancer centres (e.g., Victoria, Vancouver, Winnipeg, Ottawa and Montreal) have support groups open to AYA cancer survivors. The complex survivorship needs are further compounded by the relative rarity of the condition and the lack of dedicated research into the unique needs faced by this age group.³⁵

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Determining the appropriate setting for delivery of long-term survivorship care is yet another challenge. A tertiary oncology survivorship clinic is one venue for delivering survivorship care.³⁶ However, such tertiary care settings are often not feasible or practical on a population basis. Community-based care, while more feasible and practical, raises concern about the knowledge and expertise of primary care physicians with regard to specific cancer treatments as well as optimal clinical surveillance and management. Specific psychosocial needs, such as treatment-related developmental delays and infertility, are just two examples of issues that are encountered by community physicians.³⁶ For this reason, a shared-care model is recommended. Survivorship care plans are one of the tools proposed to facilitate the shared-care approach.^{37,38} Such plans provide a summary about the cancer, its treatment, as well as an individualized approach for delivery of care that is ideally suited to the needs of the AYA population.

Implications and recommendations

A comprehensive report prepared in 2006 by the Working Group on Cancer in Young Adults in Canada described cancer trends and patterns since the early 1980s in young adults aged 20-44 years old.⁵ Several other major reports from the US National Cancer Institute and from the Surveillance Epidemiology and End Results program highlighted poor progress made in improving health outcomes for AYAs.^{39,40} Together, these reports offer several common recommendations for addressing the gaps in AYA oncology and care, including:

- ◆ The need for ongoing surveillance of incidence and mortality, and projection of future burden of disease in AYAs. This included the need to identify the characteristics and risk factors that distinguish the cancer burden in the AYA population;
- ◆ Refining tools to study cancer in AYAs, such as tumour classification and selection of appropriate age groupings;
- ◆ Providing greater oncology education, training, and communication to improve awareness among health care providers;
- ◆ Finding innovative ways to increase and improve communication, diagnosis, treatment, and medical follow-up of AYAs. This includes enhancing prevention efforts, access, and quality of cancer care to AYAs;
- ◆ Ensuring excellence in service delivery across the cancer control continuum – from prevention, screening, diagnosis, treatment, survivorship, to end of life care. There is a need to extend the evidence base for guidelines on long-term follow-up in survivors of AYA cancer and to standardize such guidelines.⁴¹
- ◆ Strengthen advocacy and support for the AYA cancer patient; and
- ◆ Research and surveillance on the effects of cancer diagnosis and its treatment. Clinical research should occur alongside research on quality of life and health services delivery.

Several ongoing activities in the field of AYA oncology are aimed at addressing the above recommendations. For example, the Children's Oncology Group (the major cooperative group of pediatric cancer institutions in North America) and several adult cooperative groups have planned to increase participation of young adult patients in

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clinical trials. It is expected that the Children's Oncology Group will now enrol patients up to age 50 for trials of certain cancers – e.g., Ewing's sarcoma and other cancers that have traditionally been studied almost exclusively in pediatric centres.⁴² Several cooperative groups of adult cancer centres have also planned to lower the age of eligibility for some of their trials of cancers that are mostly prevalent in older adults to allow enrolment of both adolescents and young adults.

National organizations such as Young Adult Cancer Canada and the Lance Armstrong Young Adult Alliance in the US, as well as numerous cancer support websites, are filling the void in peer support for AYAs with cancer as well as for their families, who must typically navigate through the health system in isolation. Greater support is still needed from individuals, communities, and governments to bolster the prevention of cancer in AYAs. This includes personal efforts to engage in healthier lifestyles, community infrastructure and regulations that encourage cancer prevention, and policies that create opportunities for healthy living. Finally, the profile of the AYA age group will need to be raised on the cancer control agenda in order to make it an active area of research with greater funding and exposure in the scientific and medical communities.

Adolescents and young adults (AYAs) aged 15-29 years are a largely understudied population with treatment and care issues that include delays in diagnosis, low participation in clinical trials, lack of age-appropriate care, concerns around social support during cancer treatment, as well as late effects of treatment, second cancers and long-term psychosocial requirements for cancer survivors.

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Table 9.1

Potential Years of Life Lost Due to Cancer, Canada, 2004

	Potential Years of Life Lost (PYLL)					
	Total		Males		Females	
	Years	%	Years	%	Years	%
All Cancers	1,026,600	100	495,000	100	531,700	100
Age Group						
0-14	10,200	1.0	5,200	1.1	5,000	0.9
15-19	4,100	0.4	2,500	0.5	1,600	0.3
20-24	5,400	0.5	3,100	0.6	2,300	0.4
25-29	6,500	0.6	3,400	0.7	3,200	0.6
30-39	33,400	3.3	13,900	2.8	19,500	3.7
40-49	115,700	11.3	48,700	9.8	67,100	12.6
50-59	225,400	22.0	104,000	21.0	121,400	22.8
60-69	260,400	25.4	134,000	27.1	126,400	23.8
70-79	244,400	23.8	126,700	25.6	117,700	22.1
80+	121,100	11.8	53,500	10.8	67,600	12.7

Note: Figures are calculated based on life expectancy. Column totals may not sum to row totals due to rounding.

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

Data source: Canadian Vital Statistics Death database at Statistics Canada

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Table 9.2

New Cases and Average Annual Age-Standardized Cancer Incidence Rates by Diagnostic Group in Adolescents and Young Adults (15-29 Years), Canada, 1992-2005*

Diagnostic Group [†]	Males		Females	
	New Cases	ASIR per 1,000,000 per year	New Cases	ASIR per 1,000,000 per year
Total (14 years)	14,005	319.5	15,043	359.6
Average Per Year	1,000		1,075	
Oral Cavity and Pharynx	289	6.7	281	6.6
Digestive System	511	12.1	500	12.2
Esophagus	13	0.3	8	0.2
Stomach	67	1.6	72	1.8
Colorectal	312	7.4	297	7.3
Anus	NR	NR	NR	NR
Hepatic Tumours	60	1.4	55	1.3
Gallbladder	<6	NR	<6	NR
Pancreas	29	0.7	46	1.1
Other Biliary and Other Digestive	19	0.4	12	0.3
Respiratory	183	4.3	162	3.9
Larynx	15	0.4	9	0.2
Lung and Bronchus	144	3.4	138	3.3
Trachea, Mediastinum and Other Respiratory	24	0.6	15	0.4
Malignant Bone Tumours	515	11.2	305	6.9
Osteosarcomas	238	5.1	141	3.2
Chondrosarcomas	69	1.6	48	1.1
Ewing Tumour and Related Sarcomas	160	3.4	82	1.8
Other Specified Malignant Bone Tumours	48	1.1	34	0.8
Soft Tissue and Other Extrasosseous Sarcoma	853	19.5	675	15.8
Rhabdomyosarcomas	88	1.8	63	1.4
Fibrosarcoma, Peripheral Nerve Sheath Tumours	102	2.3	88	2.1
Kaposi sarcoma	157	3.9	9	0.2
Other Specified Soft Tissue Sarcomas	401	9.1	434	10.3
Unspecified Soft Tissue Sarcomas	105	2.4	81	1.9
Melanoma	993	23.2	1,655	39.9
Breast	<6	NR	1,041	26.2
Female Genital System	–	–	2,207	54.2
Ovary	–	–	605	14.2
Cervix	–	–	1,405	35.1
Corpus Uteri	–	–	108	2.7
Other Female Genital	–	–	89	2.2
Male Genital System	3,396	78.5	–	–
Testis	3,375	78.0	–	–
Prostate	10	0.2	–	–
Other Male Genital	11	0.3	–	–

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Table 9.2 (continued)

New Cases and Average Annual Age-Standardized Cancer Incidence Rates by Diagnostic Group in Adolescents and Young Adults (15-29 Years), Canada, 1992-2005*

Diagnostic Group [†]	Males		Females	
	New Cases	ASIR per 1,000,000 per year	New Cases	ASIR per 1,000,000 per year
Urinary System	279	6.6	229	5.5
Bladder	149	3.5	98	2.4
Kidney	121	2.8	129	3.1
Ureter	<6	NR	<6	NR
Other Urinary	NR	NR	<6	NR
Central Nervous System	1,133	25.6	929	21.7
Ependymomas and Choroid Plexus Tumour	67	1.5	57	1.3
Astrocytomas	520	11.7	456	10.6
Intracranial and Intraspinial Embryonal Tumours	129	2.8	70	1.6
Other Gliomas	301	7.0	225	5.3
Other Specified Intracranial and Intraspinial Neoplasms	18	0.4	25	0.6
Unspecified Intracranial and Intraspinial Neoplasms	98	2.2	96	2.2
Endocrine	686	16.0	2,903	69.7
Thyroid	658	15.3	2,875	69.1
Other Endocrine Including Thymus	28	0.7	28	0.7
Lymphoma	3,386	76.2	2,795	65.1
Hodgkin Lymphoma	2,009	44.8	1,973	45.6
Non-Hodgkin Lymphoma	973	22.3	622	14.8
Burkitt Lymphoma	109	2.4	26	0.6
Unspecified Lymphomas	295	6.8	174	4.1
Leukemia	1,185	26.2	868	20.1
Lymphoid Leukemia	504	10.8	256	5.8
Acute Myeloid Leukemia	355	7.9	361	8.4
Chronic Myeloproliferative Diseases	219	5.1	154	3.6
Myelodysplastic Syndrome and Other Myeloproliferative	32	0.7	31	0.7
Unspecified and Other Specified Leukemia	75	1.7	66	1.5
Other	595	13.5	493	11.7

– Not applicable

NR Suppressed to meet confidentiality requirements.

* Data are shown for the most recent period available and exclude non-melanoma skin cancer (basal and squamous) and in situ carcinomas except bladder. Rates are age-standardized to the 1991 Canadian population and due to disease rarity are expressed per million per year. The total (14 years) is rounded to the nearest 5 for males to avoid disclosure of cells less than 6.

