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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.

HIGHLIGHTS

Current Incidence and Mortality

- An estimated 159,900 new cases of cancer and 72,700 deaths from cancer will occur in Canada in 2007.
- The total number of lung cancer cases (men and women combined) is greater than the number of either prostate or breast cancer cases.
- 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.

Geographic Patterns of Cancer Occurrence

- Generally, both incidence and mortality rates are higher in Atlantic Canada and Quebec and lowest in British Columbia.
- Generally, incidence and mortality rates in Ontario are lower than the national average.
- Lung cancer incidence and mortality rates continue to be higher in Atlantic Canada and Quebec and lowest in British Columbia.

Trends in Incidence and Mortality

- The increased number of new cases of cancer is primarily due to a growing and aging population.
- Between 1994 and 2003, incidence rates rose by more than 2% per year only for melanoma and liver cancer in males, and thyroid cancer in both sexes.
- Between 1994 and 2003, incidence rates declined by 2% or more for lung cancer in males, stomach and larynx cancers in both sexes and cervical cancer in females.
- Lung cancer incidence and mortality rates continue to climb among women while decreasing among men.
- Mortality rates have declined for all cancers combined and for most types of cancer in both sexes since 1994. Exceptions are lung cancer in females and liver cancer in males.
- Excluding lung cancer, mortality rates have dropped 20% in women since 1978.

Age and Sex Distribution of Cancer

- 44% 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 18% of cancer deaths will occur in young and middle-aged adults in their most productive stage of life.
- Cancer incidence is rising in young adults ages 20-29 and females up to 39.
- Cancer incidence and mortality rates are higher in females than males during the reproductive years although males have higher rates at all other stages of life.
- Mortality is declining for males at all ages and for females under 70. Declines are most rapid in children and adolescents (ages 0-19).

HIGHLIGHTS

Probability of Developing/Dying from Cancer

- On the basis of current incidence rates, 39% of Canadian women and 44% of men will develop cancer during their lifetimes.
- On the basis of current mortality rates, 24% of women and 28% of men, or approximately 1 out of every 4 Canadians, will die from cancer.

Potential Years of Life Lost Due to Cancer

- Lung cancer is by far the leading cause of premature death due to cancer.
- Smoking is responsible for 28% of potential years of life lost (PYLL) due to cancer.

Prevalence

- In 2003, 2.5% of Canadian men and 2.8% of Canadian women had a diagnosis of cancer in the previous 15 years.
- 1.0% of the female population are survivors of breast cancer, and 0.8% of the male population are survivors of prostate cancer, diagnosed within the previous 15 years.

Five-year Relative Cancer Survival in Canada, 1996-1998

- Relative survival ratios were lowest for pancreatic, esophageal, liver, and lung cancer.
- Comparison of survival estimates can help to identify gaps and establish priorities for systemic change that may lead to improvement in survival.
- Relative survival for lung cancer tends to decline with increasing age.
- Relative survival ratios were best for testicular, thyroid, prostate cancer, and melanoma.

Cancer in Children

- About 1,300 Canadian children develop cancer each year, but due to the successful treatment of the most common cancers, the number of deaths is about one-sixth the number of cases.
- While cancer incidence in children has been relatively constant since 1985, cancer mortality continues to decline.

Breast Cancer

- Breast cancer is the most common cancer in women worldwide and in Canada, with an estimated 22,000 Canadian women diagnosed each year.
- Breast cancer is the most common cancer in women aged under 50, 50-69 and 70+ years, and is the most common cancer cause of death in women under 50.
- Incidence and mortality rates have declined consistently since 1969 in women aged 20-39.
- After long-term increases in women aged 40 and over, incidence rates began to either stabilize or drop in the 1990s.

HIGHLIGHTS

- Mortality rates have declined in all ages combined and in every age group since at least the mid 1990s.
- Survival has been improving gradually since the 1970s, significantly so since 1989, especially in the age groups where screening is recommended (50-59 and 60-69).
- Unlike most other cancers, relative survival continues to decline after diagnosis, from 86% at 5 years to 70% at 20 years post-diagnosis.

ACKNOWLEDGEMENTS

This monograph was developed by members of the Steering Committee, supported by the National Cancer Institute of Canada. The Steering Committee is responsible for developing content, reviewing statistical information, interpreting the data and writing the text. The Steering Committee includes representatives of the National Cancer Institute of Canada, the Canadian Cancer Society, Public Health Agency of Canada, Statistics Canada, the Canadian Council of Cancer Registries, the Canadian Association of Provincial Cancer Agencies as well as university-based and provincial/territorial cancer agency-based cancer researchers. The preparation, production and distribution of the monograph is the result of collaboration among these groups, with additional assistance and support as noted below.

Data sources

- The Canadian Cancer Registry (CCR), the National Cancer Incidence Reporting System (NCIRS) and the mortality data files are maintained in Health Statistics Division, Statistics Canada. These represent the primary sources of data (see *Appendix II,* Data Sources and Processing).
  - Cancer data in the CCR and NCIRS are supplied by provincial/territorial cancer registries. Staff of these registries play a key role in ensuring data quality.
  - Mortality data are collected by provincial/territorial vital statistics registries.
- Estimates of non-melanoma (basal cell and squamous cell) skin cancer are provided by the B.C. Cancer Agency, CancerCare Manitoba and the Department of Health, New Brunswick. Most provincial cancer registries do not collect data on these very common cancers.

Review and analysis

- Provincial and territorial cancer registries reviewed the cancer estimates for incidence and mortality data for their own jurisdictions before publication in this monograph. (The results of their input are noted in *Appendix II*, Incidence Estimates for 2007).
- The Surveillance Division, Centre for Chronic Disease Prevention and Control (CCDPC), Public Health Agency of Canada (PHAC) conducted the data analysis for most of the sections. Tables and figures were updated by Bob McRae.
- The Health Statistics Division, Statistics Canada provided data for development of the tables and figures and conducted analyses for the section on Five-year Relative Survival. Larry Ellison's contribution to this section is particularly acknowledged.
- The French translation was reviewed by Michel Beaupré of the Fichier des tumeurs du Québec and Ghislaine Villeneuve of Statistics Canada.

Special topic

- The cancer registries of PEI and New Brunswick provided stage data, and the Ontario Cancer Registry contributed long-term survival data.
- Erin Pichora and Diane Nishri of Cancer Care Ontario completed the long-term survival analyses.
- Verna Mai, Beth Theis and Michelle Cotterchio of Cancer Care Ontario reviewed this section and provided helpful comments.

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Production and distribution

- The National Cancer Institute and Canadian Cancer Society provided administrative support to produce, print and distribute this report, with charitable funds collected by the Canadian Cancer Society. The work of Monika Dixon in particular is acknowledged.

INTRODUCTION

This monograph is part of an annual series that began publication in 1987. Its main purpose is to provide health professionals, researchers and policy-makers with detailed information regarding incidence and mortality of the most common types of cancer by age, sex, time period and province or territory. These data may stimulate new research and assist decision-making and priority-setting processes at the individual, community, provincial/territorial and national levels. The monograph is also used by educators, the media and members of the public with an interest in cancer.

The statistics contained herein refer to all types of cancer, defined according to the standardized classification that is used worldwide. As is customary in reports from cancer registries, the statistics exclude basal cell and squamous cell carcinoma of the skin. Benign tumours and carcinoma in situ (except for bladder cancer) are also excluded. Details of how cancers are classified and definitions of technical terms are provided in the *Glossary*.

It is important to emphasize that the figures provided for 2007 are estimates, rather than actual data. Because the most current available data on cancer occurrence/deaths are always a few years old (e.g., actual national data now available are only to 2003), this publication presents estimates for the current year, using projections based on past numbers of cancers and trends. Details of the statistical methods, data sources and terminology used to produce the projections are provided in *Appendix II: Methods*.

Special Topics are included each year, and topics from 1997 onwards are available on the Canadian Cancer Society's website (www.cancer.ca); hard copies of previous Special Topics can be obtained by writing to stats@cancer.ca. To see a list of previous Special Topics please refer to *Appendix III*. This year's Special Topic is Breast Cancer.

Individuals who require additional information can refer to the section entitled *For Further Information.*

Related information can also be found in other publications, including reports from provincial and territorial cancer registries; *Cancer Statistics*,[1] and *Health Reports*, published by Statistics Canada; *Chronic Diseases in Canada* and the *Canadian Cancer Incidence Atlas*,[2] published by Health Canada/Public Health Agency of Canada; a collaborative monograph entitled *Cancer in North America, 1999-2003*,[3] published by the North American Association of Central Cancer Registries; and *Cancer Incidence in Five Continents*,[4] published by the International Agency for Research on Cancer.

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, including ideas on how the report can be improved** (an *Order and Evaluation Form* is included on page 111). Finally, **readers can be included on the mailing list for next year's publication** by completing the *Order and Evaluation Form*.

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CURRENT INCIDENCE AND MORTALITY

The importance of different types of cancer in Canada in 2007 can be measured in two ways, as shown in Table 1. Incidence is expressed as the number of new cases of a given type of cancer diagnosed per year. Mortality is expressed as the number of deaths attributed to a particular type of cancer during the year. Frequencies listed in Tables 1 to 11 are estimates based on modeling trends in cancer and population data since 1986 for both cancer incidence and mortality (an exception was made for prostate cancer; see *Appendix II* for details). These estimates are rounded to the nearest 5, 10, 50 or 100. Readers requiring actual data or information on less common sites of cancer may refer to Tables A1 and A6 in *Appendix I* or to source publications.[1,4]

Some problems that may be inherent in using these statistics are considered below.

Data Sources

Incidence figures collected by provincial and territorial cancer registries are reported to the Canadian Cancer Registry (CCR) maintained by Statistics Canada, beginning with cases diagnosed in 1992. The patient-oriented CCR has evolved from the event oriented National Cancer Incidence Reporting System, which collected data from 1969 to 1991. The CCR is regularly updated; it is internally linked to track patients with tumours diagnosed in more than one province/territory, and its records are linked to death certificates, which reduces duplication to a negligible rate. Data from these series are published by Statistics Canada,[1] the North American Association of Central Cancer Registries,[3] the International Agency for Research on Cancer (every five years),[4] and in occasional reports.[1,2]

Every effort is made to count all newly diagnosed cases of cancer among people who reside in a given province/territory at the time of diagnosis, and to accurately and consistently record, for each case, the type of cancer from pathology reports and other records, according to definitions in the CCR Data Dictionary. Cancers included in this report are defined according to the groupings listed in the *Glossary*.

Although the provincial/territorial cancer registries strive, through the Canadian Council of Cancer Registries and its Standing Committee on Data Quality, to achieve uniformity in defining and classifying new cases, reporting procedures and completeness still vary across the country. This is particularly true for skin cancer (other than melanoma), which occurs frequently but is difficult to register completely because it is often treated successfully without requiring hospitalization. **For this reason, all tables of cancer incidence in this monograph exclude the estimated 69,000 cases of non-melanoma (basal cell and squamous cell) skin cancer for Canada in 2007.*** Registration levels for cancer have become more comparable across the country, particularly in the period starting in the early 1980s, as registries standardized their procedures for case-finding, including linkage to provincial mortality data files.

* The number of new cases of non-melanoma skin cancer is calculated using estimates from the B.C. Cancer Agency, CancerCare Manitoba and the Department of Health, New Brunswick. Please refer to *Appendix II: Methods* for further details. Comparisons during years prior to 2006 should be made with caution because of a change in calculation methods.

CURRENT INCIDENCE AND MORTALITY

Cancer deaths are those attributed to some form of cancer as the underlying cause of death by the certifying physician. Cancer mortality statistics are derived from death records maintained by the provincial and territorial registrars of vital statistics for people residing in that province or territory at the time of death.

Although these procedures 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. These facts may help to account, in part, for the numbers of cases and deaths listed under "all other sites" throughout the Tables. Cancer deaths occurring in a given year will usually be the result of cancers diagnosed in previous years.

Estimates for Cancer Incidence and Mortality, Canada, 2007

An estimated 159,900 new cases of cancer and 72,700 deaths from cancer will occur in Canada in 2007. Men outnumber women for both new cases and deaths, by 7% for incidence and 12% for mortality (Table 1).

Three types of cancer account for at least 55% of new cases in each sex: prostate, lung, and colorectal cancers in males, and breast, lung, and colorectal cancers in females. Twenty-nine percent of cancer deaths in men and 26% in women are due to lung cancer alone (Figures 1.1 and 1.2). Comparisons during years prior to 2003 with respect to colorectal cancer mortality should be made with caution because of a change in classification practices (see *Appendix II* for further details).

Lung cancer will continue as the leading cause of cancer death in Canadian women in 2007, increasing to an estimated 8,900 deaths, compared with the 5,300 deaths expected for breast cancer. This reflects the rapid increase in lung cancer mortality rates among women over the past three decades, while age-standardized breast cancer mortality rates declined slightly. Lung cancer incidence among women also continues to rise. With an estimated 10,900 new cases, lung cancer is the second leading type of cancer in women, ahead of the 9,400 new cases expected for colorectal cancer, which ranks third. Breast cancer continues to lead in incidence among Canadian women, with slightly more than twice as many new cases as lung cancer.

In Canadian men in 2007, prostate cancer will continue as the leading type of cancer diagnosed, with an estimated 22,300 newly diagnosed cases, compared with 12,400 lung cancers. Prostate cancer estimates were produced by a variation on the methods employed for other cancers (see *Appendix II: Methods*). Lung cancer will remain the leading cause of cancer death in Canadian men in 2007; the estimated 11,000 lung cancer deaths far exceed the 4,700 deaths due to colorectal cancer, the second leading cause of cancer death in men. Prostate cancer is third in mortality, causing 4,300 deaths.

The total number of lung cancer cases (men and women combined) is greater than the number of either prostate or breast cancer cases; lung cancer remains by far the most frequent cause of death from cancer.

Table 1

Estimated New Cases and Deaths for Cancers by Sex, Canada, 2007

	New Cases 2007 Estimates			Deaths 2007 Estimates		
	Total	M	F	Total	M	F
All Cancers	**159,900**	**82,700**	**77,200**	**72,700**	**38,400**	**34,300**
Lung	23,300	12,400	10,900	19,900	11,000	8,900
Breast	22,500	170	22,300	5,400	50	5,300
Prostate	22,300[2]	22,300[2]	–	4,300	4,300	–
Colorectal	20,800	11,400	9,400	8,700	4,700	4,000
Non-Hodgkin Lymphoma	6,800	3,700	3,100	3,100	1,700	1,400
Bladder[1]	6,600	5,000	1,700	1,750	1,250	520
Kidney	4,900	3,000	1,800	1,650	1,000	620
Melanoma	4,600	2,500	2,100	900	560	340
Leukemia	4,200	2,500	1,750	2,400	1,400	980
Body of Uterus	4,100	–	4,100	740	–	740
Thyroid	3,700	790	2,900	170	65	110
Pancreas	3,600	1,750	1,850	3,600	1,750	1,850
Oral	3,200	2,100	1,050	1,100	740	360
Stomach	2,800	1,850	1,000	1,850	1,150	730
Brain	2,600	1,450	1,150	1,700	980	740
Ovary	2,400	–	2,400	1,700	–	1,700
Multiple Myeloma	2,000	1,100	900	1,000	530	470
Esophagus	1,550	1,150	410	1,700	1,300	430
Liver	1,350	1,050	310	670	510	150
Cervix	1,350	–	1,350	390	–	390
Larynx	1,150	950	220	510	420	90
Hodgkin Lymphoma	880	480	400	120	65	50
Testis	830	830	–	30	30	–
All Other Cancers	12,300	6,300	6,000	9,300	4,900	4,400

– Not applicable

[1] The substantial increase in incidence of bladder cancer as compared with previous years reflects the decision to include in situ carcinomas (excluding Ontario) as of 2006. See Table A3 for in situ bladder cancer in Ontario.

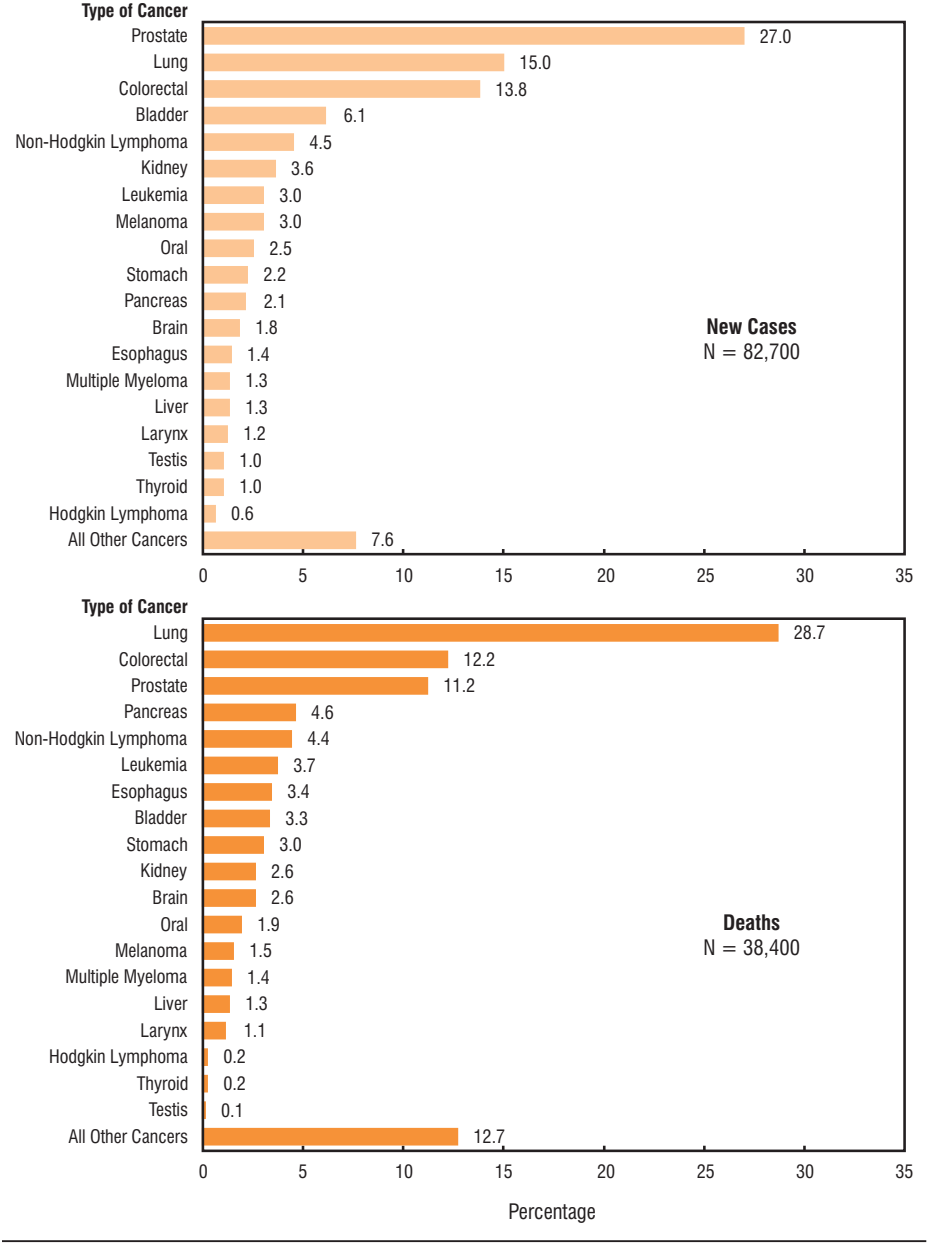
[2] A five-year average was used to calculate the estimates for prostate cancer.

Note: Incidence figures exclude an estimated 69,000 new cases of non-melanoma (basal cell and squamous cell) skin cancer. All cancer deaths include about 220 deaths with underlying cause other malignant neoplasms of skin (ICD-10 code C44). Total of rounded numbers may not equal rounded total number. Please refer to *Appendix II: Methods* for further details.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Figure 1.1

Percentage Distribution of Estimated New Cases and Deaths for Selected Cancers, Males, Canada, 2007

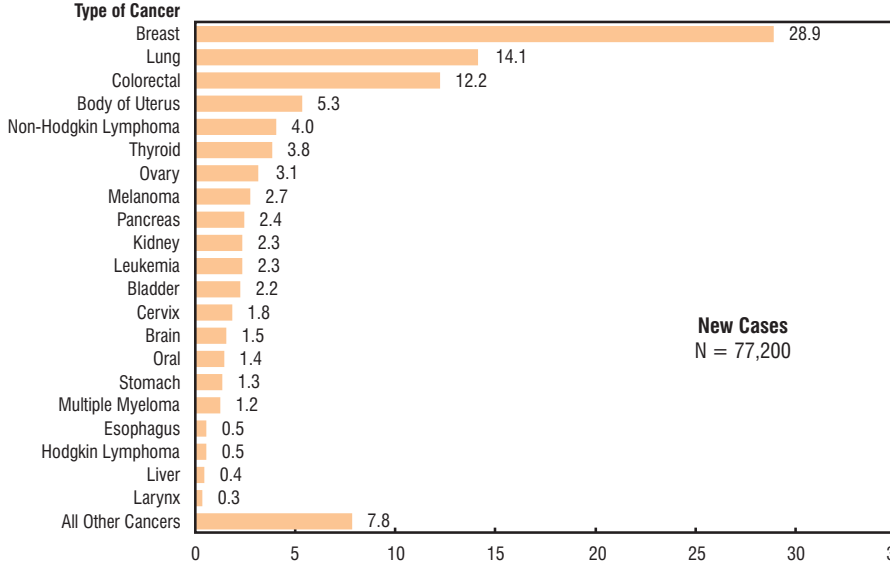


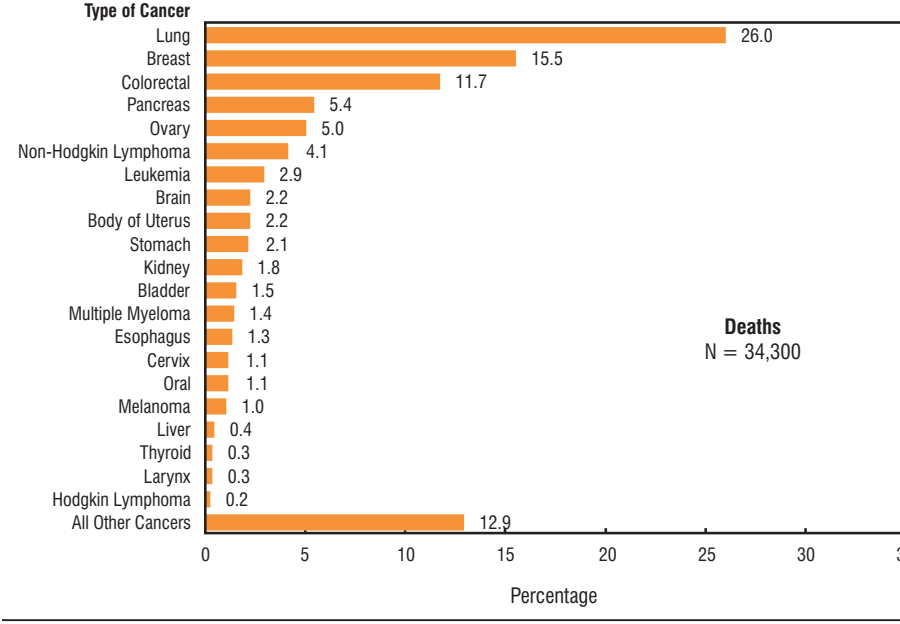
Note: Incidence figures exclude an estimated 69,000 new cases of non-melanoma (basal cell and squamous cell) skin cancer among both sexes combined. Mortality figures for 'all other cancers' include about 220 deaths with underlying cause 'other malignant neoplasms' of skin among both sexes combined.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Figure 1.2

Percentage Distribution of Estimated New Cases and Deaths for Selected Cancers, Females, Canada, 2007





Note: Incidence figures exclude an estimated 69,000 new cases of non-melanoma (basal cell and squamous cell) skin cancer among both sexes combined. Mortality figures for 'all other cancers' include about 220 deaths with underlying cause 'other malignant neoplasms' of skin among both sexes combined.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

GEOGRAPHIC PATTERNS OF CANCER OCCURRENCE

Table 2 presents population projections and estimates of new cases and deaths for all cancers combined, by sex and province or territory for 2007. Tables 3 and 4 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 2007. The age-standardized estimates take into consideration the differences in provincial/territorial age distributions, thus facilitating inter-provincial comparisons. Similarly, Tables 5 and 6 present estimates of the number of deaths and the age-standardized mortality rates for each of the most common cancers, by sex and province/territory for 2007. The calculation of age-standardized rates using the 1991 Canadian population as the standard is described in the *Glossary*, and in more detail in *Appendix II: Methods*. Adjustments were necessary for estimated incident cases in most provinces/territories. Tables A3 to A6 in *Appendix I* provide the most recent actual data across the provinces/territories.

Although the incidence rates of some cancers (e.g., breast) appear to be reasonably consistent across jurisdictions, the rates of others (e.g., prostate, lung) appear to vary more widely. Overall cancer mortality rates are higher in Atlantic Canada and Quebec, and lowest in British Columbia. A similar pattern was observed for incidence, after discounting the effects of undercounting in Newfoundland and Labrador, and omitting prostate cancer (which shows large provincial differences due to differences in PSA screening).

Data on provincial/territorial numbers and rates of incident cancer cases and cancer deaths provide valuable information for research, knowledge synthesis, planning and decision-making at the provincial/territorial level. These data are therefore of interest to researchers, health care workers, planners and policy-makers. Inevitably, these data will be used for inter-provincial comparisons.

Inter-provincial differences in rates may reflect true underlying differences in the risk of developing or dying of cancer, which in turn may reflect differences in the prevalence of risk factors. For example, historically high tobacco consumption in eastern Canada has contributed to current lung cancer rates that are higher in these regions than in other parts of Canada. Lower socio-economic status has been associated with higher cancer mortality in general, and with increased incidence of certain cancers (e.g., cervical) but decreased incidence of breast cancer; geographic differences in socio-economic status may influence regional differences in cancer risk.

However, inter-provincial variations must be interpreted with caution because a variety of reasons could account for the observations.

First, if the cancer is rare, the number of cases occurring annually in a given province/territory may be so small that estimates may be unreliable and vary considerably from one year to the next.

Second, correlations found between the incidence of disease and the prevalence of risk factors for a given geographic location can be misleading. Proof of a causal association between a risk factor and a disease requires more detailed studies of individuals.

Third, 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.

Fourth, the availability of and the completeness of coverage in target populations of screening programs (e.g., for breast and cervical cancer), or of screening behaviours in the absence of formal screening programs (e.g., prostate cancer) differ among provinces/territories. This will result in cancer incidence rates that will be temporarily elevated through the identification of previously undiagnosed cases in asymptomatic individuals (e.g., breast cancer), or reduced through the identification and treatment of pre-malignant lesions (e.g., cervical cancer), or permanently elevated by the identification of cancers which would otherwise never be detected (e.g., prostate cancer). As well, the availability of diagnostic procedures may differ regionally.

Finally, there are differences in the reporting procedures used in cancer registration (e.g., registration of second primary cancers and use of death certificates – see *Appendix II* regarding cancer registry methodology). For example, death certificate information has not been available for registry purposes in Newfoundland and Labrador until now, and this falsely lowers the number of incident cases with short life expectancy, such as cases of lung and pancreatic cancer. 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 incidence data. In Quebec, because of the registry's dependence on hospital data, the numbers of prostate, melanoma and bladder cases have been estimated to be underreported by 32%, 35% and 14% respectively.[5] Those who maintain the Quebec tumour registry are aware of this and are taking steps to correct the problem. 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 *in situ* cases are not reported.

Even with these cautions, it should be noted that Canada is one of the few nations where cancer patterns can be monitored for the whole population. The provincial/territorial and national cancer registries are important resources for making comparisons that generate hypotheses warranting further investigation. The factors that cause these real differences are not well understood, but may include earlier detection of cancer by well-established, population-based screening programs, better or more accessible treatment in some regions, clustering of risk factors in one province or region, or increased penetration of a risk factor in a population (e.g., higher historic smoking rates in Quebec and Atlantic Canada). 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 by targeting unmet needs.

Generally, both incidence and mortality rates are higher in Atlantic Canada and Quebec and lowest in British Columbia.

Table 2

Estimated Population, New Cases and Deaths for All Cancers by Sex and Geographic Region, Canada, 2007

	Population (000s) 2007 Estimates[1]			New Cases 2007 Estimates[2]			Deaths 2007 Estimates		
	Total	M	F	Total	M	F	Total	M	F
Canada	**32,822**	**16,251**	**16,571**	**159,900**	**82,700**	**77,200**	**72,700**	**38,400**	**34,300**
Newfoundland and Labrador*	515	252	262	2,400	1,300	1,100	1,350	760	600
Prince Edward Island	139	68	71	820	430	380	340	180	160
Nova Scotia	941	461	480	5,600	3,000	2,600	2,600	1,400	1,200
New Brunswick	754	372	382	4,200	2,200	1,950	1,950	1,050	870
Quebec	7,684	3,795	3,889	41,000	20,900	20,100	19,500	10,400	9,100
Ontario	12,822	6,329	6,493	59,500	30,300	29,200	26,900	14,000	12,900
Manitoba	1,189	591	598	6,000	3,100	2,900	2,700	1,400	1,300
Saskatchewan	989	491	498	5,000	2,700	2,300	2,400	1,300	1,100
Alberta	3,333	1,682	1,650	14,500	7,700	6,800	5,800	3,000	2,800
British Columbia	4,351	2,156	2,195	20,600	10,900	9,700	9,000	4,700	4,300
Yukon	31	16	15	110	60	50	60	35	25
Northwest Territories	44	23	21	100	50	50	60	30	30
Nunavut	30	16	15	65	30	35	40	20	20

* Likely an underestimate of the number of cases for the years used to generate the 2007 estimates, see *Appendix II: Methods*.

[1] 2007 population projections were provided by the Census and Demographics Branch, Statistics Canada.

[2] Figures exclude non-melanoma (basal cell and squamous cell) skin cancer.

