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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.

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The production and distribution of the monograph is the result of collaboration among all these groups.

- ◆ The provincial and territorial cancer registries supply and review the cancer incidence data used to produce the statistics in this report. The Committee wishes to acknowledge the essential contribution of the staff at the registries.
- ◆ The Surveillance and Risk Assessment Division, Centre for Chronic Disease Prevention and Control (CCDPC), Health Canada, produced the estimates, trends, projections, tables and figures for all sections of the document. Other analyses include producing the probabilities of developing and dying of cancer, calculations of premature mortality, and the contribution of risk factors to cancer. Les Mery of Health Canada contributed to the section on childhood cancer statistics.
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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 10. 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 10.

For Information from Health Canada:

More detailed information on methodology is available from the Surveillance and Risk Assessment Division, Health 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 Health Canada Website noted below for the URL.

For Information from Statistics Canada:

Detailed standard tables or 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 8 and 9 for addresses, telephone numbers, fax numbers and Websites.)

Data contained in this document are available on the CCS and NCIC Websites at (<http://www.cancer.ca>) or (<http://www.ncic.cancer.ca>). Additional information is also available from:

- ◆ Canadian Cancer Society (CCS)
<http://www.cancer.ca>
- ◆ National Cancer Institute of Canada (NCIC)
<http://www.ncic.cancer.ca>
- ◆ Health Canada
<http://www.hc-sc.gc.ca/pphb-dgspsp/dsol-smed/> (select cancer button)
- ◆ Statistics Canada
<http://www.statcan.ca>
- ◆ Canadian Strategy for Cancer Control
<http://www.cancercontrol.org>
- ◆ Canadian Association of Provincial Cancer Agencies (CAPCA)
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This monograph is published by the Canadian Cancer Society and the National Cancer Institute of Canada in collaboration with Health Canada, Statistics Canada, provincial/territorial cancer registries as well as university-based and provincial/territorial cancer agency-based researchers. It is part of an annual series that began publication in 1987.

The main purpose of the publication is to provide health professionals, researchers and policy-makers with detailed information regarding the incidence and mortality of the most common types of cancer by age, sex, time period and province or territory. It is hoped that these data will 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.

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 summary of previous Special Topics please refer to *Appendix III*. This year's Special Topics are International Variation in Cancer Incidence, 1993-1997, and the Economic Burden of Cancer in Canada, 1998.

Information on cancer incidence and mortality comes from the provincial and territorial cancer registries and offices of vital statistics, which send their data to Statistics Canada for compilation at the national level. The process of collecting complete information about cancer cases in each province/territory and then compiling this information at the national level results in a considerable delay before reliable information for a particular year is available for all of Canada. This report contains actual rates and frequencies up to the most recent year for which complete data were available at the time of writing (2000 for both incidence and mortality) and, in addition, estimated values for the years up to 2004. The estimates are made in the following way: first, time trends in the known rates are examined; second, these trends are projected to the present time to obtain current rate estimates; and third, these rate estimates for the current year are applied to current population estimates.

The statistical methodology used for publication in recent years has involved the standardization of incidence and mortality rates on the basis of the 1991 Canadian population rather than the World Standard Population. Age-standardized rates are higher with this methodology because the Canadian population has a higher proportion of older people, among whom cancer is more common. Standardization using the Canadian population provides results that are more relevant and useful to those concerned with cancer in Canada. **It should be noted that it is not appropriate to compare the age-standardized rates presented here with those from publications that employ a different standard population.**

Details of the statistical methods used to produce the projections are described in *Appendix II: Methods*. **It is important to emphasize that the figures provided for 2004 are estimates, rather than actual data.**

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 are also excluded. Details of how cancer sites are classified and definitions of technical terms are provided in the *Glossary*.

INTRODUCTION

Individuals who require additional information can refer to the section entitled *For Further Information*, which indicates how to contact the various agencies involved, including Health Canada, Statistics Canada, the Canadian Cancer Society, the National Cancer Institute of Canada, and provincial and territorial cancer registries.

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; a collaborative monograph entitled *Cancer in North America, 1996-2000*,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 107). Finally, **readers can be included on the mailing list for next year's publication** by completing the *Order and Evaluation Form*.

Current Incidence and Mortality

- ◆ An estimated 145,500 new cases of cancer and 68,300 deaths from cancer will occur in Canada in 2004.
- ◆ In 2004, the most frequently diagnosed cancers will continue to be breast cancer for women and prostate cancer for men.
- ◆ 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 eastern provinces and lower in western provinces.
- ◆ Lung cancer rates continue to be higher in eastern Canada than in western Canada.

Trends in Incidence and Mortality

- ◆ The increased number of new cases of cancer is primarily due to an increasing and aging population.
- ◆ Mortality rates due to prostate cancer are dropping.
- ◆ Lung cancer incidence and mortality continue to climb among women.

Age and Sex Distribution of Cancer

- ◆ Among men, 75% of new cancer cases and 82% of deaths due to cancer occur among those who are at least 60 years old.
- ◆ Among women, 63% of new cases and 78% of cancer deaths occur among those who are at least 60 years old.

Probability of Developing/Dying from Cancer

- ◆ On the basis of current incidence rates, during their lifetimes 38% of Canadian women and 43% of men will develop cancer.
- ◆ On the basis of current mortality rates, 23% of women and 28% of men, or approximately 1 out of every 4 Canadians, will die of 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 about one-third of potential years of life lost (PYLL) due to cancer, and this proportion is increasing.

Prevalence

- ◆ 2.4% of Canadian men and 2.6% of Canadian women have had a diagnosis of cancer in the previous 15 years.
- ◆ In the female population, 1% are survivors of breast cancer diagnosed within the previous 15 years, and 0.7% of the male population are survivors of prostate cancer.

HIGHLIGHTS

Cancer in Children and Youth

- ◆ About 1,300 Canadian children develop cancer each year. Their chances of survival have improved dramatically over the past three decades.

International Variation in Cancer Incidence, 1993-1997

- ◆ The incidence rates of all types of cancer combined are high in Canada and other Western countries compared with Asia and Latin America.
- ◆ Canada's incidence rates for lung, female breast, prostate and colorectal cancer are among the highest in the world.
- ◆ Canada's incidence rates for the other most common cancers worldwide – cancers of the stomach, liver, cervix and esophagus – are among the lowest in the world.

Economic Burden of Cancer in Canada

- ◆ The total cost of cancer in Canada was estimated to be \$14.2 billion in 1998. Of this, the direct cost of health care services was \$2.5 billion, and the indirect cost due to mortality and lost productivity was \$11.8 billion.
- ◆ Cancer ranked third in terms of attributable total cost, after cardiovascular and musculoskeletal diseases.
- ◆ Hospital services accounted for the largest component of direct costs for cancer. Cancer was the leading cause of premature death in Canada, and premature mortality contributed the largest component of indirect costs due to cancer.

The importance of different types of cancer in Canada in 2004 can be measured in three 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. The deaths to cases ratio (the number of deaths divided by the number of new cases) is a crude indicator of disease severity. The closer a value is to 1.0, the poorer the prognosis for that cancer. 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 A2 in *Appendix I* or to source publications.^{1,4}

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

Sources of Data

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. 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 site and histological type of cancer from pathology reports and other records, according to definitions in the CCR Data Dictionary. Cancer sites 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 usually treated successfully without requiring hospitalization or the review of a pathologic specimen. **For this reason, all tables in this monograph exclude the estimated 76,000 cases of non-melanoma skin cancer for Canada in 2004.*** 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 estimated using incidence rates from the cancer registry in British Columbia, which is considered to have the most complete data. Please refer to *Appendix II: Methods* for further details.

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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 precise than that obtained by the cancer registries from hospital and pathology records. These facts may help to account, in part, for the number 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, 2004

An estimated 145,500 new cases of cancer and 68,300 deaths from cancer will occur in Canada in 2004. Men outnumber women for both new cases and deaths, by 5.8% for incidence and 12.8% for mortality (Table 1).

Three types of cancer account for at least 50% of new cases in each sex: prostate, lung, and colorectal cancers in males, and breast, lung, and colorectal cancers in females. Thirty percent of cancer deaths in men and 26% in women are due to lung cancer alone (Figures 1.1 and 1.2). Comparisons between this year and other years with respect to colorectal cancer 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 2004, accounting for an estimated 8,200 deaths, compared with the 5,200 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 9,800 new cases, lung cancer is the second leading form of cancer in women, ahead of the 8,800 new cases expected for colorectal cancer, which ranks third. Breast cancer continues to lead in incidence among Canadian women, with more than twice as many new cases as lung cancer.

In Canadian men in 2004, prostate cancer will continue as the leading form of cancer diagnosed, with an estimated 20,100 newly diagnosed cases, compared with 11,900 lung cancers. The rapid increase in the number of prostate cancers detected in all provinces in the early 1990s resulted from the widespread rise in the use of earlier detection techniques. The projected number of new prostate cancer cases was derived from a Poisson regression model using data from 1991 to the most recent year of incidence data available (see *Appendix II: Methods*). Lung cancer will remain the leading cause of cancer death in Canadian men in 2004; the estimated 10,700 lung cancer deaths far exceed the 4,500 deaths due to colorectal cancer, the second leading cause of cancer death in men.

Deaths to Cases Ratio

The ratio of deaths to new cases, at 47% overall, is slightly higher in males than in females. On the basis of these ratios, the cancer sites listed in Table 1 could be classified arbitrarily into three groups: those with a very good prognosis (a ratio of 30% or less—female breast, prostate, melanoma, body of the uterus, cervix, thyroid, Hodgkin’s disease, testis and male bladder); those with a fairly good prognosis (a ratio

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greater than 30% but less than 50% – male breast, colorectal, non-Hodgkin's lymphoma, female bladder, kidney, oral and larynx); and those with a poor prognosis (ratio greater than 50% – lung, leukemia, pancreas, stomach, ovary, brain, multiple myeloma and esophagus).

Breast cancer and prostate cancer remain the most frequent cancers; lung cancer remains the most frequent cause of death from cancer.