[†] Adapted from Weir et al²⁵, see Appendix W1 – www.cancer.ca/statistics

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

Data source: Canadian Cancer Registry database at Statistics Canada

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Table 9.3

Deaths and Average Annual Age-Standardized Cancer Mortality Rates by Diagnostic Group in Adolescents and Young Adults (15-29 Years), Canada, 1991-2004*

Diagnostic Group [†]	Males		Females	
	Deaths	ASMR per 1,000,000 per year	Deaths	ASMR per 1,000,000 per year
Total (14 years)	2,556	57.8	2,007	47.6
Average Per Year	183		143	
Oral (Buccal Cavity and Pharynx)	39	0.9	24	0.6
Lip	0	0.0	0	0.0
Tongue	10	0.2	8	0.2
Salivary Gland	4	0.1	3	0.1
Mouth	5	0.1	3	0.1
Nasopharynx	19	0.4	7	0.2
Oropharynx	0	0.0	2	0.0
Other and Unspecified	1	0.0	1	0.0
Digestive Organs	214	5.0	198	4.8
Esophagus	11	0.3	5	0.1
Stomach	43	1.0	54	1.3
Large Intestine and Rectum	85	2.0	70	1.7
Anus	0	0.0	2	0.1
Liver	28	0.7	24	0.6
Gallbladder	1	0.0	1	0.0
Pancreas	15	0.3	15	0.4
Other and Unspecified	31	0.7	27	0.7
Respiratory System	85	2.0	54	1.3
Larynx	1	0.0	0	0.0
Lung	54	1.3	42	1.0
Other and Unspecified	30	0.7	12	0.3
Bone	241	5.2	133	3.0
Soft Tissue (including Heart)	156	3.5	131	3.0
Skin (Melanoma)	113	2.7	66	1.6
Breast	0	0.0	132	3.3
Genital Organs	133	3.1	224	5.5
Cervix	-	-	123	3.1
Body of Uterus	-	-	1	0.0
Ovary	-	-	85	2.0
Prostate	4	0	-	-
Testis	126	2.9	-	-
Other and Unspecified	3	0.1	15	0.4

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Table 9.3 (continued)

Deaths and Average Annual Age-Standardized Cancer Mortality Rates by Diagnostic Group in Adolescents and Young Adults (15-29 Years), Canada, 1991-2004*

Diagnostic Group [†]	Males		Females	
	Deaths	ASMR per 1,000,000 per year	Deaths	ASMR per 1,000,000 per year
Urinary Organs	44	1.0	22	0.5
Bladder	10	0.2	5	0.1
Kidney	32	0.7	17	0.4
Other Urinary	2	0.1	0	0.0
Eye	4	0.1	0	0.0
Brain and Other Nervous System	389	8.8	264	6.2
Endocrine Glands	45	1.0	38	0.9
Thyroid	9	0.2	5	0.1
Other Endocrine	36	0.8	33	0.8
Hodgkin Lymphoma	154	3.6	118	2.8
Non-Hodgkin Lymphoma [‡]	288	6.5	157	3.7
Multiple Myeloma	4	0.1	5	0.1
Leukemia	528	11.6	351	8.1
All Other and Unspecified Cancers	119	2.7	90	2.2

– Not applicable

* Data are shown for the most recent period available. Rates are age-standardized to the 1991 Canadian population and due to disease rarity are expressed per million per year.

† For ICD-10 codes see Appendix W2 - www.cancer.ca/statistics

‡ Non-Hodgkin Lymphoma includes Burkitt lymphoma and unspecified lymphomas.

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

Data source: Canadian Vital Statistics Death database at Statistics Canada

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Table 9.4

Annual Percent Change (APC) in Age-Standardized Incidence Rates for Selected Cancers in Adolescents and Young Adults (15-29 Years), by Sex, Canada, 1996-2005

	Males		Females	
	APC	Change-point [†]	APC	Change-point [†]
All Cancers	0.8*		1.4**	
Non-epithelial	0.5		-0.6	
Hodgkin Lymphoma	-0.5		-1.3	
Testis	2.7**		-	
Melanoma	-1.2		-0.9	
Central Nervous System	-0.9		1.1	
Leukemia	1.8		1.0	
Non-Hodgkin Lymphoma [‡]	-1.2		-2.4*	
Soft Tissue and Other Extrasosseous Sarcoma	5.9*	2001	0.3	
Epithelial	2.3*		3.4**	
Thyroid	3.1		6.5**	
Cervix	-		-2.1*	
Breast	-		1.9	

- Not applicable

* Significant, $p < 0.05$

** Significant, $p < 0.01$

[†] Changepoint indicates the baseline year, if the slope of the trend changed after 1996. Changepoints were fit to rates from 1992 to 2005. See *Appendix II: Methods* for further details.

[‡] Non-Hodgkin lymphoma includes Burkitt lymphoma and unspecified lymphomas.

Note: Annual Percent Change is calculated assuming a log linear model. 'All Cancers' incidence rates include other cancers not listed in this table but exclude non-melanoma skin cancer (basal and squamous). For histology codes used for epithelial and non-epithelial cancers, see Appendix W3 - www.cancer.ca/statistics

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

Data source: Canadian Cancer Registry database at Statistics Canada

9. CANCER IN ADOLESCENTS AND YOUNG ADULTS (15-29 YEARS)

Table 9.5

Estimated Observed Survival Proportion (95% Confidence Interval) for Selected Cancers in Adolescents and Young Adults (15-29 Years), by Survival Duration, Canada (Excluding Quebec*), 1997-2004

	Observed Survival Proportion (%) (95% Confidence Interval)		
	1-year	3-year	5-year
All Cancers	93 (93-94)	86 (85-87)	83 (82-84)
Thyroid	100 (99-100)	99 (99-100)	99 (99-100)
Testis	99 (98-99)	96 (95-97)	96 (94-97)
Hodgkin Lymphoma	99 (98-99)	96 (94-96)	94 (93-95)
Melanoma	98 (97-99)	95 (94-96)	92 (91-94)
Cervix	96 (94-97)	88 (85-90)	86 (83-88)
Non-Hodgkin Lymphoma [†]	84 (82-86)	76 (73-78)	74 (71-77)
Breast	97 (95-98)	83 (80-86)	73 (69-77)
Soft Tissue and Other Extraosseous Sarcoma	89 (86-91)	76 (73-79)	72 (69-76)
Central Nervous System	88 (86-90)	75 (72-77)	66 (63-69)
Leukemia	81 (78-83)	66 (63-69)	61 (58-64)

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

[†] Non-Hodgkin Lymphoma includes Burkitt lymphoma and unspecified lymphomas.

Analysis by: Health Statistics Division, Statistics Canada

Data source: Canadian Cancer Registry database at Statistics Canada

9. CANCER IN ADOLESCENTS AND YOUNG ADULTS (15-29 YEARS)

Table 9.6

Estimated Five-Year Observed Survival Proportion (95% Confidence Interval) for Selected Cancers in Adolescents and Young Adults (15-29 Years), by Sex and Age Group, Canada (Excluding Quebec*), 1997-2004

	Observed Survival Proportion (%) (95% Confidence Interval)				
	Males	Females	Age Group		
			15-19	20-24	25-29
All Cancers	80 (79-81)	86 (85-86)	81 (79-82)	84 (83-85)	83 (83-84)
Thyroid	98 (95-99)	100 (99-100)	100 (97-100)	99 (98-100)	100 (99-100)
Testis	96 (94-97)	—	91 (86-94)	96 (94-98)	96 (95-97)
Hodgkin Lymphoma	93 (92-95)	94 (93-96)	94 (91-96)	94 (91-95)	94 (92-96)
Melanoma	86 (83-89)	96 (95-97)	97 (92-99)	94 (91-96)	91 (89-93)
Cervix	—	86 (83-88)	87 (57-96)	81 (73-87)	87 (84-90)
Non-Hodgkin Lymphoma [†]	69 (65-73)	81 (77-85)	73 (67-79)	76 (71-81)	73 (68-77)
Breast	—	73 (69-77)	79 (36-94)	78 (63-87)	73 (68-77)
Soft Tissue and Other Extraneous Sarcoma	67 (62-72)	77 (72-82)	76 (69-82)	73 (66-79)	70 (64-75)
Central Nervous System	62 (58-66)	70 (65-74)	69 (63-75)	65 (59-71)	64 (59-69)
Leukemia	60 (55-64)	63 (58-68)	62 (56-67)	64 (58-69)	58 (52-63)

— Not applicable

— Estimate unavailable due to the small number of cases.

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

[†] Non-Hodgkin Lymphoma includes Burkitt lymphoma and unspecified lymphomas.

Analysis by: Health Statistics Division, Statistics Canada

Data source: Canadian Cancer Registry database at Statistics Canada.

9. CANCER IN ADOLESCENTS AND YOUNG ADULTS (15-29 YEARS)

Table 9.7

Estimated Five-Year Observed Survival Proportion (95% Confidence Interval) for Selected Cancers in Adolescents and Young Adults (15-29 Years), by Calendar Period, Canada (Excluding Quebec*)

	Observed Survival Proportion (%) (95% Confidence Interval)	
	1992-1995	2001-2004
All Cancers	80 (79-81)	85 (84-85)
Thyroid	100 (99-100)	99 (99-100)
Testis	94 (92-96)	95 (94-97)
Hodgkin Lymphoma	95 (93-96)	95 (93-96)
Melanoma	93 (90-94)	93 (91-95)
Cervix	87 (83-90)	87 (83-90)
Non-Hodgkin Lymphoma [†]	66 (62-71)	78 (74-81)
Breast	69 (63-75)	73 (67-78)
Soft Tissue and Other Extrasosseous Sarcoma	63 (57-68)	72 (67-77)
Central Nervous System	65 (60-69)	68 (64-72)
Leukemia	57 (52-61)	67 (63-72)

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

[†] Non-Hodgkin Lymphoma includes Burkitt lymphoma and unspecified lymphomas.

Note: Survival for 1992-1995 was based on the cohort method; for 2001-2004 it was based on the period method.