Note: Total of rounded numbers may not equal rounded total number. Please refer to *Appendix II: Methods*.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Table 3

Estimated New Cases for the Most Common Cancers by Sex and Province, Canada, 2007

	New Cases										
	Canada[1]	NL*	PE	NS	NB	QC	ON	MB	SK	AB	BC
Males											
All Cancers	**82,700**	**1,300**	**430**	**3,000**	**2,200**	**20,900**	**30,300**	**3,100**	**2,700**	**7,700**	**10,900**
Prostate	22,300	350	140	780	580	4,200*	8,900	780	870	2,400	3,200
Lung	12,400	170	65	490	400	4,200	4,000	430	350	910	1,400
Colorectal	11,400	260	55	440	270	3,000	4,200	430	360	950	1,400
Bladder**	5,000	85	25	210	150	1,600	1,250	200	180	450	780
Non-Hodgkin Lymphoma	3,700	40	20	130	100	860	1,400	150	120	320	530
Kidney	3,000	40	15	120	95	780	1,200	120	90	260	320
Melanoma	2,500	45	15	120	60	310	1,100	70	55	260	420
Leukemia	2,500	20	15	70	55	590	990	90	100	270	310
Oral	2,100	50	5	90	60	540	800	100	60	170	270
Stomach	1,850	45	10	60	50	470	680	80	50	150	230
Pancreas	1,750	10	10	60	60	510	580	70	55	150	240
Brain	1,450	30	5	45	35	380	540	45	40	130	180
Esophagus	1,150	15	5	50	30	250	440	35	30	110	170
Multiple Myeloma	1,100	10	5	30	25	280	440	40	30	85	140
Liver	1,050	10	–	15	10	260	390	25	15	110	190
Females											
All Cancers	**77,200**	**1,100**	**380**	**2,600**	**1,950**	**20,100**	**29,200**	**2,900**	**2,300**	**6,800**	**9,700**
Breast	22,300	370	110	680	540	5,900	8,500	810	630	2,000	2,700
Lung	10,900	120	45	360	250	3,300	3,900	400	280	900	1,400
Colorectal	9,400	190	60	360	240	2,400	3,600	360	300	720	1,150
Body of Uterus	4,100	60	20	130	90	950	1,600	190	130	390	530
Non-Hodgkin Lymphoma	3,100	40	10	95	75	740	1,250	120	90	270	420
Thyroid	2,900	35	5	45	50	590	1,600	60	45	280	200
Ovary	2,400	25	10	65	60	650	990	95	65	180	280
Melanoma	2,100	35	20	110	70	320	900	60	60	230	300
Pancreas	1,850	5	10	65	55	530	640	75	50	160	280
Kidney	1,800	30	10	80	60	490	700	70	55	150	180
Leukemia	1,750	15	5	55	40	450	670	70	65	170	210
Bladder**	1,700	25	5	70	50	530	450	65	60	150	270
Cervix	1,350	25	10	55	35	280	500	45	45	160	170
Brain	1,150	15	5	35	25	320	440	35	35	90	130
Oral	1,050	15	5	40	20	250	410	50	35	90	150
Stomach	1,000	25	5	30	25	280	360	40	30	90	120

– Fewer than 3 cases

* Likely an underestimate of the number of cases for the years used to generate the 2007 estimates, see *Appendix II: Methods*.

** Inter-provincial variation. Ontario does not currently report in situ bladder cases. See text.

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

Note: Total of rounded numbers may not equal rounded total number. The Canada and provincial totals for all cancers exclude an estimated 69,000 cases of non-melanoma (basal cell and squamous cell) skin cancer. Caution is needed if the 2007 estimates are compared to previously published estimates (see *Appendix II: Methods*). These estimates may vary from actual figures. Please see *Appendix I* for most current actual data or contact provincial cancer registries for further information.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Table 4

Estimated Age-Standardized Incidence Rates for the Most Common Cancers by Sex and Province, Canada, 2007

	Rate per 100,000										
	Canada[1]	NL*	PE	NS	NB	QC	ON	MB	SK	AB	BC
Males											
All Cancers	**454**	**418**	**523**	**529**	**494**	**477**	**437**	**470**	**464**	**478**	**421**
Prostate	122	113	169	136	128	95*	129	120	151	154	123
Lung	68	54	82	86	91	94	58	66	59	58	53
Colorectal	62	83	65	76	59	68	60	65	63	59	54
Bladder**	27	27	33	37	33	37	18	30	30	29	30
Non-Hodgkin Lymphoma	20	13	25	24	22	19	20	22	21	19	21
Kidney	16	13	17	20	21	17	17	19	16	15	12
Leukemia	14	7	19	13	12	14	14	14	17	17	12
Melanoma	13	14	20	22	13	7	16	11	10	15	16
Oral	11	16	8	15	12	11	11	15	10	10	10
Stomach	10	15	9	10	11	11	10	12	9	9	9
Pancreas	10	3	13	10	13	12	8	11	9	10	9
Brain	8	10	6	8	8	9	8	8	7	8	7
Esophagus	6	5	8	8	7	6	6	5	5	7	6
Liver	6	3	2	3	2	6	5	4	2	6	7
Multiple Myeloma	6	4	6	6	6	6	6	6	5	5	5
Females											
All Cancers	**358**	**310**	**403**	**386**	**362**	**371**	**357**	**376**	**344**	**368**	**328**
Breast	104	101	111	101	100	111	104	107	98	106	93
Lung	50	35	49	52	48	60	46	51	42	49	46
Colorectal	41	51	58	50	41	41	41	43	40	38	37
Body of Uterus	19	17	19	19	17	17	20	24	21	21	18
Thyroid	16	11	5	9	12	14	23	9	9	16	9
Non-Hodgkin Lymphoma	15	12	12	14	14	14	15	15	13	14	14
Melanoma	11	12	23	18	15	7	12	9	10	13	11
Ovary	11	7	9	10	12	12	12	13	10	9	9
Pancreas	8	2	8	9	9	9	7	8	6	8	9
Kidney	8	8	8	11	11	9	9	9	8	8	6
Leukemia	8	5	7	8	8	8	8	9	10	9	7
Cervix	7	8	10	11	8	6	7	7	9	10	7
Bladder**	7	7	7	10	9	9	5	8	9	8	9
Brain	6	4	6	6	6	7	6	5	6	5	5
Oral	5	5	5	6	4	5	5	6	5	5	5
Stomach	4	6	3	4	4	5	4	5	4	5	4

* Likely an underestimate of the number of cases for the years used to generate the 2007 estimates, see *Appendix II: Methods*.

** Inter-provincial variation. Ontario does not currently report in situ bladder cases. See text.

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

Note: Rates exclude non-melanoma (basal cell and squamous cell) skin cancer and are adjusted to the age distribution of the 1991 Canadian population. Caution is needed if the 2007 estimates are compared to previously published estimates (see *Appendix II: Methods*). These estimates may vary from actual figures.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Table 5

Estimated Deaths for the Most Common Cancers by Sex and Province, Canada, 2007

	Deaths										
	Canada[1]	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC
Males											
All Cancers	**38,400**	**760**	**180**	**1,400**	**1,050**	**10,400**	**14,000**	**1,400**	**1,300**	**3,000**	**4,700**
Lung	11,000	240	65	430	360	3,600	3,600	350	330	770	1,200
Colorectal	4,700	110	25	180	120	1,300	1,750	180	160	340	560
Prostate	4,300	80	20	150	130	890	1,650	170	250	430	550
Pancreas	1,750	30	5	70	50	450	620	65	60	140	240
Non–Hodgkin Lymphoma	1,700	15	5	60	45	400	670	70	50	130	250
Leukemia	1,400	15	5	45	30	300	560	55	55	120	180
Esophagus	1,300	20	5	50	30	240	520	55	45	110	210
Bladder	1,250	25	5	45	30	290	490	50	40	95	170
Stomach	1,150	40	5	35	25	330	420	35	30	75	140
Kidney	1,000	20	5	40	30	260	350	50	30	95	120
Brain	980	20	–	35	25	290	340	30	30	90	120
Oral	740	15	5	30	20	190	270	25	15	65	95
Melanoma	560	5	–	20	10	100	280	20	15	40	70
Multiple Myeloma	530	5	5	25	15	130	210	20	15	30	70
Liver	510	5	–	5	5	160	210	25	5	40	60
Females											
All Cancers	**34,300**	**600**	**160**	**1,200**	**870**	**9,100**	**12,900**	**1,300**	**1,100**	**2,800**	**4,300**
Lung	8,900	140	50	350	190	2,600	3,200	290	230	730	1,100
Breast	5,300	100	25	200	130	1,400	2,000	210	150	440	640
Colorectal	4,000	95	25	170	100	1,100	1,500	160	120	270	470
Pancreas	1,850	25	10	65	50	480	690	70	55	140	260
Ovary	1,700	35	5	55	40	370	670	65	55	140	240
Non–Hodgkin Lymphoma	1,400	20	5	40	35	330	570	60	50	110	180
Leukemia	980	10	5	30	20	230	390	40	35	95	120
Body of Uterus	740	10	5	30	15	190	300	30	15	65	80
Brain	740	10	5	25	20	220	250	25	20	65	90
Stomach	730	25	–	20	15	220	250	30	20	65	85
Kidney	620	15	5	25	20	170	200	25	25	55	75
Bladder	520	10	–	15	15	130	200	15	15	45	70
Cervix	390	10	5	20	15	75	140	15	15	40	50
Oral	360	–	–	10	10	90	140	15	10	30	50
Melanoma	340	5	–	15	10	60	160	10	10	25	50
Thyroid	110	–	–	5	5	30	35	5	5	10	20

– Fewer than 3 deaths

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

Note: Total of rounded numbers may not equal rounded total number. Caution is needed if the 2007 estimates are compared to previously published estimates (see *Appendix II: Methods*). These estimates may vary from actual figures.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Table 6

Estimated Age-Standardized Mortality Rates for the Most Common Cancers by Sex and Province, Canada, 2007

	Rate per 100,000										
	Canada[1]	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC
Males											
All Cancers	**212**	**253**	**229**	**248**	**239**	**241**	**204**	**214**	**216**	**194**	**180**
Lung	61	76	79	77	81	83	52	53	55	49	47
Colorectal	26	36	31	31	26	30	25	28	26	22	21
Prostate	25	29	27	27	30	22	24	26	39	29	21
Pancreas	9	10	9	12	11	10	9	10	10	9	9
Non-Hodgkin Lymphoma	9	6	8	11	11	9	10	11	8	8	9
Leukemia	8	6	8	8	7	7	8	9	9	8	7
Esophagus	7	6	8	9	6	5	7	8	8	7	8
Bladder	7	9	6	8	7	7	7	7	7	6	7
Stomach	6	13	8	6	6	8	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	7	5	6	5
Oral	4	6	5	5	4	4	4	4	3	4	4
Melanoma	3	2	3	4	2	2	4	3	2	2	3
Multiple Myeloma	3	2	5	4	3	3	3	3	3	2	3
Liver	3	2	1	1	1	4	3	1	2	2	2
Females											
All Cancers	**148**	**161**	**153**	**169**	**151**	**156**	**146**	**154**	**146**	**143**	**134**
Lung	40	39	53	50	35	47	38	36	34	40	37
Breast	23	27	27	27	23	24	23	25	22	22	20
Colorectal	16	25	23	22	17	18	16	17	15	13	14
Pancreas	8	7	8	9	8	8	8	8	7	7	8
Ovary	7	9	6	8	7	6	8	8	8	7	8
Non-Hodgkin Lymphoma	6	5	7	6	6	6	6	7	7	6	6
Brain	4	4	4	4	4	4	3	3	4	4	3
Leukemia	4	3	4	4	3	4	4	5	5	5	4
Stomach	3	7	1	3	3	4	3	3	3	3	3
Body of Uterus	3	3	3	4	3	3	3	3	2	3	2
Kidney	3	4	3	3	4	3	2	3	3	3	2
Oral	2	0	2	2	1	2	2	2	2	2	2
Melanoma	2	1	1	2	1	1	2	1	1	1	2
Cervix	2	4	3	3	3	1	2	2	2	2	2
Bladder	2	2	1	2	2	2	2	1	2	2	2

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

Note: Rates are adjusted to the age distribution of the 1991 Canadian population. Caution is needed if the 2007 estimates are compared to previously published estimates (see *Appendix II: Methods*). These estimates may vary from actual figures.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

TRENDS IN INCIDENCE AND MORTALITY

Trends in incidence and mortality for major types of cancer are assessed by comparing annual age-standardized rates. The process of age standardization permits comparisons across calendar years (and provinces), since it accounts for changes that have occurred over time (and across provinces) in the age distribution of the population. Rates in this publication have been standardized to the 1991 Canadian population. Improved registration of new cases in several provincial registries took place throughout the 1970s. Registration levels, however, have generally stabilized since 1981 because of increasing consistency of cancer reporting procedures across Canada.[1]

Figures 2.1 and 2.2 present the number of new cases and deaths for Canadian men and women, together with the corresponding age-standardized rates, for all cancers combined from 1978 to 2003 and estimates to the year 2007. Figures 3.1 and 3.2 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 the aging of the population, while Figure 4 demonstrates the impact of changes in lung cancer mortality rates on overall cancer mortality trends. Detailed depictions of the trends in annual rates for selected cancers over the past 30 years are presented in Figures 5.1, 5.2 and 6.1, 6.2 with the data points provided in Tables 7.1, 7.2 and 8.1, 8.2. The average annual percent changes in cancer-specific incidence and mortality rates between 1994 and 2003 are listed in Table 9, and the net change in frequencies and rates over this time period in Figures 7.1 and 7.2.

All Cancers Combined

Among men, the cancer mortality rate, after reaching a peak in 1988, is declining slowly as a result of decreases in mortality rates for lung, colorectal and other cancers (Figure 2.2, Table 7.2). In contrast, the all cancer incidence rate rose in the early 1990s and then declined sharply, following the trend in prostate cancer incidence during this period (Figure 2.1, Table 7.1). Incidence has since been dropping gradually, probably because of the declining incidence of lung cancer. Among women, the rising cancer incidence rate may be stabilizing, whereas mortality rates have declined slightly (Figures 2.1 and 2.2, Tables 8.1, 8.2).

The numbers of new cases and deaths are important measures of cancer burden on the Canadian population and health care system. Figures 2.1 and 2.2 show that, despite relative stability in age-standardized rates, the numbers of new cancer cases and deaths continue to rise steadily as the Canadian population grows and ages. In 2007, the number of new cases is estimated to be 159,900 and the number of deaths to be 72,700. This is an additional 6,800 new cases over the estimate for 2006. Approximately 1,600 of these additional cases are prostate, 800 colorectal and 600 lung cancers.

Figures 3.1 and 3.2 show that the main reasons for the rising numbers of new cases of and deaths from cancer are population growth and aging. The lowest solid line represents the total number of cases (or deaths) that would have occurred each year if only the rates had changed but the population size and age structure had remained as in 1978. The middle line represents the number of cases (or deaths) that would have occurred each year if that year's rates were applied to a population that was the same size as that year's population but with the age distribution of 1978. The top line represents the number of cases (or deaths) that actually occurred and thus reflects the

combined impact of rate change, population growth and the aging of the population. An important implication is that as the Canadian population continues to age and grow in size, there will be a corresponding increase in the numbers of new cases and deaths each year unless a major drop in cancer rates occurs. Decreasing mortality from cardiovascular disease as the major competing cause of death contributes to the increasing numbers of patients with cancer.

Figure 4 plots an index (see definition in *Glossary*) of age-standardized mortality rates from 1978 to 2007 for all cancers combined and for all cancers excluding lung cancer. The different pattern in males compared to females is striking and reflects partly the different state of the lung cancer epidemic in the two sexes (tailing off in males and still having a major impact in females) and partly different mortality trends for other important cancers (10% lower than 1978 for men and 20% lower for females). The all cancer mortality trend in males largely reflects the trend in lung cancer mortality (the two lines are very close through the time period): the declining rate of cancer mortality since 1988 is predominantly due to dropping lung cancer mortality rates. In females, however, the lung cancer mortality rate is still increasing. Thus, the all cancer mortality rate that has been essentially stable since 1978 conceals the major (20%) decline that has occurred for other types of cancer over the 30 year period (the two lines diverge).

Trends for Selected Cancers

The cancers included in Figures 5.1, 5.2, 6.1 and 6.2 and Tables 7.1, 7.2, 8.1 and 8.2 are those that are most common (lung, breast, prostate, colorectal and non-Hodgkin lymphoma) plus others from Table 1 that exhibit significantly increasing or decreasing trends in their rates of at least 2% per year over the period 1994-2003 (Table 9).

Incidence rates for only 3 of the 23 cancers included in Table 1 have exhibited statistically significant annual increases of 2% or more for either males or females between 1994 and 2003 (Tables 7.1, 8.1 and 9; Figure 5.1 and 6.1): melanoma and liver cancer in males, and thyroid cancer in both sexes. During the same time period, incidence rates for 4 cancers have decreased significantly by 2% or more per year: lung cancer in males (since 1999), stomach and larynx cancers in both sexes and cervical cancer. In contrast, mortality rates have declined for almost all types of cancers (Table 9) in both sexes. Exceptions are lung cancer in females, for which the mortality rate rose significantly by 1.2% per year, and liver cancer in males (by 1.9% per year). Statistically significant drops of 2% or more annually occurred for lung, prostate, oral, stomach, larynx and testis cancers, and both non-Hodgkin and Hodgkin lymphomas in males (Tables 7.2 and 9 and Figure 5.2) and for stomach and cervical cancers in females (Tables 8.2 and 9 and Figure 6.2).

Comments about trends for specific cancers follow.

Lung cancer:

- In males, rising incidence and mortality rates began to level off in the mid-1980s and have been declining ever since. Rates have dropped significantly by 2.8% per year since 1999 for incidence and by 2.1% annually since 1994 for mortality.

TRENDS IN INCIDENCE AND MORTALITY

- In females, incidence and mortality rates have been increasing since at least 1978, and continue to do so (by 1.4% and 1.2% per year respectively since 1994; both statistically significant), resulting in a 2-3 fold increase since 1978. Incidence may be leveling off, but too recently to be reflected in projections to 2007.
- Males continue to have higher incidence and mortality rates than females.
- These patterns reflect the drop in tobacco consumption that began for males in the mid-1960s and only much later – in about the mid-1980s – for females.[6]

Breast cancer: (See Special Topic for more detailed description and interpretation)

- Breast cancer incidence rose steadily but gradually between 1978 and 1999 but has since stabilized. Much of the increase was probably due to the gradual uptake of screening, especially mammography, that took place during the 1980s and 1990s. This would result in identification of cases of breast cancer earlier than would have occurred without screening. However, changes in risk and protective factors likely have played a role also.[7,8]
- Mortality rates have been declining since the mid-1980s. The downward trend has accelerated to 1.2% per year since 1999. This is likely a result of the use of a combination of mammographic screening, and the use of adjuvant therapies following breast cancer surgery.[9,10,11] The breast cancer death rate in 2003 is the lowest it has been since 1950.[12] Similar declines have also occurred in the US, UK and Australia.[12]

Prostate cancer:

- Against a background of gradually increasing incidence rates, two peaks are evident: one in 1993 and another smaller one in 2001, each time followed by a decline. This is compatible with two waves of intensified screening activity with the PSA (prostate specific antigen) test for early prostate cancer. The first follows the introduction of PSA as a screening test; the second, which does not appear in US, may be explained by the publicity around Allan Rock's, then Canada's Minister of Health, 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; the second decline is too recent to know whether the increasing trend will return. (In the face of this uncertainty, prostate cancer incidence projections have used a conservative approach, holding incidence more or less constant. See *Appendix II: Methods*.)
- 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 etiology of prostate cancer.[13]
- In contrast to incidence, mortality rates rose much more slowly from 1978, and started to decline in the mid 1990s. Mortality declined significantly by 2.7% per year between 1994 and 2003 (Table 9), probably due to a combination of earlier detection and improved treatment.

Colorectal cancer:

- In both males and females, incidence rates were stable through the period 1994-2003. Prior to 1994, incidence had been increasing slightly in men and declining slightly in women.
- Mortality rates continue to decline in both sexes, by 1.3% and 1.7% per year in men and women, respectively; both are statistically significant and likely result from improvements in treatment, specifically chemotherapy.
- Screening for colorectal cancer can reduce both incidence and mortality.[14] Opportunistic screening has been occurring in many provinces already, which may account for some of the mortality decline. Many provinces are either considering or have recently announced establishment of colorectal cancer screening programs, for example Ontario and Manitoba.

Non-Hodgkin lymphoma:

- In both males and females, incidence rates increased by about 50% between 1978 and late 1990s. Since that time they have stabilized. Mortality rates have followed a similar pattern, although a statistically significant decline (2.2% per year) is noted for males since 1999 (Table 9).
- The reasons for the increasing incidence likely represent a combination of improved detection and classification of this complex set of diseases, and changes in risk factors. The clearest risk factor for NHL is immunosuppression (which can result from immune disorders, immunosuppressive therapy, or the human immunodeficiency virus (HIV)). Other factors that increase risk are poorly understood, but may include occupational exposures to pesticides and organochlorines such as phenoxy herbicides and dioxins.[15]

Other types of cancer:

- Incidence rates for *kidney cancer* increased significantly (by 1.0% and 1.3% per year in males and females respectively) between 1994 and 2003, although mortality rates remained stable. Increasing incidence is partly due to improved detection but may also be related to the rising prevalence of obesity, which is a strong risk factor for renal cell carcinoma, the major type of kidney cancer.[16]
- *Melanoma* incidence continues to increase, particularly in men (2.0% per year). This is likely related to more leisure time spent in the sun without adequate protection. Mortality rates are stable.
- *Thyroid cancer* incidence is increasing the most rapidly of all cancers (4.9% per year in males in 1994-2003 and 10.4% per year in females since 1997). Similar increases have been noted in Europe and parts of the United States. It is postulated that improved detection practices (ultrasound and needle biopsy) are identifying early stage cancers more frequently than was possible in the past. Mortality rates have not changed, probably because modern treatment is highly effective in the management of early thyroid cancers.
- *Larynx cancer* incidence and mortality rates are decreasing for both males and females, significantly so except mortality rates in women. Larynx cancer is associated with tobacco use.

- *Stomach cancer* continues its long-running downward trajectory in incidence and mortality rates for both males and females. This likely reflects improved diets and, more recently, the recognition and treatment of the bacterium *Helicobacter pylori.*
- For the first time, trends in *liver cancer* incidence and mortality have been examined in this publication. Rates for both are increasing rapidly in males (2.5% per year for incidence and 1.9% annually for mortality). Liver cancer incidence and mortality rates are also increasing in females, but not significantly, probably because liver cancer is rare in women (only 310 new cases and 150 deaths in 2007). Similar increases have been noted in other developed countries, and may be related to the increasing prevalence of hepatitis B and C. The extent to which the rise in incidence is related to changing patterns of immigration, whereby an increasing proportion of the population was born in countries where hepatitis B is relatively common, or to transmission of hepatitis C through the blood supply prior to screening procedures, is unknown. In the US, incidence rates appear to have stabilized since 1999.[17]
- *Cervical cancer* incidence and mortality rates have been declining for many decades, largely due to widespread regular use of Pap test screening.
- Mortality rates are very low for both *testis cancer* and *Hodgkin lymphoma*, and have declined sharply between 1994 and 2003 (although the latter not significantly so for females). In the case of testis cancer, the drop has occurred because of treatment improvements, despite a long term rise in incidence rates. The declines for Hodgkin lymphoma result from both declining incidence and improved therapy.

Implications

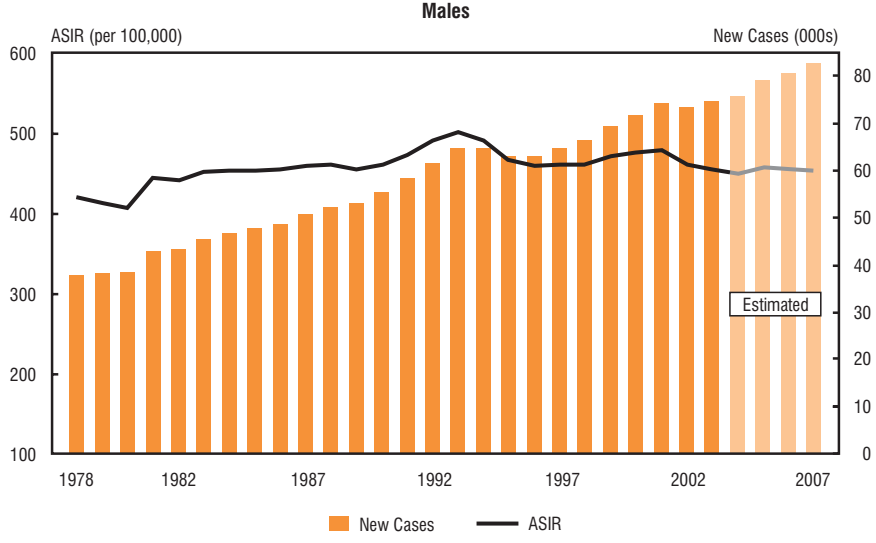
Figures 2.1 and 2.2 highlight the increasing burden that cancer will place on Canadian society, largely independently of trends in incidence and mortality rates, and show why we cannot be complacent. Figures 7.1 and 7.2 only serve to reinforce the importance of population growth and aging in determining the overall cancer burden. It is not surprising to see an increased number of new cases when we know incidence rates are rising, as for thyroid cancer. However, even when incidence rates are declining, the numbers of new cases and deaths may rise because of population growth and aging. For example, Figure 7.1 shows that despite a significant decline in the bladder cancer incidence rate for males between 1994 and 2003 (-0.6% per year, Table 9), the number of males diagnosed with bladder cancer grew by about 20% over the same period. This is even more dramatically illustrated in Fig. 7.2: despite the fact that mortality rates declined for most cancers between 1994 and 2003, the numbers of deaths increased for many of these.

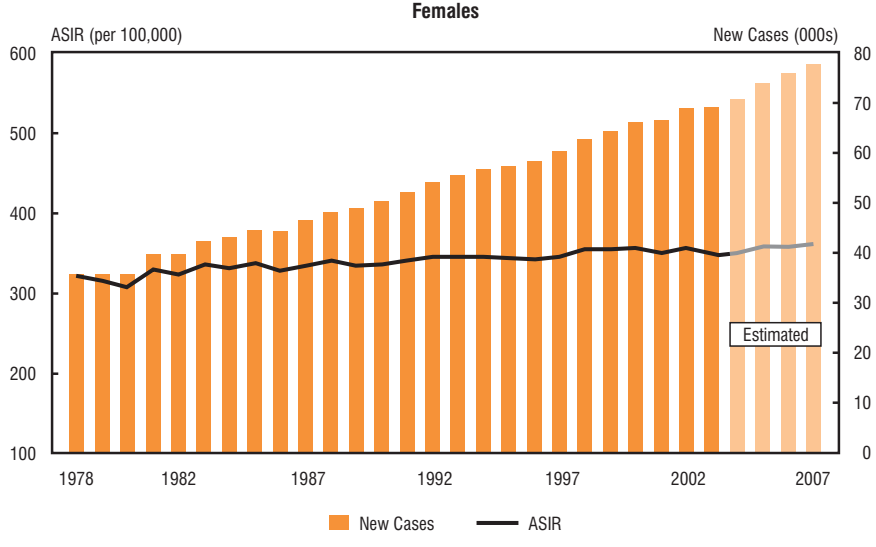
The two lessons from this underlie some key messages from Canada's national cancer control strategy: we have to plan for that part of the increasing number of cancer cases which is currently unavoidable, including enhanced capacity for adequate palliative care services, and we must do a much better job of primary prevention to reduce the number of avoidable cases of cancer.

We have to plan for that part of the increasing number of cancer cases which is unavoidable, and we must do a much better job of primary prevention of those cancers which are amenable to it.

Figure 2.1

New Cases and Age-Standardized Incidence Rates (ASIR) for All Cancers, Canada, 1978-2007



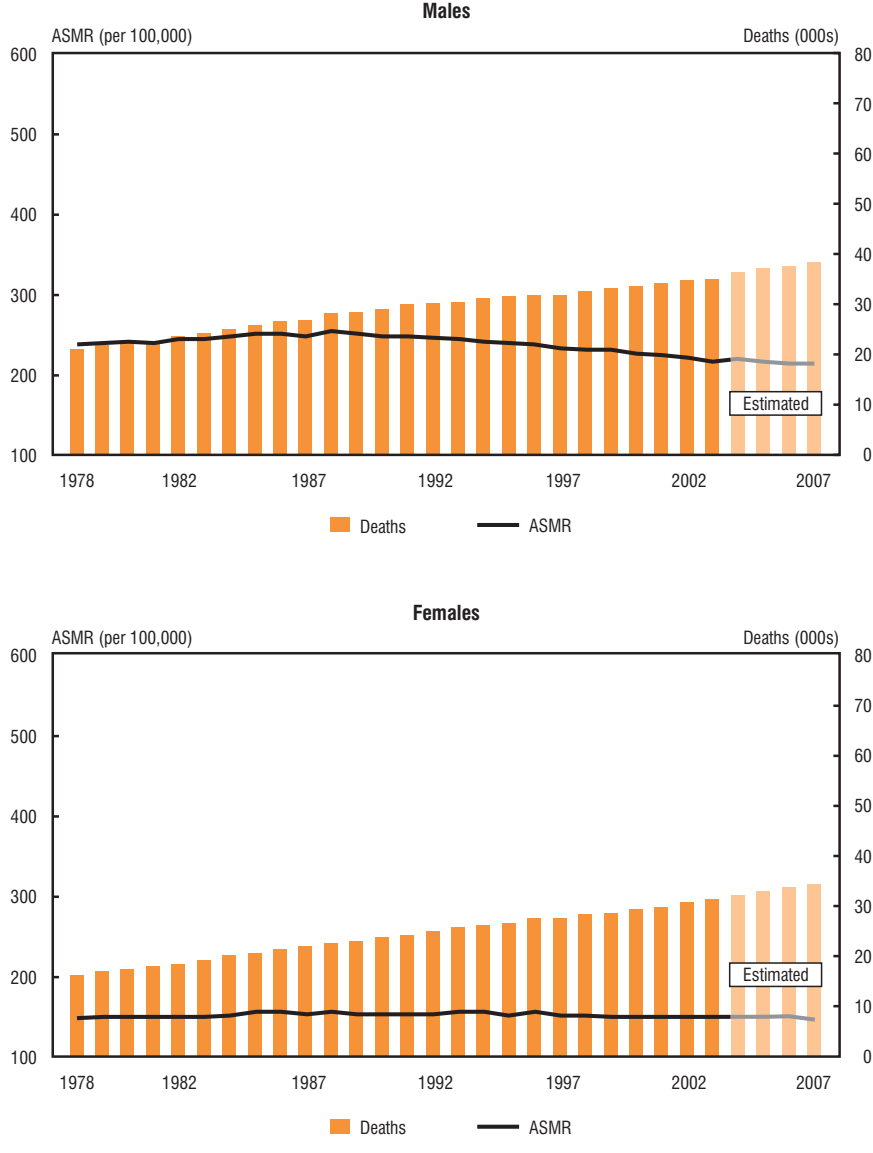


Note: All cancers exclude non-melanoma skin cancer. Rates are standardized to the 1991 Canadian population. Actual incidence data are available to 2004 except for Newfoundland and Labrador, Quebec and Ontario where 2004 incidence is estimated.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Figure 2.2

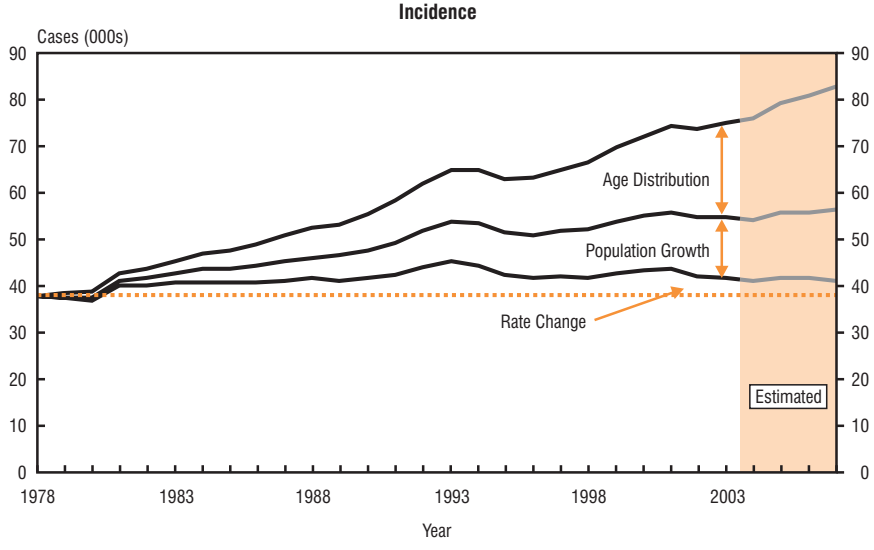
Deaths and Age-Standardized Mortality Rates (ASMR) for All Cancers, Canada, 1978-2007