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Table 1

Estimated New Cases and Deaths for Cancer Sites by Sex, Canada, 2004

	New Cases 2004 Estimates			Deaths 2004 Estimates			Deaths/Cases Ratio 2004 Estimates		
	Total	M	F	Total	M	F	Total	M	F
All Cancers	145,500	74,800	70,700	68,300	36,200	32,100	0.47	0.48	0.45
Lung	21,700	11,900	9,800	18,900	10,700	8,200	0.87	0.90	0.84
Breast	21,400	145	21,200	5,300	45	5,200	0.25	0.31	0.25
Prostate	20,100	20,100	–	4,200	4,200	–	0.21	0.21	–
Colorectal	19,100	10,400	8,800	8,300	4,500	3,900	0.44	0.43	0.44
Non-Hodgkin's Lymphoma	6,200	3,300	2,900	2,900	1,550	1,350	0.47	0.47	0.46
Bladder	5,000	3,700	1,250	1,600	1,150	490	0.32	0.30	0.39
Kidney	4,300	2,600	1,600	1,500	950	560	0.35	0.36	0.35
Melanoma	4,200	2,300	1,950	850	520	330	0.20	0.23	0.17
Leukemia	3,900	2,300	1,650	2,200	1,300	930	0.57	0.57	0.57
Body of Uterus	3,800	–	3,800	700	–	700	0.19	–	0.19
Pancreas	3,300	1,600	1,700	3,300	1,600	1,700	0.99	0.98	1.00
Oral	3,100	2,100	1,050	1,050	690	340	0.33	0.33	0.33
Stomach	2,800	1,800	1,000	1,900	1,150	750	0.68	0.65	0.75
Thyroid	2,800	640	2,100	170	65	110	0.06	0.10	0.05
Ovary	2,300	–	2,300	1,550	–	1,550	0.66	–	0.66
Brain	2,300	1,300	1,050	1,600	930	690	0.70	0.72	0.67
Multiple Myeloma	1,850	990	850	1,250	670	580	0.68	0.67	0.68
Esophagus	1,400	1,000	400	1,600	1,200	420	1.14 ¹	1.18 ¹	1.04 ¹
Cervix	1,350	–	1,350	410	–	410	0.30	–	0.30
Larynx	1,200	970	210	510	420	90	0.43	0.43	0.43
Hodgkin's Disease	830	450	380	120	70	55	0.15	0.15	0.14
Testis	820	820	–	35	35	–	0.04	0.04	–
All Other Sites	11,800	6,500	5,300	8,300	4,600	3,800	0.70	0.70	0.70

– Not applicable

¹ The high ratio (in excess of 1.0) for cancer of the esophagus may result from incomplete registration of this cancer before death. Please refer to *Appendix II: Methods* for further details.

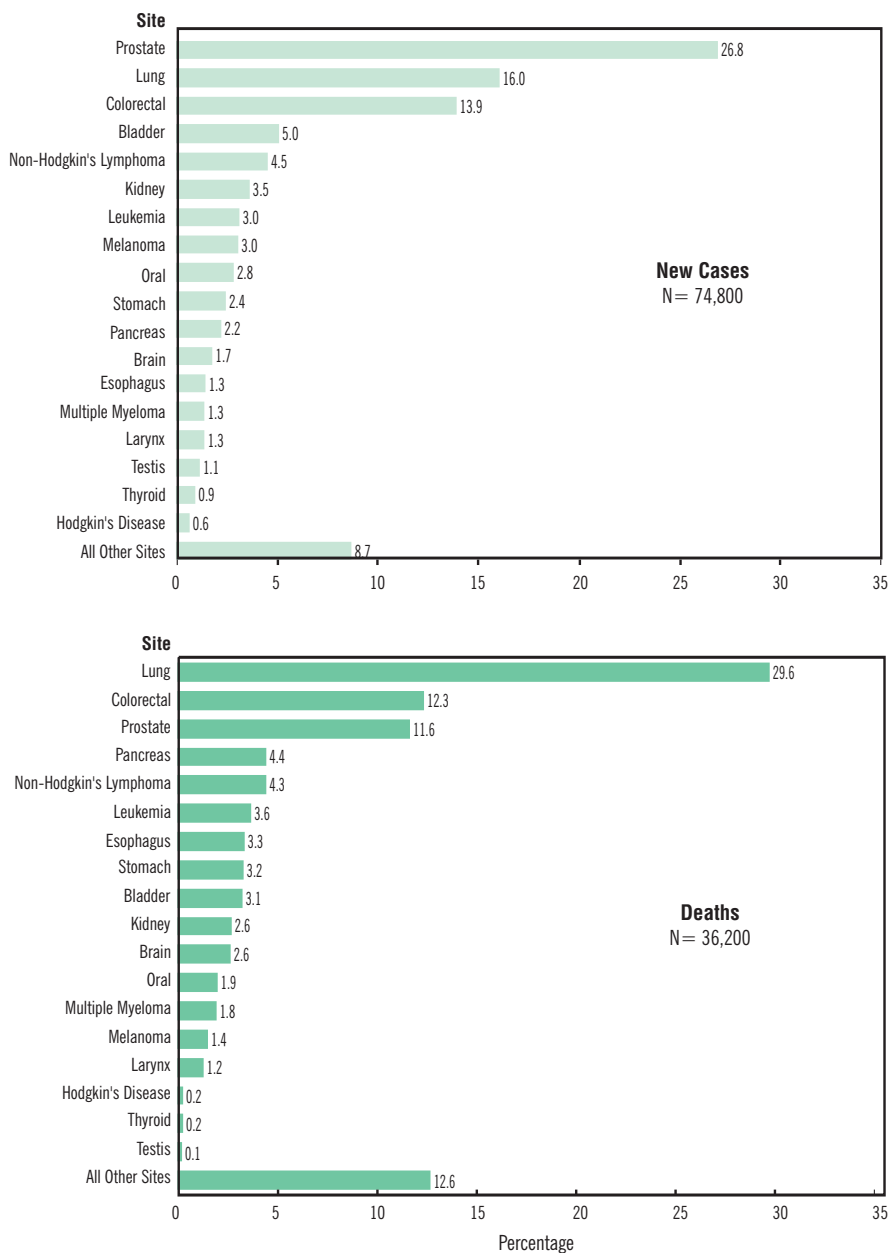
Note: Incidence figures exclude an estimated 76,000 new cases of non-melanoma (basal and squamous) skin cancer.

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

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Figure 1.1

Percentage Distribution of Estimated New Cases and Deaths for Selected Cancer Sites, Males, Canada, 2004



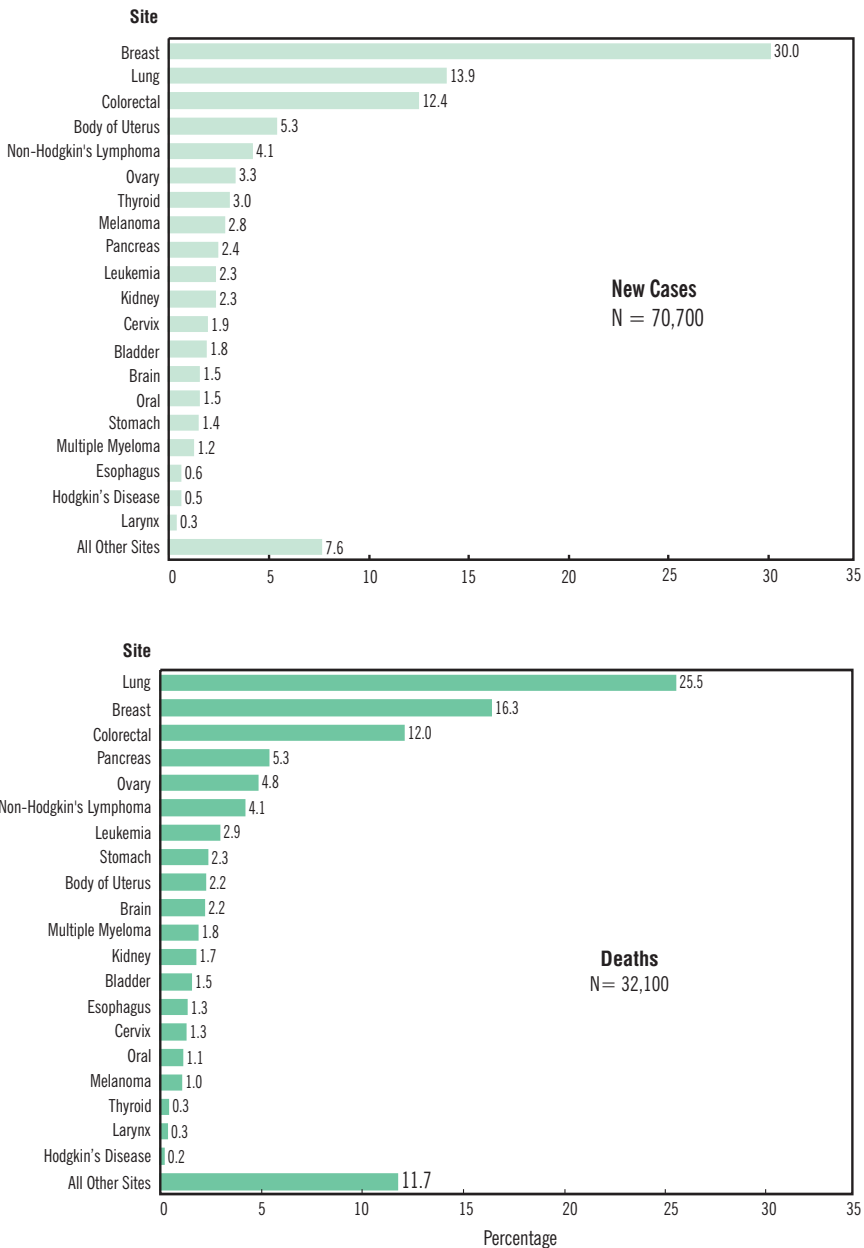
Note: Incidence figures exclude an estimated 76,000 new cases of non-melanoma (basal and squamous) skin cancer.