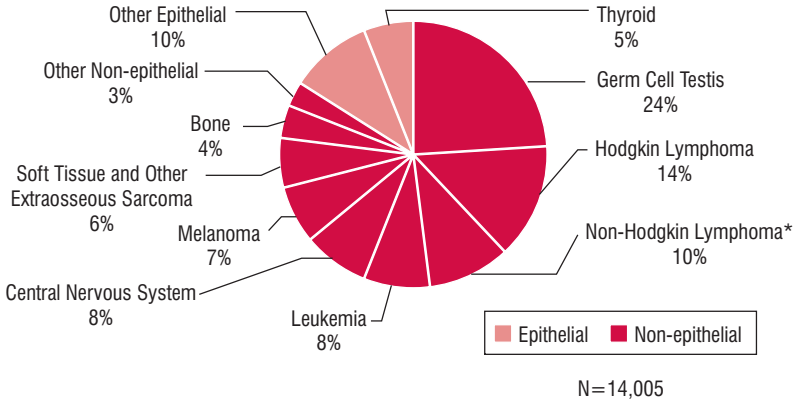
Analysis by: Health Statistics Division, Statistics Canada

Data source: Canadian Cancer Registry database at Statistics Canada

9. CANCER IN ADOLESCENTS AND YOUNG ADULTS (15-29 YEARS)

Figure 9.1a

Leading Types of Cancer Among Young Men (15-29 Years), Percentage of New Cases, Canada, 1992-2005



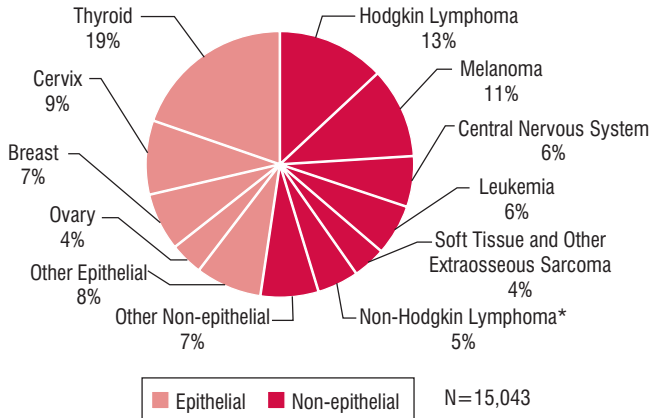
* Non-Hodgkin lymphoma includes Burkitt lymphoma and unspecified lymphomas.

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

Data source: Canadian Cancer Registry database at Statistics Canada

Figure 9.1b

Leading Types of Cancer Among Young Women (15-29 Years), Percentage of New Cases, Canada, 1992-2005



* Non-Hodgkin lymphoma includes Burkitt lymphoma and unspecified lymphomas.

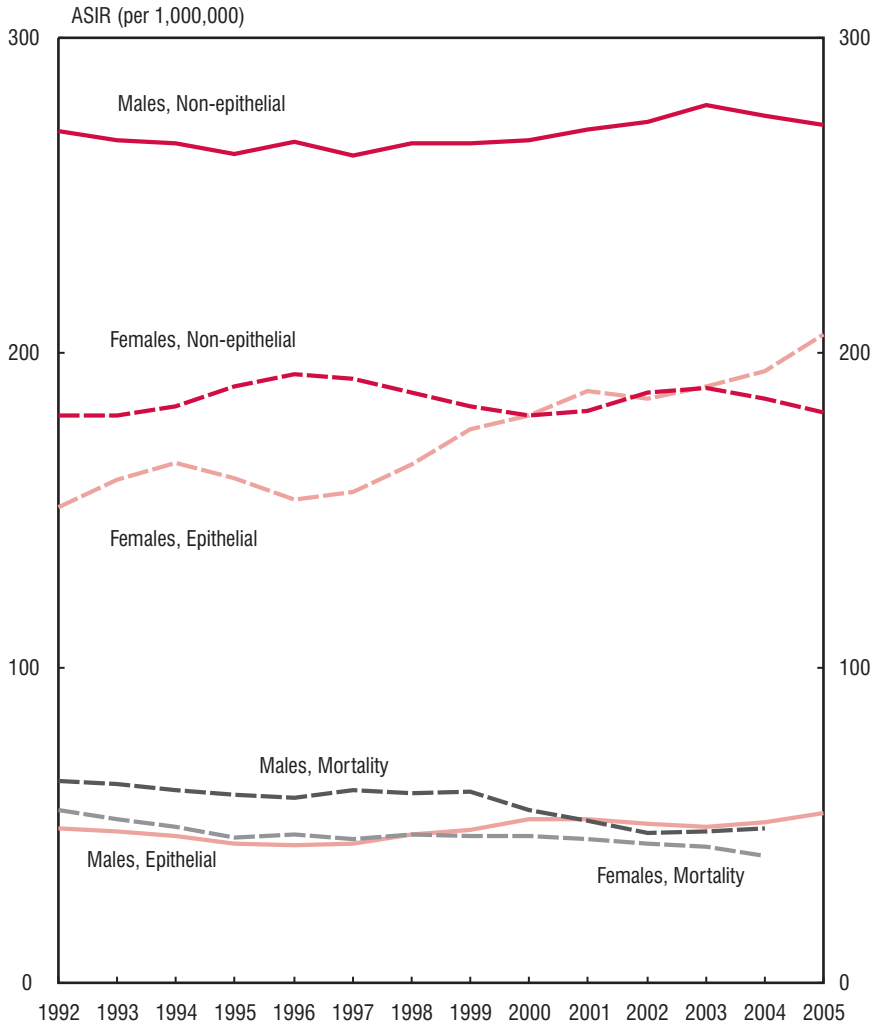
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

Data source: Canadian Cancer Registry database at Statistics Canada

9. CANCER IN ADOLESCENTS AND YOUNG ADULTS (15-29 YEARS)

Figure 9.2

Age-Standardized 3-Year Moving Average Incidence Rates (ASIR) for Epithelial and Non-Epithelial* Cancers and Overall Mortality Rates (to 2004), in Adolescents and Young Adults (15-29 Years), by Sex, Canada, 1992-2005



* For histology codes used for epithelial and non-epithelial cancers see Appendix W3 – www.cancer.ca/statistics. Rates exclude the 0.4% of cases with unknown cancer site and histology in this age group.

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

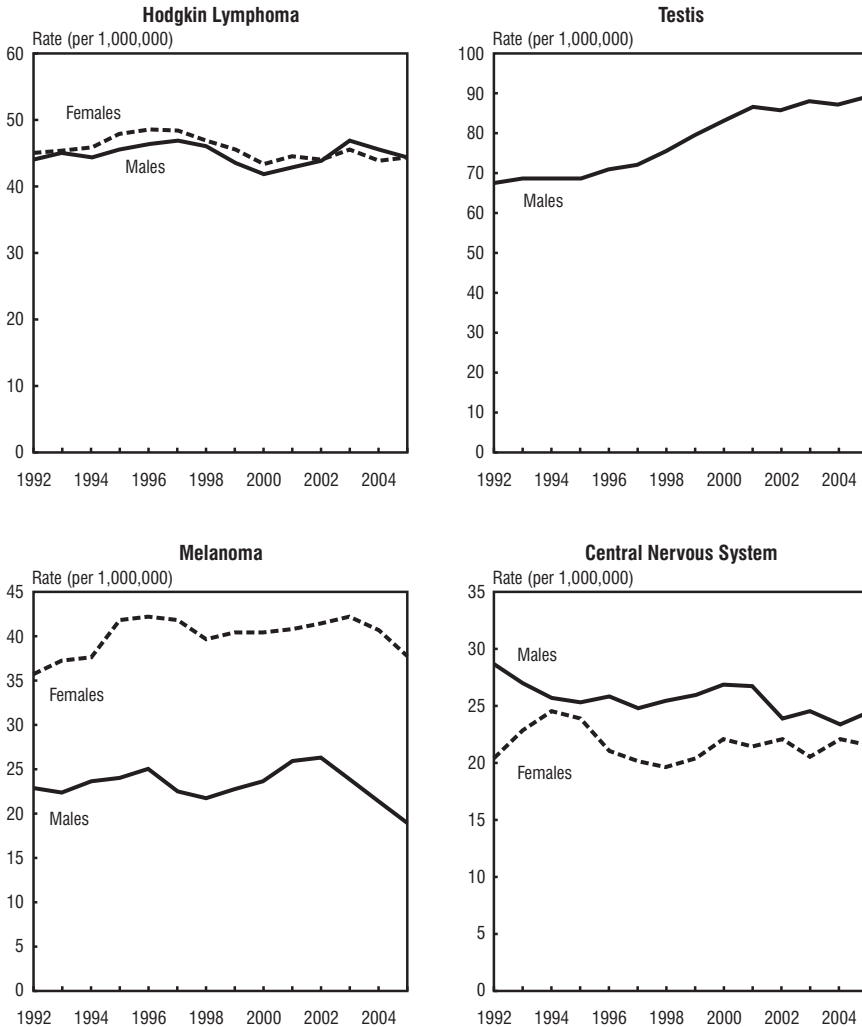
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

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

9. CANCER IN ADOLESCENTS AND YOUNG ADULTS (15-29 YEARS)

Figure 9.3a

Age-Standardized 3-Year Moving Average Incidence Rates (ASIR) for Common Non-Epithelial Cancers, in Adolescents and Young Adults (15-29 Years), by Sex, Canada, 1992-2005



Note: The range of rate scales differs widely between the cancers.