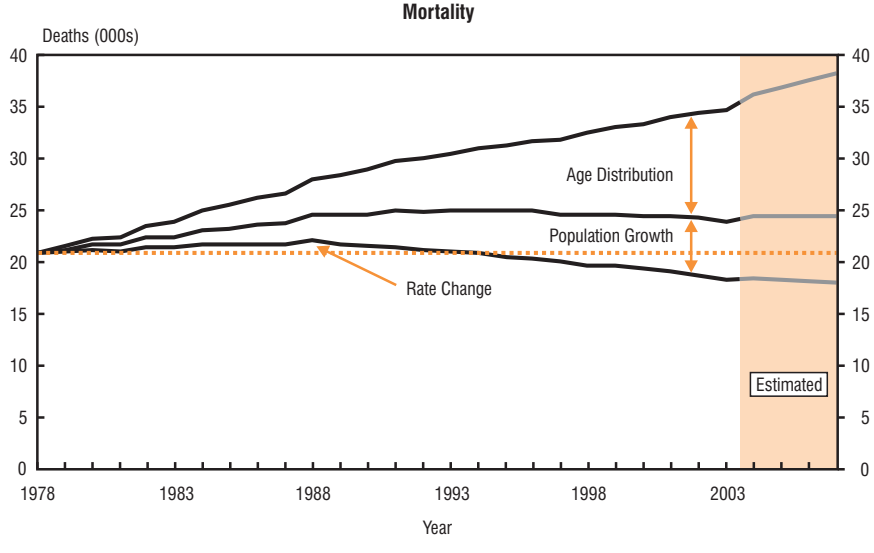


Note: Rates are standardized to the 1991 Canadian population.
Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Figure 3.1

Trends in New Cases and Deaths, Attributed to Cancer Rate, Population Growth, and Population Age Distribution, All Cancers, All Ages, Males, Canada, 1978-2007



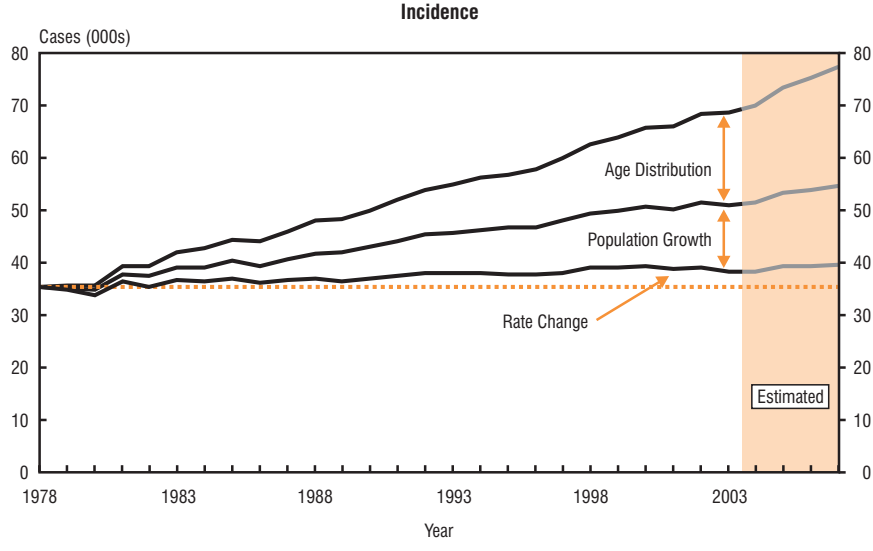


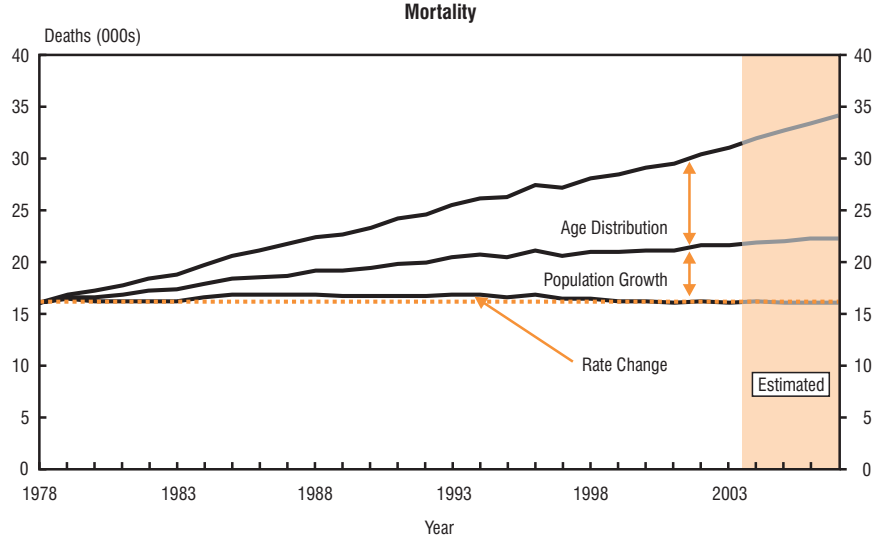
Note: Incidence figures exclude non-melanoma (basal cell and squamous cell) skin cancer. Magnitude of area represents the number of cases/deaths due to each change. Actual incidence data are available to 2004 except for Newfoundland and Labrador, Quebec and Ontario where 2004 incidence is estimated. Please refer to *Appendix II: Methods* for further details.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Figure 3.2

Trends in New Cases and Deaths, Attributed to Cancer Rate, Population Growth, and Population Age Distribution, All Cancers, All Ages, Females, Canada, 1978-2007



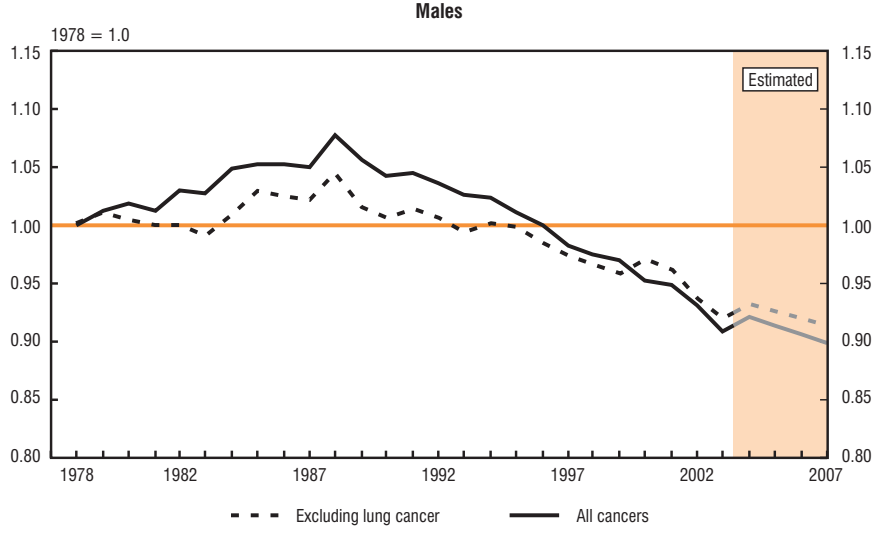


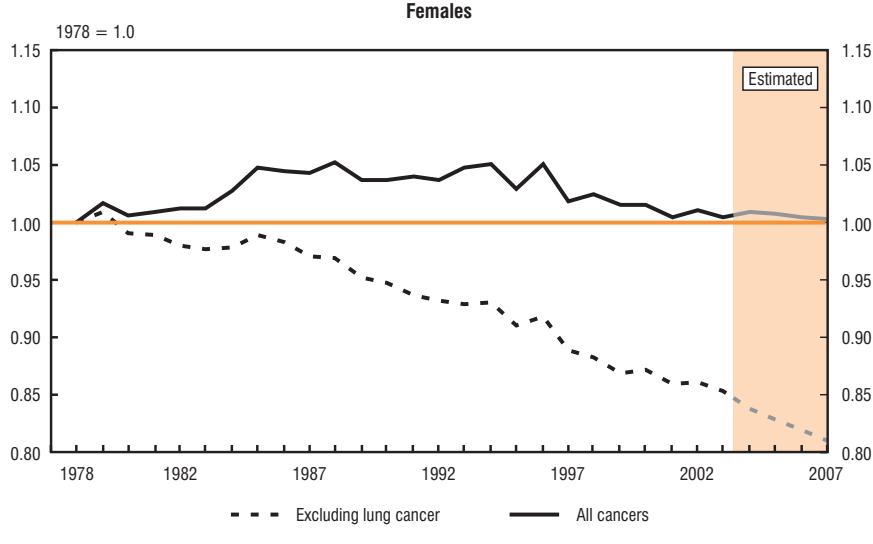
Note: Incidence figures exclude non-melanoma (basal cell and squamous cell) skin cancer. Magnitude of area represents the number of cases/deaths due to each change. Actual incidence data are available to 2004 except for Newfoundland and Labrador, Quebec and Ontario where 2004 incidence is estimated. Please refer to *Appendix II: Methods for further details*.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Figure 4

Relative Change in Age-Standardized Mortality Rates Including and Excluding Lung Cancer, Canada, 1978-2007*





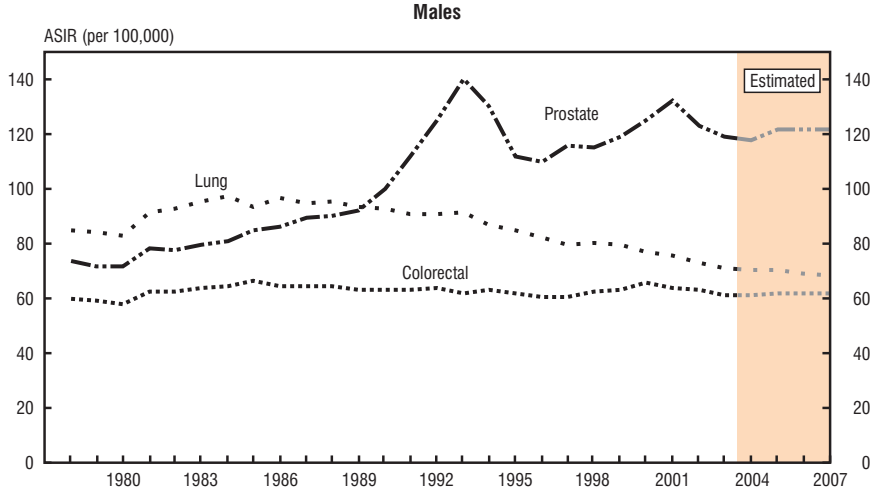
* Rates are relative to 1978 (current year divided by 1978 rate).

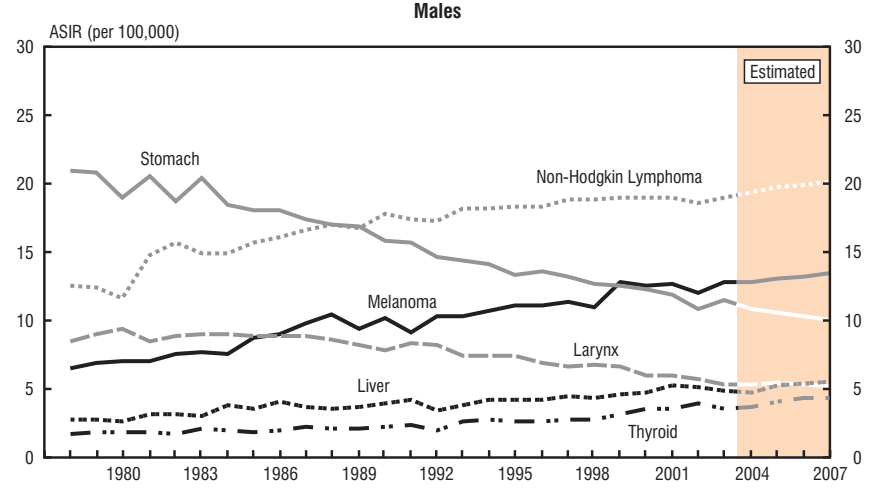
Note: Rates are standardized to the age distribution of the 1991 Canadian population. See also the *Glossary* and *Appendix II: Methods*.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Figure 5.1

Age-Standardized Incidence Rates (ASIR) for Selected Cancers, Males, Canada, 1978-2007



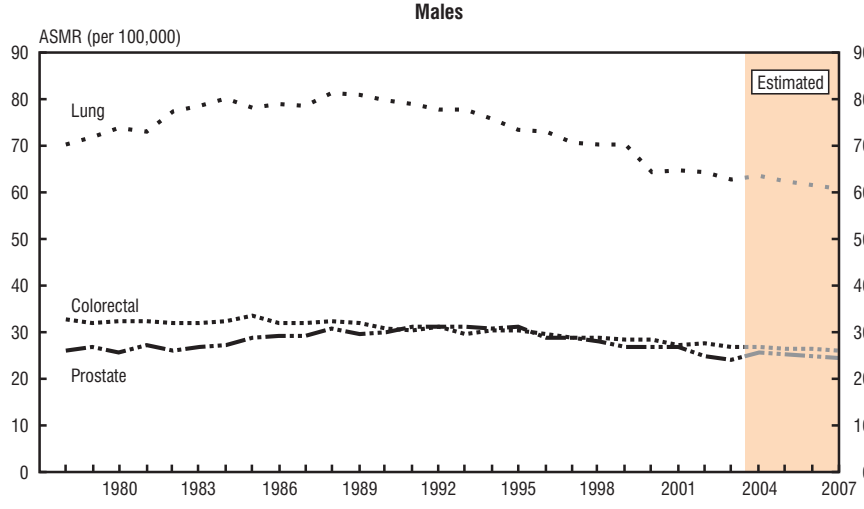


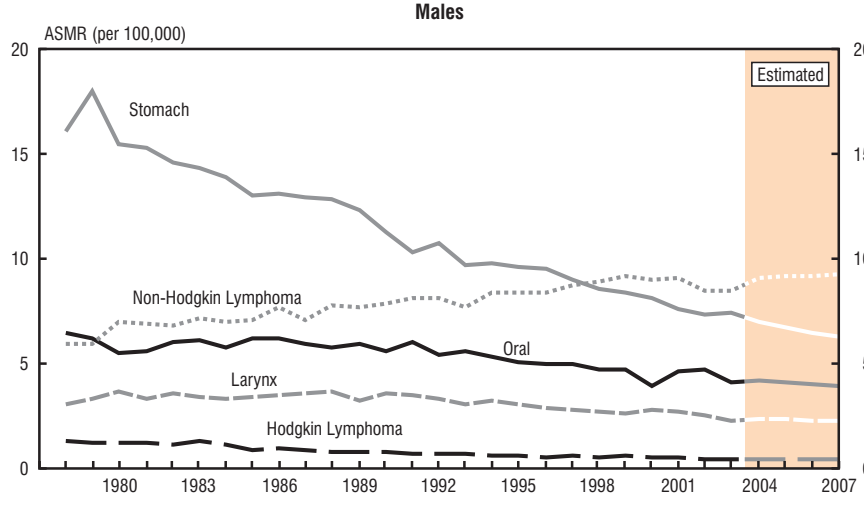
Note: Rates are standardized to the age distribution of the 1991 Canadian population. See Table 7.1 for data points. Actual incidence data are available to 2004 except for Newfoundland and Labrador, Quebec and Ontario where 2004 incidence is estimated. Please note that each graph has a different scale for the y-axis because of the wide range. Please refer to *Appendix II: Methods* for further details.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Figure 5.2

Age-Standardized Mortality Rates (ASMR) for Selected Cancers, Males, Canada, 1978-2007



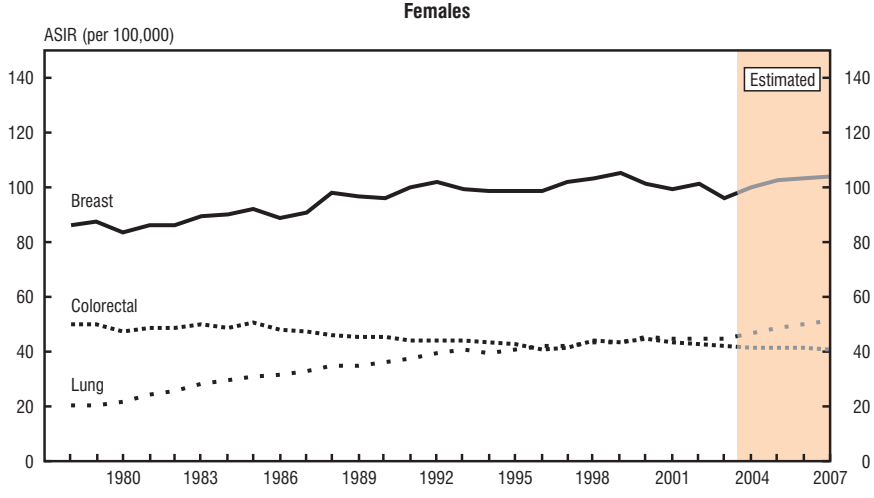


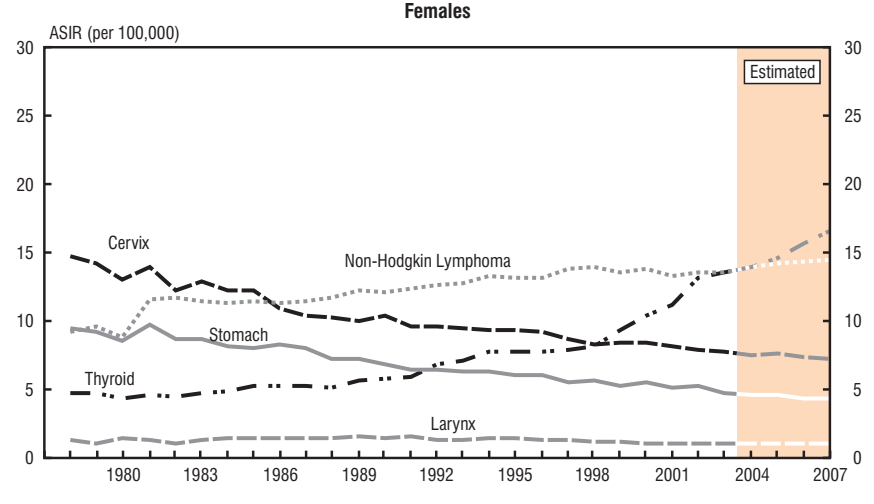
Note: Rates are standardized to the age distribution of the 1991 Canadian population. See Table 7.2 for data points. Please note that each graph has a different scale for the y-axis because of the wide range. Testis cancer is excluded because there are too few deaths (30 in 2007).

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Figure 6.1

Age-Standardized Incidence Rates (ASIR) for Selected Cancers, Females, Canada, 1978-2007



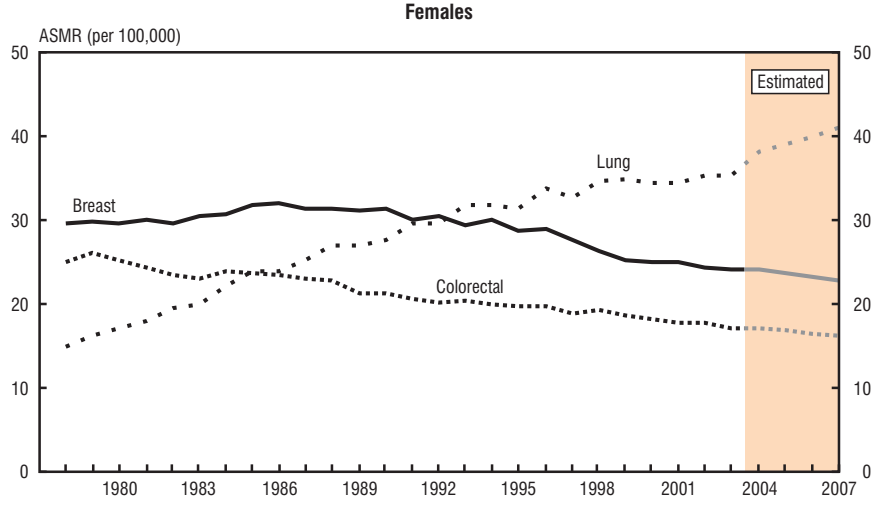


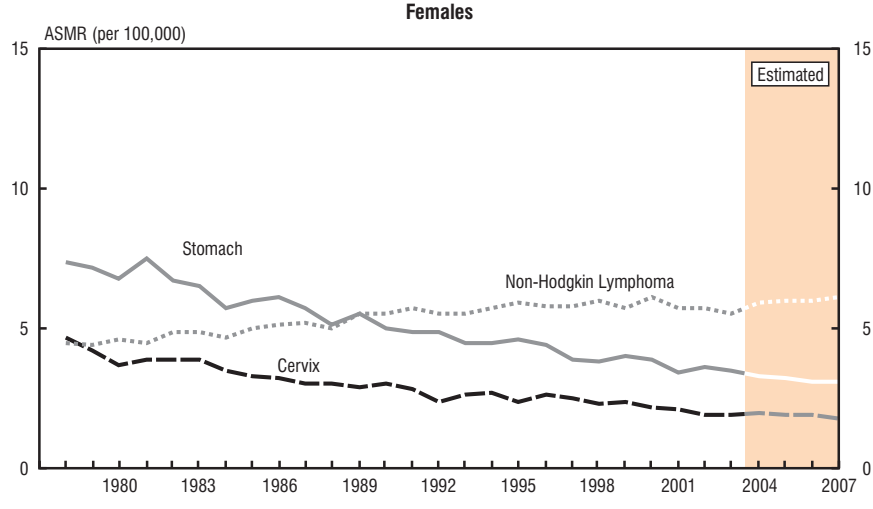
Note: Rates are standardized to the age distribution of the 1991 Canadian population. See Table 8.1 for data points. Actual incidence data are available to 2004 except for Newfoundland and Labrador, Quebec and Ontario where 2004 incidence is estimated. Please note that each graph has a different scale for the y-axis because of the wide range. Please refer to *Appendix II: Methods* for further details.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Figure 6.2

Age-Standardized Mortality Rates (ASMR) for Selected Cancers, Females, Canada, 1978-2007





Note: Rates are standardized to the age distribution of the 1991 Canadian population. See Table 8.2 for data points. Please note that each graph has a different scale for the y-axis because of the wide range.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Table 7.1

Age-Standardized Incidence Rates for Selected† Cancers, Males, Canada, 1978-2007

Year	Rate per 100,000									
	All Cancers	Lung	Prostate	Colorectal	Non-Hodgkin Lymphoma	Melanoma	Thyroid	Stomach	Liver	Larynx
1978	418.8	85.1	74.0	59.9	12.5	6.4	1.7	20.9	2.8	8.4
1979	411.1	83.9	72.0	59.2	12.4	6.8	1.8	20.8	2.8	9.0
1980	407.1	83.2	71.4	57.9	11.6	7.0	1.9	19.0	2.6	9.3
1981	442.9	91.2	78.5	62.6	14.7	7.0	1.9	20.5	3.2	8.4
1982	442.0	92.6	77.8	62.7	15.6	7.5	1.7	18.7	3.1	8.8
1983	450.3	95.2	79.6	63.9	14.9	7.6	2.1	20.4	3.0	9.0
1984	451.9	97.1	80.9	64.7	14.9	7.5	2.0	18.4	3.8	8.9
1985	451.9	93.2	85.1	66.2	15.7	8.7	1.8	18.0	3.5	8.8
1986	453.9	96.4	86.1	64.7	16.0	9.0	2.0	18.0	4.1	8.8
1987	458.7	95.0	89.6	64.7	16.6	9.7	2.2	17.4	3.7	8.8
1988	461.2	95.5	90.4	64.6	17.0	10.4	2.1	17.0	3.6	8.6
1989	454.0	93.6	91.9	63.1	16.7	9.3	2.1	16.8	3.7	8.1
1990	460.4	92.7	99.9	63.0	17.7	10.1	2.2	15.8	4.0	7.7
1991	472.0	90.7	112.3	62.9	17.4	9.1	2.4	15.6	4.2	8.3
1992	489.1	90.5	125.4	64.1	17.2	10.3	2.0	14.6	3.4	8.1
1993	502.1	91.5	140.5	61.9	18.2	10.3	2.6	14.3	3.8	7.4
1994	490.4	86.9	129.6	63.1	18.2	10.7	2.7	14.1	4.2	7.4
1995	466.1	84.6	111.7	61.6	18.3	11.1	2.6	13.3	4.2	7.4
1996	457.7	82.2	110.0	60.7	18.3	11.0	2.6	13.6	4.2	6.9
1997	460.7	79.5	115.6	60.3	18.8	11.3	2.7	13.1	4.5	6.6
1998	459.8	80.4	114.8	62.4	18.8	10.9	2.7	12.6	4.4	6.7
1999	470.6	79.5	119.3	63.4	18.9	12.7	3.2	12.5	4.6	6.6
2000	475.7	77.2	124.7	65.6	19.0	12.5	3.5	12.3	4.7	5.9
2001	477.3	75.8	132.3	64.1	19.0	12.6	3.6	11.8	5.3	5.9
2002	460.5	73.0	122.7	63.3	18.6	12.0	4.0	10.8	5.1	5.7
2003	455.5	70.9	119.1	60.9	18.9	12.7	3.6	11.5	4.9	5.3
2004**	449.3	70.4	118.5	61.5	19.4	12.7	3.7	10.8	4.8	5.3
2005*	457.1	70.4	122.3	62.1	19.7	13.0	4.1	10.5	5.3	5.4
2006*	455.4	69.2	122.3	62.1	19.9	13.2	4.3	10.3	5.4	5.2
2007*	453.6	68.1	122.3	62.0	20.1	13.4	4.4	10.0	5.5	5.1

* Estimated rates

** Estimated for Newfoundland and Labrador, Quebec and Ontario

† Five most frequent cancers (both sexes combined) and those cancers in Table 1 with a statistically significant incidence rate increase or decrease of more than 2% per year (Table 9).

Note: Rates exclude non-melanoma (basal cell and squamous cell) skin cancer and are standardized to the age distribution of the 1991 Canadian population.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Table 7.2

Age-Standardized Mortality Rates for Selected† Cancers, Males, Canada, 1978-2007

Year	Rate per 100,000								
	All Cancers	Lung	Prostate	Colorectal	Non-Hodgkin Lymphoma	Oral	Stomach	Larynx	Hodgkin Lymphoma
1978	236.4	70.1	26.1	32.9	5.9	6.5	16.1	3.1	1.3
1979	239.4	71.7	26.7	31.8	5.9	6.2	18.0	3.3	1.2
1980	240.7	74.0	25.8	32.3	7.0	5.5	15.5	3.7	1.2
1981	239.2	73.2	27.1	32.2	6.9	5.6	15.3	3.3	1.2
1982	243.5	77.4	26.0	31.9	6.8	6.0	14.6	3.6	1.1
1983	242.9	78.4	26.7	31.8	7.2	6.1	14.3	3.4	1.3
1984	247.9	80.2	27.4	32.4	7.0	5.8	13.9	3.3	1.1
1985	249.0	78.0	28.9	33.4	7.1	6.2	13.0	3.4	0.9
1986	249.0	79.0	29.4	32.0	7.7	6.2	13.1	3.5	1.0
1987	248.2	78.6	29.4	32.0	7.1	5.9	12.9	3.6	0.9
1988	254.8	81.3	30.7	32.4	7.8	5.8	12.8	3.7	0.8
1989	249.6	81.1	29.7	31.9	7.7	5.9	12.3	3.2	0.8
1990	246.5	79.6	30.1	30.9	7.9	5.6	11.3	3.6	0.8
1991	247.2	78.8	31.2	30.4	8.1	6.0	10.3	3.5	0.7
1992	244.7	77.6	31.0	31.1	8.1	5.4	10.7	3.3	0.7
1993	242.8	77.9	31.1	29.7	7.7	5.6	9.7	3.1	0.7
1994	241.8	75.6	30.7	30.3	8.4	5.3	9.8	3.2	0.6
1995	239.0	73.3	31.0	30.2	8.4	5.1	9.6	3.1	0.6
1996	236.5	73.0	29.0	29.5	8.4	5.0	9.5	2.9	0.5
1997	232.3	70.6	28.7	29.0	8.7	5.0	9.0	2.8	0.6
1998	230.5	70.3	28.0	28.9	8.9	4.7	8.6	2.7	0.5
1999	229.4	70.4	26.9	28.5	9.2	4.7	8.4	2.6	0.6
2000	225.4	64.4	26.8	28.5	9.0	3.9	8.1	2.8	0.5
2001	224.0	64.6	26.7	27.1	9.1	4.6	7.6	2.7	0.5
2002	219.9	64.5	25.0	27.7	8.5	4.7	7.3	2.5	0.4
2003	215.1	62.7	23.9	26.8	8.5	4.1	7.4	2.3	0.4
2004*	217.9	63.4	25.5	26.9	9.1	4.2	7.0	2.4	0.4
2005*	216.1	62.5	25.2	26.6	9.2	4.1	6.7	2.4	0.4
2006*	214.2	61.6	24.8	26.4	9.2	4.0	6.5	2.3	0.4
2007*	212.4	60.8	24.5	26.1	9.3	3.9	6.3	2.3	0.4

* Estimated rates

† Five most frequent cancers (both sexes combined) and those cancers in Table 1 with a statistically significant incidence rate increase or decrease of more than 2% per year (Table 9) except testis cancer, which has too few deaths (30 in 2007).

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

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Table 8.1

Age-Standardized Incidence Rates for Selected† Cancers, Females, Canada, 1978-2007

Year	Rate per 100,000								
	All Cancers	Lung	Breast	Colorectal	Non-Hodgkin Lymphoma	Thyroid	Stomach	Cervix	Larynx
1978	319.7	20.1	86.1	50.2	9.2	4.8	9.5	14.7	1.3
1979	314.1	20.3	87.3	49.7	9.6	4.7	9.2	14.2	1.1
1980	305.8	21.7	83.3	47.4	8.8	4.4	8.6	13.0	1.4
1981	328.3	24.3	86.5	48.6	11.6	4.6	9.8	13.9	1.3
1982	321.3	25.9	86.0	48.9	11.7	4.5	8.7	12.3	1.1
1983	333.2	28.3	89.3	50.2	11.5	4.8	8.7	12.9	1.3
1984	329.9	29.6	90.4	48.9	11.3	4.9	8.1	12.2	1.4
1985	336.1	30.9	92.2	50.6	11.4	5.3	8.0	12.3	1.5
1986	325.5	31.7	88.6	48.2	11.3	5.2	8.3	10.9	1.4
1987	331.4	33.2	91.1	47.6	11.5	5.2	8.0	10.4	1.5
1988	336.8	34.8	97.8	46.1	11.7	5.1	7.2	10.2	1.5
1989	330.7	35.0	96.4	45.3	12.2	5.6	7.2	10.0	1.6
1990	333.9	36.5	96.0	45.7	12.1	5.8	6.9	10.4	1.4
1991	337.7	37.7	100.1	44.1	12.4	5.9	6.4	9.6	1.6
1992	343.3	39.7	101.9	44.2	12.6	6.9	6.5	9.6	1.3
1993	342.9	40.7	99.1	44.2	12.7	7.1	6.3	9.5	1.3
1994	343.3	39.8	98.9	43.6	13.3	7.7	6.3	9.4	1.4
1995	341.6	40.8	98.9	42.5	13.1	7.7	6.0	9.3	1.4
1996	339.5	42.0	98.6	41.1	13.1	7.8	6.0	9.2	1.3
1997	343.6	42.0	102.1	41.6	13.8	7.9	5.5	8.7	1.3
1998	351.4	43.7	103.2	43.9	14.0	8.2	5.6	8.3	1.2
1999	352.1	43.6	105.1	43.2	13.5	9.4	5.3	8.4	1.2
2000	354.2	45.1	101.6	44.5	13.8	10.4	5.5	8.4	1.1
2001	348.7	44.6	99.6	43.2	13.3	11.2	5.1	8.2	1.1
2002	354.2	45.0	101.5	43.0	13.5	13.2	5.2	7.9	1.1
2003	346.6	44.9	95.9	42.2	13.6	13.6	4.8	7.7	1.1
2004**	347.3	46.7	100.1	41.4	13.9	14.0	4.6	7.5	1.0
2005*	355.4	48.2	103.0	41.4	14.2	14.5	4.6	7.6	1.1
2006*	356.7	49.1	103.5	41.2	14.4	15.5	4.5	7.4	1.1
2007*	358.1	50.0	104.0	41.0	14.5	16.5	4.4	7.3	1.0

* Estimated rates

** Estimated for Newfoundland and Labrador, Quebec, and Ontario

† Five most frequent cancers (both sexes combined) and those cancers in Table 1 with a statistically significant incidence rate increase or decrease of more than 2% per year (Table 9).