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

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Figure 1.2

Percentage Distribution of Estimated New Cases and Deaths for Selected Cancer Sites, Females, Canada, 2004



Note: Incidence figures exclude an estimated 76,000 new cases of non-melanoma (basal and squamous) skin cancer.

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Table 2 presents population projections and estimates of new cases and deaths for all cancer sites combined, by sex and province or territory for 2004. Tables 3 and 4 present estimates of the number of new cases and the age-standardized incidence rates for each of the major cancer sites, by sex and province/territory for 2004. 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 major cancer sites, by sex and province/territory for 2004. The calculation of standardized rates using the 1991 Canadian population as the standard is described in the *Glossary*. Adjustments were necessary for estimated incident cases in most provinces/territories. Age-standardized rates are calculated directly from the case estimates as described in *Appendix II: Methods*. Tables A3 to A6 in *Appendix I* provide the most recent actual data across the provinces/territories. Generally speaking, both incidence and mortality rates are higher in eastern provinces than in the western provinces.

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. 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. These 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. However, different patterns of tobacco consumption among the provinces/territories contribute to some of the variation, as demonstrated by the higher lung cancer rates in eastern Canada.

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. 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 others.

Fourth, the availability of and the completeness of coverage in target populations of screening programs (e.g. for breast and cervical cancer) differ among provinces/territories. The year of initiation of screening programs differs by province/territory, and cancer rates will be altered temporarily through identification of previously undiagnosed cases in asymptomatic individuals. As well, the availability of diagnostic procedures may differ regionally.

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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 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 incident data. In Quebec, because of the registry's dependence on hospital data, the estimated number of prostate, melanoma and bladder cases is underreported by an estimated 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.

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 modalities 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 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.

Generally, both incidence and mortality rates are higher in eastern provinces and lower in western provinces.

Table 2

Estimated Population, New Cases and Deaths for All Cancers by Sex and Geographic Region, Canada, 2004

Province/Territory	Population (000s) 2004 Estimates ¹			New Cases 2004 Estimates ²			Deaths 2004 Estimates		
	Total	M	F	Total	M	F	Total	M	F
Canada	31,757	15,714	16,043	145,500	74,800	70,700	68,300	36,200	32,100
Newfoundland and Labrador	523	258	265	2,100	1,150	970	1,250	700	560
Prince Edward Island	140	68	71	770	410	350	340	190	150
Nova Scotia	943	461	482	5,200	2,700	2,400	2,500	1,350	1,150
New Brunswick	760	376	384	3,900	2,100	1,850	1,850	1,050	820
Quebec	7,465	3,682	3,783	36,300	18,100	18,300	18,400	9,900	8,500
Ontario	12,320	6,081	6,239	54,600	27,900	26,800	25,000	13,100	11,900
Manitoba	1,158	574	584	5,700	2,900	2,800	2,600	1,400	1,250
Saskatchewan	996	493	503	4,700	2,500	2,200	2,300	1,250	1,050
Alberta	3,196	1,611	1,585	13,100	7,000	6,100	5,300	2,800	2,600
British Columbia	4,157	2,058	2,099	18,900	10,000	8,900	8,500	4,500	4,000
Yukon	28	14	14	75	35	40	50	30	20
Northwest Territories	41	21	20	95	50	45	50	25	25
Nunavut	30	16	15	50	20	25	40	20	15

¹ 2004 population projections were provided by the Census and Demographics Branch, Statistics Canada.

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

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

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

GEOGRAPHIC PATTERNS OF CANCER OCCURRENCE

Table 3

Estimated New Cases for Major Cancer Sites by Sex and Province, Canada, 2004

	New Cases										
	Canada ¹	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Males											
All Cancers	74,800	1,150	410	2,700	2,100	18,100	27,900	2,900	2,500	7,000	10,000
Prostate	20,100	310	150	710	560	3,200	8,000	750	810	2,500	3,100
Lung	11,900	170	70	470	380	3,900	4,000	430	350	840	1,350
Colorectal	10,400	230	50	370	260	2,600	3,900	400	330	820	1,350
Bladder	3,700	30	10	170	130	1,400	1,200	120	160	140	370
Non-Hodgkin's Lymphoma	3,300	40	20	100	100	810	1,300	130	100	270	470
Kidney	2,600	40	15	95	75	640	1,050	120	75	230	290
Melanoma	2,300	30	15	100	60	340	980	70	55	240	360
Leukemia	2,300	15	15	65	55	560	870	85	95	250	270
Oral	2,100	55	10	75	55	500	800	100	65	170	260
Stomach	1,800	50	5	50	50	460	650	65	65	150	240
Pancreas	1,600	5	10	50	45	460	570	60	50	130	230
Brain	1,300	20	5	40	30	350	490	45	40	100	170
Multiple Myeloma	990	10	5	30	25	270	380	40	30	75	130
Larynx	970	25	5	30	25	350	320	30	30	60	100
Females											
All Cancers	70,700	970	350	2,400	1,850	18,300	26,800	2,800	2,200	6,100	8,900
Breast	21,200	340	100	690	540	5,700	7,900	810	610	1,850	2,600
Lung	9,800	100	45	340	230	2,800	3,500	400	250	780	1,250
Colorectal	8,800	160	50	340	250	2,200	3,400	340	270	660	1,050
Body of Uterus	3,800	60	20	130	85	870	1,500	180	110	350	470
Non-Hodgkin's Lymphoma	2,900	35	10	75	95	710	1,150	110	85	230	370
Ovary	2,300	30	10	80	55	630	910	90	70	160	290
Thyroid	2,100	25	5	40	50	450	1,050	65	45	190	180
Melanoma	1,950	30	25	90	60	320	800	65	55	240	270
Pancreas	1,700	5	10	65	55	480	590	70	50	140	240
Leukemia	1,650	15	5	50	35	420	620	70	60	160	190
Kidney	1,600	25	5	60	60	410	620	65	55	140	160
Cervix	1,350	25	10	60	40	270	510	55	50	170	160
Bladder	1,250	10	5	55	45	470	410	40	55	50	120
Oral	1,050	15	5	40	20	230	390	45	35	85	160
Brain	1,050	15	5	30	25	280	410	35	30	80	120
Stomach	1,000	20	5	30	25	290	350	35	35	95	130
Multiple Myeloma	850	5	5	25	20	220	350	30	25	60	110

¹ Canada totals include provincial and territorial estimates. However, territories are not listed separately because of the small numbers.

Note: Total of rounded numbers may not equal rounded total number. The Canada and provincial totals for all cancers exclude an estimated 76,000 cases of non-melanoma (basal and squamous) skin cancer. Because of changes and improvements in source data and in methodology (as described in *Appendix II: Methods*), caution is needed if the 2004 estimates are compared with previously published estimates. These estimates may vary from actual figures. Please see *Appendix I* for most current actual data or contact provincial/territorial cancer registries for further information.

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Table 4

Estimated Age-Standardized Incidence Rates for Major Cancer Sites by Sex and Province, Canada, 2004

	Rate per 100,000										
	Canada ¹	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Males											
All Cancers	449	419	534	549	533	466	461	492	466	470	437
Prostate	121	111	190	139	140	79	128	125	147	175	129
Lung	72	58	89	90	95	97	63	70	63	58	57
Colorectal	62	80	64	72	64	66	61	65	57	56	56
Bladder	23	11	16	33	33	35	19	20	29	10	16
Non-Hodgkin's Lymphoma	20	14	23	19	24	20	20	20	19	18	20
Kidney	15	13	16	17	17	16	16	19	14	15	12
Leukemia	14	6	18	13	14	14	14	14	17	17	12
Melanoma	13	10	20	20	14	8	15	12	10	15	15
Oral	12	19	11	14	13	12	12	16	11	11	11
Stomach	11	18	9	10	12	12	10	11	11	10	10
Pancreas	10	2	13	10	11	11	9	10	8	9	10
Brain	8	6	6	8	8	9	8	8	7	7	7
Larynx	6	7	8	6	6	8	5	4	5	4	4
Multiple Myeloma	6	4	6	6	6	7	6	6	5	5	5
Females											
All Cancers	351	292	382	384	369	360	350	377	340	355	323
Breast	106	100	108	109	107	113	104	112	98	107	97
Lung	48	31	52	53	46	55	46	55	40	47	45
Colorectal	41	47	52	50	47	41	42	43	37	37	36
Body of Uterus	19	17	19	21	17	17	20	25	18	21	17
Non-Hodgkin's Lymphoma	14	11	11	12	19	14	15	15	13	14	14
Ovary	12	9	10	13	12	13	12	12	11	9	11
Thyroid	12	9	5	7	11	11	16	10	9	12	8
Melanoma	10	11	27	16	14	7	11	10	10	14	10
Pancreas	8	2	8	9	10	9	7	8	7	8	8
Cervix	8	8	10	11	10	6	7	9	9	10	7
Kidney	8	8	7	9	12	8	8	9	8	8	6
Leukemia	8	5	7	8	7	8	8	10	10	10	7
Bladder	6	3	3	8	8	9	5	5	8	3	4
Brain	6	4	5	5	6	6	6	5	5	5	5
Oral	5	5	5	6	4	5	5	6	5	5	6
Stomach	5	7	3	4	4	5	4	4	5	5	4
Multiple Myeloma	4	2	4	4	4	4	4	4	3	3	4

¹ Canada totals include provincial and territorial estimates. However, territories are not listed separately because of the small numbers.

Note: Rates exclude non-melanoma (basal and squamous) skin cancer and are adjusted to the age distribution of the 1991 Canadian population. Because of changes and improvements in source data and in methodology (as described in *Appendix II: Methods*), caution is needed if the 2004 estimates are compared with previously published estimates. These estimates may vary from actual figures.