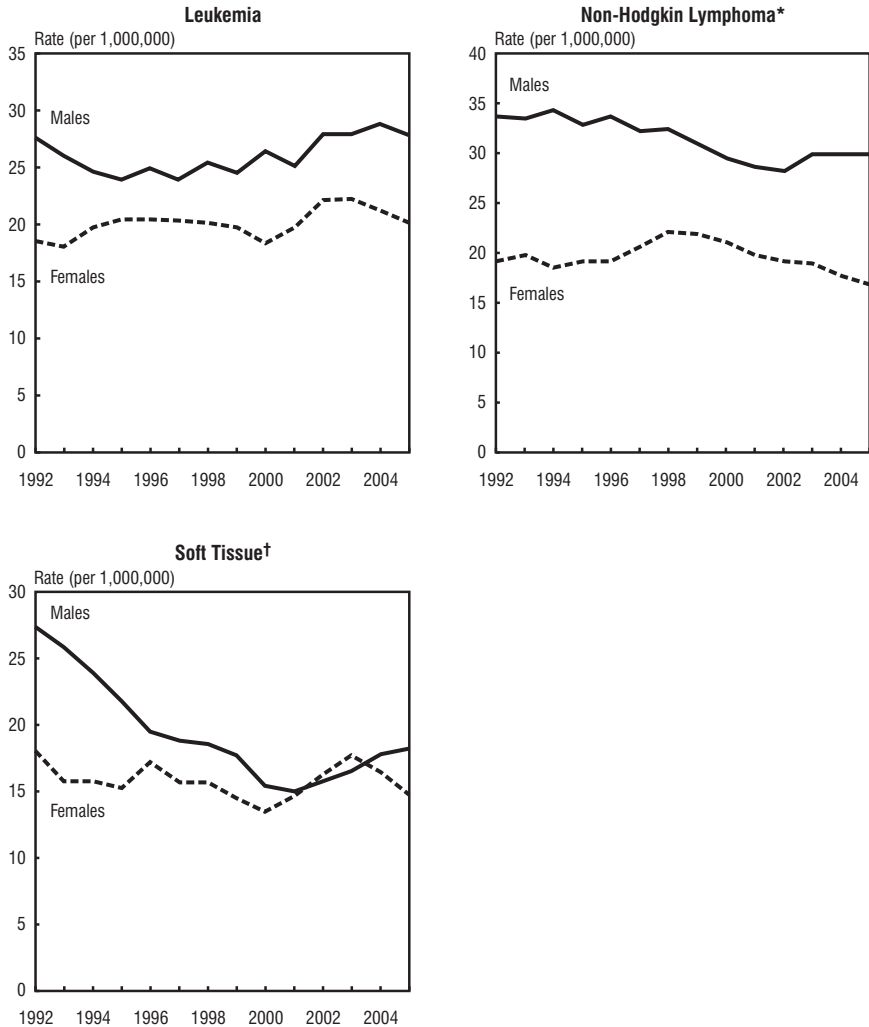
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

Data source: Canadian Cancer Registry database at Statistics Canada

9. CANCER IN ADOLESCENTS AND YOUNG ADULTS (15-29 YEARS)

Figure 9.3a (continued)

Age-Standardized 3-Year Moving Average Incidence Rates (ASIR) for Common Non-Epithelial Cancers, in Adolescents and Young Adults (15-29 Years), by Sex, Canada, 1992-2005



* Non-Hodgkin lymphoma includes Burkitt lymphoma and unspecified lymphomas.

† Soft Tissue includes Other Extraosseous Sarcoma.

Note: The range of rate scales differs widely between the cancers.

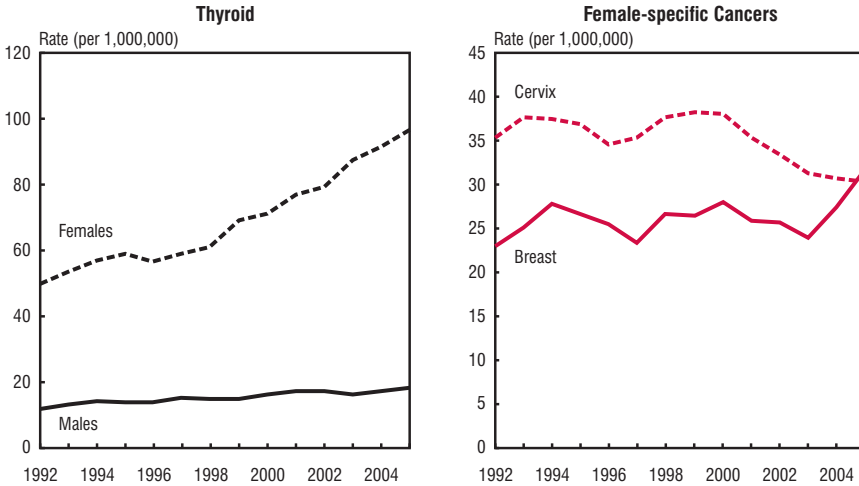
Analysis by: Chronic Disease Surveillance Division, CCDPC, Public Health Agency of Canada

Data source: Canadian Cancer Registry database at Statistics Canada

9. CANCER IN ADOLESCENTS AND YOUNG ADULTS (15-29 YEARS)

Figure 9.3b

Age-Standardized 3-Year Moving Average Incidence Rates (ASIR) for Common Epithelial Cancers, in Adolescents and Young Adults (15-29 Years), by Sex, Canada, 1992-2005



Note: The range of rate scales differs widely between the cancers.

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

Data source: Canadian Cancer Registry database at Statistics Canada

The focus of this publication is current year estimates that are 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. These data represent the most recent year in the long series of data used to derive the current year estimates. Tables A1 and A2 list the actual number of new cases (2005) and deaths (2004) that occurred in Canada, and specify the ICDO-3 and ICD-10 codes, respectively, 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 to 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 are given (five-year average) for the most common cancers. The Appendix tables also indicate that among provinces/territories there was some variation in the years for which data were available (as of August 2008 when these analyses began). 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/territories can be obtained by contacting the provincial cancer registries (see section *For Further Information*).

APPENDIX I: ACTUAL DATA FOR NEW CASES AND DEATHS

Table A1

Actual Data for New Cases of Cancer, Canada, 2005

Cancer	ICDO-3 Site/Type*	Total	Males	Females
All Cancers	All invasive sites	153,126	79,599	73,527
Oral (Buccal Cavity and Pharynx)	C00-C14	3,344	2,260	1,084
Lip	C00	296	219	77
Tongue	C01-C02	809	548	261
Salivary Gland	C07-C08	400	241	159
Mouth	C03-C06	671	384	287
Nasopharynx	C11	228	158	70
Oropharynx	C10	121	96	25
Other and Unspecified	C09,C12-C14	819	614	205
Digestive Organs	C15-C26,C48	32,098	17,741	14,357
Esophagus	C15	1,474	1,091	383
Stomach	C16	3,000	1,908	1,092
Small Intestine	C17	572	322	250
Large Intestine	C18,C26.0	13,227	6,689	6,538
Rectum and Anus	C19-C21	6,880	4,114	2,766
Liver	C22.0	1,348	1,014	334
Gallbladder	C23	401	126	275
Pancreas	C25	3,689	1,758	1,931
Other and Unspecified	C22.1,C24,C26.8-.9,C48	1,507	719	788
Respiratory System	C30-C34,C38.1-.9,C39	23,312	13,164	10,148
Larynx	C32	1,096	910	186
Lung	C34	21,866	12,048	9,818
Other and Unspecified	C30-31,C33,C38.1-.9,C39	350	206	144
Bone	C40-C41	322	175	147
Soft Tissue (including Heart)	C38.0,C47,C49	1,020	560	460
Skin (Melanoma)	Type 8720-8790	4,270	2,220	2,050
Breast	C50	20,075	158	19,917
Genital Organs	C51-C63	30,407	21,970	8,437
Cervix	C53	1,266	-	1,266
Body of Uterus	C54	3,828	-	3,828
Uterus, Part Unspecified	C55	147	-	147
Ovary	C56	2,442	-	2,442
Prostate	C61	20,938	20,938	-
Testis	C62	849	849	-
Other and Unspecified	C51-52,C57,C58,C60,C63	937	183	754
Urinary Organs	C64-C68	10,964	7,565	3,399
Bladder	C67	6,424	4,731	1,693
Kidney	C64-C65	4,101	2,530	1,571
Other Urinary	C66,C68	439	304	135
Eye	C69	255	141	114
Brain and Central Nervous System	C70-C72	2,431	1,352	1,079
Endocrine Glands	C73,C74-C75	4,034	963	3,071
Thyroid	C73	3,740	819	2,921
Other Endocrine	C73,C74-C75	294	144	150
Hodgkin Lymphoma*	Type 9650-9667	864	485	379
Non-Hodgkin Lymphoma*	See Table A9	6,352	3,475	2,877
Multiple Myeloma*	Type 9731,9732,9734	1,935	1,093	842
Leukemia*	See Table A9	4,247	2,450	1,797
Mesothelioma*	Type 9050-9055	459	362	97
All Other and Unspecified Cancers	See Table A9	6,737	3,465	3,272

- 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.⁴³ Figures 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

APPENDIX I: ACTUAL DATA FOR NEW CASES AND DEATHS

Table A2

Actual Data for Cancer Deaths, Canada, 2004

Cancer	ICD-10	Total	Males	Females
All Cancers	C00-C97	66,947	35,156	31,791
Oral (Buccal Cavity and Pharynx)	C00-C14	1,067	699	368
Lip	C00	19	13	6
Tongue	C01-C02	279	178	101
Salivary Gland	C07-C08	90	55	35
Mouth	C03-C06	207	112	95
Nasopharynx	C11	104	73	31
Oropharynx	C10	85	57	28
Other and Unspecified	C09,C12-C14	283	211	72
Digestive Organs	C15-C25,C26.0,C26.8-.9,C48	17,883	9,859	8,024
Esophagus	C15	1,488	1,112	376
Stomach	C16	1,919	1,163	756
Small Intestine	C17	150	92	58
Large Intestine	C18,C26.0	6,724	3,449	3,275
Rectum and Anus	C19-C21	1,677	983	694
Liver	C22.0,C22.2-.7	596	453	143
Gallbladder	C23	266	99	167
Pancreas	C25	3,577	1,751	1,826
Other and Unspecified	C22.1,C22.9,C24,C26.8-.9,C48	1,486	757	729
Respiratory System	C30-C34,C38.1-.9,C39	18,208	10,566	7,642
Larynx	C32	446	360	86
Lung	C34	17,642	10,129	7,513
Other and Unspecified	C30-31,C33,C38.1-.9,C39	120	77	43
Bone	C40-C41	127	74	53
Soft Tissue (including Heart)	C38.0,C47,C49	390	191	199
Skin (Melanoma)	C43	790	489	301
Breast	C50	4,998	34	4,964
Genital Organs	C51-C63	6,638	3,756	2,882
Cervix	C53	388	-	388
Body of Uterus	C54	371	-	371
Uterus, Part Unspecified	C55	363	-	363
Ovary	C56	1,590	-	1,590
Prostate	C61	3,685	3,685	-
Testis	C62	46	46	-
Other and Unspecified	C51-52,C57,C58,C60,C63	195	25	170
Urinary Organs	C64-C68	3,207	2,112	1,095
Bladder	C67	1,634	1,131	503
Kidney	C64-C65	1,486	937	549
Other Urinary	C66,C68	87	44	43
Eye	C69	27	15	12
Brain and Central Nervous System	C70-C72	1,609	925	684
Endocrine Glands	C73,C74-C75	270	108	162
Thyroid	C73	174	69	105
Other Endocrine	C74,C74-C75	96	39	57
Hodgkin Lymphoma	C81	127	73	54
Non-Hodgkin Lymphoma	C82-C85,C96.3	2,650	1,394	1,256
Multiple Myeloma	C90.0, C90.2	1,178	631	547
Leukemia	C91-C95, C90.1	2,262	1,310	952
Mesothelioma	C45	340	284	56
All Other and Unspecified Cancers	See Table A9	5,176	2,636	2,540