Note: Rates exclude non-melanoma (basal cell and squamous cell) skin cancer and are standardized to the age distribution of the 1991 Canadian population.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Table 8.2

Age-Standardized Mortality Rates for Selected† Cancers, Females, Canada, 1978-2007

Year	Rate per 100,000						
	All Cancers	Lung	Breast	Colorectal	Non-Hodgkin Lymphoma	Stomach	Cervix
1978	147.6	15.0	29.5	25.1	4.5	7.4	4.7
1979	150.2	16.3	29.8	26.1	4.4	7.2	4.2
1980	148.5	17.1	29.7	25.3	4.6	6.8	3.7
1981	149.0	17.9	30.1	24.4	4.5	7.5	3.9
1982	149.3	19.6	29.7	23.5	4.9	6.7	3.9
1983	149.4	19.9	30.4	23.1	4.9	6.5	3.9
1984	151.9	22.2	30.7	23.8	4.7	5.7	3.5
1985	154.8	23.8	31.8	23.7	5.0	6.0	3.3
1986	154.4	24.0	32.0	23.5	5.1	6.1	3.2
1987	154.0	25.3	31.3	23.0	5.2	5.7	3.0
1988	155.4	26.9	31.4	22.7	5.0	5.1	3.0
1989	153.1	27.0	31.2	21.3	5.5	5.5	2.9
1990	153.1	27.6	31.3	21.3	5.5	5.0	3.0
1991	153.5	29.5	30.1	20.7	5.7	4.9	2.8
1992	153.1	29.6	30.4	20.2	5.5	4.9	2.4
1993	154.8	31.7	29.4	20.3	5.5	4.5	2.6
1994	155.1	31.9	30.0	19.9	5.7	4.5	2.7
1995	152.0	31.4	28.7	19.8	5.9	4.6	2.4
1996	155.2	33.7	28.9	19.7	5.8	4.4	2.6
1997	150.3	32.7	27.7	18.8	5.8	3.9	2.5
1998	151.3	34.6	26.4	19.3	6.0	3.8	2.3
1999	149.8	34.9	25.2	18.6	5.7	4.0	2.4
2000	149.8	34.4	25.1	18.2	6.1	3.9	2.2
2001	148.2	34.4	25.0	17.8	5.7	3.4	2.1
2002	149.3	35.3	24.4	17.7	5.7	3.6	1.9
2003	148.2	35.4	24.1	17.1	5.5	3.5	1.9
2004*	148.9	37.7	24.1	17.0	5.9	3.3	2.0
2005*	148.7	38.5	23.7	16.8	6.0	3.3	1.9
2006*	148.4	39.3	23.3	16.5	6.0	3.2	1.9
2007*	148.1	40.2	22.9	16.3	6.1	3.1	1.8

* Estimated rates

† Five most frequent cancers (both sexes combined) and those cancers in Table 1 with a statistically significant incidence rate increase or decrease of more than 2% per year (Table 9).

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

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Table 9

Average Annual Percent Change (AAPC) in Age-Standardized Incidence Rates and Mortality Rates 1994-2003 for Selected Cancers, Canada

	Incidence 1994-2003				Mortality 1994-2003			
	Males		Females		Males		Females	
	AAPC	Change-point†	AAPC	Change-point†	AAPC	Change-point†	AAPC	Change-point†
All Cancers	**0.1**	**1996**	**0.3***		**-1.2****		**-0.5****	
Lung	-2.8**	1999	1.4**		-2.1**		1.2**	
Breast	–		-1.8	1999	–		-1.2*	1999
Prostate	1.6	1996	–		-2.7**		–	
Colorectal	0.3		-0.8	1999	-1.3**		-1.7**	
Non-Hodgkin Lymphoma	0.0	1997	-0.6	1998	-2.2*	1999	-1.4	1998
Bladder	-0.6*		-0.3		-0.4		-0.6	
Kidney	1.0**		1.3*		-0.3		-0.6	
Melanoma	2.0**		1.1**		0.4		-0.6	
Leukemia	0.2		0.0		-0.6		-0.9	
Body of Uterus	–		0.3		–		-0.2	
Thyroid	4.9**		10.4**	1997	0.8		-1.4	
Pancreas	-0.7*		-0.3		-0.8*		-0.5	
Oral	-1.5*	1997	-0.4		-2.5**		-0.9	
Stomach	-2.5**		-2.7**		-3.5**		-3.2**	
Brain	-0.5		-2.3	1999	-0.8*		-0.6	
Ovary	–		-0.6		–		-0.5	
Multiple Myeloma	-0.1		0.1		-1.6**		-0.2	
Esophagus	0.3		-1.3*		0.4		-0.4	
Liver	2.5**		1.4		1.9*		2.3	1995
Cervix	–		-2.2**		–		-3.6**	
Larynx	-3.6**		-3.4**		-2.9**		-2.4	
Hodgkin Lymphoma	-0.6		-0.3		-4.8**		-2.8	
Testis	1.3		–		-5.8**		–	

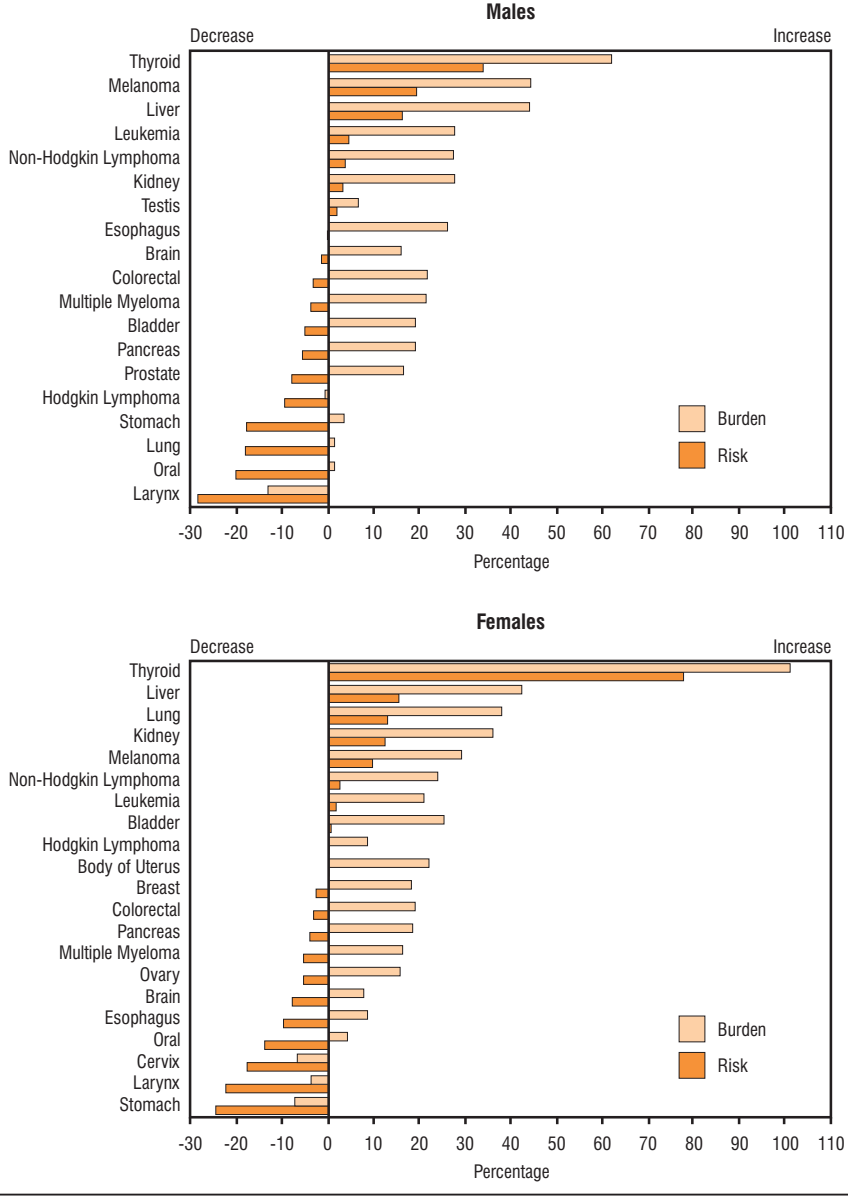
– Not applicable
* Significant at p=0.05
** Significant at p=0.01
† Changepoint indicates the baseline year, if the slope of the trend changed after 1994. Please refer to *Appendix II: Methods* for further details.

Note: Average Annual Percent Change is calculated assuming a log linear model; incidence rates exclude non-melanoma (basal cell and squamous cell) skin cancer. Changepoints were fit to rates from 1986 to 2003.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Figure 7.1

Percent Change in Cancer Incidence Burden (total number of new cases) and Risk (age-standardized incidence rates), for Selected Cancers, Canada, between 1994 and 2003

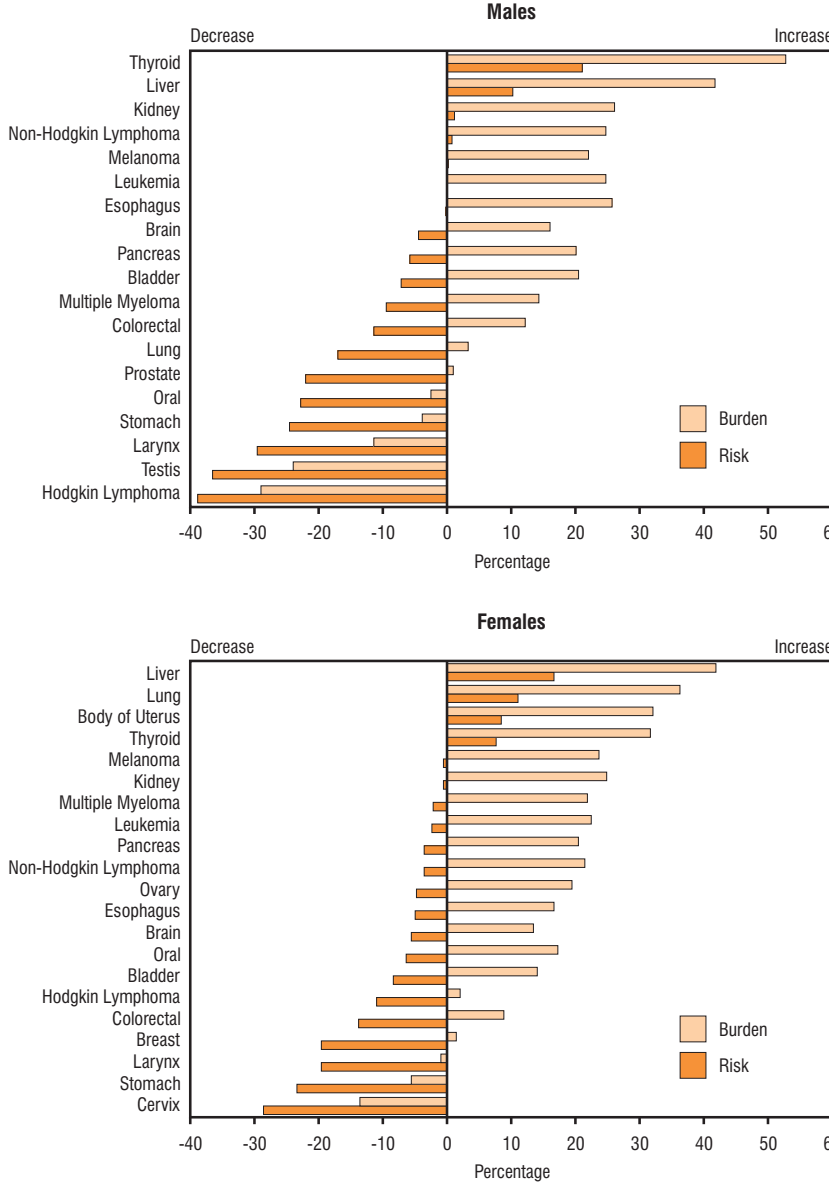


Note: See Table 9 for average annual percent change for all cancers. Sites are ranked in decreasing order of percent change of rates.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Figure 7.2

Percent Change in Cancer Mortality Burden (total number of deaths) and Risk of Death (age-standardized mortality rates), for Selected Cancers, Canada, between 1994 and 2003



Note: See Table 9 for average annual percent change for all cancers. Sites are ranked in decreasing order of percent change of rates.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

AGE AND SEX DISTRIBUTION OF CANCER

Cancer is primarily a disease of older Canadians. The estimates for 2007 shown in Table 10 indicate that 70,000 new cases (44%) and 44,000 cancer deaths (60%) will occur in Canadians aged 70 years or more, while an additional 41,000 new cases (25%) and 16,000 deaths (22%) will occur in those aged 60-69. In contrast, less than 1% of new cases and deaths occur prior to age 20. The median age at cancer diagnosis is between 65 and 69 years of age and at death between 70 and 74 for both sexes.

It is important to note though, that 48,000 new cases (30%) and 13,000 deaths (18%) will occur between ages 20 and 59. These are the most productive years for employment and raising families. As well, increasing numbers of those over 65 continue to work and made up over 2% of the work force in the 2001 census.[18] Cancer therefore has an enormous potential impact on the social fabric and economy of Canada.

Figure 8 displays age-specific rates of cancer incidence and mortality by 5-year age groups for 2003, the most recent year for which complete data are available. Cancer incidence and mortality rates increase substantially with age in both sexes. Cancer incidence rates are higher for men than women, except between the ages of 15 and 54; mortality rates for men are higher except between ages 25 to 54. The male excess is particularly great at older ages.

The age and sex distributions for the most common cancers in Canadians are presented in Table 11. More than half of all newly diagnosed lung and colorectal cancers and 47% of prostate cancers will occur among Canadians aged 70 or more. In contrast, only 29% of breast cancers are diagnosed at age 70 or later, while 20% occur in women under age 50. It is notable that although the largest number of new cases of breast cancer is estimated to occur between age 50 and 59, more deaths from breast cancer will occur in the over-80 age group, reflecting the benefits of screening and treatment in middle-aged women (see *Special Topic*). Likewise, the majority of cases of prostate cancer occur in men between 60 and 79, but more prostate cancer deaths occur in the 80+ age group. This pattern likely reflects the effect of screening in the younger men and the long natural history of the disease in many.

Trends in age-standardized incidence and mortality rates for all cancers are shown for eight age groups in Figure 9 (Note that each age group has a different scale for the y axis because of the wide range in age-specific rates). The female excess for both incidence and mortality in the age groups 20-29, 30-39, and 40-49 is particularly obvious. This is largely due to breast cancer, which is the most common cancer and cancer cause of death in women in these age groups, accounting for nearly 40% of diagnoses and 25% of deaths.

By breaking down the broader age groups described in previous publications, some other new striking observations emerge (Figure 9). There is a clear-cut increasing incidence in overall cancers in both sexes ages 20-29 over the entire time period for males and more recently since the late 1980's for females. This may be ascribed to the increasing incidence of non-Hodgkin lymphoma, thyroid and kidney cancer in females, and non-Hodgkin lymphoma, melanoma, testis and thyroid cancer in males.[19] In ages 30-39, the female incidence rate is rising while male incidence has been dropping over the 1990s, in part due to the declining incidence of Kaposi's sarcoma and lung cancer. The latter is likely due to the long-term decline in smoking among young men. Incidence rates remain stable over time for the 40-49 year age group, but rise for females in all the older age groups and males until age 70. After age 70 in males, the incidence rate has been dropping primarily due to decreasing lung cancer

occurrence. The impact of increased use of the prostate-specific antigen (PSA) test to identify early prostate cancers in the late 1980s and early 1990s is clearly evident for men 60 and over (see *Trends in incidence and mortality*). This is seen in the first peak in the graphs in Figure 9. The second peak around 2000 is probably due to increased PSA testing as well. Cancer is more common among males compared to females in youth under 20 and adults over 60. 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 incidence according to sex in ages 20-59.

Mortality rates have been dropping for both sexes for ages up to 70. After that, mortality has been increasing in females, while falling for males over 69. This is thought to reflect the long-term decline in smoking in males and its effect on lung cancer.

From 1994-2003, mortality rates have dropped significantly in all 10 year age groups for men over age 30 by about 2% per year. In females, significant declines are also observed in ages 0-19 (3% per year), 30-49 (>2% per year) and, to a lesser but statistically significant extent, 50-69.

Cancer is primarily a disease of older Canadians. Notable declines in mortality have occurred in most age groups.

Table 10

Distribution for All Cancers Combined by Age Group and Sex, Canada, 2007

Age Group	Population (000s) 2007 Estimates			New Cases 2007 Estimates			Deaths 2007 Estimates		
	Total	M	F	Total	M	F	Total	M	F
0-19	7,757	3,973	3,784	1,300	700	580	180	100	80
20-29	4,509	2,292	2,217	1,850	850	1,000	230	120	110
30-39	4,585	2,310	2,275	4,300	1,550	2,800	710	300	410
40-49	5,335	2,675	2,660	12,800	4,500	8,300	3,200	1,350	1,800
50-59	4,539	2,244	2,296	28,800	13,300	15,500	8,900	4,400	4,500
60-69	2,969	1,446	1,523	40,700	23,500	17,200	15,700	8,800	6,900
70-79	1,936	886	1,050	41,400	24,300	17,100	21,600	12,300	9,200
80+	1,192	426	766	28,800	14,000	14,800	22,300	10,900	11,400
All Ages	**32,822**	**16,251**	**16,571**	**159,900**	**82,700**	**77,200**	**72,700**	**38,400**	**34,300**

Note: Incidence figures exclude non-melanoma (basal cell and squamous cell) skin cancer. Total of rounded numbers may not equal rounded total number. Please refer to *Appendix II: Methods* for further details. 2007 population projections were provided by the Census and Demographics Branch, Statistics Canada.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Table 11

Distribution by Selected Cancers, Age Group and Sex, Canada, 2007

Age Group	Lung			Colorectal			Prostate	Breast
	Total	M	F	Total	M	F	M	F
New Cases								
0-19	10	5	5	10	5	5	–	5
20-29	25	15	10	40	20	20	–	70
30-39	120	50	70	210	110	100	5	840
40-49	1,050	410	660	1,050	550	520	340	3,500
50-59	3,500	1,650	1,800	3,200	1,850	1,350	3,500	6,200
60-69	6,700	3,600	3,100	5,200	3,200	1,950	8,000	5,300
70-79	7,600	4,300	3,200	6,100	3,500	2,600	7,000	3,800
80+	4,400	2,300	2,100	5,000	2,200	2,900	3,400	2,600
All Ages	**23,300**	**12,400**	**10,900**	**20,800**	**11,400**	**9,400**	**22,300**	**22,300**
Deaths								
0-19	–	–	–	10	–	10	–	–
20-29	5	5	5	10	5	5	–	5
30-39	65	25	40	55	25	25	–	110
40-49	730	300	430	290	160	130	15	460
50-59	2,500	1,300	1,250	960	560	400	130	950
60-69	5,300	3,000	2,300	1,750	1,100	630	530	1,000
70-79	6,700	3,900	2,800	2,500	1,500	1,000	1,350	1,150
80+	4,600	2,500	2,100	3,200	1,350	1,800	2,300	1,650
All Ages	**19,900**	**11,000**	**8,900**	**8,700**	**4,700**	**4,000**	**4,300**	**5,300**

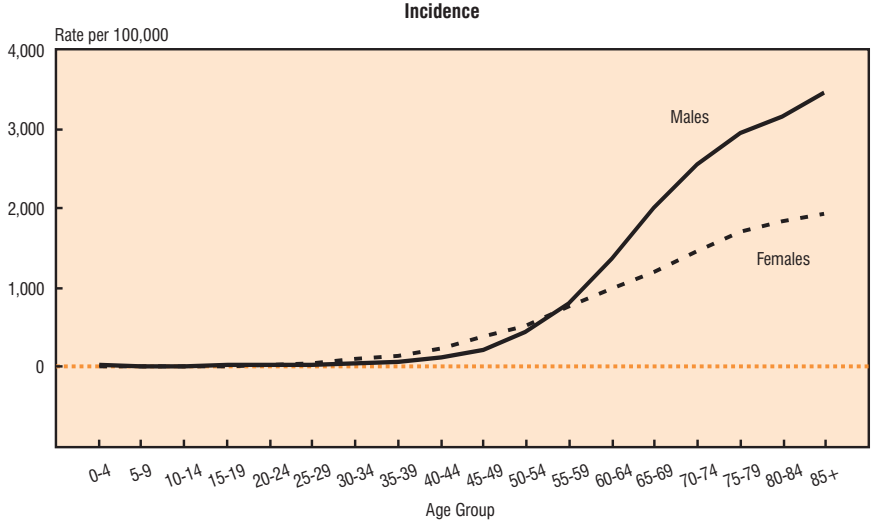
– Fewer than 3 cases or deaths.

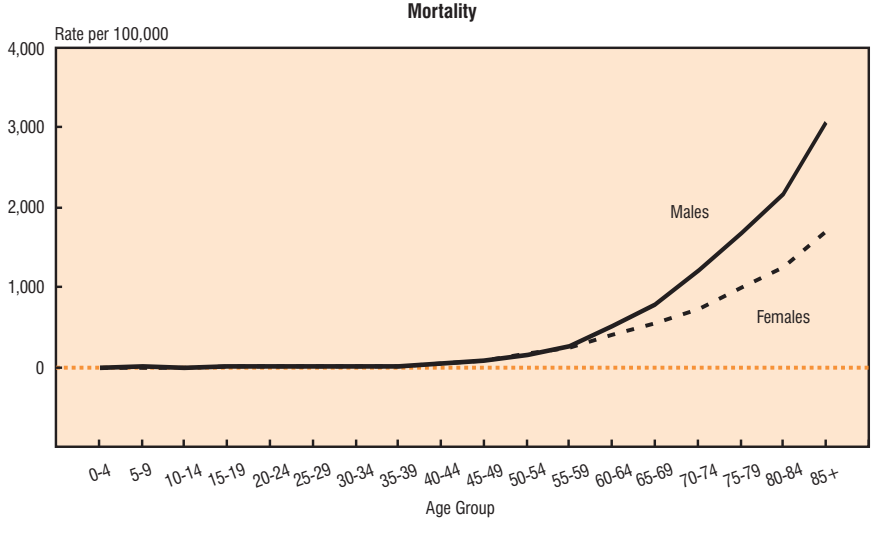
Note: Figures exclude non-melanoma (basal cell and squamous cell) skin cancer. Total of rounded numbers may not equal rounded total number. Please refer to *Appendix II: Methods* for further details.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Figure 8

Age-Specific Incidence and Mortality Rates for All Cancers by Sex, Canada, 2003

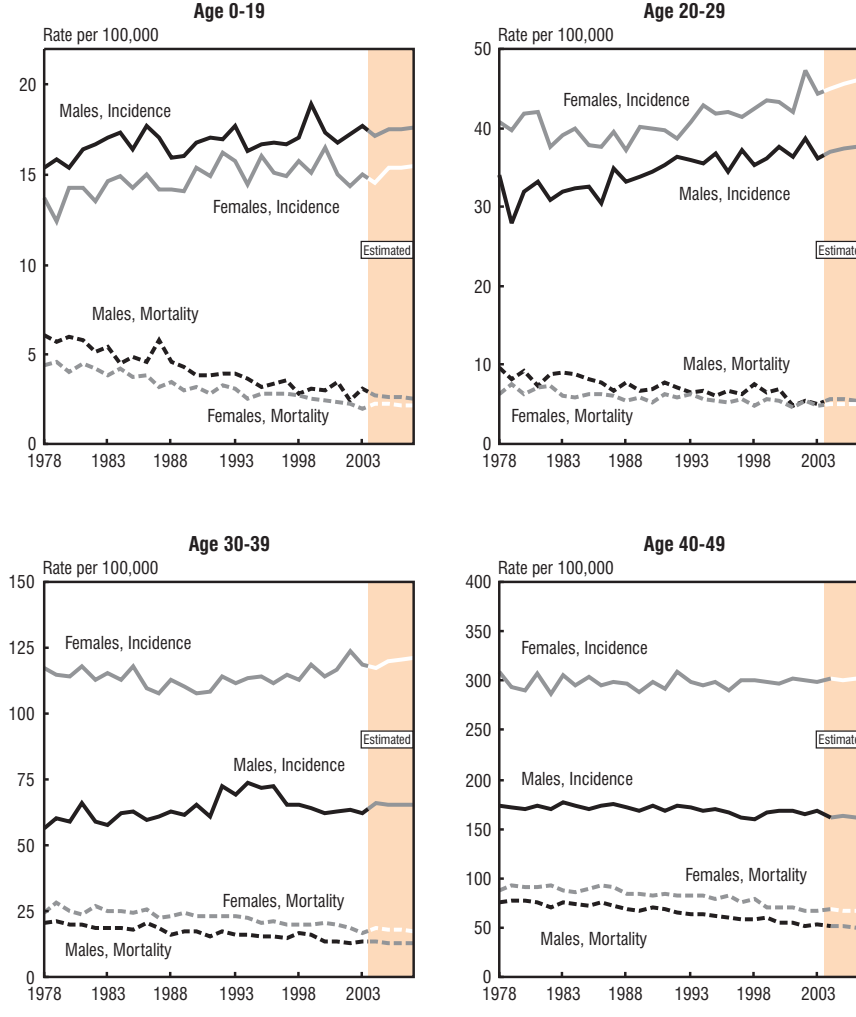




Note: Incidence rates exclude non-melanoma (basal cell and squamous cell) skin cancer.
Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Figure 9

Age-Standardized Incidence and Mortality Rates by Age Group, All Cancers, Canada, 1978-2007

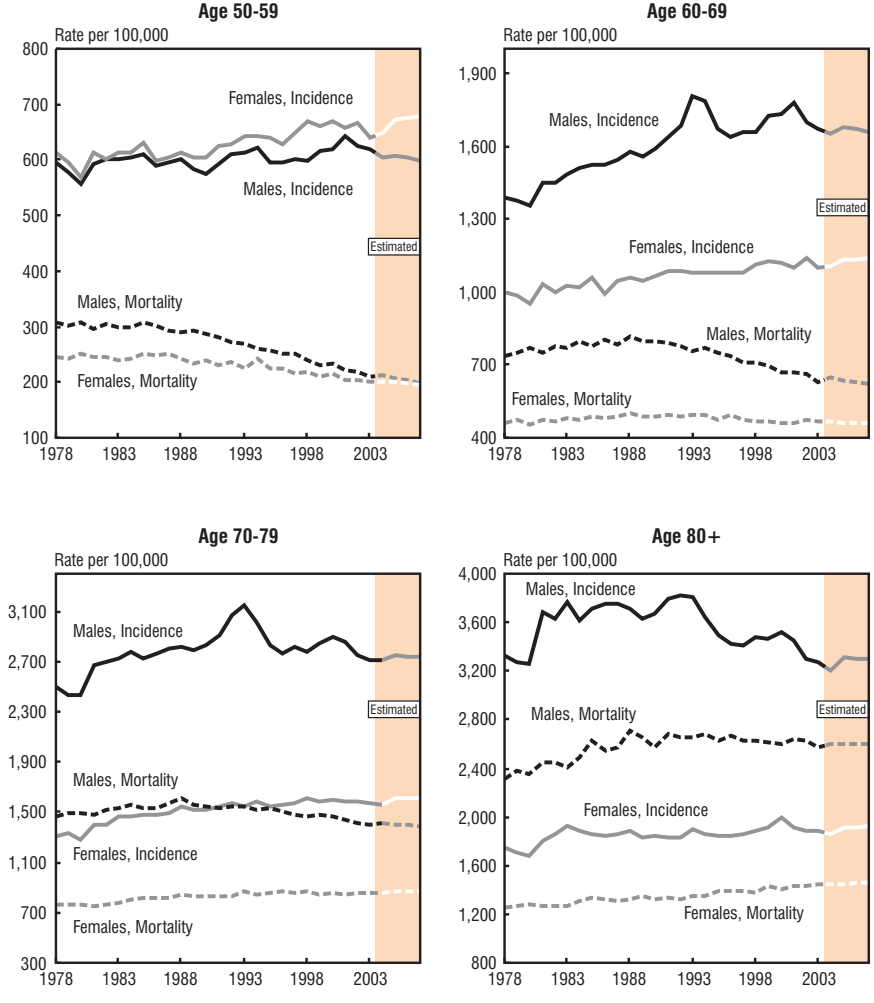


Note: The range of rate scales differ widely between the four age groups. Incidence figures exclude non-melanoma (basal cell and squamous cell) skin cancer. Actual incidence data are available to 2004 except for Newfoundland and Labrador, Quebec and Ontario where 2004 incidence is estimated.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Figure 9 *(continued)*

Age-Standardized Incidence and Mortality Rates by Age Group, All Cancers, Canada, 1978-2007



Note: The range of rate scales differ widely between the four age groups. Incidence figures exclude non-melanoma (basal cell and squamous cell) skin cancer. Actual incidence data are available to 2004 except for Newfoundland and Labrador, Quebec and Ontario where 2004 incidence is estimated.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

PROBABILITY OF DEVELOPING/DYING FROM CANCER

Table 12 presents the probability (expressed as a percentage) of Canadians developing the more common cancers within specific decades of age, as well as the lifetime probability of developing, or dying from, one of these cancers.

The calculation of these probabilities models the occurrence of cancer in a hypothetical cohort. For example, if a cohort of 1,000 women of age 50 is followed until the end of age 59, 62 of them, or 6 % (1 in 16), will develop some type of cancer within this 10-year period; this percentage therefore describes, for a 50-year-old woman, the risk of developing some type of cancer before age 60. Similarly, a 60-year-old man has a 15% (1 in 7) chance of developing some type of cancer before age 70. For the lifetime probability of developing cancer, the data are presented both as the probability of developing cancer expressed as a percentage and as the inverse of that probability. For example, men have a lifetime probability of 0.44 (44%) of developing cancer, and the inverse of that probability is 1 in 2.3. Thus, approximately 2 of every 5 men are expected to develop cancer of some type during their life. Similarly, 1 in 2.6 women (slightly more than 1 of every 3 women) will develop cancer during their life. One in 3.5 men and 1 in 4.2 women, or approximately 1 in 4 of all Canadians, will die of cancer.