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

GEOGRAPHIC PATTERNS OF CANCER OCCURRENCE

Table 5

Estimated Deaths for Major Cancer Sites by Sex and Province, Canada, 2004

	Deaths										
	Canada ¹	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Males											
All Cancers	36,200	700	190	1,350	1,050	9,900	13,100	1,400	1,250	2,800	4,500
Lung	10,700	220	60	450	340	3,500	3,500	370	330	740	1,200
Colorectal	4,500	100	25	150	110	1,250	1,600	180	160	330	520
Prostate	4,200	70	25	160	120	900	1,600	170	230	400	540
Pancreas	1,600	30	10	60	45	420	560	55	55	120	220
Non-Hodgkin's Lymphoma	1,550	15	5	70	45	340	620	85	45	110	230
Leukemia	1,300	15	5	45	30	280	520	50	45	120	170
Stomach	1,150	45	5	35	25	360	400	40	40	75	140
Bladder	1,150	30	5	40	30	270	430	45	40	85	160
Kidney	950	20	5	35	25	230	320	65	30	85	130
Brain	930	20	–	30	20	270	310	35	30	85	110
Oral	690	20	5	30	20	190	250	25	20	45	85
Multiple Myeloma	670	10	5	30	20	160	260	30	25	40	90
Melanoma	520	5	–	20	10	95	250	20	10	35	65
Larynx	420	10	–	15	20	150	140	15	15	20	45
Females											
All Cancers	32,100	560	150	1,150	820	8,500	11,900	1,250	1,050	2,600	4,000
Lung	8,200	120	50	260	170	2,300	2,900	320	280	670	1,100
Breast	5,200	95	25	200	130	1,400	2,000	200	150	410	620
Colorectal	3,900	90	25	180	100	1,100	1,400	160	120	240	440
Pancreas	1,700	25	10	65	55	450	610	70	65	140	240
Ovary	1,550	30	5	50	40	360	580	60	55	130	220
Non-Hodgkin's Lymphoma	1,350	15	5	55	40	310	530	55	45	100	180
Leukemia	930	15	5	30	15	210	370	40	35	90	130
Stomach	750	35	–	25	15	230	240	20	30	60	80
Body of Uterus	700	10	5	30	20	180	270	30	20	60	75
Brain	690	10	5	25	20	210	240	25	20	60	80
Multiple Myeloma	580	10	5	20	15	150	230	25	20	45	70
Kidney	560	10	5	15	20	170	170	25	30	45	70
Bladder	490	10	–	15	15	120	180	20	15	45	65
Cervix	410	10	5	20	10	85	150	15	15	40	50
Oral	340	–	–	10	5	85	130	15	10	30	45
Melanoma	330	5	–	10	5	55	160	10	10	25	45

– Fewer than 3 deaths

¹ Canada totals include provincial and territorial estimates. However, territories are not listed separately because of the small numbers.

Note: Total of rounded numbers may not equal rounded total number. Because of changes and improvements in source data and in methodology (as described in *Appendix II: Methods*), caution is needed if the 2004 estimates are compared with previously published estimates. These estimates may vary from actual figures.

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Table 6

Estimated Age-Standardized Mortality Rates for Major Cancer Sites by Sex and Province, Canada, 2004

	Rate per 100,000										
	Canada ¹	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Males											
All Cancers	221	252	251	266	253	253	211	225	216	198	189
Lung	65	77	80	87	85	89	56	60	59	52	51
Colorectal	27	36	32	30	27	32	26	30	26	23	22
Prostate	27	29	34	33	30	25	27	27	37	31	23
Pancreas	10	10	14	12	12	10	9	9	9	8	9
Non-Hodgkin's Lymphoma	9	5	8	13	11	8	10	14	8	8	10
Leukemia	8	6	8	8	8	7	8	9	8	8	7
Stomach	7	16	9	7	6	9	6	6	7	5	6
Bladder	7	11	6	8	7	7	7	7	7	6	7
Kidney	6	7	9	7	6	6	5	10	6	6	5
Brain	5	7	2	6	5	7	5	6	6	5	5
Oral	4	6	6	5	4	5	4	4	3	3	4
Multiple Myeloma	4	4	5	6	5	4	4	5	4	3	4
Melanoma	3	1	3	4	2	2	4	3	2	2	3
Larynx	2	3	3	3	4	4	2	2	2	1	2
Females											
All Cancers	150	161	154	170	152	157	147	155	148	146	136
Lung	40	36	55	41	34	45	37	43	42	40	38
Breast	24	27	28	29	26	26	25	26	22	23	21
Colorectal	17	26	23	24	17	19	17	18	15	13	14
Pancreas	8	7	9	9	9	8	7	8	8	8	8
Ovary	7	10	7	8	7	7	7	8	8	8	8
Non-Hodgkin's Lymphoma	6	4	4	8	7	6	7	7	6	6	6
Brain	4	4	4	4	4	4	3	3	4	4	3
Leukemia	4	4	5	4	3	4	5	5	5	5	4
Stomach	3	9	2	4	3	4	3	2	4	3	3
Body of Uterus	3	3	3	4	4	3	3	3	3	3	3
Multiple Myeloma	3	3	3	3	3	3	3	3	2	3	2
Kidney	3	3	2	2	4	3	2	3	4	2	2
Oral	2	–	2	2	1	2	2	2	1	2	2
Melanoma	2	1	1	1	1	1	2	2	1	1	2
Cervix	2	4	3	3	2	2	2	2	3	2	2
Bladder	2	2	1	2	2	2	2	2	2	2	2

¹ Canada totals include provincial and territorial estimates. However, territories are not listed separately because of small numbers.

Note: Rates adjusted to the age distribution of the 1991 Canadian population. Because of changes and improvements in source data and in methodology (as described in *Appendix II: Methods*), caution is needed if the 2004 estimates are compared with previously published estimates. These estimates may vary from actual figures.

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Trends in incidence and mortality for major types of cancer are assessed by comparing annual age-standardized rates. 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 from 1975 to 2000 and estimates to the year 2004. 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. Detailed depictions of the trends in annual rates for selected sites over the past 30 years are presented in Figures 4.1, 4.2 and 5.1, 5.2 with the data points provided in Tables 7.1, 7.2 and 8.1, 8.2. The average annual percent changes in site-specific incidence and mortality rates from 1993 to 2000 are listed in Table 9 and plotted in Figure 6.

The process of age standardization permits comparisons among calendar years, since it accounts for changes that have occurred over time in the age distribution of the population. Rates in this publication have been standardized to the 1991 Canadian population. Note also that the rapid increase in incidence rates throughout the 1970s displayed in Figures 2.1 and 2.2 largely reflects improved registration of new cases in several provincial registries during this period. Registration levels, however, have generally stabilized since 1981 because of increasing consistency of cancer reporting procedures across Canada.¹

All Sites

Among men, the cancer mortality rate, after reaching a peak in 1988 (Figure 2.2, Table 7.2) is declining slowly as a result of decreases in mortality rates for lung, colorectal and other cancers. In contrast, the cancer incidence rate rose slightly in the early 1990s because of the sharp increase in incidence of prostate cancer, and more recently has begun to decline. Among women, cancer incidence has risen slightly since 1989, whereas mortality rates have declined slightly (Figures 2.1 and 2.2, Tables 8.1, 8.2).

Figures 2.1 and 2.2 show that despite the relative stability in age-standardized rates, the numbers of new cancer cases and deaths continue to rise steadily as the Canadian population increases and ages. The numbers of new cases and deaths, as opposed to rates, are an important measure of cancer burden on the Canadian population and health care system. In 2004 the number of new cases is estimated to be 145,500 and the number of deaths to be 68,300. These numbers can be used to plan patient services and health care facilities to meet the increasing demand. Figures 3.1 and 3.2 show how changes since 1971 in the total population and in the age structure of the population have affected trends in the total number of cases and deaths. The lowest plot in these graphs represents the total number of cases (or deaths) that would have occurred each year if only the rates had changed but the population had remained the same as in 1971. The middle line represents the number of cases (or deaths) that would have occurred each year if the annual rates had acted upon a population that grew larger but maintained the same age distribution as in 1971. 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. These figures demonstrate that changes in population size and age structure have been the major determinants of the increasing burden of cancer among Canadians. An important implication is that as the Canadian population continues to age and grow in size, there will be a concordant increase in the numbers of new cases and deaths each year unless a major drop in the rate occurs.

Figure 7 plots an index (see definition in Glossary) of age-standardized mortality rates from 1975 to 2000 for all sites combined and for all sites excluding lung cancer. Among men, lung cancer was responsible for the increase in cancer mortality rates until overall rates peaked in 1988. Since then, overall cancer mortality rates among men declined by similar percentages, whether or not lung cancer rates were included. Among women, the index shows that overall cancer mortality rates remained essentially stable until 2000; however, cancer mortality for all sites other than lung cancer dropped by 15% during that period.

Trends by Selected Sites

Time trends of incidence and mortality rates over a 30-year period for selected cancer sites are shown for men in Figures 4.1 and 4.2 and for women in Figures 5.1 and 5.2, with the corresponding data points tabulated in Tables 7.1, 7.2, 8.1 and 8.2. Average annual percent changes are summarized in Table 9 and Figure 6. In general, incidence and mortality rates for the majority of cancer sites have stabilized or declined during the past decade, with some notable exceptions.

Among women, lung cancer incidence and mortality rates continue their rapid increase and are three times as high as rates in 1975. However, estimated rates of lung cancer incidence and mortality among women in 2004 are still much lower than those among men. Among men, lung cancer rates leveled off in the mid-1980s and have since consistently declined, reflecting their drop in tobacco consumption beginning in the mid-1960s. Among women, smoking rates began to decline slightly only in the mid-1980s,⁶ thus benefits in terms of declining lung cancer rates have yet to become apparent (Figure 5.1 and Table 8.1).

After years of steady increases, incidence rates of prostate cancer rose particularly sharply from 1989 to 1993 (Table 7.1). By contrast, mortality rates rose much more slowly from 1978, and started to decline in the mid 1990s. The sharp increase since 1990 was predominantly the result of increased early detection using PSA (determination of the prostate-specific antigen level).⁷ That early detection has now exhausted the pool of prevalent cancer in the population that was screened, and the trend has reverted to its previous more gradual rate of increase.⁸ Although much of the past increase in incidence has likely been due to early detection, changes in risk or protective factors might also account for some of the increases. However, no such risk or protective factors have yet been identified that could explain these changes.⁷ To reflect these patterns, a conservative estimate for current prostate cancer incidence was derived by projecting rates from the most recent period (see *Appendix II: Methods*). Until now, no significant change in mortality had been associated with the increased detection rate; however, there has now been a significant drop in mortality from 1993 to 2000 (2.5% average annual percent change as shown in Table 9). It is not clear whether the declining mortality is due to earlier detection or improved treatment.