- Not applicable

Note: ICD-10 refers to the Tenth Revision of the International Statistical Classification of Diseases and Related Health Problems.⁴⁵

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 Selected Cancers by Sex and Geographic Region, Most Recent Year*, Canada

	New Cases													
	Canada [†]	NL [‡]	PE	NS	NB	QC [‡]	ON	MB	SK	AB	BC	YT	NT	NU
Males														
All Cancers	79,600	1,450	440	3,100	2,300	20,000	30,800	2,700	2,400	7,000	9,800	45	45	30
Prostate	20,900	420	150	910	720	4100	9,000	650	700	2,100	3,000	10	10	5
Lung [§]	12,000	210	55	470	360	3,900	4,100	390	320	840	1,200	5	5	10
Colorectal	10,800	260	45	410	280	2,800	4,100	400	330	880	1,250	10	10	5
Bladder [§]	4,700	100	30	210	150	1,550	1,350	190	140	500	670	5	-	-
Non-Hodgkin Lymphoma	3,500	45	10	110	95	780	1,400	120	110	300	490	-	-	-
Kidney [§]	2,500	50	20	130	75	720	880	120	75	250	240	-	-	-
Leukemia	2,500	15	5	70	45	610	980	80	90	230	320	-	-	-
Oral	2,300	45	5	65	55	530	930	100	65	190	240	-	5	-
Melanoma	2,200	35	20	110	65	280	1,050	70	65	240	360	-	-	-
Stomach	1,900	50	-	60	55	510	700	65	50	160	210	-	-	-
Pancreas	1,750	25	5	55	50	480	610	70	50	140	220	-	-	-
Brain	1,350	20	5	40	30	380	490	35	40	100	140	-	-	-
Multiple Myeloma	1,100	15	15	45	25	280	450	25	35	75	110	-	-	-
Esophagus	1,100	20	5	50	25	280	410	30	30	100	150	-	-	-
Liver	1,000	15	5	30	20	290	400	30	15	80	140	-	-	-
Females														
All Cancers	73,500	1,100	310	2,600	1,900	19,000	28,700	2,600	2,200	6,100	8,700	45	45	30
Breast	19,900	280	75	700	480	5,000	7,700	730	600	1,750	2,500	15	15	5
Lung [§]	9,800	140	50	360	300	2,800	3,500	360	320	730	1,150	5	5	10
Colorectal	9,300	190	50	380	210	2,400	3,500	350	290	710	1,050	5	5	5
Body of Uterus	4,000	60	20	120	120	950	1,550	160	120	370	530	5	-	-
Thyroid	2,900	30	5	80	85	650	1,500	60	45	250	180	-	-	-
Non-Hodgkin Lymphoma	2,900	65	10	100	80	690	1,150	120	110	250	390	-	-	-
Ovary	2,400	25	10	60	55	620	1,000	90	75	150	290	-	-	-
Melanoma	2,100	30	5	90	70	290	940	55	45	220	290	-	-	-
Pancreas	1,950	10	10	65	50	570	660	65	50	150	190	-	-	-
Leukemia	1,800	10	5	55	30	450	740	65	75	190	230	-	-	-
Bladder [§]	1,700	35	10	55	45	540	500	60	50	140	230	-	-	-
Kidney [§]	1,550	25	10	80	50	450	590	55	60	150	140	-	-	-
Cervix	1,250	25	5	50	30	280	510	40	35	160	130	-	-	-
Stomach	1,100	25	5	35	35	340	400	35	35	85	110	-	-	-
Oral	1,100	15	5	25	25	260	460	55	45	85	130	-	-	-
Brain	1,100	15	5	35	35	300	440	30	35	75	110	-	-	-

- Fewer than 3 cases

* 2005 for Canada, Quebec, Ontario; 2006 for Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, Manitoba, Saskatchewan, Alberta, British Columbia; 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 2009 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 2,100 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

APPENDIX I: ACTUAL DATA FOR NEW CASES AND DEATHS

Table A4

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

	Cases per 100,000													
	Canada [†]	NL [‡]	PE	NS	NB	QC [‡]	ON	MB	SK	AB	BC	YT	NT	NU
Males														
All Cancers	459	473	551	558	518	481	466	421	421	439	387	382	342	531
Prostate	121	134	175	163	163	99	137	103	124	133	118	100	70	49
Lung [§]	70	69	71	85	83	93	62	61	55	54	47	54	56	234
Colorectal	62	84	56	74	63	66	61	61	57	56	50	62	95	97
Bladder [§]	27	34	40	38	35	37	21	30	24	32	26	24	–	–
Non-Hodgkin Lymphoma	20	16	15	18	22	18	21	18	19	18	19	–	–	–
Leukemia	14	6	10	13	11	15	15	13	16	14	13	–	–	–
Kidney [§]	14	15	23	22	17	17	13	18	12	15	9	–	–	–
Melanoma	13	13	27	20	15	7	16	11	12	15	14	–	–	–
Oral	12	14	7	10	13	12	13	16	12	11	9	–	20	–
Stomach	11	16	3	11	12	12	11	10	9	10	8	–	–	–
Pancreas	10	8	9	10	12	11	9	11	8	9	8	–	–	–
Brain	8	6	9	7	7	9	7	6	7	6	6	–	–	–
Multiple Myeloma	6	6	18	8	6	7	7	4	6	5	4	–	–	–
Esophagus	6	7	9	9	6	7	6	5	5	6	6	–	–	–
Liver	6	4	7	5	4	7	6	5	3	5	5	–	–	–
Females														
All Cancers	357	318	330	395	361	364	367	347	345	339	306	325	317	626
Breast	97	80	82	108	91	98	100	98	96	96	90	103	105	68
Lung [§]	47	41	55	55	57	53	44	47	49	42	41	38	50	304
Colorectal	43	55	52	55	38	44	43	43	40	38	36	47	57	97
Body of Uterus	19	17	19	19	22	18	20	22	18	20	18	22	–	–
Thyroid	17	10	4	15	21	15	22	10	9	14	8	–	–	–
Non-Hodgkin Lymphoma	14	19	11	15	16	13	15	16	16	14	14	–	–	–
Ovary	12	8	9	9	10	12	13	12	12	8	10	–	–	–
Melanoma	11	10	7	16	14	6	12	8	8	12	11	–	–	–
Leukemia	9	4	7	8	6	9	10	9	11	11	8	–	–	–
Pancreas	9	3	7	9	9	10	8	8	7	8	6	–	–	–
Bladder [§]	8	9	9	7	9	10	6	7	8	7	8	–	–	–
Kidney [§]	8	7	11	12	10	8	7	7	9	8	5	–	–	–
Cervix	7	11	6	9	6	6	7	6	7	9	6	–	–	–
Brain	6	4	6	7	8	7	6	5	7	4	4	–	–	–
Oral	5	5	6	4	5	5	6	7	7	5	5	–	–	–
Stomach	5	8	6	5	7	6	5	4	5	5	4	–	–	–

– Rate is based on less than 3 cases per year.

* 2005 for Canada, Quebec, Ontario; 2006 for Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, Manitoba, Saskatchewan, Alberta, British Columbia; 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 2009 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 31 among men and 10 among women.

Note: '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

APPENDIX I: ACTUAL DATA FOR NEW CASES AND DEATHS

Table A5

Actual Data for Deaths for Selected Cancers by Sex and Geographic Region, Canada, 2004*