During their lifetimes, 1 in 9 women are expected to develop breast cancer, the most common cancer (excluding non-melanoma skin cancer) to afflict women, and 1 in 27 women are expected to die from it. One in 16 women will develop colorectal cancer, but only 1 in 32 will die from it. One in 16 will develop lung cancer, and 1 in 19 will die from this disease, making it the most likely cause of cancer death in Canadian women. Over their lifetimes, 1 in 8 men will develop prostate cancer, but only 1 in 27 will die from it. One in 12 men will develop lung cancer, and 1 in 12 will die from this condition. Lung cancer is thus by far the leading cause of cancer deaths in Canadian men.

The probability of developing cancer within the next 10 years gives a useful indication of the short-term risk of cancer. Although the lifetime risk of developing breast cancer is 11% (1 in 9), and although the risk increases with age, the chance of a 60-year-old woman developing breast cancer before age 70 is only 3% (1 in 33); this figure may be more meaningful than the lifetime probability statistic for a 60-year-old woman contemplating her risk of breast cancer. Table 12 shows how steeply the risk of developing prostate cancer rises with age. A man has very little probability of developing prostate cancer by age 50. However, a 70-year-old man has a 6% (1 in 16) chance of developing 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 decrease in the probability of very old people (80-89) developing, or dying from, many cancers, in contrast to the general increasing risk with increasing age, is due to the increase in the probability of death from other causes at an advanced age.

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

Table 12

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

	Lifetime Probability of Developing		Lifetime Probability of Dying		Probability (%) of Developing Cancer in next 10 years by age					
	%	One in:	%	One in:	30-39	40-49	50-59	60-69	70-79	80-89
Male										
All Cancers	**44.0**	**2.3**	**28.2**	**3.5**	**0.6**	**1.7**	**6.0**	**14.9**	**21.5**	**20.4**
Prostate	13.2	7.6	3.7	27.3	–	0.1	1.6	5.2	6.1	4.8
Lung	8.5	11.7	8.1	12.4	–	0.2	0.8	2.5	4.3	3.6
Colorectal	7.1	14.0	3.6	28.1	–	0.2	0.8	2.0	3.2	3.3
Bladder*	3.5	28.5	1.0	99.7	–	0.1	0.3	0.9	1.7	1.8
Non-Hodgkin Lymphoma	2.1	48.4	1.1	93.7	0.1	0.1	0.3	0.6	0.8	0.8
Kidney	1.8	56.6	0.7	141.2	–	0.1	0.3	0.5	0.7	0.6
Leukemia	1.7	59.0	1.1	93.8	–	0.1	0.2	0.4	0.6	0.8
Stomach	1.4	70.7	1.0	103.8	–	–	0.1	0.3	0.6	0.7
Oral	1.3	74.2	0.5	205.0	–	0.1	0.3	0.4	0.5	0.3
Melanoma	1.3	75.7	0.3	301.6	0.1	0.1	0.2	0.4	0.4	0.4
Pancreas	1.2	80.8	1.3	75.7	–	–	0.1	0.3	0.6	0.6
Brain	0.8	126.0	0.6	172.4	–	0.1	0.1	0.2	0.3	0.2
Esophagus	0.7	140.3	0.8	126.2	–	–	0.1	0.2	0.3	0.3
Multiple Myeloma	0.7	144.2	0.5	191.2	–	–	0.1	0.2	0.3	0.3
Liver	0.6	180.9	0.3	312.5	–	–	0.1	0.2	0.2	0.2
Female										
All Cancers	**38.9**	**2.6**	**23.9**	**4.2**	**1.2**	**3.0**	**6.2**	**10.2**	**13.8**	**13.7**
Breast	10.9	9.2	3.7	26.9	0.4	1.2	2.3	3.0	3.1	2.5
Colorectal	6.3	15.8	3.2	31.5	–	0.2	0.6	1.3	2.3	2.8
Lung	6.1	16.3	5.2	19.1	–	0.2	0.7	1.8	2.5	1.7
Body of Uterus	2.4	41.9	0.6	176.2	–	0.1	0.6	0.7	0.7	0.5
Non-Hodgkin Lymphoma	1.8	55.8	0.9	109.8	–	0.1	0.2	0.4	0.6	0.6
Ovary	1.4	69.4	1.1	87.7	–	0.1	0.3	0.3	0.4	0.4
Pancreas	1.4	73.8	1.4	71.5	–	–	0.1	0.3	0.5	0.7
Bladder*	1.2	81.4	0.4	233.4	–	–	0.1	0.2	0.4	0.5
Leukemia	1.2	84.8	0.8	125.7	–	0.1	0.1	0.2	0.4	0.5
Kidney	1.1	89.0	0.4	227.9	–	0.1	0.1	0.3	0.4	0.3
Thyroid	1.1	89.4	0.1	1365.0	0.2	0.2	0.2	0.2	0.1	0.1
Melanoma	1.0	96.0	0.2	491.2	0.1	0.1	0.2	0.2	0.2	0.2
Stomach	0.7	134.4	0.6	165.8	–	–	0.1	0.1	0.2	0.4
Cervix	0.7	147.1	0.2	437.0	0.1	0.1	0.1	0.1	0.1	0.1
Oral	0.6	154.8	0.2	401.3	–	–	0.1	0.2	0.2	0.2
Brain	0.6	157.7	0.5	216.6	–	–	0.1	0.1	0.2	0.1

– Value less than 0.05

* The substantial increase in the lifetime probability of developing bladder cancer as compared with previous years reflects the decision to include in situ carcinomas (excluding Ontario) as of 2006.

Note: The probability of developing cancer is calculated based on age- and sex-specific cancer incidence (excluding non-melenoma basal cell and squamous cell skin cancer) and mortality rates for Canada in 2003 and on life tables based on 2001-2003 all cause mortality rates. The probability of dying from cancer represents the proportion of persons dying from cancer in a cohort subjected to the mortality conditions prevailing in the population at large in 2003. See *Appendix II: Methods* for details.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

POTENTIAL YEARS OF LIFE LOST DUE TO CANCER

Figure 10 shows the rank order of 12 causes of premature death in Canada in 2003 as represented by potential years of life lost (PYLL). This illustrates that cancer was the leading cause of PYLL for men and women: 1,006,000 potential years were lost as a result of cancer (Table 13), representing 32% of the PYLL resulting from all causes of death. Diseases of the heart were the second leading cause.

The PYLL due to specific types of cancer (Table 13) show that lung cancer was responsible for 266,800 PYLL, representing 27% of the premature mortality caused by cancer. For men in 2003, the three leading cancers were lung, colorectal and prostate, accounting for 48% of the PYLL due to cancer. The three leading cancers for women were lung, breast and colorectal, accounting for 52% of PYLL due to cancer. The ranking by relative importance of these cancers for men and women with respect to PYLL has been consistent in recent years. For women, however, the potential years of life lost due to lung cancer, which are greater than for breast cancer, reflect the high rates of lung cancer mortality among women aged 50 to 79. Among men, although prostate cancer is more common than lung cancer, the PYLL due to lung cancer are four times higher than for prostate cancer, reflecting higher mortality rates for lung cancer and the younger age at which men develop and die from this disease.

Potential years of life lost is higher for cancers that are more common, have an earlier age of onset, and more quickly lead to death. With regard to the most common cancers in women and men, the PYLL from breast cancer (95,300) far exceed the PYLL from prostate cancer (33,400), reflecting the relatively young age at which women die from breast cancer. In contrast, the PYLL for Hodgkin lymphoma, at 2,500, reflects a cancer that is less common and relatively curable.

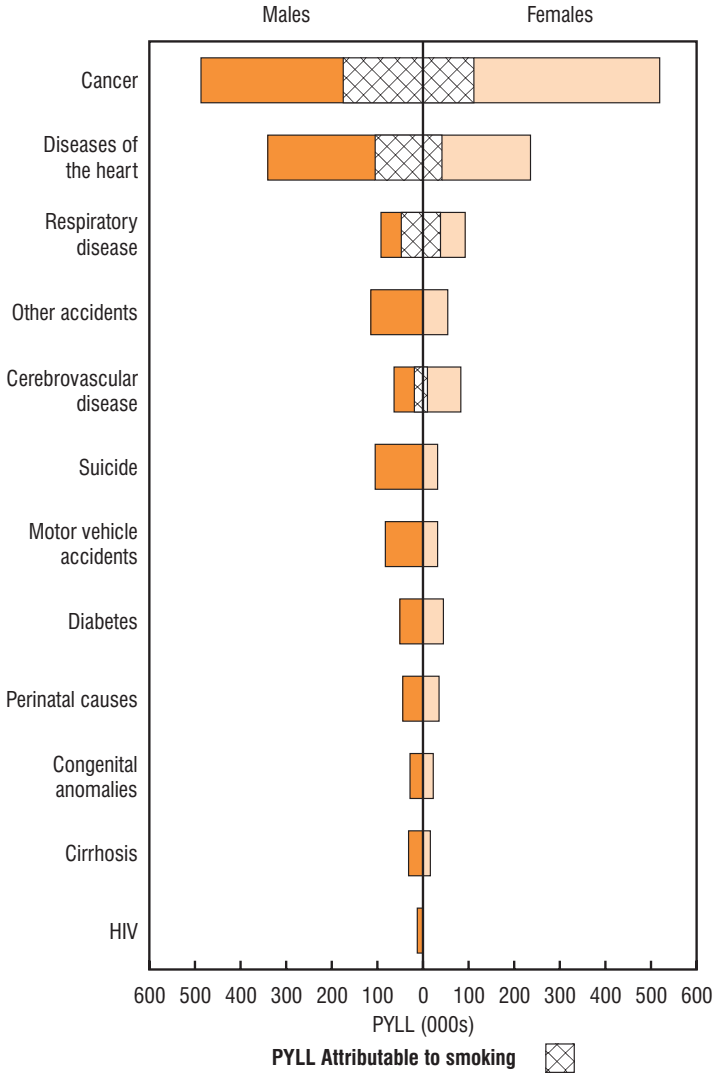
Although the number of men who die from cancer each year exceeds the number of women, the PYLL for women (520,700) are slightly higher than the PYLL for men (485,300). This is because women generally live longer than men, and some of the deaths due to female cancers occur at younger ages.

The use of tobacco products is the single most important cause of preventable, premature cancer deaths. Many deaths from other diseases also occur because of smoking (Figure 10). Among men, smoking is responsible for more than one-third of PYLL due to all cancers, about 30% of PYLL due to diseases of the heart, and over 50% of PYLL due to respiratory disease. Among women, smoking is responsible for about one-fifth of PYLL due to all cancers.

Cancer is the leading cause of premature death in Canada. For the first time, cancer is responsible for over 1 million potential years of life lost in Canada.

Figure 10

Selected Causes of Potential Years of Life Lost (PYLL), Canada, 2003



Note: Figures are ranked in order of total PYLL for males and females combined and are calculated based on life expectancy. Count and percentage totals may not add due to rounding and to the exclusion of other sites. Smoking attributable PYLL are based on relative risk estimates from follow up of CPS-II cohort and 2003 Canadian smoking prevalence estimates. See *Appendix II: Methods* for details.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Table 13
Potential Years of Life Lost Due to Cancer, Canada, 2003

	Potential Years of Life Lost (PYLL)					
	Total		Males		Females	
	Years	%	Years	%	Years	%
ALL CAUSES	3,175,900	–	1,702,500	–	1,473,400	–
All Cancers	1,006,000	100	485,300	100	520,700	100
Cancer Type						
Lung	266,800	26.5	142,000	29.3	124,800	24.0
Colorectal	111,300	11.1	58,300	12.0	53,100	10.2
Breast	95,300	9.5	–	–	95,300	18.3
Pancreas	50,300	5.0	24,700	5.1	25,600	4.9
Non-Hodgkin Lymphoma	40,600	4.0	22,100	4.6	18,500	3.6
Leukemia	37,000	3.7	20,800	4.3	16,200	3.1
Brain	35,700	3.5	19,600	4.0	16,100	3.1
Prostate	33,400	3.3	33,400	6.9	–	–
Stomach	29,000	2.9	17,200	3.5	11,800	2.3
Ovary	28,400	2.8	–	–	28,400	5.5
Kidney	22,700	2.3	14,100	2.9	8,700	1.7
Esophagus	21,700	2.2	16,500	3.4	5,100	1.0
Oral	17,900	1.8	12,300	2.5	5,600	1.1
Bladder	18,000	1.8	12,300	2.5	5,700	1.1
Multiple Myeloma	16,100	1.6	8,200	1.7	7,900	1.5
Melanoma	14,300	1.4	8,200	1.7	6,100	1.2
Body of Uterus	11,700	1.2	–	–	11,700	2.2
Liver	10,500	1.0	7,900	1.6	2,600	0.5
Cervix	9,900	1.0	–	–	9,900	1.9
Larynx	7,100	0.7	5,700	1.2	1,400	0.3
Hodgkin Lymphoma	2,500	0.2	1,400	0.3	1,100	0.2
Testis	1,300	0.1	1,300	0.3	–	–

– Not applicable

Note: Figures are ranked in order of total PYLL for both sexes combined and are calculated based on life expectancy. Count and percentage totals may not add due to rounding and to the exclusion of other sites.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

PREVALENCE

Prevalence counts refer to the total number of people who are living with a diagnosis of cancer at a certain point in time. Table 14 reports estimates of the number of Canadians who were alive in 2003 within 15 years of their cancer having been diagnosed. These prevalence estimates are reported for the four most common cancers, other cancers combined and all cancers. The table shows counts, the percentage of the population and its reciprocal (i.e., the population that gives rise to one prevalent case) who were living with a cancer that was diagnosed in the 15 years preceding 2003. These estimates are based on survival rates from Saskatchewan, which were applied to the Canadian incidence data.

The overall prevalence of cancer in the Canadian population is 2.5% among men and 2.8% among women. In the year 2003, there were an estimated 387,700 male and 445,400 female cancer survivors, for a total of approximately 833,100 Canadians (2.6% overall). That means that 1 in 40 Canadian men and 1 in 36 Canadian women have had cancer diagnosed at some time during the previous 15 years.

Among men, the most prevalent cancer site is the prostate, at 122,400 prevalent cases or 0.8% of the male population, followed by colorectal (53,400) and lung (18,100) cancers. Breast cancer is the most common site in women (162,600 cases or 1.0% of the female population), which is also followed by colorectal (53,600 cases) and lung (19,500) cancers. Prevalence rates are influenced by incidence rates and the average period of survival, both of which are age-dependent. Therefore, even though age adjusted incidence rates and survival rates are higher overall for prostate than breast cancer, the prevalence of breast cancer is higher than that of prostate cancer because breast cancer is more common in younger age groups. In the case of lung cancer, survival is poor, so even though incidence is high, prevalence is relatively low.

National survival data dating back 15 years are not available. In estimating prevalence rates, it was assumed that survival rates from Saskatchewan were representative of those for Canada. Although there are alternative estimation methods, they would be limited in their ability to report national prevalence for specific types of cancer. For example, 5.4% of respondents to the Canadian Community Health Survey (CCHS 2005) reported a personal history of cancer, which, as expected, is higher than the prevalence estimate for all Canadians (2.6%). This may be partly because the CCHS 2005 includes non-melanoma skin cancers, which are common and associated with very high survival, but which are not included the Canadian Cancer Statistics estimates.

Another approach, employed at the Ontario Cancer Registry, counted the number of cancer patients not known to be deceased, which for colorectal cancer gave a prevalence of 0.3% (i.e., identical to the results reported in Table 14). Thus, it is reassuring that estimates obtained by other means produced similar prevalence results.

Prevalence is a useful indicator of the burden cancer poses both at the personal level and at the level of the health care system. 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 to patients and to their families and loved ones. These challenges may persist beyond the point of physical recovery from the cancer itself, often requiring extensive use of rehabilitation and supportive care resources. A large number of Canadians live with the effects of cancer, require repeated active treatment and have continuing need for cancer care resources and support services. This increased demand and the complexity of survivors' health needs must be considered in the planning and development of interdisciplinary health services.

Table 14

Prevalence for the Most Common Cancers, by Sex, Canada, 2003

	Prevalence Count 15 Year			Prevalence Percentage of 2003 Population			Prevalence one in		
	Both	Males	Females	Both	Males	Females	Both	Males	Females
All Cancers	**833,100**	**387,700**	**445,400**	**2.6**	**2.5**	**2.8**	**38**	**40**	**36**
Breast	–	–	162,600	–	–	1.0	–	–	98
Prostate	–	122,400	–	–	0.8	–	–	128	–
Colorectal	107,000	53,400	53,600	0.3	0.3	0.3	296	294	298
Lung	37,600	18,100	19,500	0.1	0.1	0.1	842	867	820
All Other Cancers	403,500	193,800	209,700	1.3	1.2	1.3	78	81	76

Note: Survival rates are based on Saskatchewan data from 1986 to 2001 with follow-up to 2002.
Source: Surveillance Division, CCDPC, Public Health Agency of Canada

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

FIVE-YEAR RELATIVE SURVIVAL FOR CANCERS DIAGNOSED IN 1996-1998

Why examine cancer survival?

Like incidence and mortality rates, population-based cancer survival is an indicator of the burden of cancer. Its unique contribution is a measure of the severity of disease: a poor five-year relative survival, such as is the case for lung cancer, means that a patient has a small probability of living until the fifth anniversary of his/her diagnosis. Examined across cancer types and regions, survival estimates can thus be used to establish priority areas for improving prognosis.[20] Examined over time, and in conjunction with incidence and mortality trends, they represent an important indicator of progress in cancer control.[21]

While a population-based survival estimate is a useful "average" indicator,[22] it does not necessarily reflect a specific individual'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.

What are the determinants of survival?

The prognosis of a cancer patient may be influenced by host factors (e.g., age, sex, risk of death from other diseases, socio-economic status and lifestyle factors), tumour-related factors (e.g., stage of disease, histologic 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 available in Canada at a population level.

What is the relative survival ratio? (see *Glossary* for details)

The relative survival ratio (RSR) is the preferred measure for assessing the survival of cancer patients in a population. It is defined as the ratio of the observed survival for a group of cancer patients to the survival expected for people in the same general population.[23] A five-year relative survival ratio of 80% means that people with that cancer had 80% of the likelihood of living for 5 years after diagnosis compared to similar people in the general population. An alternative interpretation is that 20% of people with that cancer died within 5 years of diagnosis as a direct or indirect result of their cancer, or the risk factors that predisposed them to developing cancer.

Estimated relative survival ratios

Estimates included here have either been extracted from the more detailed results published by Statistics Canada[24] or have been produced by this agency specifically for this monograph. Canadian five-year relative survival ratios based on cases diagnosed from 1996 to 1998 are shown in Table 15 and Figure 11. 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 60%. This implies that those diagnosed with cancer from 1996 to 1998 were 60% as likely to live for another five years as were 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 52% (data not shown). Relative survival was better among women (62%) than men (58%).

Five-year RSRs were highest for testicular (96%) and thyroid (96%) cancer. Among men, prostate cancer also had a very favourable prognosis (92% RSR) as did melanoma among women (93% RSR) (Table 15). The lowest RSRs were observed among those diagnosed with pancreatic cancer (males 6%, females 7%) followed by cancers of the esophagus (males 12%, females 16%) and liver (males 13%, females 15%). For all of the cancers examined, survival was similar or superior among women with the notable exceptions of larynx (men 68%, women 60%) and bladder cancers (men 80%, women 76%).

Provincial age-standardized RSRs for prostate, breast, colorectal and lung cancers (i.e., the most commonly diagnosed cancer types) are provided in Table 16. Relative survival ratios for prostate cancer ranged from a low of 84% in Saskatchewan to a high of 94% in both Nova Scotia and Prince Edward Island. The highest provincial age-standardized RSR for colorectal cancer was in Prince Edward Island (64%) and the lowest in Nova Scotia (58%) and Alberta (58%); otherwise provincial RSRs were either 60% or 61%. The highest provincial age-standardized RSR for breast cancer, 89%, was observed for both Prince Edward Island and Saskatchewan; the lowest occurred in Nova Scotia (84%). There was little provincial variation in age-standardized lung cancer RSRs.

There are a number of possible explanations for the observed variation between provinces, some real and some artefactual. Real reasons include differential patterns of use and diffusion of screening and early detection tests; varying patterns of diagnosis and availability and access to specialized cancer treatments; or differences in population attributes. For example, breast cancer survival may be significantly better in Saskatchewan compared to Nova Scotia in part because of higher rates of participation in breast cancer screening in the former.[14] Without data on stage of disease at diagnosis and treatment details, it is difficult to assess which of these might be important.

Five-year RSRs were consistent across age groups for colorectal and breast cancer with one exception: at 79%, breast cancer relative survival was lowest among those diagnosed under the age of 40 (Table 17). The best prognosis for prostate cancer, approximately 95%, was observed among those diagnosed at 50 to 69 years of age. For lung cancer, relative survival was highest in the youngest age group, then generally decreased with increasing age from 29% among those 20 to 39 years at diagnosis to 13% among those aged 70 to 99 at diagnosis. Relative survival is generally poorer among those diagnosed 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 'co-morbidity'); and they may receive less aggressive treatment independently of co-morbidity.[25,26]

Comparison of survival estimates can help to identify gaps and establish priorities for systemic change that may help improve survival.

FIVE-YEAR RELATIVE SURVIVAL FOR CANCERS DIAGNOSED IN 1996-1998

Table 15

Five-year Relative Survival Ratio (%) (and 95% Confidence Interval) by Cancer Type, and by Sex, Canada Excluding Quebec*, Cases Diagnosed 1996-1998

	Relative Survival Ratio (%) (and 95% Confidence Interval)		
	Both Sexes	Males	Females
All Cancers†	**60 (60-60)**	**58 (58-58)**	**62 (62-62)**
Testis	96 (94-97)	96 (94-97)	–
Thyroid	96 (95-96)	92 (89-94)	97 (96-98)
Prostate	92 (91-92)	92 (91-92)	–
Melanoma	89 (88-90)	86 (84-87)	93 (92-94)
Breast	86 (86-87)	85 (78-92)	86 (86-87)
Body of Uterus	86 (85-87)	–	86 (85-87)
Hodgkin Lymphoma	86 (84-87)	85 (82-88)	86 (83-89)
Bladder (including in situ)**	79 (77-80)	80 (78-82)	76 (73-78)
Cervix	72 (70-74)	–	72 (70-74)
Larynx	66 (64-69)	68 (65-70)	60 (54-66)
Kidney	65 (63-66)	63 (62-65)	67 (65-69)
Oral	62 (61-64)	61 (60-63)	64 (62-67)
Colorectal	60 (60-61)	60 (59-61)	61 (60-62)
Non-Hodgkin Lymphoma	58 (57-59)	55 (53-56)	61 (59-63)
Leukemia	47 (45-48)	47 (45-49)	47 (45-49)
Ovary	38 (36-39)	–	38 (36-39)
Multiple Myeloma	30 (28-32)	31 (28-33)	30 (27-33)
Stomach	24 (22-25)	22 (20-23)	27 (25-29)
Brain	24 (22-25)	22 (20-24)	25 (23-28)
Lung	16 (15-16)	14 (13-15)	18 (17-19)
Liver	14 (12-15)	13 (11-15)	15 (12-19)
Esophagus	13 (12-15)	12 (11-14)	16 (13-19)
Pancreas	6 (6-7)	6 (5-7)	7 (6-8)

– Not applicable

* Data from Quebec have been excluded, in part because its method of ascertaining the date of cancer diagnosis differs from the method for other registries and because of issues in correctly ascertaining the vital status of cases.

** Excluding data from Ontario which does not currently report in situ bladder cases.

† Cancers have been ranked from best to worst relative survival are described. Estimates are based on individuals diagnosed at ages 15-99.

Note: Differences in cancer definitions with other sections are described in *Appendix II: Methods*.

Source: Statistics Canada. 2006. *Cancer Survival Statistics*. Statistics Canada Catalogue no. 82-226-XIE-2006001. Ottawa: Minister of Industry. (Available at: http://www.statcan.ca/english/freepub/82-226-XIE/82-226-XIE2006001.htm).

Table 16

Age-Standardized Five-year Relative Survival Ratio (%) (and 95% Confidence Interval) Both Sexes Combined by Province* for Selected Cancers, Cases Diagnosed 1996-1998

	Relative Survival Ratio (%) (and 95% Confidence Interval)			
	Prostate	Breast	Colorectal	Lung
Canada	**91 (91-92)**	**86 (86-87)**	**60 (60-61)**	**16 (15-16)**
P.E.I.**	94 (88-100)	89 (83-94)	64 (56-72)	15 (10-20)
N.S.	94 (91-97)	84 (82-86)	58 (55-61)	15 (13-17)
N.B.	93 (90-95)	87 (84-89)	60 (56-63)	16 (14-18)
Ont.	92 (91-92)	86 (86-87)	60 (59-61)	16 (16-17)
Man.	90 (88-93)	87 (85-89)	60 (57-63)	16 (14-17)
Sask.	84 (82-87)	89 (87-91)	61 (58-64)	14 (12-16)
Alta.	88 (87-90)	85 (84-86)	58 (56-60)	14 (13-15)
B.C.	93 (92-94)	87 (86-88)	61 (59-62)	14 (13-15)

* NL survival ratios are not shown because they are artefactually high. This is because, in the years under study, cancers were under-reported as the cancer registry did not receive death certificate information from the provincial vital statistics office. The survival of such "missed" cases is generally less favourable.[27] Data from Quebec have been excluded, in part because the method of ascertaining the date of cancer diagnosis differs from the method for other registries and because of issues in correctly ascertaining the vital status of cases.

** All expected survival proportions for Prince Edward Island were derived from Canadian life tables as stable estimates for single ages could not be produced for this province because of small population counts. Relative survival estimates for Prince Edward Island may be biased to the extent and direction that general population expected survival differed between this province and Canada as a whole.
Data from the territories are included in the national survival estimates but age-standardized territorial relative survival ratios are not presented because in each case there were too few cases to calculate reliable age-standardized estimates.

Note: Differences in cancer definitions with other sections are described in *Appendix II: Methods*.

Source: Statistics Canada. 2006. *Cancer Survival Statistics*. Statistics Canada Catalogue no. 82-226-XIE-2006001. Ottawa: Minister of Industry. (Available at: http://www.statcan.ca/english/freepub/82-226-XIE/82-226-XIE2006001.htm).

Table 17

Five-year Relative Survival Ratio (%) (and 95% Confidence Interval) by Age Group for Selected Cancers, Cases Diagnosed 1996-1998, Canada Excluding Quebec

	Relative Survival Ratio (%) (and 95% Confidence Interval)				
	20-39	40-49	50-59	60-69	70-99
Prostate	–	87 (83-90)	94 (93-95)	95 (95-96)	89 (88-90)
Breast	79 (77-81)	87 (86-87)	87 (86-88)	89 (88-89)	88 (86-89)
Colorectal	61 (57-65)	64 (61-66)	62 (60-63)	61 (60-62)	59 (58-60)
Lung	29 (24-34)	18 (16-20)	20 (19-21)	17 (16-18)	13 (12-13)

– Estimates not available

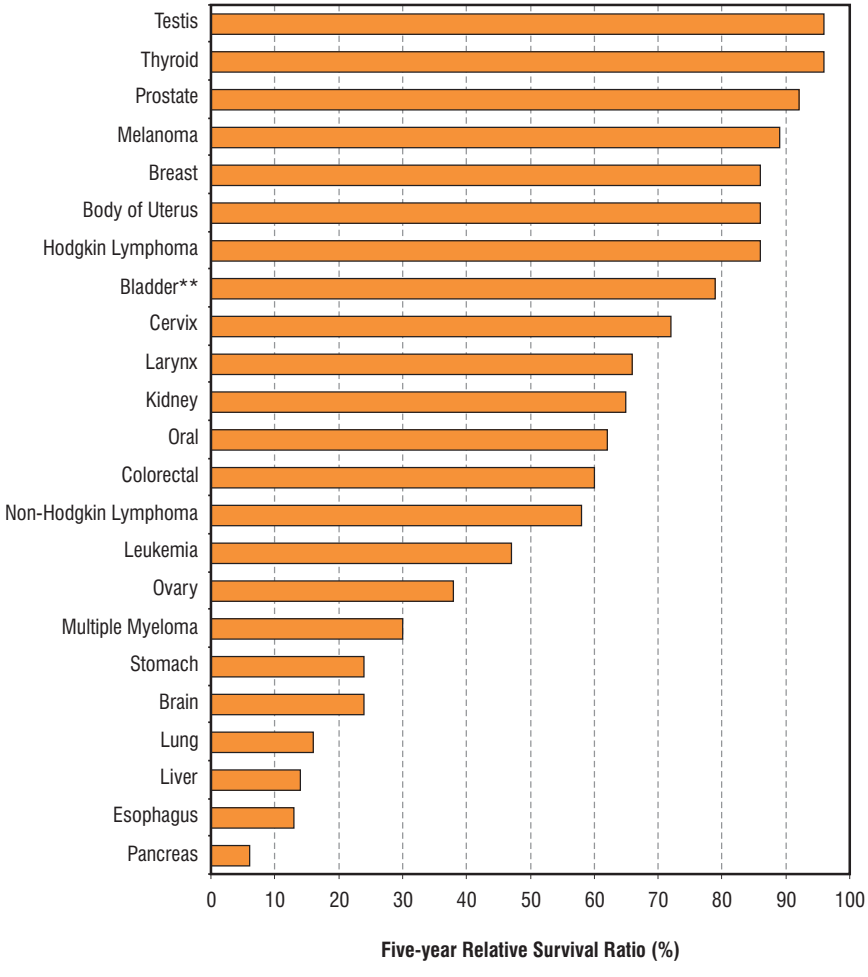
Note: Differences in cancer definitions with other sections are described in *Appendix II: Methods*.

Source: Statistics Canada. 2006. *Cancer Survival Statistics*. Statistics Canada Catalogue no. 82-226-XIE-2006001. Ottawa: Minister of Industry. (Available at: http://www.statcan.ca/english/freepub/82-226-XIE/82-226-XIE2006001.htm).

FIVE-YEAR RELATIVE SURVIVAL FOR CANCERS DIAGNOSED IN 1996-1998

Figure 11

Five-year Relative Survival Ratio (%) by Cancer Type, Both Sexes Combined, Canada Excluding Quebec*, Cases Diagnosed 1996-1998



* Data from Quebec have been excluded, in part because its method of ascertaining the date of cancer diagnosis differs from the method for other registries and because of issues in correctly ascertaining the vital status of cases.

** Excluding data from Ontario which does not currently report in situ bladder cases.

Source: Statistics Canada. 2006. *Cancer Survival Statistics*. Statistics Canada Catalogue no. 82-226-XIE-2006001. Ottawa: Minister of Industry. (Available at: http://www.statcan.ca/english/freepub/82-226-XIE/82-226-XIE2006001.htm).

Table 18 shows the number of new cases of cancer with age-standardized incidence rates, and the number of deaths due to cancer with age-standardized mortality rates (1999-2003) for Canadian children and youth aged 0-19. For this period, cancer was diagnosed in an average of 1,289 children every year, and 210 died each year from their disease. Leukemia accounted for 25% of new cases and 29% of deaths due to cancer in children, and remains the most common of the childhood cancers. Lymphomas, the second most common group of childhood cancers, now constitute approximately 17% of new cases and 8% of deaths, and cancers of the brain and spinal cord accounted for 17% of new cases and 24% of deaths.