Breast cancer incidence among women also rose steadily, but gradually, between 1975 and 1992. This increase may be due, in part, to the rising use of mammography since the mid-1980s, but may also be affected by reproductive patterns.^{9,10} However, since 1993 actual incidence rates have stabilized, and mortality rates for breast cancer have declined steadily. The most recent actual data for 2000 showed the breast cancer

mortality rate to be at its lowest since 1950.¹¹ Similar declines are also occurring in the United States, the United Kingdom, and Australia.¹¹ Further research is needed to determine the reasons for this decline and the impact of screening, improved treatment and changes in risk or protective factors.

Of all the cancers analyzed in this report, the incidence of just two cancers among men and one among women has increased at an average rate greater than 2% annually since 1993 (Table 9). These were cancers of the thyroid (+3.7%) and melanoma (+2.5%) in men, and thyroid cancer (+4.6%) in women. The increasing rate of thyroid cancer has also been noted in Europe and parts of the United States. It is postulated that improved early detection practices (ultrasound and needle biopsy) are identifying early stage cancers more frequently than was possible in the past. As modern treatment is effective for most patients it is unlikely that the mortality rate will increase. An increase in melanoma incidence may be related to intense sunlight exposure and to improvements in the detection of the disease. Other cancers showing a significant increase, but of less than 2%, were non-Hodgkin's lymphoma in both men and women, and lung cancer and melanoma among women.

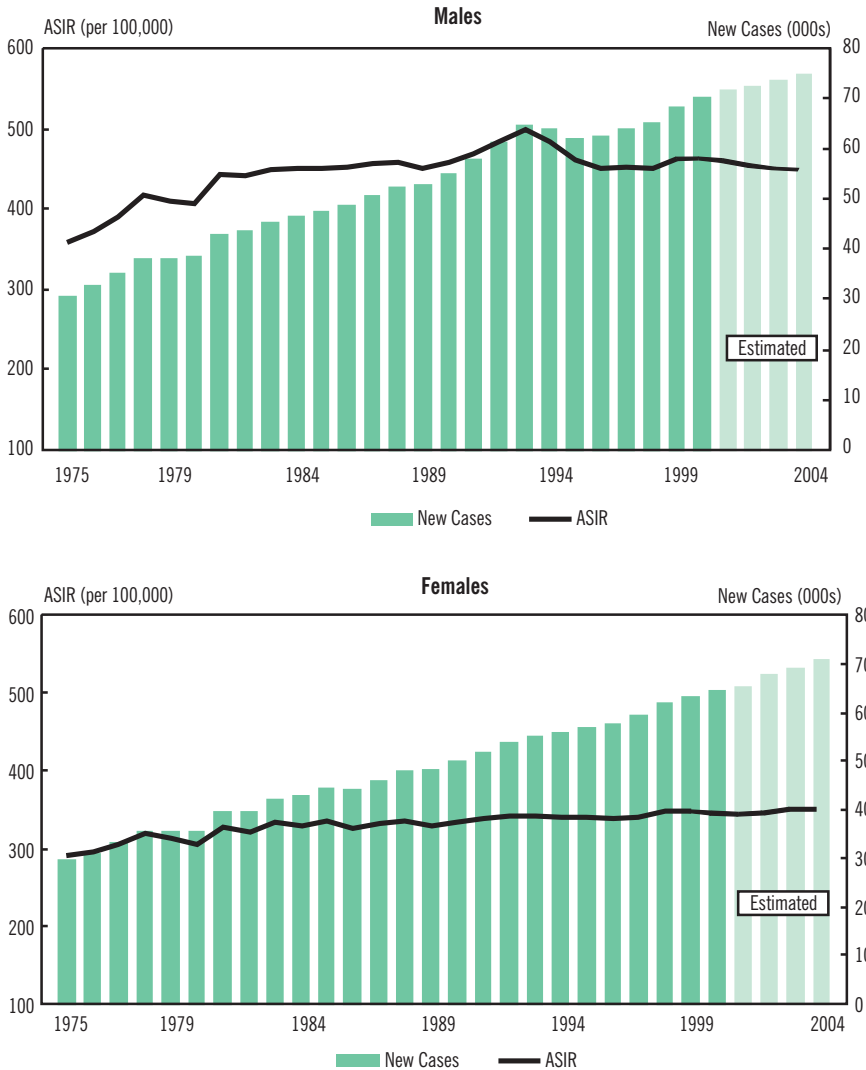
The mortality rate increase was greatest for non-Hodgkin's lymphoma among men, at 2.1% per year. A significant increase in melanoma mortality rate was also seen among men (1.8%). Among women, the mortality rate for lung cancer increased significantly, at 1.5% per year.

Although the recent trend had been for decreasing incidence and mortality associated with colorectal cancer and the projections were made on those data, there has been an actual slight increase in incidence among both men and women annually since 1997 (Tables 7.1 and 8.1). The mortality has continued to decline for both sexes but more so among women. Consensus is emerging internationally about the benefits of population-based screening for colorectal cancer. This is under consideration in Canada at both provincial and national levels. However, casual screening is already prevalent in Canada and may have contributed to the most recent increased incidence and decreased mortality rates. This effect can best be evaluated by the establishment and evaluation of organized screening programs.

Table 9 shows continuing declines in the incidence of stomach cancer (-2.3% among men and -2.6% among women) and mortality (-2.8% among men and women), which may reflect improved diets and the role of infectious agents and their treatment (e.g. *Helicobacter pylori*). Significantly lower rates of invasive cervical cancer (-2.4% incidence and -2.6% mortality) likely reflect the impact of early detection and treatment of pre-malignant lesions through Pap smear screening and treatment of non-invasive lesions. Statistically significant declines in incidence also occurred for laryngeal, oral and lung cancer among men, and ovarian and laryngeal cancer among women. Likewise, statistically significant declines in mortality rates have occurred in oral, pancreatic, laryngeal and lung cancer among men, and in pancreatic and ovarian cancer among women.

Figure 2.1

New Cases and Age-Standardized Incidence Rates (ASIR) for All Cancers, Canada, 1975-2004

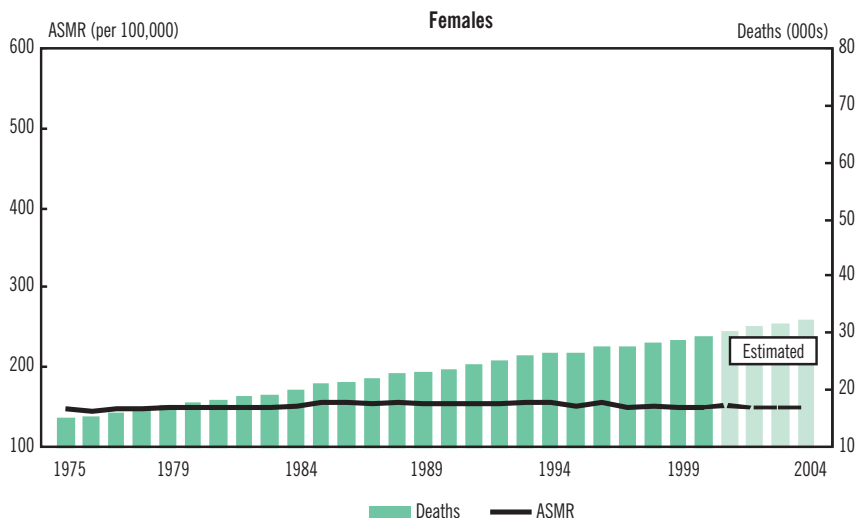
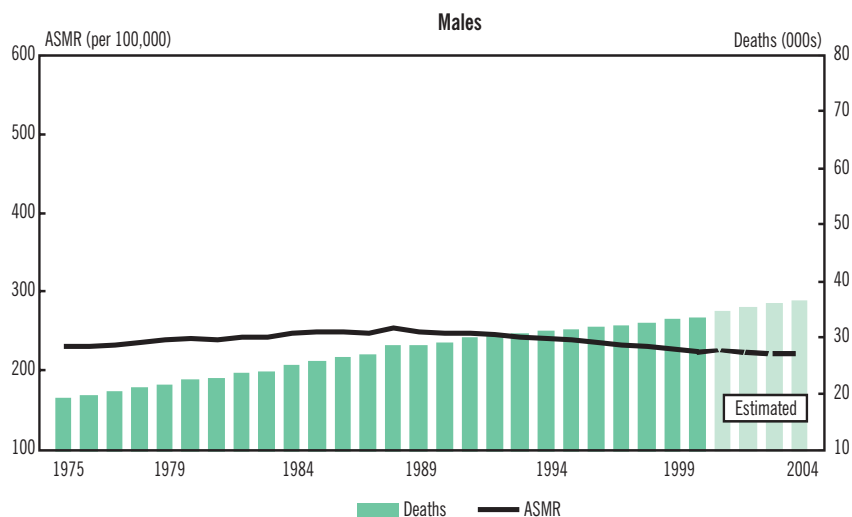


Note: All cancers exclude non-melanoma (basal and squamous) skin cancer. Rates are standardized to the 1991 Canadian population. For 2001, Quebec incidence is estimated.