	Deaths													
	Canada†	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC	YT	NT	NU
Males														
All Cancers	35,200	630	180	1,300	940	9,500	12,800	1,400	1,200	2,700	4,400	25	25	15
Lung‡	10,100	170	55	400	310	3,300	3,400	350	280	710	1,150	10	5	10
Colorectal	4,400	130	20	190	110	1,150	1,600	200	150	350	510	5	5	-
Prostate	3,700	75	30	130	90	730	1,400	180	220	330	520	-	-	-
Pancreas	1,750	25	10	65	60	460	630	70	60	130	250	-	-	-
Non-Hodgkin Lymphoma	1,400	15	5	60	30	310	560	55	55	110	200	-	-	-
Leukemia‡	1,300	15	5	45	20	300	520	50	55	100	190	-	-	-
Stomach	1,150	30	5	35	35	330	430	40	40	85	130	-	-	-
Bladder	1,150	15	5	40	30	270	420	50	40	85	170	-	-	-
Esophagus	1,100	15	5	50	30	220	470	40	30	80	170	-	-	-
Kidney‡	940	20	5	40	25	260	320	40	35	80	110	-	-	-
Brain	930	10	5	30	25	260	330	25	25	85	130	-	-	-
Oral	700	10	5	25	10	190	280	30	15	40	95	-	-	-
Multiple Myeloma‡	630	10	5	20	15	150	240	20	25	60	85	-	-	-
Melanoma	490	5	-	15	15	80	210	20	15	45	80	-	-	-
Liver‡	450	5	-	10	5	120	180	10	5	45	70	-	-	-
Females														
All Cancers	31,800	500	160	1,150	780	8,400	11,900	1,350	1,000	2,500	4,000	20	20	15
Lung‡	7,500	110	35	270	190	2,200	2,600	310	230	570	1,050	5	5	5
Breast	5,000	65	25	160	120	1,300	1,950	230	160	360	610	5	5	-
Colorectal	4,000	100	25	150	80	1,100	1,500	160	140	300	450	-	5	-
Pancreas	1,850	20	5	75	50	480	650	80	45	180	250	-	-	-
Ovary	1,600	20	5	65	35	360	600	85	55	150	220	-	-	-
Non-Hodgkin Lymphoma	1,250	15	5	45	35	340	480	65	45	90	150	-	-	-
Leukemia‡	950	5	5	40	20	210	390	35	35	90	120	-	-	-
Stomach	760	30	5	30	15	190	290	35	25	60	90	-	-	-
Body of Uterus	730	10	-	30	20	170	300	30	25	60	90	-	-	-
Brain	680	5	10	25	15	180	250	20	15	75	85	-	-	-
Kidney‡	550	15	-	15	20	170	180	25	15	55	60	-	-	-
Bladder	500	5	5	15	10	130	220	15	10	30	60	-	-	-
Cervix	390	10	5	25	10	70	170	15	10	30	50	-	-	-
Oral	370	5	5	10	5	95	150	10	5	25	55	-	-	-
Melanoma	300	-	-	15	5	50	140	10	10	25	50	-	-	-

- Fewer than 3 deaths

* 2000-2004 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, 2004*

	Deaths per 100,000													
	Canada [†]	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC	YT	NT	NU
Males														
All Cancers	212	230	232	246	229	239	203	218	205	194	185	269	238	326
Lung [‡]	61	62	70	75	76	82	53	56	49	50	49	104	71	180
Colorectal	27	46	29	35	27	30	26	31	26	25	21	38	55	–
Prostate	23	30	39	24	22	20	23	28	34	25	22	–	–	–
Pancreas	10	9	9	12	14	11	10	11	10	9	10	–	–	–
Non-Hodgkin Lymphoma	8	5	5	11	6	8	9	9	9	7	8	–	–	–
Leukemia [‡]	8	6	9	9	5	8	8	8	10	7	8	–	–	–
Stomach	7	10	6	7	9	8	7	6	7	6	6	–	–	–
Bladder	7	5	6	7	7	7	7	8	6	6	7	–	–	–
Esophagus	7	4	8	9	7	5	7	7	5	6	7	–	–	–
Kidney [‡]	6	8	5	7	6	6	5	6	6	6	5	–	–	–
Brain	5	4	6	6	6	6	5	4	5	5	5	–	–	–
Oral	4	3	4	4	3	5	4	5	3	2	4	–	–	–
Multiple Myeloma [‡]	4	3	6	4	3	4	4	3	4	4	4	–	–	–
Melanoma	3	2	4	3	3	2	3	3	2	3	3	–	–	–
Liver [‡]	3	2	2	2	1	3	3	2	1	3	3	–	–	–
Females														
All Cancers	147	146	158	163	139	154	145	159	138	143	138	180	196	435
Lung [‡]	36	31	37	42	36	41	33	39	34	34	36	45	52	249
Breast	23	19	24	21	20	24	24	28	22	20	21	29	30	–
Colorectal	17	29	23	20	13	18	17	16	17	16	14	–	31	–
Pancreas	8	6	4	10	9	9	8	9	6	10	8	–	–	–
Ovary	7	6	6	9	7	7	7	11	8	9	8	–	–	–
Non-Hodgkin Lymphoma	6	4	7	6	6	6	6	7	6	5	5	–	–	–
Leukemia [‡]	4	2	4	6	4	4	5	4	5	5	4	–	–	–
Brain	3	2	11	4	3	4	3	3	2	4	3	–	–	–
Body of Uterus	3	2	2	4	4	3	4	4	3	3	3	–	–	–
Stomach	3	8	3	4	3	3	3	4	3	3	3	–	–	–
Kidney [‡]	3	3	3	2	3	3	2	3	2	3	2	–	–	–
Bladder	2	1	3	2	2	2	2	1	1	2	2	–	–	–
Cervix	2	4	4	4	2	1	2	2	2	2	2	–	–	–
Oral	2	1	2	1	1	2	2	1	1	2	2	–	–	–
Melanoma	1	1	1	3	1	1	2	1	2	1	2	–	–	–

– Rate is based on less than 3 cases per year.

* 2000-2004 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

DATA SOURCES

Incidence data: the Canadian Cancer Registry (CCR)

Actual cancer incidence data used in this report cover the time period 1980-2006. Data were obtained from the CCR (1992-2006),²¹ 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, who 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 patients 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, 3rd edition (ICDO-3).⁴³

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

The actual cancer mortality data cover the period 1980-2004 and were obtained from the CVS: D.⁴⁴

- ◆ 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 2004.
- ◆ Data are also included for Canadian residents who died in some U.S. states.
- ◆ The Health Statistics Division at Statistics Canada maintains this database.
- ◆ Cause of death is classified according to the International Statistical Classification of Diseases and Related Health Problems, 10th revision (ICD-10).⁴⁵
- ◆ Cancer deaths are those attributed to some form of cancer as the underlying cause of death by the certifying physician.

Population data: the Census of Canada

Population estimates for Canada, the provinces and the territories are based on quinquennial censuses conducted in 1976 through 2001.

- ◆ Intercensal estimates prepared by Statistics Canada are used for the years between these censuses and postcensal estimates are used for 2001-2007.⁴⁶
- ◆ Projected estimates of population are used for 2008 and 2009 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 returning Canadians.

Life tables

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

- ◆ Data from the 1990/1992 life tables⁴⁷ were used for case follow-up in 1992 and 1993, data from 1995/1997 life tables⁴⁸ were used for follow-up from 1994 to 1998, and data from the 2000/2002 life tables⁴⁹ were used for follow-up from 1999 to 2004. As complete life tables were not available for Prince Edward Island and 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.⁵⁰ Where this was not possible (i.e., territories 1990-92), Canadian complete 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 from 85 to 99 years.

METHODS

Cancer definitions

- ◆ Cancers are generally defined according to the groupings of ICDO-3⁴³ for incidence and ICD-10⁴⁵ for mortality, as indicated in Table A9.
- ◆ Some of these definitions have changed slightly over time; changes occurring since the 2004 issue of this publication are outlined in Table A7.
- ◆ For survival and prevalence, groupings as in Table A9 were used with the following minor exceptions:
 - ‘Colorectal’ excludes anus (ICDO-3 code C21)
 - ‘Body of uterus’ excludes ‘uterus not otherwise specified’ (ICDO-3 code C55)
 - ‘Brain’ excludes other nervous system (ICDO-3 codes C70, C72)
- ◆ For *children aged 0-14 years*, cancers were classified and reported according to the *International Classification of Childhood Cancer, 3rd edition (ICCC-3)*.⁹ This system is most appropriate for reporting childhood cancers because it acknowledges the major differences between cancers arising during childhood versus older ages.
 - The category ‘intracranial and intraspinal’ includes non-malignant tumours for purposes of survival but not for incidence and mortality.
- ◆ For *adolescents and young adults aged 15-29 years*, cancers are reported using a special classification system that represents a combination of ICCC-3 and ICDO-3. This system is described in Appendix W1 and W2 (www.cancer.ca/statistics).

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, age group (0-4, 5-9, and so forth up to 80-84, and 85+) and cancer type.

APPENDIX II: DATA SOURCES AND METHODS

- ◆ Rates for each category are calculated by dividing the number of cases or deaths in each category (e.g., province, year, age group, etc.) by the corresponding provincial/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 section 3: 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 5-year age group according to the age distribution of the 1991 Canadian population (see *Glossary*).

Estimation of incidence (new cases) and mortality (deaths) for 2009

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

Poisson modeling

The primary method for estimating the number of new cases or deaths in 2009 for each cancer type reported in Table 1.1 (except new cases of non-melanoma skin cancer, see below) by sex is Poisson regression modeling. The assumption underlying Poisson regression is that the annual numbers 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 1986-2006 (1986-2005 for Quebec) for incidence and 1986-2004 for mortality. For *prostate cancer incidence*, regression modeling 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 groupings described above), and 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 2009. The predicted numbers of cancer cases in 2009 were calculated by multiplying these extrapolated incidence rates and the sex-, age-, province-specific population projections for the same year.
- ◆ Incidence of ‘all cancers except prostate’ is also modeled as are incidence of ‘All Cancers’ in females and mortality from “All Cancers’ in males and females.
- ◆ Poisson modeling is not done for the territories due to small numbers of cancers.

Five-year averaging

New cases and deaths in 2009 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 (for which Poisson modeling, based on a longer time trend, results in poor estimates) or when frequencies are low and result in unstable estimates using the Poisson model.

- ◆ The average of rates for the most recent 5 years is calculated for each age group, sex, cancer type and province. The predicted numbers were then obtained by multiplying these rates by the corresponding projected population sizes.
- ◆ For the territories, five-year average estimates are prepared only for ‘All Cancers’.

Selection of ‘best’ estimates

Estimates from the two methods are compared for each sex, cancer type and geographic region (all ages combined). The ‘best’ estimate for each category was selected in consultation with individual provincial/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, testis 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 from the two methods was calculated and expressed relative to the Poisson 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 $(4-4.5)/4$, or 12.5%.
- ◆ Provinces closely examine estimates for cancers where the absolute value of the relative difference exceeded 10% and the coefficient of variation of the age-standardized rate was 33% or less. Such situations may be indicative of important deviations from the long-term trend.
- ◆ Provinces were asked to recommend their choice of estimate, along with a rationale, which was usually availability of in-house projections, knowledge of local trends, or access to more current data.
- ◆ 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 which were reported according to the five-year average method for 2009. In these situations, the age-standardized rates for 2009 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 modeling. For females (incidence and mortality) and for mortality in males, provincial estimates for ‘All Cancers’ are those based on modeling of all cancers together. 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.