An indicator of disease prognosis is provided by the ratio of the number of deaths to the number of cases and can be calculated using the data available from Table 18. The deaths to cases ratio for all childhood cancers combined was approximately 0.16, indicating that the number of deaths was about one-sixth the number of cases. The highest ratios (> 0.25) were found in children with liver (hepatic) cancer, tumours of the sympathetic nervous system (primarily neuroblastoma), tumours of bone, and some tumours of the brain and spinal cord. The high ratio for neuroblastoma reflects the advanced stage at which this disease is frequently diagnosed. Amongst soft tissue sarcomas (0.18), rhabdomyosarcomas (0.26) have a relatively poor prognosis. The ratio for acute non-lymphocytic leukemia (0.34) was much higher than that observed for acute lymphocytic leukemia (0.10), resulting in a relatively high overall ratio for leukemia. Although the lymphomas have a relatively good prognosis overall, Hodgkin lymphoma (0.02) has a very low death to cases ratio compared with non-Hodgkin lymphoma (0.14). The low ratios observed for retinoblastoma and germ cell tumours indicate the low fatality rate associated with these tumours.

The low death rates for acute lymphocytic leukemia, Hodgkin's disease and germ cell tumours reflect the major advances made in treating these cancers over 30 years. Figure 12 demonstrates age-standardized incidence and mortality rates for all cancers, leukemia, brain and central nervous system tumours and lymphoma for children and youth aged 0-19 years between 1985 and 2007. While overall incidence rates remain relatively constant over the time period, mortality rates are seen to diminish for all major forms of childhood cancer, but particularly for leukemia. Since the early 1950s, mortality rates for childhood cancer have declined by more than 50%, with most of the improvement occurring after 1970. Improved survival has been particularly dramatic for the most common childhood neoplasm, acute lymphocytic leukemia, as well as for lymphomas and kidney cancer. Although essentially no one survived childhood leukemia 50 years ago,[28] currently approximately 80% of Canadian children and teenagers with acute lymphoblastic leukemia are alive five years after diagnosis.[29] The improvement in childhood cancer survival relative to that of most adults with cancer reflects biological differences in cancer in adults as compared with children, as well as differences in treatment approaches. The success of clinical trials in identifying new agents and treatment modalities has been significant; a much larger proportion of children than adults with cancer participate in therapeutic trials. As well, a shift towards multidisciplinary care has improved overall outcomes and decreased morbidity. Improving survival in childhood cancer is increasing the need for long term follow-up as the number of childhood cancer survivors increases.

Table 18

New Cases and Age-Standardized Cancer Incidence Rates and Deaths and Age-Standardized Cancer Mortality Rates by Histologic Cell Type for Children and Youth Aged 0-19 Years, Canada, 1999-2003

Diagnostic Group[2]	New cases (1999-2003)[1]		ASIR per 1,000,000 per year	Deaths (1999-2003)		ASMR per 1,000,000 per year	Deaths/ Cases Ratio
	Number	%		Number	%		
Leukemia	**1,628**	**25.3**	**42.5**	**302**	**28.7**	**7.6**	**0.19**
Acute lymphocytic	1,197	18.6	31.4	125	11.9	3.1	0.10
Acute non-lymphocytic	244	3.8	6.3	83	7.9	2.1	0.34
Lymphoma	**1,102**	**17.1**	**26.6**	**81**	**7.7**	**1.9**	**0.07**
Hodgkin lymphoma	600	9.3	14.3	14	1.3	0.3	0.02
Non-Hodgkin lymphoma	488	7.6	12.0	67	6.4	1.6	0.14
Brain and Spinal	**1,068**	**16.6**	**27.1**	**252**	**24.0**	**6.3**	**0.24**
Astrocytoma	492	7.6	12.4	66	6.3	1.6	0.13
Primitive neuroectodermal	240	3.7	6.2	70	6.7	1.8	0.29
Ependymoma	84	1.3	2.2	18	1.7	0.5	0.21
Carcinoma	**581**	**9.0**	**13.9**	**28**	**2.7**	**0.7**	**0.05**
Thyroid	236	3.7	5.6	0	0.0	0.0	0.00
Melanoma	172	2.7	4.1	2	0.2	0.0	0.01
Soft Tissue	**423**	**6.6**	**10.6**	**77**	**7.3**	**1.9**	**0.18**
Rhabdomyosarcoma	168	2.6	4.3	44	4.2	1.1	0.26
Fibrosarcoma	78	1.2	2.0	3	0.3	0.1	0.04
Germ Cell and Other Gonadal	**419**	**6.5**	**10.2**	**26**	**2.5**	**0.6**	**0.06**
Gonadal germ cell tumours	269	4.2	6.4	5	0.5	0.1	0.02
Bone	**327**	**5.1**	**7.9**	**106**	**10.1**	**2.5**	**0.32**
Osteosarcoma	159	2.5	3.8	54	5.1	1.3	0.34
Ewing's sarcoma	126	2.0	3.1	47	4.5	1.1	0.37
Sympathetic Nervous System	**318**	**4.9**	**9.0**	**96**	**9.1**	**2.5**	**0.30**
Neuroblastoma	302	4.7	8.6	96	9.1	2.5	0.32
Renal Tumours	**254**	**3.9**	**6.9**	**33**	**3.1**	**0.8**	**0.13**
Wilm's tumour	222	3.4	6.1	24	2.3	0.6	0.11
Retinoblastoma	**104**	**1.6**	**3.0**	**3**	**0.3**	**0.1**	**0.03**
Hepatic Tumours	**75**	**1.2**	**2.1**	**22**	**2.1**	**0.6**	**0.29**
Other Cancers	**147**	**2.3**	**3.8**	**26**	**2.5**	**0.6**	**0.18**
Total (5 years)	**6,446**	**100.0**	**163.7**	**1,052**	**100.0**	**26.3**	**0.16**
Average Per Year	**1,289**				**210**		

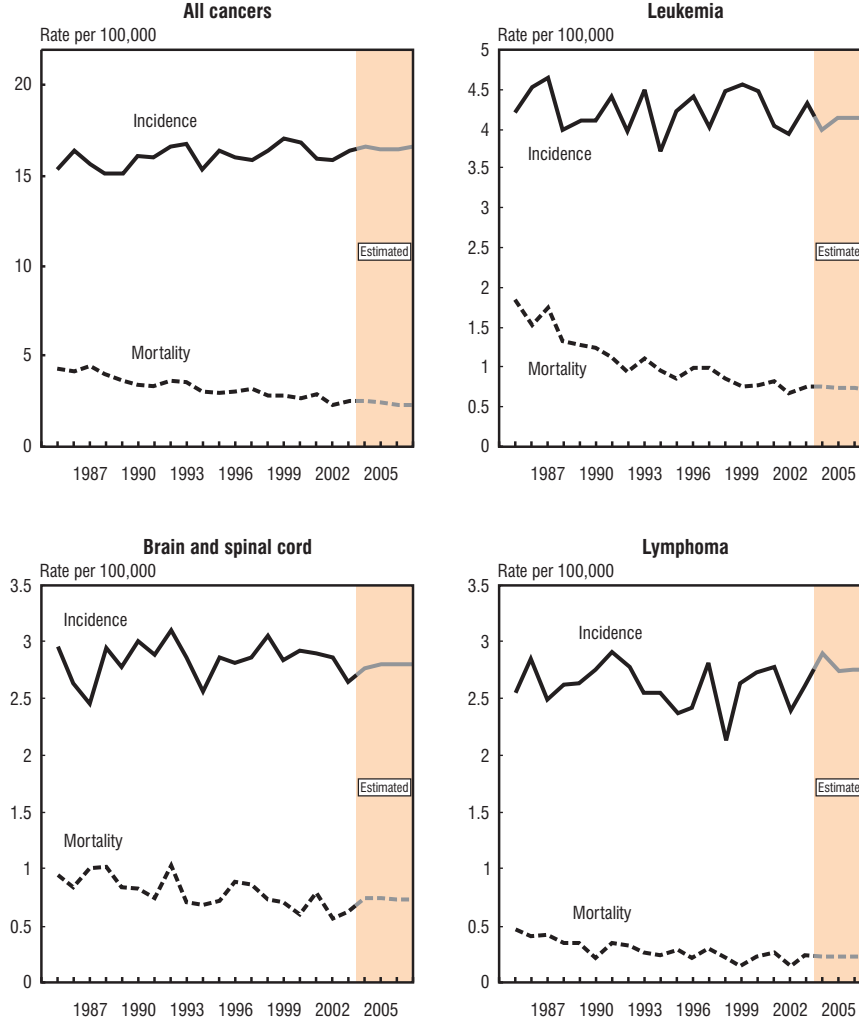
[1] Data are shown for the most recent five-year period available and exclude non-melanoma (basal cell and squamous cell) skin cancer and in-situ carcinomas except bladder. Data are grouped according to the International Classification Scheme for Childhood Cancer, World Health Organization (1996) and ranked by the number of cases. Rates are age-standardized to the 1991 Canadian population and due to disease rarity are expressed per million per year.

[2] Only major subcategories within each group are included. Acute lymphocytic includes all lymphoid, approximately 99% are acute. Non-Hodgkin lymphoma includes Burkitt's lymphoma and unspecified lymphomas. The neuroblastoma category includes ganglioneuroblastoma; Wilm's tumour includes rhabdoid and clear cell sarcoma; rhabdomyosarcoma includes embryonal sarcoma; and fibrosarcoma includes other fibromatous neoplasms.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada and Health Statistics Division, Statistics Canada

Figure 12

Age-Standardized Incidence and Mortality Rates for Selected Cancers for Children and Youth Aged 0-19 Years, Canada, 1985-2007



Note: The range of rate scales differ widely between the types. Incidence figures exclude non-melanoma (basal cell and squamouscell) skin cancer. Actual incidence data are available to 2004 except for Newfoundland and Labrador, Quebec and Ontario where 2004 incidence is estimated.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Cancer occurs rarely among Canadian children, and most children who develop cancer will survive their illness.

SPECIAL TOPIC: BREAST CANCER

Introduction

Breast cancer is an important public health issue in Canada and around the world, no matter what measure is used: it is common, and represents a major cause of premature mortality in women. Because survival is good, many women live for a long time following a diagnosis of breast cancer. This has implications for resource utilization and survivorship issues, such as recurrences, long term effects of treatment, impact on family, etc. Furthermore, considerable resources are expended every year for mammography screening programs to detect breast cancers at an early stage.

Breast cancer is the most common female malignancy in the world.[1] Globally, it accounts for 22% of all new cancer diagnoses in women, and approximately 10% of all cases when men and women are combined. It represents 7% of the more than 7.6 million cancer-related deaths worldwide.

In Canada, breast cancer is the most common cancer in women, with more than 22,000 new diagnoses every year (Table 1). It kills more than 5,000 Canadian women every year, more than any other type of cancer except lung (Table 1). One in nine women will be diagnosed with and 1 in 27 will die of breast cancer in their lifetime (Table 12). It accounts for an estimated 95,300 potential years of life lost (Table 13). Fortunately, largely due to advances in adjuvant therapy and greater participation in screening programs in Canada and other developed countries, breast cancer mortality rates are now declining. This means that increasing numbers of women are living with a diagnosis of breast cancer: an estimated 162,600 Canadian women alive today – about one in every 100 females – have had a diagnosis of breast cancer at some time in the past 15 years (Table 14).

Although breast cancer can also occur in men, it is rare: approximately 170 Canadian men will be diagnosed with breast cancer in 2007, which represents less than 1% of all estimated breast cancer cases. Men and women share many of the same risk factors for breast cancer, including age, family history of breast and/or ovarian cancer, obesity, and exposure to radiation of the chest wall, most commonly as a result of treatment for non-Hodgkin or Hodgkin lymphoma. They also share many of the same risk reduction strategies, signs and symptoms of disease, methods of diagnosis, treatment options, and outcome measures. Given these similarities, much of the information in this special topic will apply to both men and women.

Breast cancer in females, Canada
Summary statistics 2007 (estimates)

Number of new cases	22,300
Incidence rate	104 per 100,000
% of all cancers in females	29%
Incidence rank in females	1*
Number of deaths	5,300
Mortality rate	23 per 100,000
5-year relative survival	86%**
PYLL rank in females	2 (18% of all cancer PYLL)
Prevalence (15 year)	162,600

* Excluding non-melanoma skin cancer
** Actual relative survival for women diagnosed in 1996-98

International Variation

Female breast cancer rates in Canada are amongst the highest in the world. The United States, northern Europe and Australia have incidence rates that are similar to Canada's, while regions of Asia, Latin America and Africa have significantly lower rates (about 1/3 those in Canada).[2] Within Canada, First Nations and Inuit women have lower incidence than the population-at-large.[3,4] These differences can be at least partly attributed to variation in risk factors such as reproductive patterns, body size, levels of physical activity, use of hormones, and possibly screening intensity.

Age specific incidence and mortality

The incidence of breast cancer, like that of most epithelial cancers, rises steeply with age. Unlike most epithelial cancers, however, the incidence is already significant by age 25 (Figure 13.1). Mortality rates also rise steeply with age, but are considerably lower than incidence rates at every age up to about 85. This is a reflection of the relatively good survival.

In every adult age group, breast cancer is the most common female cancer, accounting for over 30% of all new diagnoses in women aged 20-49 and 50-69, and 20% among older women (Figures 13.2). It is the leading cancer cause of death in young women (Figure 13.3), and ranks second and third, respectively, at older ages.

Trends in incidence and mortality

Figures 13.4a-b illustrate the considerable gap between incidence and mortality rates in every age group. Also evident is the rise in the all ages incidence rate since 1969 (Figure 13.4a): an increase of 1% per year up until 1999, or 30% over the 30 year period. Since 1999, the all ages incidence has been stable (a non-significant decrease of 1.8% per year, Table 19).

Incidence trends vary considerably by age at diagnosis (Figures 13.4a-b). Results of the statistical analysis of these trends over the period 1969-2003 are shown in Table 19. The figures and analysis indicate the following, according to age group at diagnosis:

- 20-39: incidence rates have declined slightly (0.2% per year) over the entire time period, and the decline is statistically significant;
- 40-49: incidence rates appear to have been more or less stable up to 1982 and increased between 1982 and 1992 (there is a significant increase in incidence in this period; data not shown); between 1992 and 2003 they have declined significantly by 0.7% per year;
- 50-59: prior to 1999, incidence rates were rising; between 1999 and 2003, they appear to be decreasing, although the decline is not statistically significant (probably because the downward trend is too short, covering only a few recent years);
- 60-69: incidence rates have been increasing since 1969. Since 1989, they have been rising by 0.6% per year. Although Figure 13.4b suggests that incidence rates might have stabilized or declined in the few years immediately prior to 2003 (similar to what is seen for 50-59 year old women), a change in trend has not been detected by

the statistical analysis. It is necessary to wait for additional years of data to be sure of the recent trend;

- 70 and over: after many years of rising rates, incidence began to decline in 1991 with a statistically significant drop of 0.9% per year between 1991 and 2003.

The reasons for these patterns are likely complex. At least part of the long-term increase in incidence is probably due to greater participation in screening programs among women in the target age range (aged 50-69) and improved quality of screening, resulting in detection of small tumours that were not yet diagnosable clinically. Similar to prostate cancer, screening may have eventually exhausted the pool of prevalent cancers in the screened population, resulting in recent declines, as incidence rates drop back closer to pre-screening levels. It is possible that the same explanation applies to women aged 40-49 and 70+, many of whom may have been screened also. Other possible explanations include changing patterns of childbearing and hormones (i.e. number of children, age at first birth, age at menarche and menopause, use of oral contraceptives and combined hormone replacement therapy). For example, older age at first birth increases a woman's breast cancer risk; between 1965 and 2003, the average age at first birth among Canadian women rose from less than 24 in 1965 to nearly 28 in 2003.[5]

Time trends for mortality are striking: the age-standardized mortality rate for breast cancer in women in Canada has fallen 25% since 1986 from 32 to 24.1 per 100,000 (Table 8.2), corresponding to a 1% decline per year up to 1994 and a more marked decline of 2.5% annually thereafter (Table 19). Mortality has been declining over the long term (i.e., since 1969) in age groups 20-39, 40-49 and 50-59 (Figure 13.4a), with significantly greater rates of decline since the late 1980s or mid-1990s (Table 19). For older women, mortality was stable or slightly increasing until more recently: in women 60-69, mortality rates dropped steeply between 1990 and 1999 (3.5% per year) but then leveled off, while in women aged 70 and over mortality began to decline in 1995 and has continued to do so significantly (1.9% per year). These declines are generally attributed to two factors: first, improvements in screening, where development of organized screening programs, increased participation in screening (by women aged 50-69 in particular) and improved quality of mammography since the late 1980s have led to detection of more breast cancers at an earlier stage where treatment is more effective; and second, advances in therapy.

Although separating the impact of screening from that of treatment is challenging, Berry et al. concluded that mammographic screening and adjuvant systemic therapy have contributed about equally to improved breast cancer outcomes in the US.[6] Figure 13.5 illustrates the increasing use of chemotherapy and tamoxifen, particularly together sequentially, over the period during which the mortality rate has dropped. More recently, targeted therapy has resulted in improved outcomes in patients whose cancers overexpress the her-2 oncogene. There is evidence that postmastectomy chest wall radiation has also contributed to improved survival in certain patient groups.[7,8]

Survival

The five-year relative survival for breast cancer at the national level, excluding Quebec, for women diagnosed in 1996-1998 is 86% (Table 15). It ranges between 87 and 89% for women aged 40-49, 50-59, 60-69 and 70+, but is only 79% in women under 40, reflecting the more aggressive nature of breast cancer in young women (Table 17). Geographically, survival is similar in the eight provinces with data (Table 16).

Ontario data are available to examine long-term trends in survival. Between 1975 and 1999, survival improved consistently (Figure 13.6), although significantly so only since 1989 (0.8% per year thereafter). The trend towards improved survival is evident at every age (Figure 13.7), but appears strongest in the age groups most affected by screening (50-59 and 60-69). This suggests that therapeutic improvements have benefited women at all ages, while only selected age groups show the additional benefit of screening.

Stage of disease is an important determinant of survival. Table 20 indicates the range of estimated five-year relative survival for patients diagnosed during the mid 1990s and seen at one of Ontario's specialized cancer treatment centres. The majority was diagnosed at early stages where survival is excellent (96% and 86% respectively for stages I and II); for those diagnosed at stages III or IV, prognosis is much worse. This highlights the importance of screening to detect cancers when they are still at an early stage. Table 21 shows population-based staging for females diagnosed in 2003 and 2004 in New Brunswick and Prince Edward Island combined. Nearly half the patients were diagnosed at stage I and the vast majority was stage I or II, i.e. at a curable stage. Staging data are not yet available nationally.

Unfortunately breast cancer can recur many years after apparently successful treatment. Figure 13.8 shows the steadily declining survival over the years following diagnosis in Ontario; the 20-year relative survival is only about 70% (compared to 86% at 5 years post-diagnosis). In the future, long-term national survival data will be available from the Canadian Cancer Registry.

Screening

The introduction and now widespread availability of organized breast cancer screening in asymptomatic women between the age of 50 and 69 has resulted in an anticipated increase in breast cancer incidence rates and a shift towards earlier stage at diagnosis. In the United States, the introduction of mammography and clinical breast examination is associated with a 27% reduction in late stage disease and an increase in earlier stage disease, which is generally more successfully treated.[9]

Although previous estimates that organized screening with biennial mammography and clinical breast exam could reduce breast cancer mortality rates by up to 25% have been questioned by a recently published meta-analysis[10], it is clear that maximizing the impact of screening depends to a great extent on our ability to increase and sustain participation rates over time. In Canada, although available measures indicate that participation is increasing in most provinces and territories, none of the provincial or territorial screening programs has yet reached the nationally established target of 70% participation. Reaching women who have not been screened or who are under screened will require a multi-pronged approach, as discussed in some detail in the 2006 edition of Canadian Cancer Statistics special topic on organized breast cancer screening.[11]

Risk factors

Factors known to affect the risk of breast cancer constitute a mixture of modifiable behaviours and non-modifiable characteristics, including reproductive/hormonal factors, lifestyle behaviours, and heredity. Truly modifiable factors (such as body mass, physical inactivity, alcohol consumption) collectively explain only a small fraction of breast cancer incidence (unlike lung cancer, for example, where the majority is known to be caused by tobacco).

Risk factors for breast cancer

Reproductive/hormonal	Lifestyle	Other
■ Fewer births ■ Later age at first full-term pregnancy ■ Did not breastfeed ■ Early age at menarche ■ Irregular menses ■ Late menopause ■ Use of exogenous hormones (e.g., oral contraceptives, combined hormone therapy)	■ Obesity (post-menopausal breast cancer) ■ Physical inactivity ■ Alcohol consumption	■ Family history of breast cancer ■ BRCA1 or BRCA2 mutations ■ Ionizing radiation (medical or occupational exposure) ■ Benign breast disease

Adapted from Cancer in Young Adults in Canada (p. 80), Cancer Care Ontario

Opportunities for primary prevention

Based on current knowledge, the best opportunities for reducing breast cancer risk are eating a healthy diet and being physically active throughout life (thereby maintaining a healthy body weight), minimizing alcohol consumption and avoiding nonessential hormones. Regular participation in high quality screening programs will further lower the breast cancer burden by reducing mortality and improving prognosis.

Conclusions/Implications

Breast cancer is the most common cancer in Canadian women, both before and after menopause, and is a major cause of premature death. Although incidence remains obstinately high, due in part to limited opportunities for primary prevention, mortality is declining significantly at all ages, and survival is increasing. These improvements are due to more and better screening and the introduction of new treatments, especially use of adjuvant systemic therapy.

There are clear needs if we are to further reduce the burden of breast cancer:

- Conduct more research to identify additional modifiable risk factors for breast cancer, such as occupational and environmental exposures and vitamin D;
- Increase participation in organized breast cancer screening programs among women aged 50-69 through development of effective methods for recruitment and retention;

- Increase research to identify further genetic factors so that women at high risk can take appropriate actions;
- Continue to disseminate optimal therapies, and develop and test new therapeutic regimens.

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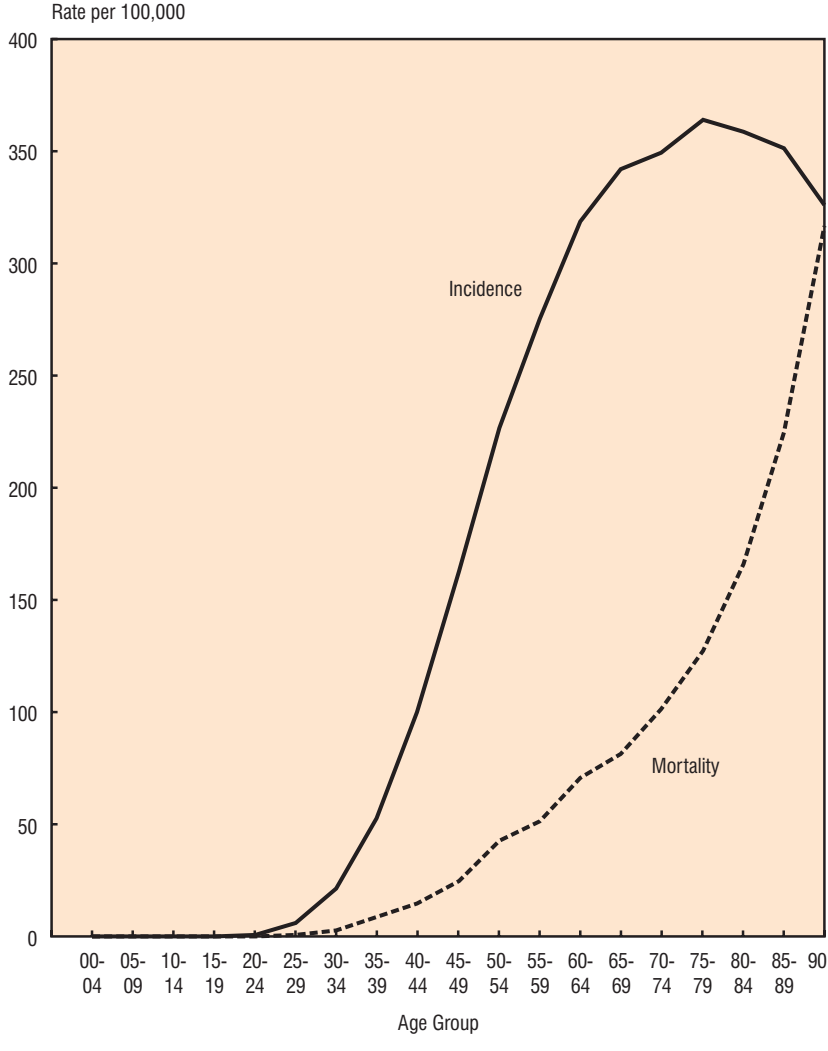
Figure 13.1

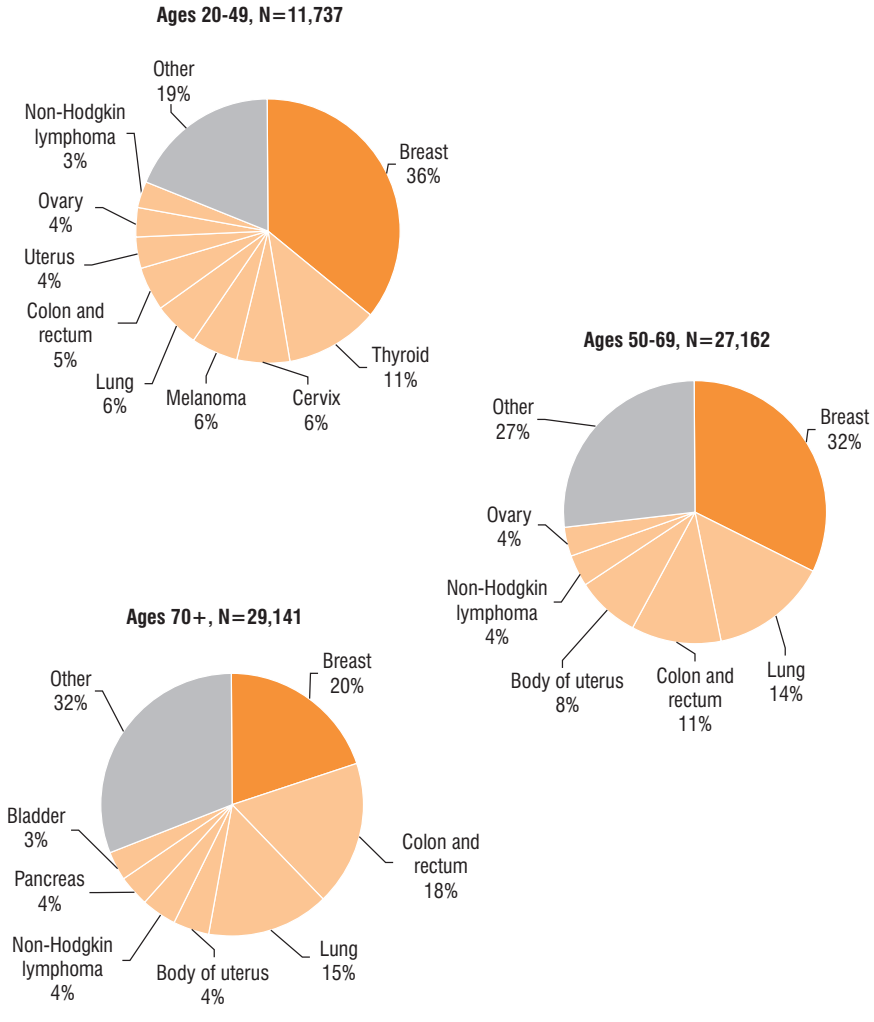
Age-Specific Incidence and Mortality Rates for Breast Cancer, Females, Canada, 1999-2003



Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Figure 13.2

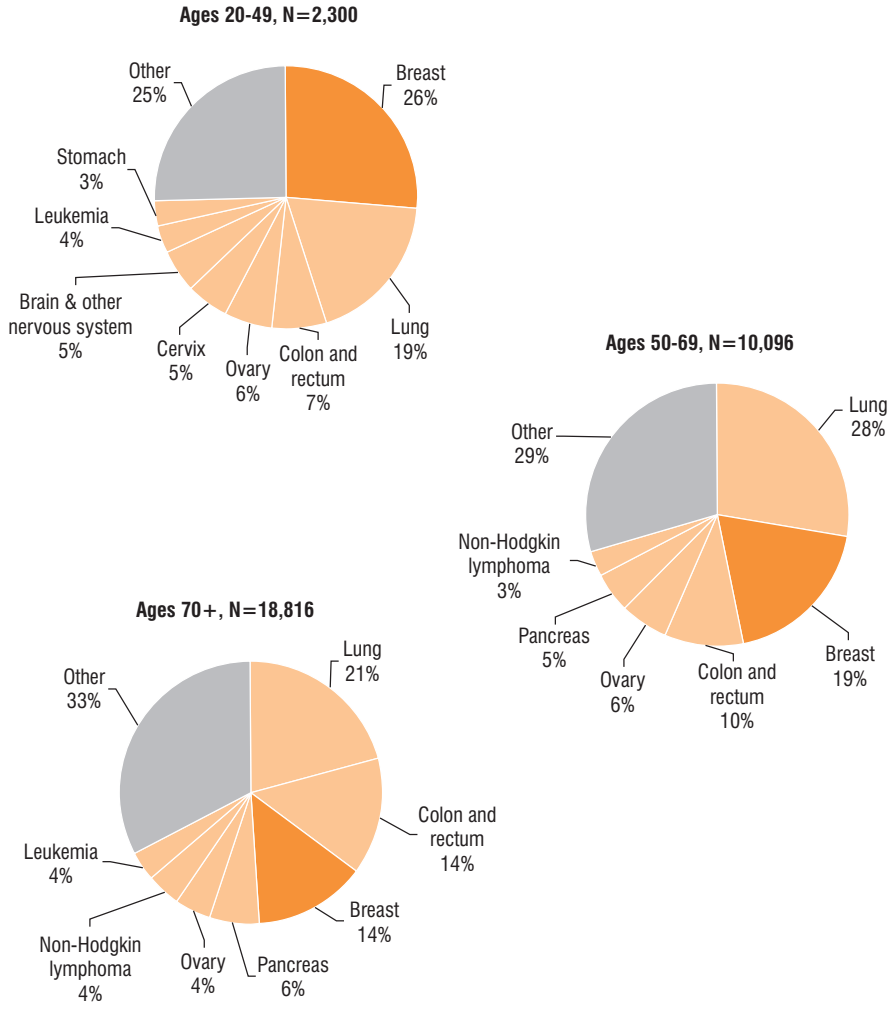
Leading Types of Cancer Among Women, Percentage of New Cases, Canada, 2003



Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Figure 13.3

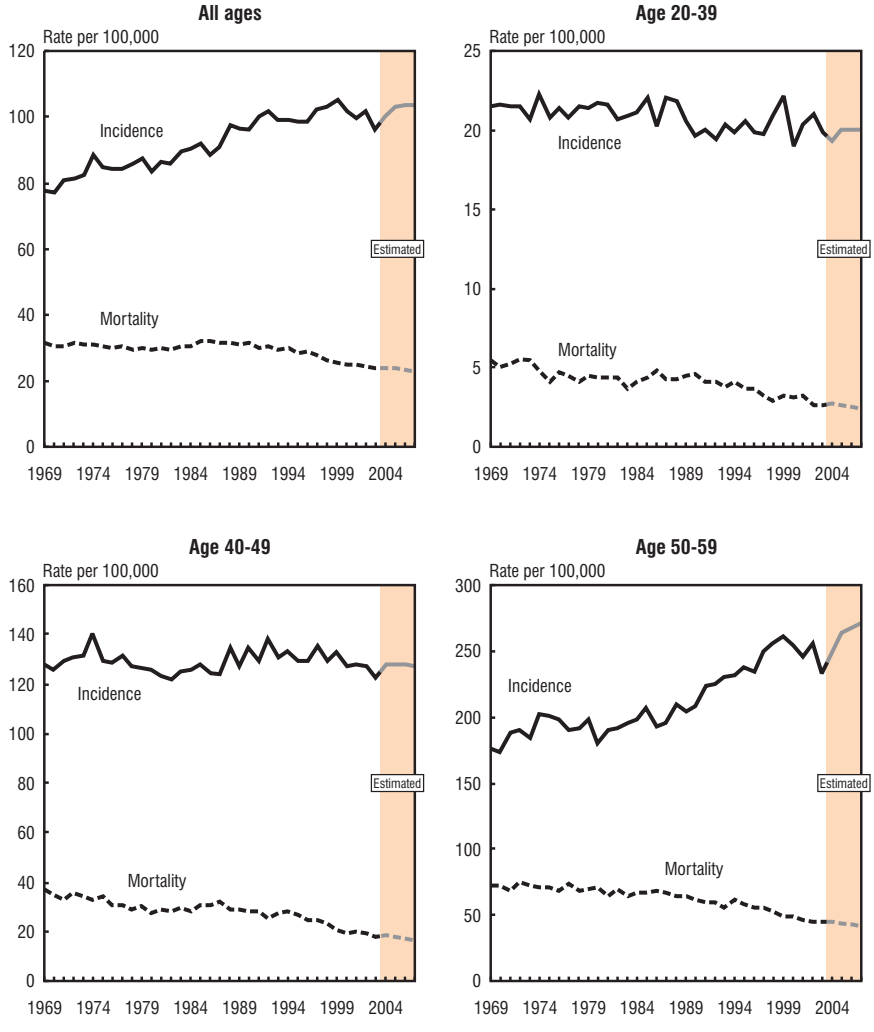
Leading Causes of Cancer Death Among Women, Percentage of Deaths, Canada, 2003



Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Figure 13.4a

Age-Standardized Incidence and Mortality Rates by Age Group, Breast Cancer, Females, Canada, 1969-2007

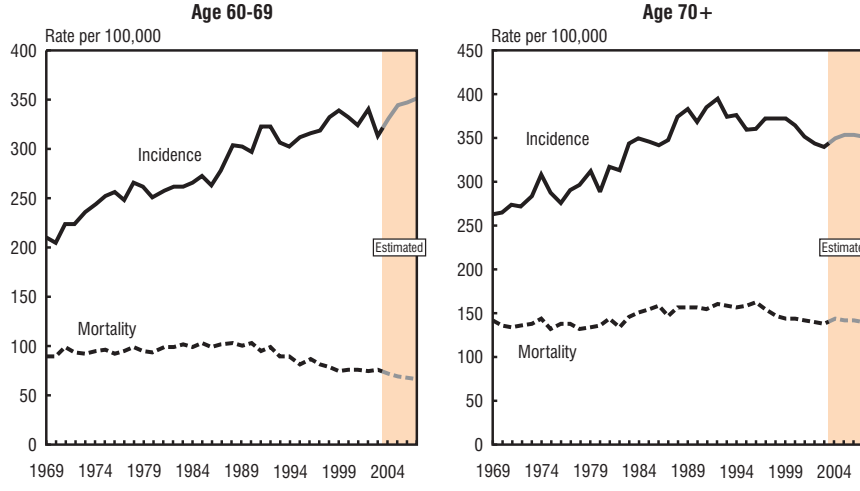


Note: The range of rate scales differ widely between the six age groups. Actual incidence data are available to 2004 except for Newfoundland and Labrador, Quebec and Ontario where 2004 incidence is estimated.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Figure 13.4b

Age-Standardized Incidence and Mortality Rates by Age Group, Breast Cancer, Females, Canada, 1969-2007

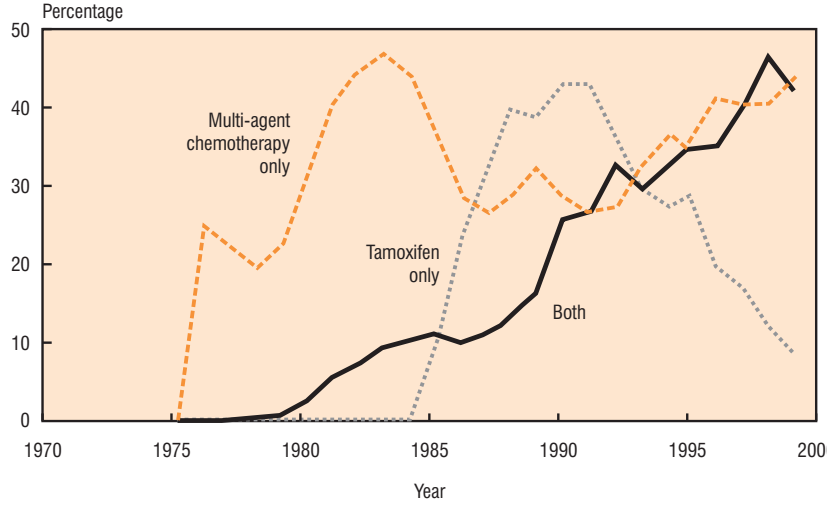


Note: The range of rate scales differ widely between the six age groups. Actual incidence data are available to 2004 except for Newfoundland and Labrador, Quebec and Ontario where 2004 incidence is estimated.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Figure 13.5

Changes in the Pattern of Use of Adjuvant Therapy Among Women 50-69 Years of Age with Node-Positive Stage II or IIIA Breast Cancer*



* These data were derived from United States SEER Registries treatment information adjusted for underreporting as assessed from SEER patterns-of-care studies.

Source: New England Journal of Medicine 2005; 353(17):1784-1792

Figure 13.6

Five-year Relative Survival Ratio (%) (and 95% Confidence Interval) by Year of Diagnosis, Ontario, Breast Cancer, Females, Cases Diagnosed 1975-1999

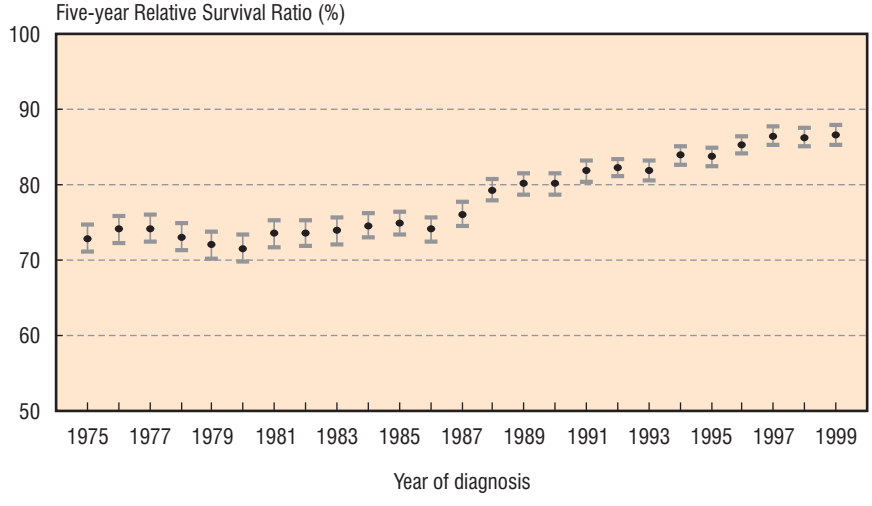


Figure 13.7

Age-Specific Five-year Relative Survival Ratio (%) by Five-year Period of Diagnosis, Breast Cancer, Females, Ontario 1975-1999

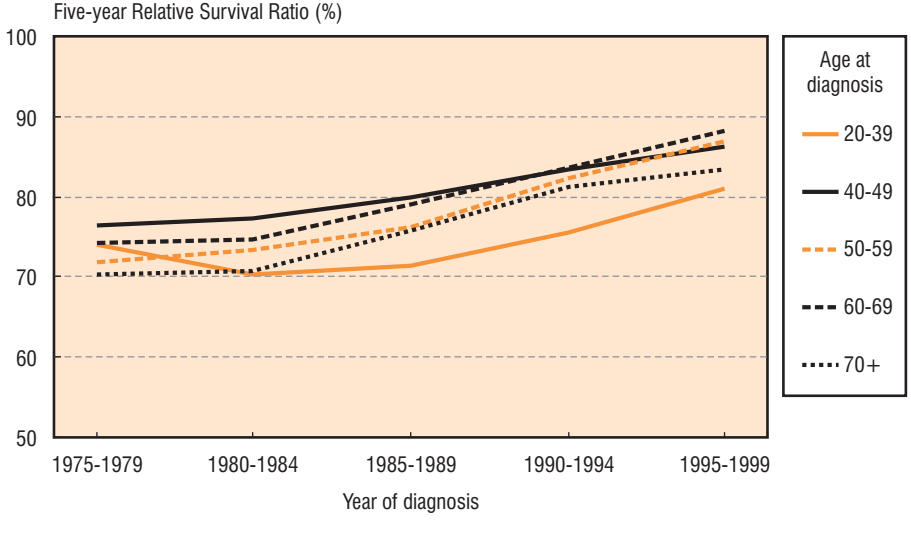
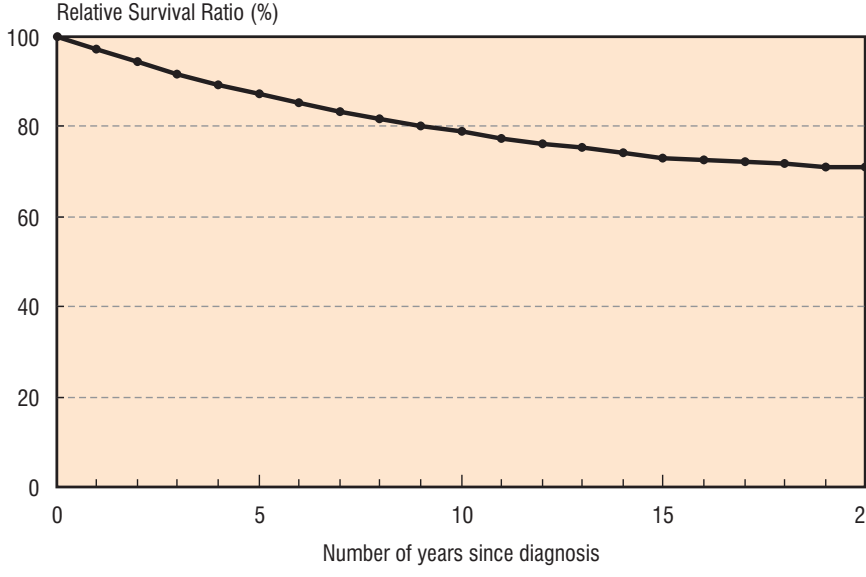


Figure 13.8

Relative Survival Ratio (%) by Number of Years Since Diagnosis, Breast Cancer, Females, Ontario*



* Based on patients observed in 2001-2003, diagnosed 1-20 years earlier ("period survival analysis")

Source: Cancer Care Ontario (Ontario Cancer Registry, 2006)

Table 19

Average Annual Percent Change (AAPC) in Age-Standardized Incidence and Mortality Rates 1969-2003 for Breast Cancer Among Females by Age at Diagnosis, Canada

	Incidence 1969-2003		Mortality 1969-2003	
Age Group	AAPC	Changepoint†	AAPC	Changepoint†
All ages	**-1.8**	**1999**	**-2.5***	**1994**
20-39	-0.2*		-3.7*	1989
40-49	-0.7*	1992	-4.7*	1995
50-59	-2.2	1999	-3.5*	1994
60-69	0.6*	1989	0.3	1999
70+	-0.9*	1991	-1.9*	1995

* Significant at p=0.01

† Changepoint indicates the baseline year, if the slope of the trend changed after 1969. Please refer to *Appendix II: Methods* for further details.

Note: Values may differ from Table 9 because of the longer time period.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Table 20

Breast Cancer, Females, Five-Year Relative Survival Ratio by Stage[1] 1994-1997

TNM stage*	No. (%)	Five-Year Relative Survival Ratio (%) (and 95% Confidence Interval)
Stage I	812 (42)	96 (93-98)
Stage II	843 (44)	86 (82-89)
Stage III	155 (8)	59 (48-69)
Stage IV	112 (6)	26 (16-36)

* Excludes 270 unstaged cases.
[1] Adapted from Ugnat et al. 2004 which used data from the Ottawa Regional Cancer Centre.
Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Table 21

Breast Cancer, Females, Stage Distribution, Prince Edward Island and New Brunswick, 2003-2004

	Age at diagnosis					
	0-49	50-59	60-69	70-79	80-89	Total
TNM stage[1]	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
Stage I	82 (37)	137 (46)	129 (49)	111 (55)	51 (35)	510 (45)
Stage II	104 (46)	110 (37)	103 (40)	59 (29)	58 (40)	434 (38)
Stage III	29 (13)	48 (16)	27 (10)	22 (11)	27 (18)	153 (14)
Stage IV	9 (4)	4 (1)	2 (1)	11 (5)	11 (8)	37 (3)
						1,134 (100)

[1] AJCC 6th edition. Excludes 185 unstaged cases.
Source: Surveillance Division, CCDPC, Public Health Agency of Canada

GLOSSARY

Age The age of the patient (in completed years) at the time of diagnosis or death.

ICDO-3 International Classification of Diseases for Oncology, Third Edition.[30]

ICD-10 International Statistical Classification of Diseases and Related Health Problems, Tenth Revision.[31]

Incidence The number of new cases of a given type of cancer diagnosed during the year. The basic unit of reporting is a new case of cancer rather than an individual patient.

Mortality The number of deaths attributed to a particular type of cancer that occurred during the year. Included are deaths of patients whose cancer was diagnosed in earlier years, people with a new diagnosis during the year, and patients for whom a diagnosis of cancer is made only after death.

Observed survival proportion One minus the proportion of cancer patients who have died from any cause in a given time period.

Potential years of life lost (PYLL) A measure of the relative impact of various diseases based on premature mortality.

Province/ Territory For cancer incidence and mortality data, this is the province/ territory of the patient's permanent residence at the time of diagnosis or death, which may or may not correspond to the province/territory in which the new case of cancer or the cancer death was registered.

Relative survival ratio The ratio of the observed survival for a group of cancer patients to the survival that would have been expected for members of the general population, assumed to be practically free of the cancer of interest, who have the same main factors affecting patient survival (e.g., sex, age, area of residence) as the cancer patients. 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 from the general population.

GLOSSARY

Incidence, Mortality and Prevalence Rates

Crude rate The number of new cases of cancer or cancer deaths during the year, expressed as a rate per 100,000 persons in the population.

Age-specific rate The number of new cases of cancer or cancer deaths during the year, expressed as a rate per 100,000 persons in a given age group.

Age-standardized rate The number of new cases of cancer or cancer deaths per 100,000 that would have occurred in the standard population (1991 Canadian population) if the actual age-specific rates observed in a given population had prevailed in the standard population.

Index of age-standardized rates The age-standardized rate of the base year, 1978, is set at 1. Index values for subsequent years are derived by dividing the age-standardized rate for that year by the 1978 rate.

Prevalence The definition of prevalence is the proportion of a population that is affected by disease at a given point in time and is referred to as complete prevalence. In this document our estimate is more accurately described as limited-duration prevalence, and the duration is 15 years. By this we mean the prevalence of cases diagnosed within 15 years before the point in time for which the estimate is calculated. This estimate should always be an underestimate of complete prevalence, and the magnitude of the underestimate is dependent on cancer site.[32]

1991 Canadian Population/World Standard Population

The population used to standardize rates had the following age distribution:

	Population			Population			Population	
Age Group	Canadian	World Standard	Age Group	Canadian	World Standard	Age Group	Canadian	World Standard
0-4	6,946.4	12,000	30-34	9,240.0	6,000	60-64	4,232.6	4,000
5-9	6,945.4	10,000	35-39	8,338.8	6,000	65-69	3,857.0	3,000
10-14	6,803.4	9,000	40-44	7,606.3	6,000	70-74	2,965.9	2,000
15-19	6,849.5	9,000	45-49	5,953.6	6,000	75-79	2,212.7	1,000
20-24	7,501.6	8,000	50-54	4,764.9	5,000	80-84	1,359.5	500
25-29	8,994.4	8,000	55-59	4,404.1	4,000	85+	1,023.7	500
							TOTAL	100,000

Source: The Canadian population distribution is based on the final post-censal estimates of the July 1, 1991 Canadian population, adjusted for census undercoverage. The World Standard Population is used in *Cancer Incidence in Five Continents*.

Cancer Definitions

Cancer data presented in this monograph are classified according to the following groupings, except where otherwise noted.

Cancer	ICDO-3 Site/Type[1] (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	C33-C34	C33-C34
Melanoma	Type 8720-8790	C43
Breast	C50	C50
Cervix	C53	C53
Body of Uterus	C54-C55	C54-C55
Ovary	C56	C56
Prostate	C61	C61
Testis	C62	C62
Bladder (including in situ)	C67	C67
Kidney	C64-C66,C68	C64-C66,C68
Brain	C70-C72	C70-C72
Thyroid	C73	C73
Hodgkin Lymphoma[1]	Type 9650-9667	C81
Non-Hodgkin Lymphoma[1]	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[1]	Type 9731,9732,9734	C90
Leukemia[1]	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
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 C33-C34	C00-C97 excluding C33-C34
All Other and Unspecified Cancers (grouping used only in Appendix Tables 1 and 2)	Type 9140, 9740, 9741, 9750-9758, 9760-9769, 9950-9962, 9965-9989 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	C44,C46,C76-C80, C88,C96.0-.2, C96.7-.9, C97
All Cancers	All invasive sites	All invasive sites

[1] 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. Figures are for invasive sites including in situ bladder and excluding non-melanoma skin cancer.

APPENDIX I: ACTUAL DATA FOR NEW CASES AND DEATHS

The focus of this monograph is on current year estimates that are obtained by analyzing actual data and making short-term projections using statistical techniques (*see Appendix II*). For users 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 for the nation. These data represent the most recent year in the long series of data used to derive the current year estimates. Appendix Tables A1 and A2 list the actual number of new cases (2003) and deaths (2003) that occurred in Canada, and specify the ICDO-3 codes used to define each diagnostic group. Given the reliability of these actual counts, it is feasible to examine the frequency of additional cancer types, thus Appendix Tables A1 and A2 list a larger number of cancer types than the previous Tables. Appendix 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 monograph, several other points need to be made. As noted in Tables A3-A6 of this Appendix, because of the small populations of the Territories, it was feasible to provide only summaries (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 September 2006 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 by Type and Sex, Canada, 2003

Cancer	ICDO-3 Site/Type[1]	Total	Males	Females
All Cancers	**All invasive sites**	**143,466**	**74,848**	**68,618**
Oral (Buccal Cavity and Pharynx)	**C00-C14**	**3,153**	**2,162**	**991**
Lip	C00	344	268	76
Tongue	C01-C02	727	492	235
Salivary Gland	C07-C08	361	201	160
Mouth	C03-C06	623	357	266
Nasopharynx	C11	214	145	69
Oropharynx	C10	140	101	39
Other and Unspecified	C09,C12-C14	744	598	146
Digestive Organs	**C15-C26,C48**	**29,960**	**16,482**	**13,478**
Esophagus	C15	1,382	1,008	374
Stomach	C16	2,902	1,897	1,005
Small Intestine	C17	507	277	230
Large Intestine	C18,C26.0	12,352	6,232	6,120
Rectum and Anus	C19-C21	6,528	3,812	2,716
Liver	C22.0	1,129	824	305
Gallbladder	C23	400	143	257
Pancreas	C25	3,449	1,663	1,786
Other and Unspecified	C22.1,C24,C26.1-.9,C48	1,311	626	685
Respiratory System	**C30-C36,C38.1-.9,C39**	**21,970**	**12,688**	**9,282**
Larynx	C32	1,103	888	215
Lung	C33-C34	20,560	11,619	8,941
Other and Unspecified	C30-31,C35-36,C38.1-.9,C39	307	181	126
Bone	**C40-C41**	**284**	**160**	**124**
Soft Tissue (including Heart)	**C38.0,C47,C49**	**887**	**521**	**366**
Skin (Melanoma)	**Type 8720-8790**	**3,959**	**2,142**	**1,817**
Breast	**C50**	**18,996**	**172**	**18,824**
Genital Organs	**C51-C63**	**28,555**	**20,439**	**8,116**
Cervix	C53	1,339	–	1,339
Body of Uterus	C54	3,697	–	3,697
Uterus, Part Unspecified	C55	133	–	133
Ovary	C56	2,286	–	2,286
Prostate	C61	19,472	19,472	–
Testis	C62	787	787	–
Other and Unspecified	C51-52,C57,C58,C60,C63	841	180	661
Urinary Organs	**C64-C68**	**10,591**	**7,277**	**3,314**
Bladder	C67	6,301	4,649	1,652
Kidney and Other Urinary	C64-C66,C68	4,290	2,628	1,662
Eye	**C69**	**252**	**137**	**115**
Brain and Central Nervous System	**C70-C72**	**2,329**	**1,314**	**1,015**
Endocrine Glands	**C37,C73-C75**	**3,117**	**721**	**2,396**
Thyroid	C73	2,922	621	2,301
Other Endocrine	C37,C74-C75	195	100	95
Hodgkin Lymphoma[1]	**Type 9650-9667**	**857**	**461**	**396**
Non-Hodgkin Lymphoma[1]	**See Glossary**	**5,823**	**3,150**	**2,673**
Multiple Myeloma[1]	**Type 9731,9732,9734**	**1,727**	**948**	**779**
Leukemia[1]	**See Glossary**	**4,049**	**2,377**	**1,672**
Mesothelioma[1]	**Type 9050-9055**	**391**	**325**	**66**
All Other and Unspecified Cancers	**See Glossary**	**6,566**	**3,372**	**3,194**

– Not applicable

[1] 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. Figures are for invasive sites including in situ bladder and exclude non-melanoma (basal cell and squamous cell) skin cancer. Further information is available at: http://www.phac-aspc.gc.ca/dsol-smed/index.html.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

APPENDIX I: ACTUAL DATA FOR NEW CASES AND DEATHS

Table A2

Actual Data for Cancer Deaths by Type and Sex, Canada, 2003

Cancer	ICD-10	Total	Males	Females
All Cancers	**C00-C97**	**65,990**	**34,701**	**31,289**
Oral (Buccal Cavity and Pharynx)	**C00-C14**	**1,018**	**691**	**327**
Lip	C00	16	12	4
Tongue	C01-C02	239	150	89
Salivary Gland	C07-C08	81	52	29
Mouth	C03-C06	185	103	82
Nasopharynx	C11	105	76	29
Oropharynx	C10	91	66	25
Other and Unspecified	C09,C12-C14	301	232	69
Digestive Organs	**C15-C26,C48**	**17,396**	**9,569**	**7,827**
Esophagus	C15	1,413	1,052	361
Stomach	C16	1,944	1,188	756
Small Intestine	C17	155	78	77
Large Intestine	C18,C26.0	6,582	3,387	3,195
Rectum and Anus	C19-C21	1,542	921	621
Liver	C22.0,C22.2-.7	609	456	153
Gallbladder	C23	277	82	195
Pancreas	C25	3,441	1,687	1,754
Other and Unspecified	C22.1,C22.9,C24,C26.1-.9,C48	1,433	718	715
Respiratory System	**C30-C36,C38.1-.9,C39**	**17,938**	**10,637**	**7,301**
Larynx	C32	465	375	90
Lung	C33-C34	17,374	10,203	7,171
Other and Unspecified	C30-31,C35-36,C38.1-.9,C39	99	59	40
Bone	**C40-C41**	**134**	**72**	**62**
Soft Tissue (including Heart)	**C38.0,C47,C49**	**346**	**170**	**176**
Skin (Melanoma)	**C43**	**748**	**455**	**293**
Breast	**C50**	**5,097**	**37**	**5,060**
Genital Organs	**C51-C63**	**6,588**	**3,736**	**2,852**
Cervix	C53	377	–	377
Body of Uterus	C54	383	–	383
Uterus, Part Unspecified	C55	348	–	348
Ovary	C56	1,573	–	1,573
Prostate	C61	3,658	3,658	–
Testis	C62	38	38	–
Other and Unspecified	C51-52,C57,C58,C60,C63	211	40	171
Urinary Organs	**C64-C68**	**3,064**	**2,015**	**1,049**
Bladder	C67	1,586	1,100	486
Kidney and Other Urinary	C64-C66,C68	1,478	915	563
Eye	**C69**	**34**	**16**	**18**
Brain and Central Nervous System	**C70-C72**	**1,587**	**897**	**690**
Endocrine Glands	**C37,C73-C75**	**251**	**106**	**145**
Thyroid	C73	150	58	92
Other Endocrine	C37,C74-C75	101	48	53
Hodgkin Lymphoma	**C81**	**107**	**59**	**48**
Non-Hodgkin Lymphoma	**C82-C85,C96.3**	**2,550**	**1,380**	**1,170**
Multiple Myeloma	**C90**	**1,217**	**634**	**583**
Leukemia	**C91-C95**	**2,303**	**1,308**	**995**
Mesothelioma	**C45**	**343**	**284**	**59**
All Other and Unspecified Cancers	**See Glossary**	**5,269**	**2,635**	**2,634**

– Not applicable

Note: ICD-10 refers to the Tenth Revision of the International Classification of Diseases.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Table A3

Actual Data for New Cases for the Most Common Cancers by Sex and Geographic Region, Most Recent Year[1], Canada

	New Cases													
	Canada	NL*	PE	NS	NB	QC	ON	MB	SK	AB	BC	YT	NT	NU
Males														
All Cancers	**74,800**	**1,150**	**410**	**2,800**	**2,000**	**18,800**	**28,000**	**2,700**	**2,700**	**6,400**	**9,400**	**50**	**40**	**25**
Prostate	19,500	260	120	730	550	3,900*	7,700	680	950	1,950	2,500	10	5	–
Lung	11,600	180	60	450	350	3,700	3,800	410	340	780	1,350	10	5	10
Colorectal	10,000	240	55	390	240	2,600	3,600	390	360	810	1,300	10	10	5
Bladder**	4,600	70	25	180	130	1,450	1,400	170	180	420	610	–	–	–
Non-Hodgkin Lymphoma	3,200	30	20	120	100	720	1,200	110	120	290	440	–	–	–
Kidney	2,600	40	15	100	95	700	1,000	130	90	220	240	–	–	–
Leukemia	2,400	20	20	70	45	560	1,000	80	110	180	280	–	–	–
Oral	2,200	45	5	85	50	560	780	90	65	160	270	–	5	–
Melanoma	2,100	35	10	95	55	290	1,000	70	45	230	360	–	–	–
Stomach	1,900	40	10	65	45	480	710	80	50	140	230	–	–	–
Pancreas	1,650	15	15	60	65	470	530	80	50	120	220	–	–	–
Brain	1,300	25	5	40	30	330	530	35	35	100	170	–	–	–
Esophagus	1,000	15	5	40	30	200	400	25	30	80	160	–	–	–
Multiple Myeloma	950	10	10	25	25	260	390	40	35	95	130	–	–	–
Liver	820	5	5	15	15	220	320	25	10	80	130	–	–	–
Females														
All Cancers	**68,600**	**1,000**	**330**	**2,400**	**1,700**	**17,600**	**26,400**	**2,600**	**2,100**	**5,700**	**8,500**	**40**	**40**	**25**
Breast	18,800	290	95	610	430	4,800	7,200	710	580	1,700	2,400	15	20	5
Lung	8,900	85	55	330	250	2,600	3,100	370	280	680	1,200	5	5	10
Colorectal	8,800	200	55	350	210	2,300	3,300	340	320	630	1,050	5	5	5
Body of Uterus	3,800	50	20	120	80	940	1,500	180	130	340	460	5	–	–
Non-Hodgkin Lymphoma	2,700	35	15	80	75	650	1,050	130	80	210	360	–	–	–
Ovary	2,300	20	10	50	70	580	970	95	60	180	270	–	–	–
Thyroid	2,300	30	5	50	70	460	1,250	65	30	250	180	–	–	–
Pancreas	1,800	10	10	70	50	550	610	70	60	140	230	–	–	–
Melanoma	1,800	30	15	95	50	230	830	55	55	220	300	–	–	–
Kidney	1,650	30	5	65	50	470	640	55	55	140	130	–	–	–
Leukemia	1,650	20	5	50	45	440	660	60	60	120	190	–	–	–
Bladder**	1,650	20	10	60	50	490	510	60	45	130	200	–	–	–
Cervix	1,350	25	5	60	40	270	530	50	45	140	140	–	–	–
Stomach	1,000	35	5	40	25	260	390	35	30	80	120	–	–	–
Brain	1,000	15	5	35	20	280	420	35	25	55	110	–	–	–
Oral	990	15	5	40	25	250	380	50	30	80	130	–	–	–

– Fewer than 3 cases

* Likely an underestimate of the number of cases, see *Appendix II: Methods*.

** Inter-provincial variation. Ontario does not report in situ bladder cases. It is estimated including in situ cases for Ontario would result in 2100 bladder cancer cases among men and 820 among women. See text.

[1] 2003 for Canada, Newfoundland and Labrador, Quebec, Ontario; 2004 for Prince Edward Island, Nova Scotia, New Brunswick, Manitoba, Saskatchewan, Alberta, British Columbia; 2000-2004 average for Yukon, Northwest Territories, Nunavut.

Note: Total of rounded numbers may not equal rounded total number and an average is used for the territories. Counts exclude cases of non-melanoma (basal cell and squamous cell) skin cancer.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

APPENDIX I: ACTUAL DATA FOR NEW CASES AND DEATHS

Table A4

Actual Age-Standardized Incidence Rates for Most Common Cancers by Sex and Geographic Region, Most Recent Year[1], Canada

	New Cases													
	Canada	NL*	PE	NS	NB	QC	ON	MB	SK	AB	BC	YT	NT	NU
Males														
All Cancers	**455**	**399**	**535**	**524**	**476**	**476**	**448**	**436**	**488**	**434**	**395**	**416**	**341**	**493**
Prostate	119	92	160	137	129	100*	123	111	172	135	105	89	63	–
Lung	71	62	78	85	83	94	61	65	60	54	56	73	58	245
Colorectal	61	82	73	74	56	65	58	62	63	56	53	73	106	67
Bladder**	29	25	36	34	30	37	23	27	31	29	26	–	–	–
Non-Hodgkin Lymphoma	19	9	24	22	24	18	19	18	21	20	18	–	–	–
Kidney	16	14	21	19	22	17	16	20	16	14	10	–	–	–
Leukemia	15	7	24	14	12	15	16	13	20	12	12	–	–	–
Oral	13	16	5	16	12	13	12	14	11	10	11	–	18	–
Melanoma	13	13	15	18	14	7	16	11	8	15	15	–	–	–
Stomach	12	15	14	12	11	12	11	13	9	10	10	–	–	–
Pancreas	10	5	16	12	16	12	9	12	9	8	9	–	–	–
Brain	8	8	5	7	8	8	8	6	7	7	7	–	–	–
Esophagus	6	5	7	8	7	5	6	4	5	5	7	–	–	–
Multiple Myeloma	6	4	10	4	6	7	6	6	6	7	5	–	–	–
Liver	5	2	3	3	3	5	5	4	2	5	5	–	–	–
Females														
All Cancers	347	308	360	367	333	351	352	349	326	335	313	312	330	625
Breast	96	86	105	95	85	96	97	97	93	97	90	99	126	40
Lung	45	27	61	51	49	52	41	48	43	41	43	32	54	297
Colorectal	42	59	54	51	38	43	42	42	44	36	37	45	65	122
Body of Uterus	19	15	19	19	16	19	20	25	22	20	17	24	–	–
Thyroid	14	10	8	10	16	11	19	11	6	15	8	–	–	–
Non-Hodgkin Lymphoma	14	11	16	13	15	13	14	16	13	12	13	–	–	–
Ovary	12	6	7	8	13	11	13	13	10	10	10	–	–	–
Melanoma	10	8	19	15	11	5	12	7	9	13	12	–	–	–
Pancreas	8	2	8	10	9	10	8	9	8	8	8	–	–	–
Cervix	8	8	7	11	10	6	8	8	8	9	6	–	–	–
Kidney	8	9	5	11	10	9	9	8	8	9	5	–	–	–
Leukemia	8	7	7	8	9	9	9	7	9	7	7	–	–	–
Bladder**	8	6	12	9	9	9	6	8	6	7	7	–	–	–
Brain	6	5	4	6	4	6	6	5	4	3	5	–	–	–
Oral	5	5	4	7	5	5	5	7	5	5	5	–	–	–
Stomach	5	10	4	6	5	5	5	4	3	4	4	–	–	–

– Age-standardized incidence rate is based on less than 3 cases per year

* Likely an underestimate of the number of cases, see *Appendix II: Methods*.