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Figure 2.2

Deaths and Age-Standardized Mortality Rates (ASMR) for All Cancers, Canada, 1975-2004



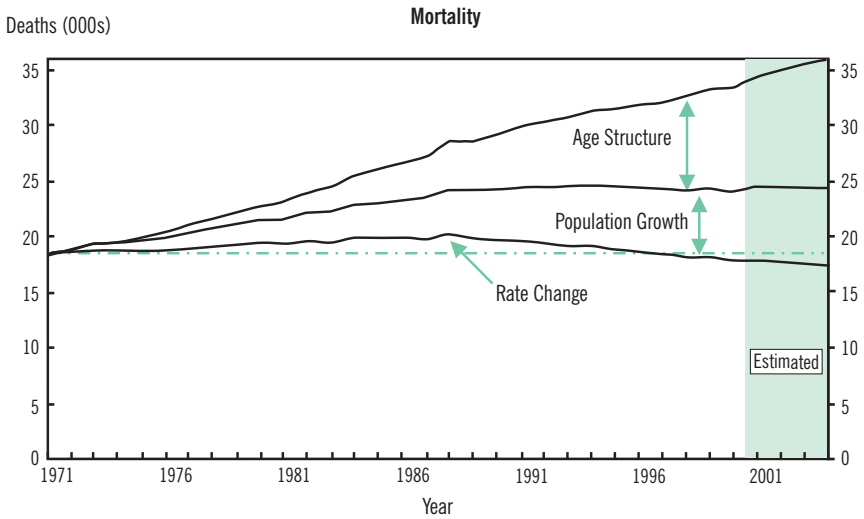
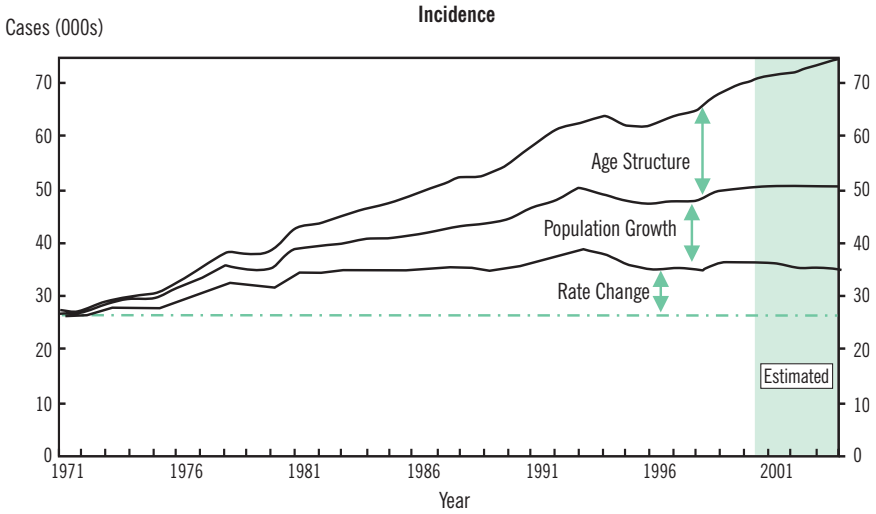
Note: Rates are standardized to the 1991 Canadian population.

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

TRENDS IN INCIDENCE AND MORTALITY

Figure 3.1

Trends in New Cases and Deaths Attributed to Cancer Rate, Population Growth and Population Age Structure, All Cancers, All Ages, Males, Canada, 1971-2004

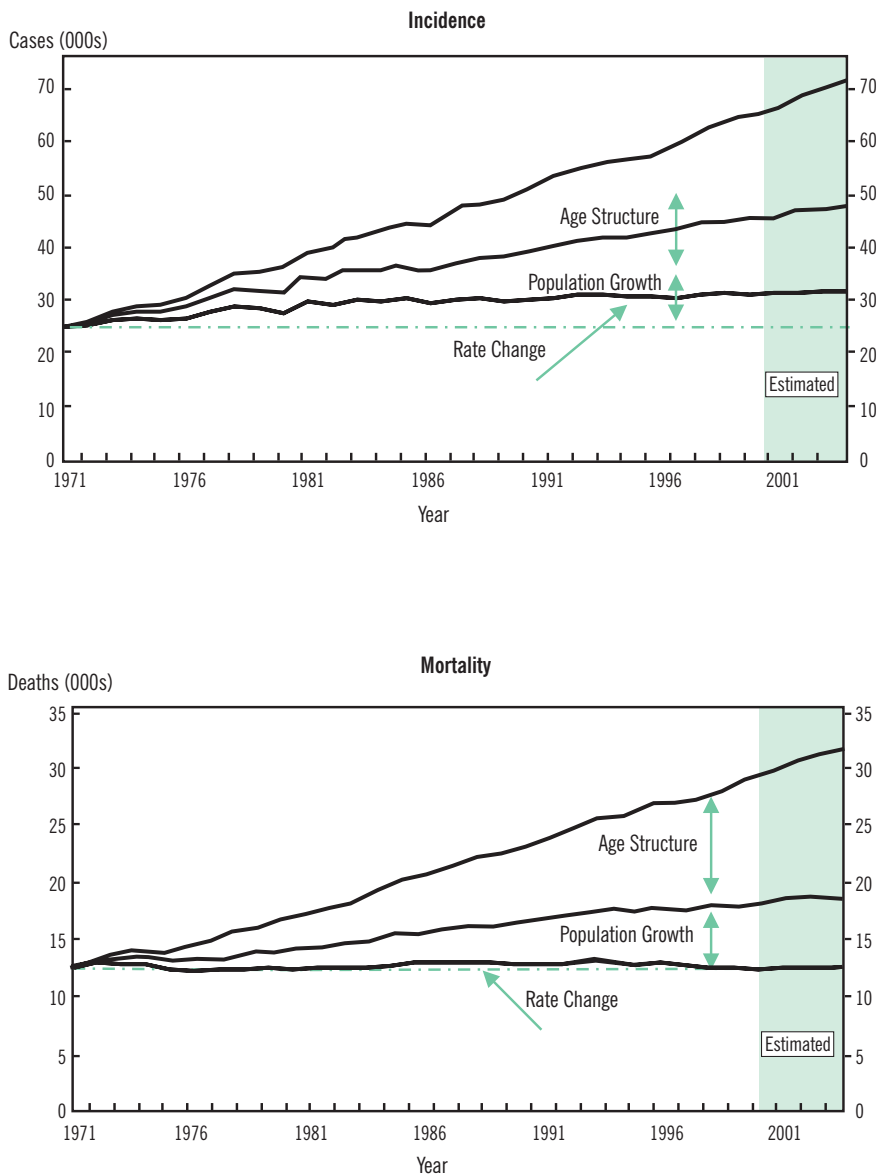


Note: Incidence figures exclude non-melanoma (basal and squamous) skin cancer. Magnitude of area represents the number of cases/deaths due to each change. For 2001, Quebec incidence is an estimate. Please refer to *Appendix II: Methods* for further details.

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Figure 3.2

Trends in New Cases and Deaths Attributed to Cancer Rate, Population Growth and Population Age Structure, All Cancers, All Ages, Females, Canada, 1971-2004



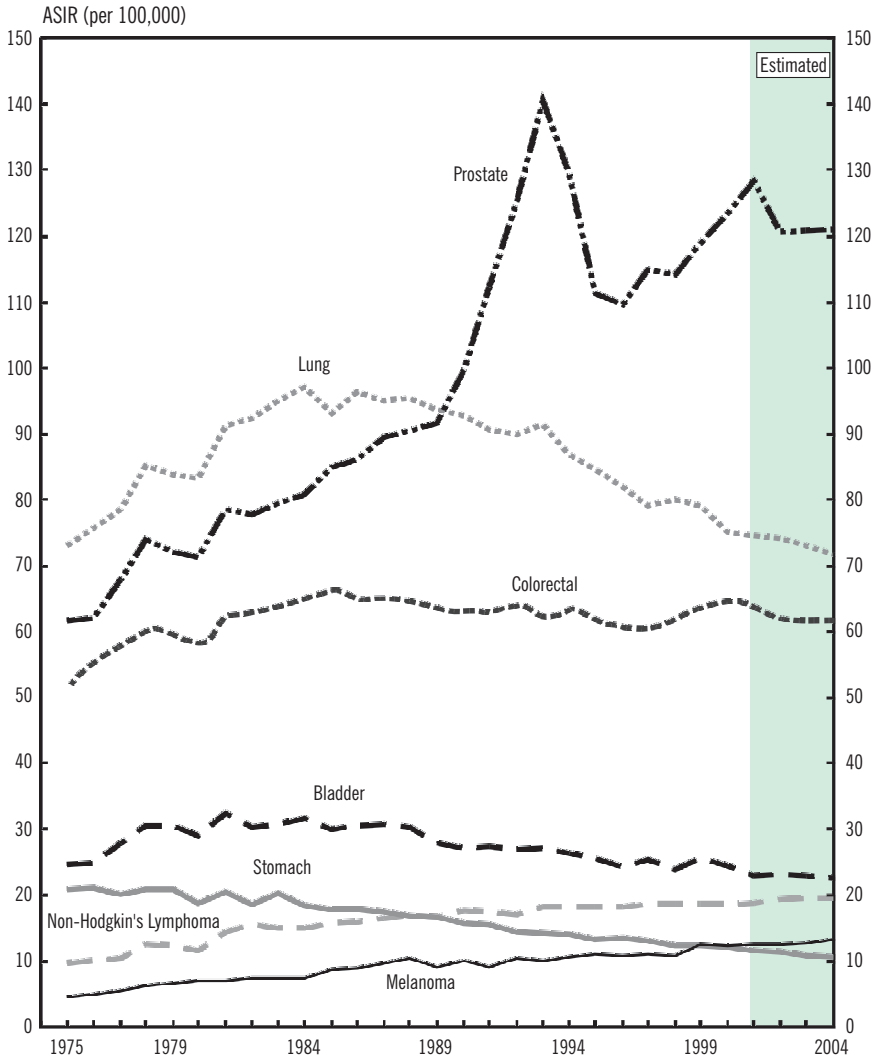
Note: Incidence figures exclude non-melanoma (basal and squamous) skin cancer, Magnitude of area represents the number of cases/deaths due to each change. For 2001, Quebec incidence is an estimate. Please refer to *Appendix II: Methods* for further details.