- ◆ The 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 1973-1994 and 2003 were projected to 2009 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 from 1986 to 2005 by year, sex and age group were provided by the Manitoba and New Brunswick Cancer Registries. Linear regressions on the log of the annual rates for each province and age group (0-39, 40-59, 60-79 and 80+) were conducted and projected to 2009.
- ◆ The predicted numbers of NMSC cases for all of Canada were calculated by multiplying the projected incidence rates for each of NB and MB by the sex-, age-specific Canadian population projections for 2009.
- ◆ Reported new cases of NMSC for all of Canada are the average of 2009 estimates from BC, MB and NB 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 and numbers greater or equal to 2,000 to the nearest 100.
- ◆ Percentages, age-standardized and age-specific rates were rounded to the nearest tenth except in Tables 4 and 6 and Appendix Tables A4 and A6, where space restrictions forced rounding to the nearest whole number.
- ◆ Age- and sex-specific numbers/rates are combined before rounding, so it is possible that the totals in the tables do not add up. However, any of these discrepancies must be within the precision of the rounding units described above.

Precision of 2009 estimates

Estimates of precision (standard errors, coefficients of variation and confidence limits) for 2009 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, sex, and province/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 1986-2005 (for incidence) and 1986-2004 (for mortality) in order to determine years where the APC changed significantly; such years are referred to as 'changepoints'.
 - A minimum of five data points (i.e., years) before and after a changepoint was required for a new trend to be identified. Thus, the most recent possible changepoint is 2001 for incidence and 2000 for mortality.
- ◆ If no changepoint was detected within the periods 1996-2005 (for incidence) or 1995-2004 (for mortality), then the APC was estimated by fitting a model within these time periods, in the same way as described above. Table 4.5 indicates the APC only.
- ◆ 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.

Probability of developing or dying from cancer

Probabilities of developing or dying from cancer were calculated according to the age- and sex-specific cancer incidence and mortality rates for Canada in 2004 and life tables based on 2002-2004 all-cause mortality rates. The methodology used was that of Zdeb⁵¹ and Seidman et al.⁵²

- ◆ For the probability of developing cancer, the method used assumes that current age-specific incidence rates will prevail throughout the future lifetime of a person as they advance in age. Since this assumption may not be true, the probabilities should be regarded only as approximations.
- ◆ The probability of dying from cancer represents the proportion of people dying from cancer in a cohort subjected to the mortality conditions prevailing in the population at large in 2004. It is estimated by determining the proportion of deaths attributed to specific types of cancer for each sex and age group, multiplying this proportion by the corresponding number of deaths in the life table and summing the life table deaths over all sex and age groups to obtain the probability of dying from each cause.

Relative survival

Five-year relative survival ratios were estimated by comparing the actual survival experience of persons diagnosed with cancer with 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 cancer cases 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, 2004.
- ◆ 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,

APPENDIX II: DATA SOURCES AND METHODS

the CCR was linked with its predecessor, the NCIRS. Supplementary information available on the CCR for residents of Ontario was also used.

- ◆ Persons whose diagnosis was established through death certificate only or autopsy only were excluded.
- ◆ Analyses were based on an algorithm written by Paul Dickman⁵³ with some minor adaptations. Expected survival proportions were derived, using the Ederer II approach,⁵⁴ from sex-specific provincial life tables produced by Statistics Canada.
- ◆ Survival analyses were conducted using both period and cohort analysis methods.¹⁷ The period approach to survival analysis provides up-to-date predictions of cancer survival.⁵⁵ With this method, follow-up data do not relate to a fixed cohort of patients. 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 method⁵⁶ are provided. To avoid implausible lower limits less than zero and/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 from 1992 to 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.

Note that for children and youth (0-14 years or 0-19 years) and adolescents/young adults (15-29 years), only observed survival is reported because the estimates of observed and relative survival are essentially the same.

Prevalence

The primary type of prevalence reported in this publication is tumour-based. Two-, 5- and 10-year limited duration prevalence are estimated by the numbers of cancers diagnosed in the previous 2, 5 and 10 years among those alive on January 1, 2005 (index date). The methods used to prepare the estimates for this report differ from those employed in previous years' publications.

- ◆ Prevalence was determined directly, using the counting method.^{57,58}
- ◆ All primary invasive cancers (including *in situ* bladder cancers) among persons alive on the index date that were diagnosed in the relevant time-period prior to that date were counted, regardless of whether they were first or subsequent primaries.
 - Different methods had to be employed for Quebec data. See Section 'Data and Methods Issues'.

- ◆ Age-specific prevalence estimates were derived using the age attained as of the index date.
- ◆ The population used to determine prevalence rates as of the index date was derived by averaging the 2004 and 2005 mid-year population estimates.⁴⁶
- ◆ Person-based 10-year prevalence is estimated as the number of individuals represented in the tumour-based 10-year prevalence counts.

For further detail please see Ellison & Wilkins 2009.²⁰

DATA AND METHODS ISSUES

Incidence

Although every effort is made by the Canadian Council of Cancer Registries and its Standing Committee on Data Quality 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/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 registries except *Ontario* report in situ bladder cancers to the CCR.
- ◆ *Quebec* has not yet reported 2006 diagnoses to the CCR so its most recent year of data is 2005.
- ◆ *Ontario* cancer cases registered solely on the basis of a death certificate ('death certificate only') in 2006 have not yet been submitted to the CCR. Numbers of these were estimated on the basis of 2005 data.
- ◆ The *Newfoundland and Labrador* cancer registry does not receive information on death certificates that mention cancer. This leads to underestimates for the incidence of some cancers (because there will be no 'death certificate only' cases) and can result in death counts/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 2000-2004 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 particularly affected.²
- ◆ Non-melanoma skin cancers are excluded since most provincial/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 the type of cancer 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 (e.g., 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, 9th revision⁵⁹ (ICD-9) codes 153-154 to be consistent with other publications. However, this underestimates colorectal cancer mortality by about 10%, because most deaths registered as ICD-9 code 159.0 (intestine not otherwise specified) are cases of colorectal cancer. Commencing with the 2003 edition, these deaths were included in the definition of colorectal cancer. As a consequence, mortality figures for colorectal cancer appearing in this report cannot be directly compared with those appearing in reports prior to 2003.

Survival

- ◆ The problems noted above for Newfoundland and Labrador may also result in overly-optimistic survival estimates.
- ◆ 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 registries⁶⁰ and because of issues in correctly ascertaining the vital status of cases.

Prevalence

- ◆ Due to issues in correctly ascertaining the vital status of cases diagnosed in Quebec, prevalence data for this province were determined indirectly. The probability of surviving until the index date was used to randomly assign the vital status of each incident case in Quebec. Survival probabilities were derived using the corresponding observed survival proportion calculated for the rest of Canada, stratified on age group (0-39, 40-49, 50-59, 60-69, 70-79 and 80+), sex, cancer and month of diagnosis.
- ◆ Year of birth was missing for 105 cases. Because the exclusion of these cases from the analysis would have led to an underestimation of age-specific prevalence, the attained age group was randomly imputed using the sex-specific attained age-group distribution of Ontario prevalent cases of known age because virtually all of the 105 affected cases were diagnosed in Ontario.

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).

APPENDIX II: DATA SOURCES AND METHODS

Table A8.1

Use of Five-Year Average Method for Incidence Projection by Cancer Type and Province, 2009

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

M – Males, F – Females

* Poisson modeling for prostate was for 1991-2005/6, unlike other cancers which were modeled for 1986-2005/6.

Note: Poisson estimate is the default. For provinces, Poisson modeling was strongly recommended for 'All Cancers', Stomach, Larynx, Cervix, Testis, Thyroid and Liver Cancer. For territories (not shown), five-year average method was used for 'All Cancers' combined because of small numbers.

Table A8.2

Use of Five-Year Average Method for Mortality Projection by Cancer Type and Province, 2009

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

M – Males, F – Females

* Poisson modeling for prostate was for 1991-2005/6, unlike other cancers which were modeled for 1986-2005/6.

Note: Poisson estimate is the default. For provinces, Poisson modeling was strongly recommended for 'All Cancers', Stomach, Larynx, Cervix, Testis, Thyroid and Liver Cancer. For territories (not shown), five-year average method was used for 'All Cancers' combined because of small numbers.

APPENDIX II: DATA SOURCES AND METHODS

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), 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).⁴³ Figures are for invasive sites including in situ bladder and excluding non-melanoma skin cancer.

APPENDIX III: PREVIOUS SPECIAL TOPICS

In past years, other Special Topics included:

- 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 diagnosed with cancer (in completed years) at the time of diagnosis or death.
Province/Territory	The province/territory of the individual's permanent residence at time of diagnosis or death. This may or may not correspond to the province/territory in which 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, 10 th Revision. ⁴⁵ This is a general system for classifying diseases/causes of death, including cancer.
ICDO-3	International Classification of Diseases for Oncology, Third Edition. ⁴³ 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. ⁹ This system accounts for the important differences between types of cancer common during childhood and those of adulthood, and is more appropriate and informative for reporting of childhood cancers.

INCIDENCE AND MORTALITY

Incidence (new cases)	The number of cases of cancer newly diagnosed during a defined time period in a specified population. The basic unit of reporting is a cancer rather than a person.
Mortality (deaths)	The number of deaths attributed to a particular type of cancer during a defined time period in a specified population. Included are deaths of those whose cancer was diagnosed in an earlier time period, people with a new diagnosis during the time period, and persons for whom a diagnosis of cancer is recorded only at time of death.
Age-specific incidence/mortality rate	The number of new cases of cancer or cancer deaths in a specific age group (usually 5 or 10 years) during a year, divided by the number of people in that age group during that year, multiplied by 100,000 and then expressed as a rate per 100,000 persons in that year. For wider age groups (e.g., ages 15-29 years), age-standardization would normally be used.
Age-standardized incidence/mortality rate (ASIR, ASMR)	The incidence/mortality rate that would have occurred if the age distribution in the population of interest was the same as that of the standard population (1991 Canadian population). It is calculated as a weighted average of the age-specific rates (usually in 5 year age groups) in the population of interest, where the weight for each age group is the proportion of the standard population in that age group. Use of this measure permits comparisons across jurisdictions or time, independent of differences in age distribution, provided the same standard population is used.
Annual percent change (APC)	A measure to assess the rate of change over time of an incidence or mortality rate, calculated by fitting a linear model to logarithmically transformed annual rates. The method assumes that cancer rates are changing over the modeled period of time as a constant percentage of the rate of the previous year.