** Inter-provincial variation. 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 34 among men and 10 among women. See text.

[1] 2003 for Canada, Newfoundland and Labrador, Quebec, Ontario; 2004 for Prince Edward Island, Nova Scotia, New Brunswick, Manitoba, Saskatchewan, Alberta, British Columbia; 2000-2004 average for Yukon, Northwest Territories, Nunavut.

Note: Rates exclude non-melanoma (basal cell and squamous cell) skin cancer and are adjusted to the age distribution of the 1991 Canadian population.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Table A5

Actual Data for Deaths for Most Common Cancers by Sex and Geographic Region, Canada, 2003[1]

	New Cases													
	Canada	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC	YT	NT	NU
Males														
All Cancers	**34,700**	**650**	**170**	**1,250**	**990**	**9,200**	**12,800**	**1,350**	**1,250**	**2,700**	**4,200**	**30**	**25**	**15**
Lung	10,200	190	50	400	330	3,300	3,400	330	310	710	1,150	10	5	10
Colorectal	4,300	85	20	180	110	1,100	1,650	160	130	290	520	5	5	5
Prostate	3,700	65	15	110	120	770	1,350	170	230	360	440	–	–	–
Pancreas	1,700	30	10	75	50	430	590	65	65	150	230	–	–	–
Non-Hodgkin Lymphoma	1,400	15	5	40	45	340	530	70	55	100	180	–	–	–
Leukemia	1,300	10	10	45	25	330	520	70	50	95	160	–	–	–
Stomach	1,200	30	10	40	30	320	470	50	35	75	130	–	–	–
Bladder	1,100	20	5	35	30	260	430	50	40	80	150	–	–	–
Esophagus	1,050	20	–	35	20	210	420	40	45	95	160	–	–	–
Kidney	920	15	5	30	25	250	340	35	35	75	100	–	–	–
Brain	900	25	–	30	25	240	330	20	25	85	130	–	–	–
Oral	690	10	–	25	20	180	260	30	15	60	90	–	–	–
Multiple Myeloma	630	5	5	15	20	150	280	20	15	45	80	–	–	–
Melanoma	460	10	–	15	10	75	210	15	15	45	60	–	–	–
Liver	460	–	–	5	–	110	200	15	5	40	75	–	–	–
Females														
All Cancers	**31,300**	**530**	**180**	**1,200**	**820**	**8,200**	**11,700**	**1,250**	**1,050**	**2,500**	**3,900**	**15**	**20**	**15**
Lung	7,200	100	45	280	180	2,000	2,500	290	230	540	930	5	5	5
Breast	5,100	90	20	220	130	1,250	1,900	220	170	410	610	5	5	–
Colorectal	3,800	85	35	170	110	1,050	1,400	140	130	270	440	–	5	–
Pancreas	1,750	30	10	50	50	470	650	70	50	150	240	–	–	–
Ovary	1,550	30	5	45	45	330	640	55	50	130	240	–	–	–
Non-Hodgkin Lymphoma	1,150	10	5	35	25	280	490	40	45	85	160	–	–	–
Leukemia	1,000	10	5	35	25	250	380	40	35	100	110	–	–	–
Stomach	760	25	5	25	15	230	270	25	15	70	80	–	–	–
Body of Uterus	730	10	5	20	10	200	300	25	20	55	80	–	–	–
Brain	690	15	5	25	15	180	250	15	20	60	95	–	–	–
Kidney	560	10	5	20	20	140	210	20	20	45	70	–	–	–
Bladder	490	5	–	20	10	130	190	10	20	40	60	–	–	–
Cervix	380	5	–	15	20	60	150	20	10	40	50	–	–	–
Oral	330	–	–	10	10	80	110	20	15	25	55	–	–	–
Melanoma	290	10	–	15	15	50	110	10	10	20	55	–	–	–

– Fewer than 3 deaths

[1] 1999-2003 average for Yukon, Northwest Territories, Nunavut

Note: Total of rounded numbers may not equal rounded total number and an average is used for the territories.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

APPENDIX I: ACTUAL DATA FOR NEW CASES AND DEATHS

Table A6

Actual Age-Standardized Mortality Rates for Most Common Cancers by Sex and Geographic Region, Canada, 2003[1]

	New Cases													
	Canada	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC	YT	NT	NU
Males														
All Cancers	**215**	**239**	**236**	**241**	**245**	**240**	**210**	**216**	**210**	**198**	**183**	**287**	**233**	**350**
Lung	63	71	69	77	82	84	55	54	53	52	49	117	77	199
Colorectal	27	31	24	35	28	29	27	26	23	21	23	39	42	71
Prostate	24	26	24	21	31	22	24	27	36	29	19	–	–	–
Pancreas	10	10	14	14	12	11	10	11	11	11	10	–	–	–
Non-Hodgkin Lymphoma	8	4	8	8	12	9	9	11	9	7	8	–	–	–
Leukemia	8	3	14	9	7	9	9	11	9	7	7	–	–	–
Stomach	7	10	11	8	7	8	8	8	6	6	6	–	–	–
Bladder	7	9	8	7	8	7	7	8	7	6	6	–	–	–
Esophagus	6	7	–	7	5	5	7	6	8	7	7	–	–	–
Kidney	6	5	8	6	6	6	5	6	6	6	4	–	–	–
Brain	5	8	–	6	6	6	5	3	5	5	5	–	–	–
Oral	4	4	–	5	4	4	4	5	3	4	4	–	–	–
Multiple Myeloma	4	1	4	3	5	4	4	3	3	3	4	–	–	–
Melanoma	3	4	–	3	2	2	3	3	3	3	3	–	–	–
Liver	3	–	–	1	–	3	3	2	1	3	3	–	–	–
Females														
All Cancers	**148**	**153**	**184**	**172**	**152**	**153**	**147**	**149**	**143**	**145**	**137**	**172**	**217**	**431**
Lung	35	31	48	42	37	40	33	38	34	33	34	38	47	232
Breast	24	24	23	32	23	24	24	27	24	24	21	35	31	–
Colorectal	17	25	36	23	19	18	17	16	17	15	15	–	34	–
Pancreas	8	8	10	7	9	9	8	8	6	8	8	–	–	–
Ovary	8	9	5	7	9	6	8	7	7	8	8	–	–	–
Non-Hodgkin Lymphoma	5	3	7	5	5	5	6	5	5	5	5	–	–	–
Leukemia	5	2	4	5	5	5	5	5	4	6	4	–	–	–
Brain	4	6	3	4	3	4	3	2	3	4	4	–	–	–
Stomach	3	8	4	4	2	4	3	3	1	4	3	–	–	–
Body of Uterus	3	3	5	3	2	4	4	3	3	3	3	–	–	–
Kidney	3	3	4	3	3	2	3	2	3	3	2	–	–	–
Oral	2	–	–	1	2	1	1	2	2	1	2	–	–	–
Cervix	2	2	–	3	4	1	2	3	2	3	2	–	–	–
Bladder	2	2	–	3	2	2	2	1	3	2	2	–	–	–
Melanoma	1	2	–	2	3	1	1	1	2	1	2	–	–	–

– Age-standardized mortality rate is based on less than 3 cases per year

[1] 1999-2003 average for Yukon, Northwest Territories, Nunavut

Note: Rates are adjusted to the age distribution of the 1991 Canadian population.

Source: Surveillance Division, CCDPC, Public Health Agency of Canada

Data Sources and Processing

The actual cancer incidence and mortality data used in this monograph were obtained from three sources: mortality data files (1950-2003),[33] the National Cancer Incidence reporting System (NCIRS, 1969-1991) and the Canadian Cancer Registry (CCR, 1992-2004)[1] (the Health Statistics Division at Statistics Canada maintains all these databases).

Actual mortality data were available at the Public Health Agency of Canada for all the provinces and territories for the period 1969 to 2003. Incidence data were available for all the provinces and territories between 1969 and 2004 except for Newfoundland and Labrador, Quebec and Ontario, where incidence was reported up to 2003. For 2003 Ontario death certificates only cases, counts were obtained from the Ontario Cancer Registry since these were not available in the CCR for the August 2006 release

Records from each province were extracted and then classified by sex, age group and selected cancer site as defined in the *Glossary*. Canada totals for selected sites were then determined as the sum of the 10 provinces and three territories.

Population figures for Canada, the provinces and the territories were taken from intercensal estimates for the period 1971 to 2000,[34] from postcensal estimates for the **period 2001 to 2005**[34] and from the Scenario 3 population projections for **2006 to 2007**.[35] The population estimates from **1971 to 2005** and the population projections include non-permanent residents as part of the population. In addition, adjustments are made for net census undercoverage and returning Canadians, and the reference date for the annual estimates is July 1 instead of June 1. The population projections incorporate assumptions of natural increase, immigration and internal migration, which closely reflect the Canadian reality. These assumptions are regularly updated to take into account the most recent changes.

Incidence and mortality estimates for 2007 were extrapolated from models that were fitted to a subset of the data described above. The data series were selected so that they begin in 1986 for both incidence and mortality. This allows consistency between the mortality and incidence estimates and ensures that the estimates accurately account for current trends. For mortality estimates, data from 1986 to 2003 were used. For incidence estimates, data from 1986 to the latest year of available data were used.

Actual incidence and mortality rates for each province/territory, sex, site and year were computed by dividing the number of cases by the corresponding provincial/territorial population figures. In previous editions, these rates were computed for the "under 45" and the "45 and over" age groups separately. In order to study the age distributions of all cancers and of the leading types of cancer (lung, colorectal, prostate and breast), age specific rates were computed for the age groups 0-19, 20-29, 30-39, 40-49, 50-59, 60-69, 70-79, and 80 years and over. Starting with the 2003 edition, rates were computed and analyzed by five-year age groups 0-4, 5-9, 10-14, up to 80-84, and 85 years of age and older.

Age-standardized incidence and mortality rates for each site were calculated using the age distribution of the 1991 Canadian population. The World Standard Population[36] was used in publications before 1995. It was replaced because it is much younger than the 1991 Canadian population. Consequently, estimates of age-standardized rates before 1995 are not comparable with later estimates.

APPENDIX II: METHODS

Commencing with the 2000 edition of *Canadian Cancer Statistics*, the Northwest Territories represent a different geographic area than in the past. Its geographic boundaries were redrawn, reducing the land area representing the Northwest Territories, and a new territory named Nunavut was incorporated.[37]

For all cancers, even those with poor survival such as pancreas and lung, the annual number of incident cases is expected to be similar to or larger than the number of deaths. However, there are situations in which the number of deaths, either observed or projected, is larger than the corresponding number of new cases. In the case of Newfoundland and Labrador, this is caused by the Registry not receiving information on death certificates that mention cancer. This results in an underestimate of the number of cases for the years used to generate the estimates. Once the Newfoundland and Labrador Registry begins receiving information in order to register these cases the difference will disappear. Deaths may correspond to cases diagnosed in previous years, so year-to-year variation is also a factor for rare cancer sites.

Incidence Estimates (New Cases) for 2007

The number of new cases was estimated for each age group, cancer site and sex by fitting Poisson regression models to the provincial and territorial yearly values. The assumption underlying Poisson regression is that the annual incidence counts are independent Poisson random variables with a mean equal to the product of the population size for a particular year and the (true) annual incidence rate.

A modification to the projection methodology was implemented for the 2003 edition. In editions before 2003, for each province/territory, age group, sex and site, a separate model for crude incidence rates was used, with year as the only independent variable. The latest projection methodology includes age as a factor with 18 levels, and the inclusion of trend terms was evaluated by the stepwise selection algorithm available in S-plus 2000. The estimates for 2007 were obtained by multiplying the extrapolated crude incidence rates by the demographic projections for the same year. Since longer data series for some provinces were available, estimates for Canada were computed as the sum of the estimates for the provinces and territories.

Occasionally, when the original data show large fluctuations, it has been impossible to obtain results of satisfactory precision from the model. For these exceptions, new cases for 2007 were estimated (after consultation with the provinces/territories) by a five-year average of the most recent available data: Newfoundland and Labrador (male – prostate); Prince Edward Island (male – prostate, lung, leukemia; female – lung); Nova Scotia (male –prostate; female – lung); New Brunswick (male – prostate, melanoma, thyroid, non-Hodgkin lymphoma; female – pancreas, thyroid, non-Hodgkin lymphoma, lung); Quebec (male – prostate, melanoma, testis, multiple myeloma); Ontario (male – prostate); Manitoba (male – prostate, stomach, pancreas, melanoma, kidney; female – stomach, uterus, ovary, brain, thyroid, lung, kidney, leukemia); Saskatchewan (male – prostate; female – lung); Alberta (male – prostate); British Columbia (male – prostate); Northwest Territories (male – All Cancers, prostate; female – All Cancers); Yukon Territories (male – All Cancers, prostate; female – All Cancers) and Nunavut (male – All Cancers, prostate; female – All Cancers).

A consequence of implementing the ICDO-3 classification for the 2004 edition is an apparent drop compared with the previous edition of about 100 ovarian cancer cases to 2,184 cases for Canada in 2000. However, the ICDO-3 classification no longer

considers borderline ovarian cancer as malignant. Based on the ICDO-3 definition for both 1998 and 2000 there were actually about 50 additional ovarian cancer cases in 2000.

Prostate cancer incidence projection methodology was modified for the 2003 edition, as the anticipated decline in age-standardized rates from a peak in 1993 was observed until 1995, at which point a new and increasing trend was established. This observation in the summary rates does not apply to the age-specific rates. Since 1981, the age-specific rates for Canada among men under 40 have revealed little change and shown no trend; among men aged 40-59 a steeply increasing trend started around 1991 and has yet to change course; among men aged 60-74 the rates follow the trends in the age-standardized rates from 1991 on; and among men over 75 years of age the brief spike in rates in the early to mid-1990s was followed by a steep decline to levels at or below the 1981 levels. Consequently, age-specific rate projections based on a Poisson regression model fit to data between 1981 and 1989 were abandoned in favour of Poisson regression models fit to data from 1991 to the most recent year of incidence data available (2003 for Newfoundland and Labrador, Quebec, Ontario and elsewhere 2004). However, the models fitted to the 1991 and later data did not provide reliable projections because prostate cancer incidence is not linear. Consequently, the five year average method was used to project prostate cancer in all jurisdictions.

The estimates of incidence counts for "all cancers" were computed as the sum of the estimated prostate cancer cases plus the estimate of "all cancers less prostate" using the standard linear model (based on data from 1986 onwards). Starting with the 2004 edition, the incidence classification uses ICDO-3 for the data from 1992 onwards. This results in an additional 1,200 cases per year as compared with the number obtained previously using the ICD-9 definition in the other cancers category and the all cancers total.

Mortality Estimates (Deaths) for 2007

The number of deaths was estimated for each age group, site and sex using a method similar to that used for incidence. For each province and territory, a linear model was used for death rates, with an 18-level age group factor and trend terms selected by a stepwise algorithm. Mortality counts by cancer site for Canada were obtained from the estimates of the provincial and territorial counts.

In the versions of this booklet published before 2003, mortality due to colorectal cancer was based on 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 cases were included in the definition of colorectal cancer. As a consequence, mortality figures for colorectal cancer have increased quite dramatically from those published before this change.

When the original data show large fluctuations, it has been impossible to obtain results of satisfactory precision from the model. For these exceptions, deaths for 2007 were estimated (after consultation with the provinces/territories) by a five-year average of the most recent available data: New Brunswick (male – non-Hodgkin lymphoma; female – lung, pancreas); Quebec (male – non-Hodgkin lymphoma); Manitoba (male –

pancreas, non-Hodgkin lymphoma, kidney; female – stomach, lung); Saskatchewan (female – stomach); Northwest Territories (male – All Cancers; female – All Cancers); Yukon Territories (male – All Cancers; female – All Cancers) and Nunavut (male – All Cancers; female – All Cancers).

Estimated Age-Standardized Incidence Rates (ASIRs) and Mortality Rates (ASMRs) for 2007

Starting with the 2003 edition, projected age-standardized rates were computed directly from the age-specific projections. This change eliminated the need to employ a separate projection methodology for age-specific and age-standardized rates. Additionally the new procedure guarantees the definition that age-standardized rates are a weighted average of the age-specific rates. In editions of this publication before 2003, incidence and mortality rates were generally estimated using weighted least squares regression, with **some exceptions.** Weights were taken as the inverse of the estimated variances of the actual age-standardized rates. Variances were calculated under the assumption that the age-specific counts used in the computation of the age-standardized rates follow independent Poisson distributions. Regressions were performed for Canada and each province or territory for each site and sex using a linear model, with year as the only independent variable.

Again, when the original data show large fluctuations, it has been impossible to obtain from the model results of satisfactory precision. For this reason and to maintain consistency between the age-specific and age-standardized estimates, annual age-standardized incidence rates for 2007 were estimated by actual age-standardized incidence rates calculated over a five-year period for each of those cases cited in the Incidence Estimates section. Similarly, annual age-standardized mortality rates for 2007 were estimated by actual age-standardized mortality rates calculated over a five-year period for each of the areas and site combinations listed in the Mortality Estimates section.

Prostate cancer incidence projection methodology was modified, starting with the 2003 edition, as the anticipated decline in age-standardized rates from a peak in 1993 was observed until 1995, at which point a new and increasing trend was established. However, this new trend has not aligned with the level that was projected on the basis of a linear model fit to the 1981-1989 data. Several options were explored, and we believe the most accurate projections were obtained by simply computing the age-standardized rate from the projected age-specific counts (discussed earlier) starting with 1991 data. As for the projection of incidence counts, this year projections for all provinces and territories were based on the five-year average.

Accuracy and Precision of Estimates

The accuracy of an estimate relates to the question of bias: whether or not an estimate is targeting the value of interest. The precision of an estimate refers to the fact that any estimate has certain variability to it; one cannot “know” an estimate exactly, and therefore the estimate serves only to provide insight into the real, unknown value of interest.

The standard error and coefficient of variation as well as the confidence interval are calculated to evaluate the precision of each estimate. The standard error is an estimate of the extent to which an estimate will vary, while the coefficient of variation relates this variation to the actual size of the quantity being estimated. Confidence intervals

use the standard error to create a range of plausible values for the quantity being estimated. These values are available upon request from the Surveillance Division, Centre for Chronic Disease Prevention and Control, Public Health Agency of Canada. Together, these quality measures assess the precision (or imprecision) of a particular estimate but not the accuracy of the estimate. Note that any estimates are subject to error, and the degree of precision depends primarily on the number of observed cases and the population size for each site-sex-province combination, whereas the accuracy is related to the adequacy of the model used in the estimation process.

Estimates of incidence and mortality have been rounded as follows: counts between 0 and 99 to the nearest 5, counts between 100 and 999 to the nearest 10, counts between 1,000 and 1,999 to the nearest 50 and counts 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 counts/rates are combined before rounding, so it is possible that the totals in the tables do not appear to add up. However, any of these discrepancies must be within the precision of the rounding units described above.

Average Annual Percent Change (AAPC) in Cancer Incidence and Mortality

The AAPC values were calculated for each site by fitting a model that assumed a constant rate of change in the ASIRs or ASMRs, that is, a linear model applied to the ASIRs and ASMRs after logarithmic transformation. The estimated slope resulting from that fit was then transformed back to represent a percentage increase or decrease. Joinpoint analysis was applied to search for the most recent linear trend using ASIR or ASMR data points from 1986 to 2003 for both incidence and mortality rates. A minimum of five data points were required to identify a new trend, so the latest year that a new trend could be detected would be starting in 1999. Data from 1994 to 2003 were used for both incidence and mortality unless the joinpoint analysis detected a new trend starting later than 1994 in which case the latest linear trend was used to estimate the AAPC.

Estimates of Non-Melanoma Skin Cancer for 2007 in Canada

For 2007 non-melanoma skin cancer estimates were the average of estimates obtained by applying British Columbia, Manitoba and New Brunswick rates to the Canadian population. The pathology laboratories in British Columbia send all diagnostic reports of non-melanoma (basal cell and squamous cell) skin cancer to the provincial registry. It is assumed that non-melanoma skin cancer is under-reported to some extent. The age and sex-specific incidence rates in British Columbia for 2003 has been projected to the current year and applied to the Canadian population estimates to generate a minimal estimate of the number of cases for Canada as a whole. For Manitoba data, estimates were obtained by applying projected 2007 sex- and age-specific rates from graphs in the paper by Demers et al. to the Canadian population.[38] For New Brunswick summary counts of new basal and squamous cell cases 1992 to 2004 by age group were provided by the Cancer Registry and rates were projected using linear regression to 2007.

APPENDIX II: METHODS

Probability of Developing/Dying from Cancer

Probabilities of developing cancer were calculated according to the age- and sex-specific cancer incidence and mortality rates for Canada in 2003 and life tables based on 2001-2003 all-cause mortality rates. The methodology used was that of Zdeb[39] and Seidman et al.[40] The life table procedures used assumed that the rate of cancer incidence for various age groups in a given chronological period will prevail throughout the future lifetime of a person as he/she advances in age. Since these may not be the rates that will prevail at the time a given age is attained, the probabilities should be regarded only as approximations of the actual ones.

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 2003. The indicator was calculated 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.

The Total Number of New Cases or Deaths, Showing the Contribution of Change in Cancer Risk, Population Growth and Change in Population Age-Structure

Figures 3.1 and 3.2 display the determinants of increases in incidence and mortality for males and females respectively. All three series plotted on each graph refer to data from 1978 as the baseline. The uppermost series is a plot of the annual Canadian cancer cases/deaths observed or projected. The next to upper most series is an estimate of the cancer events expected if the age distribution of the 1978 population were held constant through time. The next to baseline series is an estimate of the expected number of cases/deaths assuming a population constant in both magnitude and distribution from 1978 to the current year.

In preparation of a more rigorous presentation of how these series were computed, let $P_{i,t}$ represent the sex-specific total population in Canada for year t, where i = M for males or i = F for females. That is, $P_{F,1978}$ represents the total 1978 Canadian female population. Next let $ASR_{i,t}$ denote the all-cancers, sex-specific, age-standardized incidence/mortality rate with the reference population being the 1978 Canadian population of the sex corresponding to i, which is either i = M for males or i = F for females. For example, $ASR_{F,2001}$ is the age-standardized rate for Canadian females in the year 2001.

Uppermost series: the annual number of Canadian cancer cases/deaths of sex i for a given year, say t.

Next to uppermost: total population for year t times the age-standardized rate for year t or, in symbols, $P_{i,t}\,ASR_{i,t}$.

Next to baseline: total 1978 population times the age-standardized rate for year t or, in symbols, $P_{i,1978}\,ASR_{i,t}$.

Baseline: the observed number of Canadian cancer cases/deaths for sex i that occurred in 1978.

Potential Years of Life Lost (PYLL)

The indicator was calculated by obtaining deaths for ages < 1, 1-4, 5-9, . . . 90+ for Canada in 2003 and life expectancy at the midpoints of the age groups. The PYLL is the total number of years of life lost obtained by multiplying, for each age group, the number of deaths by the life expectancy of survivors.[41]

Population Attributable Risk (PAR)

Population attributable risk (PAR) estimates used in the PYLL calculations were obtained by combining mortality data, smoking prevalence and relative risk estimates by sex, age and disease. Smoking prevalence was estimated using the 2003 Canadian Community Health Survey[42] and relative risk estimates were obtained using SAMMEC II.[43] Smoking-attributable mortality (SAM) was calculated[44] for disease components with known elevated relative risks within the specific disease range. SAM was estimated as the product of the smoking-attributable fraction (SAF) and the number of deaths in each sex, age group and disease component. SAF was calculated as follows:

$$SAF= ([P_0+ P_1 (RR_1) + P_2 (RR_2)] - 1) / [P_0 + P_1(RR_1) + P_2 (RR_2)] ,$$

where P_0, P_1 and P_2 denote never, current and former smoking prevalence respectively, and RR_1 and RR_2 denote relative risk estimates for current and former smokers respectively. PAR was then calculated as the total SAM divided by the total number of deaths for each sex, age and disease grouping.

Prevalence

The prevalence of cancer cases in the Canadian population was estimated by cancer site based on diagnoses within 15 years of the target year. Cancer incidence data were obtained from the National Cancer Incidence Reporting System (before 1992) and the Canadian Cancer Registry (1992-2004), and survival data were obtained from the Information Management Division, Saskatchewan Cancer Agency. For each cancer site, data were stratified by month of diagnosis, age at diagnosis and sex. Expected prevalence was then calculated as the product of the age-specific crude survival rate and the number of incident cases. The stratum-specific estimates were aggregated by cancer site.

Survival rates were based on data from the Saskatchewan Cancer Registry. Data were first stratified by cancer site, sex and age groups 0-34, 35-64 and 65 or older, then monthly survival was calculated using the life table method as implemented in SAS version 8.02 (right censoring was adjusted for in the standard way). These estimates were based on cases diagnosed from the beginning of 1986 to the end of 2001, with follow-up to the end of 2002.

Annual national cancer incidence counts were stratified by year of diagnosis, cancer site, sex and age groups 0-1, 2-4, 5-9, 10-14 and so on by five-year age groups to age 85 and older. These data were then uniformly distributed to each month throughout the year by dividing the number of cases in each stratum by 12. Prevalence for 2003, allowing a maximum of 15 years of survival, was estimated within each stratum as the product of the crude survival rate and the corresponding case count. Estimates were limited to a maximum of 15 years' survival, which corresponds closely with lifetime prevalence, and used survival estimates up to the limit of their reliability.

APPENDIX II: METHODS

Relative survival

Cancer cases were defined based on the International Classification of Diseases for Oncology, Third Edition.[45] Surveillance, Epidemiology, and End Results (SEER) groups, with mesothelioma and Kaposi sarcoma as separate groupings, were used to define cancer type.[46] There are some differences compared to the cancer definitions in the Glossary (see reference 46). Analyses were restricted to first primary invasive tumour records diagnosed between January 1, 1996 and December 31, 1998 inclusive. These incidence years were selected due to the fact that 2003 was the most recent year of mortality data available for analysis. The pre-1992 tumour history, if any, of persons on the CCR was obtained by linking the CCR data with its predecessor the National Cancer Incidence Reporting System, a fixed, tumour oriented database containing cases as far back as 1969. Supplementary information available for the province of Ontario was also used.

Cases diagnosed in the province of Quebec were not included, in part because the method of ascertaining the date of diagnosis of cancer cases in this province clearly differed from that of the other provincial cancer registries[47] and because of issues in correctly ascertaining the vital status of cases. Records were excluded when the diagnosis was established either through autopsy only or death certificate only.

Survival time was calculated as the difference in days between the date of diagnosis and the date of last observation (date of death or December 31, 2003, whichever was earliest) to a maximum of five years. For a small percentage of subjects with missing information on day/month of diagnosis and/or day/month of death, the survival time was estimated.[47] Vital status during the first five years was determined through record linkage to the Canadian Mortality Data Base, or from information reported by provincial/territorial cancer registries. For deaths reported by a provincial registry but not confirmed by the record linkage process, it was assumed that the individual died on the date submitted by the reporting province.

The survival analysis was based on an algorithm written by Paul Dickman[48] with some minor adaptations. Relative survival ratios were estimated as the ratio of the observed survival of persons with cancer to the expected survival for the general population of the same age, sex, province of residence, and time period. Observed survival proportions were estimated using the cohort method. Expected survival proportions were derived from sex-specific complete provincial life tables produced by Statistics Canada, using the Ederer II approach.[49] All expected survival proportions for Prince Edward Island and the territories were derived from Canadian life tables as stable estimates for single ages could not be produced for these areas because of small population counts.

Age-specific and all ages (i.e., 15-99) survival estimates provide information on the actual survival experience, of the patient group. For comparison purposes, age-standardized survival estimates have been provided. Age-standardized estimates were calculated using the direct method; specifically by weighting age-specific estimates for a given cancer to the age distribution of persons diagnosed with that cancer from 1992 to 2001. Age-standardized survival estimates are interpretable as the overall survival estimate that would have occurred, if the age distribution of the patient group under study had been the same as that of the standard population. Unless they have been age-standardized to the same population, survival estimates from other sources should not be compared with those presented in this analysis.

APPENDIX III: PREVIOUS SPECIAL TOPICS

In past years, other Special Topics included:

- progress in cancer control: screening (2006)
- progress in cancer prevention: modifiable risk factors (2005);
- international variation in cancer incidence, 1993-1997 (2004);
- economic burden of cancer in Canada, 1998 (2004);
- non-Hodgkin's lymphoma (2003);
- cancer incidence in young adults (2002);
- survival rates (2002, 1995, 1991-1993);
- colorectal cancer (2001, 1995);
- progress in cancer control (2000);
- relative impact of population growth and aging on cancer incidence in Canada (1999);
- cancer surveillance in Canada (1999);
- international comparisons (1998);
- 10-year review of Canadian cancer statistics (1997);
- evaluation of the accuracy of estimates (1996);
- prostate cancer (1996);
- economic burden of cancer (1996, 1990);
- prevalence estimates (1995);
- breast cancer (1993);
- smoking prevalence and lung cancer (1991);
- cancer in Aboriginal populations (1991);
- age-specific trends among women (1990);
- cancer rates by income level (1990).

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FOR FURTHER INFORMATION

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 – the National Office and the Divisional offices – is provided on page 110. Your local CCS office is listed in the white pages of the telephone directory.

For information regarding cancer research sponsored by the **National Cancer Institute of Canada (NCIC)**, with funds provided by the CCS and The Terry Fox Foundation, contact the NCIC at the address provided on page 110.

For Information from Public Health Agency of Canada:
More detailed information on methodology is available from the Surveillance Division, Public Health Agency of Canada, 120 Colonnade Road, Ottawa, Ontario, K1A 0K9. Tel. (613) 952-3335, Fax. (613) 941-2057.

Cancer Surveillance On-Line is an interactive, Web-based tool for easy access to cancer surveillance data. It allows the user to generate data according to a choice of parameters, such as cancer site, geographic area and period of time, and a choice of presentation mode, such as tables, charts and maps. See the Public Health Agency of Canada website noted below for the URL.

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) 951-1746. Analytical articles appear regularly in Health Reports, Statistics Canada, Catalogue 82-003, quarterly.

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 108-109 for addresses, telephone numbers, fax numbers and websites.)

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

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- Statistics Canada
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