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

TRENDS IN INCIDENCE AND MORTALITY

Figure 4.1

Age-Standardized Incidence Rates (ASIR) for Selected Cancer Sites, Males, Canada, 1975-2004

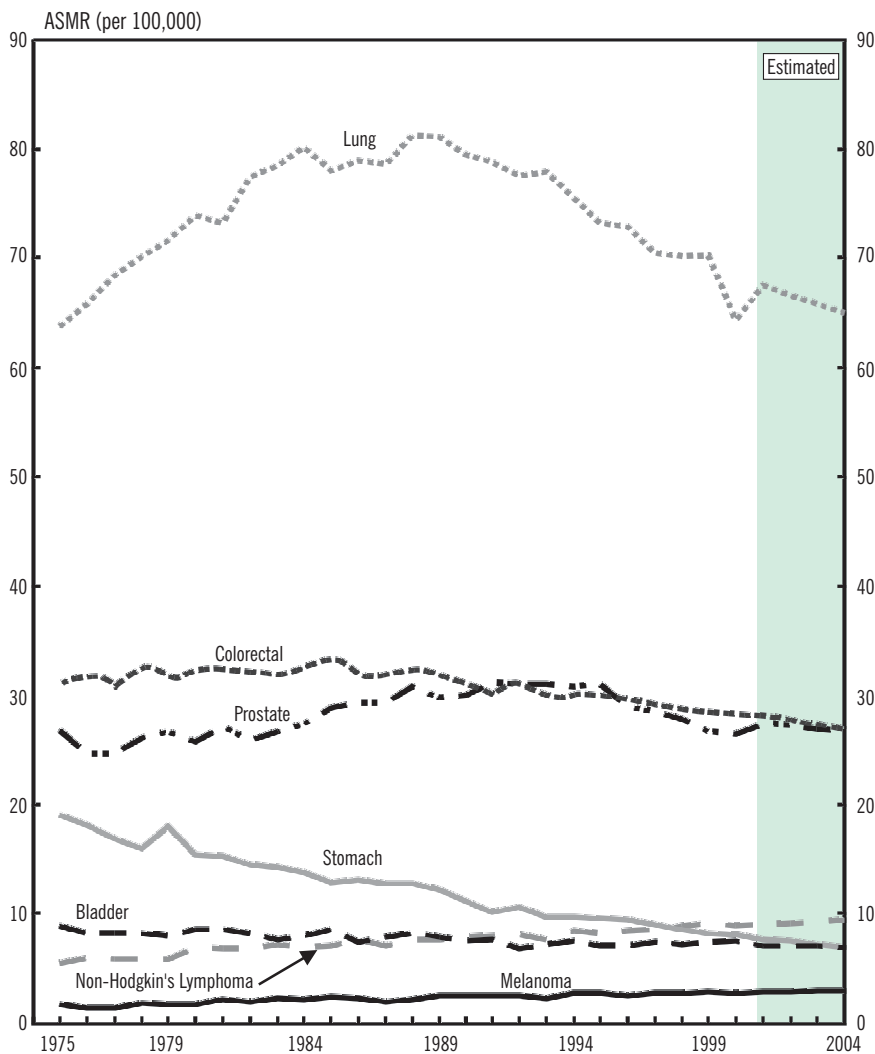


Note: Rates are standardized to the age distribution of the 1991 Canadian population. See Table 7.1 for data points. For 2001, Quebec incidence is estimated.

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Figure 4.2

Age-Standardized Mortality Rates (ASMR) for Selected Cancer Sites, Males, Canada, 1975-2004



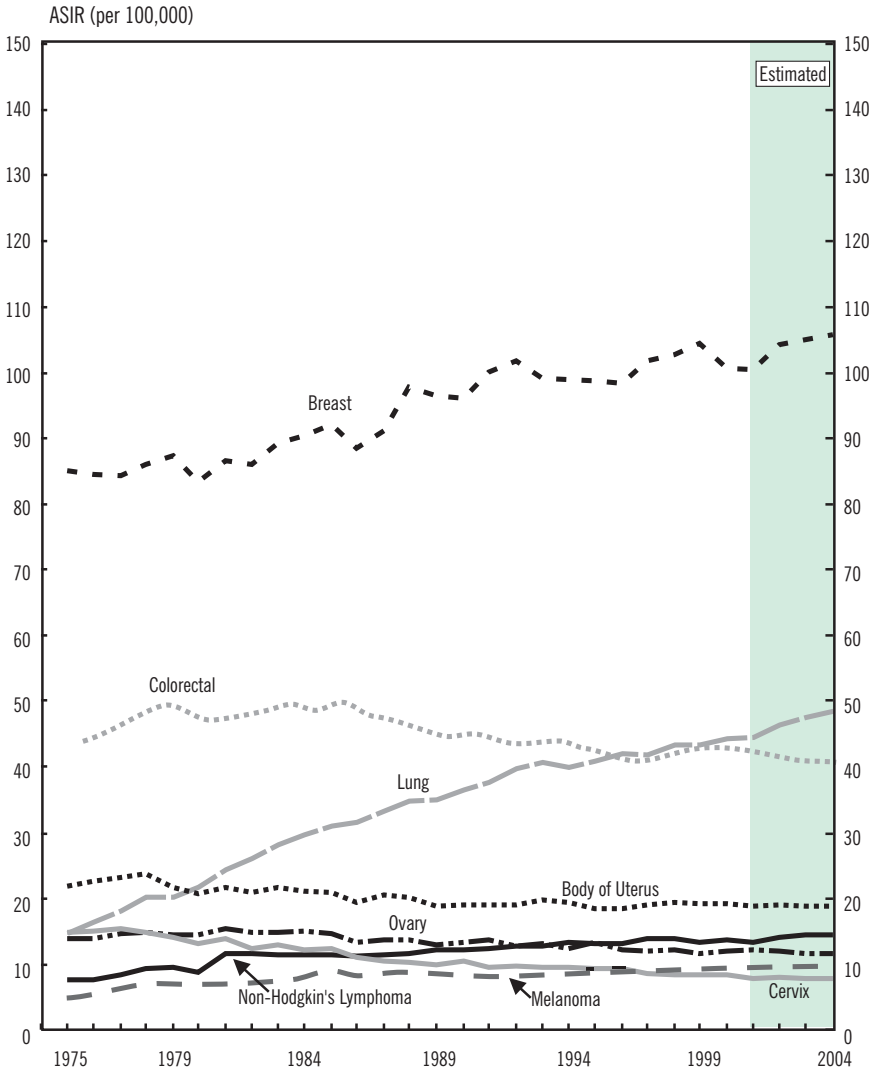
Note: Rates are standardized to the age distribution of the 1991 Canadian population. See Table 7.2 for data points.

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

TRENDS IN INCIDENCE AND MORTALITY

Figure 5.1

Age-Standardized Incidence Rates (ASIR) for Selected Cancer Sites, Females, Canada, 1975-2004

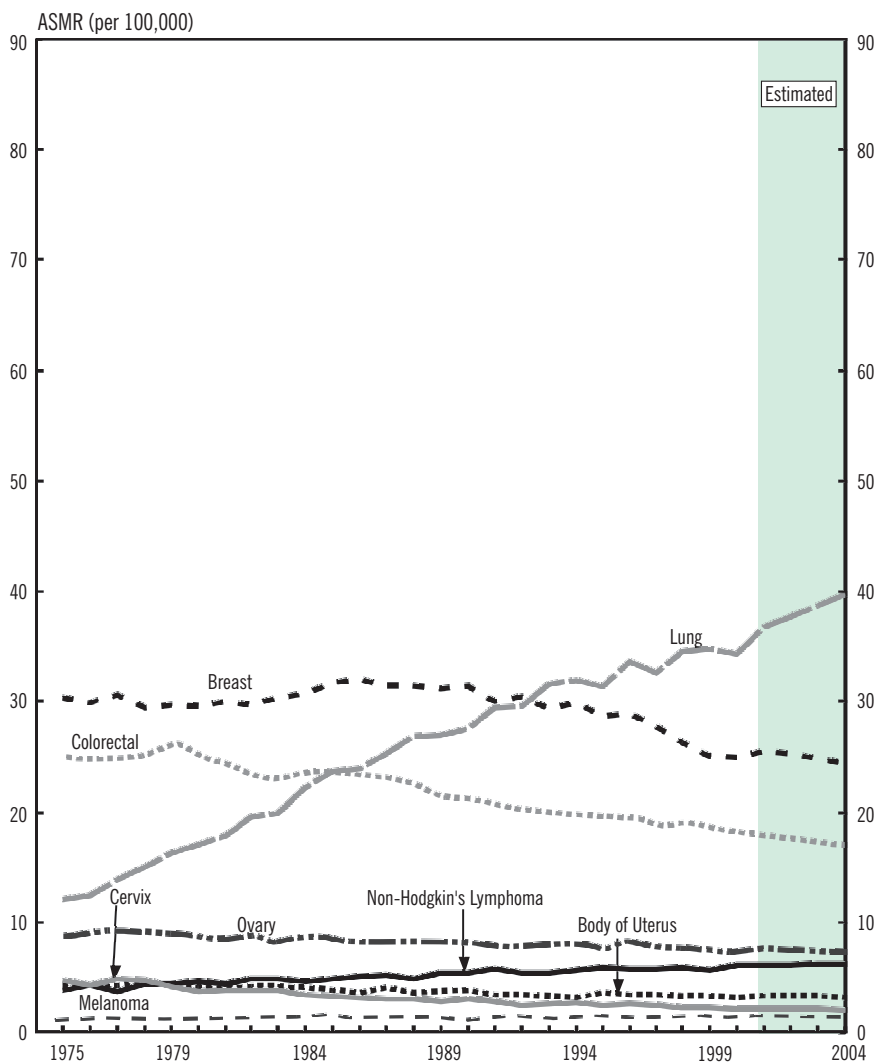


Note: Rates are standardized to the age distribution of the 1991 Canadian population. See Table 8.1 for data points. For 2001 Quebec incidence is estimated.

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Figure 5.2

Age-Standardized Mortality Rates (ASMR) for Selected Cancer Sites, Females, Canada, 1975-2004



Note: Rates are standardized to the age distribution of the 1991 Canadian population. See Table 8.2 for data points.