SURVIVAL

Observed survival proportion (OSP)

The proportion of patients 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 cancer patients 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)

A measure of the burden cancer poses at the personal and health care system levels after diagnosis. Tumour-based prevalence refers to the number of previously diagnosed cases of cancer in a given population among people alive on a specified date (index date). Limited-duration prevalence refers to prevalent cases diagnosed within a specified number of years prior to the index date. Person-based prevalence is the number of people represented by tumour-based prevalence counts.

Probability of developing/dying from cancer

A measure of the risk of getting/dying from cancer. It is calculated by applying current cancer incidence (for developing cancer) or mortality (for dying from cancer) rates to a hypothetical cohort of people free of disease or alive at the beginning of the age range of interest. Thus, the measure assumes that rates will remain unchanged into the future.

Potential years of life lost (PYLL)

A measure of the extent to which life is cut short by cancer, calculated by multiplying the number of deaths in each age group by the life expectancy of survivors. 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 post-censal 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

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Additional information related to this publication can be found in other sources, including reports from provincial and territorial cancer registries; *Cancer Incidence in Canada*,²¹ *Cancer Survival Statistics*²² and *Health Reports*, published by Statistics Canada; *Chronic Diseases in Canada* and the *Canadian Cancer Incidence Atlas*,⁶¹ published by Health Canada/ Public Health Agency of Canada; a collaborative monograph entitled *Cancer in North America, 2000-2004*,⁶² published by the North American Association of Central Cancer Registries; and *Cancer Incidence in Five Continents*,⁶³ published by the International Agency for Research on Cancer.

For general information regarding cancer statistics or any other aspect of cancer (such as cancer prevention, screening, diagnosis, treatment and care, etc.), contact the **Canadian Cancer Society's (CCS) Cancer Information Service at 1 888 939-3333**. A list of the offices of the CCS – National Office and Divisional offices – is provided on page 122. Your local CCS office is listed in the white pages of the telephone directory.

For information regarding 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 methodology is available from the 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 the user to generate tables, chart and maps according to a choice of parameters, such as cancer type, geographic area and period of time.

For information from Statistics Canada

Detailed standard 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; Health Statistics Division: (613) 952-5176. Analytical articles appear regularly in Health Reports, Statistics Canada, Catalogue 82-003.

For information from the Provincial/Territorial cancer registries

Cancer incidence data are supplied to Statistics Canada by provincial/territorial cancer registries. Detailed information regarding the statistics for each province or territory is available from the relevant registry (see pages 120-121 for addresses, telephone/fax numbers and websites).

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

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

CANADIAN COUNCIL OF CANCER REGISTRIES

Federal, Provincial and Territorial Contacts

NEWFOUNDLAND AND LABRADOR

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

PRINCE EDWARD ISLAND

Dr. Dagny E. Dryer
Director
PEI Cancer Registry
PEI Cancer Treatment Centre
Riverside Drive
Charlottetown, Prince Edward Island
C1A 8T5
Tel: (902) 894-2167
Fax: (902) 894-2187

NOVA SCOTIA

Ms. Maureen MacIntyre
Director
Surveillance and Epidemiology Unit
Cancer Care Nova Scotia
1276 South Park Street
Bethune Building, Room 569
Halifax, Nova Scotia, B3H 2Y9
Tel: (902) 473-5172
Fax: (902) 473-4425
www.cancercare.ns.ca

NEW BRUNSWICK

Dr. Eshwar Kumar and Dr. Réjean Savoie
Co-Chief Executive Officers
New Brunswick Cancer Network
PO Box 5100
Fredericton, New Brunswick E3B 6G3
Tel: (506) 453-5521
Fax: (506) 453-5522
<http://www.gnb.ca/0051/cancer/index-e.asp>

QUEBEC

Monsieur Michel Beaupré
Fichier des tumeurs du Québec
Ministère de la Santé et des Services
sociaux
Direction générale de la santé publique
1075, Chemin Ste-Foy, 11^{ème} étage
Québec, Québec G1S 2M1
Tel: (418) 266-6739
Fax: (418) 266-4609
<http://msssa4.msss.gouv.qc.ca/santpub/tumeurs.nsf/cat?OpenView>

ONTARIO

Ms. Kamini Milnes
Director, Cancer Informatics
Cancer Care Ontario
620 University Avenue
Toronto, Ontario, M5G 2L7
Tel: (416) 217-1260
Fax: (416) 217-1304
www.cancercare.on.ca

MANITOBA

Gail Noonan
 Manager
 Manitoba Cancer Registry
 CancerCare Manitoba
 675 McDermot Ave., Room ON2114
 Winnipeg, Manitoba, R3E 0V9
 Tel: (204) 787-2157
 Fax: (204) 786-0628
 www.cancercare.mb.ca

SASKATCHEWAN

Heather Stuart
 Provincial Leader Cancer Registry
 Saskatchewan Cancer Agency
 Parliament Place
 400-2631 28th Avenue
 Regina, Saskatchewan, S4S 6X3
 Tel: (306) 359-5883
 Fax: (306) 359-5604
 www.saskcancer.ca

ALBERTA

Ms. Carol Russell
 Provincial Manager
 Alberta Cancer Registry
 Division of Population Health
 Cross Cancer Institute
 11560 University Avenue
 Edmonton, AB T6G 1Z2
 Tel: (780) 432-8781
 Fax: (780) 432-8659
 www.cancerboard.ab.ca

YUKON

Ms. Sherri Wright
 Director of Insured Health Services
 Yukon Cancer Registry
 Health Services Branch
 Yukon Government
 Box 2703 (H-2)
 Whitehorse, Yukon, Y1A 2C6
 Tel: (867) 667-5202
 Fax: (867) 393-6486

BRITISH COLUMBIA

Ms. Sharon Tamaro
 Scientific Director, BC Cancer Registry
 BC Cancer Agency
 Cancer Control Research Unit
 675 West 10th Avenue
 Vancouver, British Columbia, V5Z 1L3
 Tel: (604) 675-8070
 Fax: (604) 675-8180
 www.bccancer.bc.ca

NUNAVUT

Dr. Issac Sobol
 Director of Registry
 Department of Health and Social
 Services
 Box 1000, Station 1000
 Iqaluit, Nunavut, X0A 0H0
 Tel: (867) 975-5774
 Fax: (867) 975-5755

NORTHWEST TERRITORIES

Dr. André Corriveau
 Chief Medical Health Officer and
 Registrar, Disease Registries
 Department of Health and Social
 Services
 Government of the N.W.T.
 Box 1320, 5022 49th Street
 Centre Square Tower, 6th Floor
 Yellowknife, N.W.T., X1A 2L9
 Tel: (867) 920-8646
 Fax: (867) 873-0442
 www.gov.nt.ca

STATISTICS CANADA

Ms. Julie McAuley
 Director
 Health Statistics Division
 Main Building, Room 2200
 Tunney's Pasture
 Ottawa, Ontario, K1A 0T6
 Tel: (613) 951-8571
 Fax: (613) 951-0792

CANADIAN CANCER SOCIETY

National Office

10 Alcorn Avenue, Suite 200
Toronto, ON M4V 3B1
Tel: (416) 961-7223
Fax: (416) 961-4189
E-mail: ccs@cancer.ca

For more information about cancer:
info@cis.cancer.ca
1 888 939-3333

Alberta/N.W.T. Division

325 Manning Road NE, Suite 200
Calgary, AB T2E 2P5
Tel: (403) 205-3966
Fax: (403) 205-3979
E-mail: info@cancer.ab.ca

British Columbia & Yukon Division

565 West 10th Avenue
Vancouver, BC V5Z 4J4
Tel: (604) 872-4400
Fax: (604) 872-4113
E-mail: inquiries@bc.cancer.ca

Manitoba Division

193 Sherbrook Street
Winnipeg, MB R3C 2B7
Tel: (204) 774-7483
Fax: (204) 774-7500
E-mail: info.wpg@mb.cancer.ca

New Brunswick Division

P.O. Box 2089
133 Prince William Street, Suite 201
Saint John, NB E2L 3T5
Tel: (506) 634-6272
Fax: (506) 634-3808
E-mail: ccsnb@nb.cancer.ca

Newfoundland & Labrador Division

P.O. Box 8921
136 Crosbie Road
2nd Floor, Viking Building
St. John's, NL A1B 3R9
Tel: (709) 753-6520
Fax: (709) 753-9314
E-mail: ccs@nl.cancer.ca

Nova Scotia Division

5826 South Street, Suite 1
Halifax, NS B3H 1S6
Tel: (902) 423-6183
Fax: (902) 429-6563
E-mail: ccs.ns@ns.cancer.ca

Ontario Division

55 St. Clair Avenue West, Suite 500
Toronto, ON M4V 2Y7
Tel: (416) 488-5400
Fax: (416) 488-2872
E-mail: webmaster@ontario.cancer.ca

Prince Edward Island Division

1 Rochford Street, Suite 1
Charlottetown, PEI C1A 9L2
Tel: (902) 566-4007
Fax: (902) 628-8281
E-mail: info@pei.cancer.ca

Québec Division

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

Saskatchewan Division

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

Please help us improve this publication. Your feedback on the contents of this report will be used to prepare future editions. It would be helpful for planning if you could complete and return this form by August 31, 2009, to:

**Canadian Cancer Statistics
Canadian Cancer Society National Office
10 Alcorn Ave., Suite 200
Toronto, ON
M4V 3B1**

However, we will be pleased to receive your completed form at any time. This evaluation and order form is also available at www.cancer.ca/statistics

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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*
1888 939-3333 Monday to Friday: 9 a.m. – 6 p.m.

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