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

TRENDS IN INCIDENCE AND MORTALITY

Table 7.1

Age-Standardized Incidence Rates for Selected Cancer Sites, Males, Canada, 1975-2004

Year	Rate per 100,000							
	All Cancers	Prostate	Lung	Colorectal	Bladder	Non-Hodgkin's Lymphoma	Melanoma	Stomach
1975	357.7	61.7	73.1	52.0	24.8	9.7	4.7	21.0
1976	371.9	62.1	75.7	55.9	25.1	10.1	5.1	21.2
1977	391.4	67.9	78.6	57.0	28.0	10.5	5.5	20.1
1978	417.2	74.0	85.1	59.9	30.6	12.5	6.4	20.9
1979	409.8	72.0	83.9	59.2	30.6	12.4	6.8	20.8
1980	406.2	71.4	83.2	57.9	29.2	11.6	7.0	19.0
1981	442.2	78.5	91.2	62.6	32.5	14.7	7.0	20.5
1982	440.7	77.8	92.6	62.7	30.3	15.6	7.5	18.7
1983	448.4	79.6	95.2	63.9	30.9	14.9	7.6	20.4
1984	450.1	80.9	97.1	64.7	31.7	14.9	7.5	18.4
1985	449.8	85.1	93.2	66.2	30.2	15.7	8.7	18.0
1986	451.9	86.1	96.4	64.7	30.6	16.0	9.0	18.0
1987	456.3	89.6	95.0	64.7	30.8	16.6	9.6	17.4
1988	458.5	90.4	95.5	64.6	30.3	17.0	10.4	17.0
1989	451.5	91.9	93.6	63.0	27.9	16.7	9.3	16.8
1990	457.6	99.8	92.7	63.0	27.2	17.7	10.1	15.8
1991	469.0	112.3	90.7	62.9	27.5	17.4	9.1	15.6
1992	484.4	125.2	90.0	64.0	27.0	17.2	10.3	14.5
1993	498.6	140.4	91.6	61.9	27.1	18.1	10.3	14.2
1994	484.4	129.5	87.0	63.0	26.4	18.2	10.7	14.1
1995	459.8	111.4	84.6	61.4	25.8	18.2	11.1	13.3
1996	451.0	109.7	82.1	60.5	24.3	18.3	10.9	13.6
1997	452.9	115.1	79.1	60.0	25.6	18.7	11.2	13.0
1998	451.2	114.2	80.0	62.1	24.0	18.8	10.9	12.5
1999	462.4	118.9	79.2	63.1	25.7	18.8	12.6	12.5
2000	462.0	123.6	75.3	64.7	24.4	18.8	12.3	12.1
2001*	460.5	128.5	74.4	63.0	23.1	18.8	12.7	11.6
2002**	452.9	120.7	74.3	62.1	23.3	19.4	12.6	11.3
2003**	451.0	120.9	73.1	62.0	23.0	19.6	12.9	11.0
2004**	449.2	121.2	71.9	62.0	22.7	19.7	13.2	10.7

* For 2001 Quebec incidence is estimated.

** Estimated rates

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

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Table 7.2

Age-Standardized Mortality Rates for Selected Cancer Sites, Males, Canada, 1975-2004

Year	Rate per 100,000							
	All Cancers	Lung	Colorectal	Prostate	Non-Hodgkin's Lymphoma	Bladder	Stomach	Melanoma
1975	230.4	63.7	31.3	26.8	5.6	8.8	19.1	1.7
1976	230.2	65.8	31.7	24.7	6.0	8.3	18.2	1.5
1977	233.5	68.5	30.7	24.6	5.9	8.4	17.0	1.5
1978	236.4	70.1	32.9	26.1	5.9	8.4	16.1	1.9
1979	239.4	71.7	31.8	26.7	5.9	8.1	18.0	1.7
1980	240.7	74.0	32.3	25.8	7.0	8.6	15.5	1.7
1981	239.2	73.2	32.2	27.1	6.9	8.6	15.3	2.1
1982	243.5	77.4	31.9	26.0	6.8	8.4	14.6	2.1
1983	242.9	78.4	31.8	26.7	7.2	7.8	14.3	2.3
1984	247.9	80.2	32.4	27.4	7.0	8.1	13.9	2.1
1985	249.0	78.0	33.4	28.9	7.1	8.6	13.0	2.6
1986	249.0	79.0	32.0	29.4	7.7	7.4	13.1	2.3
1987	248.2	78.6	32.0	29.4	7.1	7.9	12.9	2.0
1988	254.7	81.3	32.4	30.7	7.8	8.3	12.8	2.2
1989	249.5	81.1	31.9	29.7	7.7	7.8	12.3	2.6
1990	246.5	79.5	30.9	30.1	7.9	7.5	11.3	2.6
1991	247.2	78.8	30.4	31.2	8.1	7.7	10.3	2.6
1992	244.7	77.5	31.1	31.0	8.1	6.9	10.7	2.6
1993	242.7	77.9	29.7	31.0	7.7	7.4	9.7	2.4
1994	241.6	75.5	30.2	30.7	8.4	7.6	9.7	2.7
1995	238.7	73.2	30.1	31.0	8.4	7.2	9.6	2.8
1996	236.2	72.9	29.4	29.0	8.4	7.2	9.4	2.6
1997	231.8	70.5	28.9	28.7	8.7	7.4	9.0	2.8
1998	230.0	70.2	28.9	27.9	8.9	7.2	8.6	2.8
1999	228.7	70.3	28.5	26.7	9.2	7.5	8.4	2.9
2000	224.8	64.3	28.4	26.6	9.0	7.6	8.1	2.8
2001*	226.0	67.5	28.0	27.5	9.0	7.2	7.8	2.9
2002*	224.3	66.7	27.7	27.2	9.2	7.1	7.5	3.0
2003*	222.6	65.9	27.4	27.0	9.3	7.1	7.3	3.0
2004*	220.9	65.1	27.2	26.7	9.4	7.1	7.0	3.1

* Estimated rates

Note: Rates are standardized to the age distribution of the 1991 Canadian population.**Source:** Surveillance and Risk Assessment Division, CCDPC, Health Canada

TRENDS IN INCIDENCE AND MORTALITY

Table 8.1

Age-Standardized Incidence Rates for Selected Cancer Sites, Females, Canada, 1975-2004

Year	Rate per 100,000									
	All Cancers	Breast	Lung	Colorectal	Body of Uterus	Non-Hodgkin's Lymphoma	Ovary	Melanoma	Cervix	Stomach
1975	290.2	85.1	14.7	44.5	21.8	7.5	13.7	5.1	14.9	10.4
1976	294.9	84.6	16.3	45.4	22.7	7.5	13.9	5.6	15.2	9.3
1977	306.0	84.4	17.9	48.0	23.0	8.3	14.5	6.1	15.4	9.3
1978	319.4	86.1	20.1	50.2	23.9	9.2	14.9	7.6	14.7	9.5
1979	313.8	87.3	20.3	49.7	21.7	9.6	14.5	7.1	14.2	9.2
1980	305.5	83.3	21.7	47.4	20.8	8.8	14.4	7.5	13.0	8.6
1981	328.1	86.5	24.3	48.6	21.6	11.6	15.4	7.8	13.9	9.8
1982	321.0	86.0	25.9	48.9	21.0	11.7	14.7	7.5	12.3	8.7
1983	332.8	89.3	28.3	50.2	21.6	11.5	14.9	8.0	12.9	8.7
1984	329.5	90.4	29.6	48.9	21.2	11.3	15.0	7.7	12.2	8.1
1985	335.6	92.2	30.9	50.6	20.8	11.4	14.6	9.5	12.3	8.0
1986	324.9	88.6	31.6	48.2	19.5	11.3	13.3	8.3	10.9	8.3
1987	330.7	91.1	33.2	47.6	20.5	11.5	13.7	9.3	10.4	8.0
1988	336.0	97.8	34.8	46.1	20.1	11.7	13.6	9.2	10.2	7.2
1989	330.0	96.4	35.0	45.3	18.7	12.2	13.0	8.6	10.0	7.2
1990	333.2	96.0	36.5	45.6	19.0	12.1	13.4	8.5	10.4	6.9
1991	337.1	100.1	37.7	44.1	18.9	12.4	13.6	8.8	9.6	6.4
1992	341.9	102.0	39.6	44.1	18.9	12.5	12.6	8.7	9.6	6.5
1993	342.1	99.2	40.7	44.2	19.7	12.7	13.2	8.9	9.5	6.3
1994	340.6	98.9	39.8	43.6	19.5	13.3	12.5	9.1	9.4	6.3
1995	339.0	98.7	40.8	42.4	18.6	13.0	13.3	9.3	9.3	6.0
1996	337.1	98.6	42.0	41.0	18.5	13.1	12.2	9.5	9.2	5.9
1997	340.1	101.8	41.8	41.5	18.9	13.8	12.0	9.4	8.6	5.5
1998	347.2	102.8	43.4	43.7	19.3	14.0	12.0	9.4	8.3	5.6
1999	347.8	104.7	43.3	43.1	19.1	13.4	11.6	9.9	8.3	5.3
2000	346.5	100.5	44.3	43.8	19.2	13.6	11.8	10.2	8.3	5.4
2001*	342.9	100.4	44.5	42.5	18.8	13.4	12.2	10.2	7.7	5.1
2002**	348.3	104.3	46.5	41.6	18.8	14.1	11.9	10.2	8.0	4.9
2003**	349.5	105.1	47.4	41.3	18.8	14.3	11.8	10.3	7.8	4.8
2004**	350.8	105.9	48.4	41.0	18.8	14.5	11.7	10.4	7.7	4.7

* For 2001 Quebec incidence is estimated.

** Estimated rates

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

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Table 8.2

Age-Standardized Mortality Rates for Selected Cancer Sites, Females, Canada, 1975-2004

Year	Rate per 100,000									
	All Cancers	Lung	Breast	Colorectal	Ovary	Non-Hodgkin's Lymphoma	Stomach	Body of Uterus	Cervix	Melanoma
1975	147.3	12.1	30.3	24.9	8.9	4.0	8.8	4.3	4.7	1.2
1976	146.0	12.4	29.9	25.0	9.1	4.4	8.5	4.4	4.4	1.3
1977	147.1	13.9	30.6	25.2	9.1	3.8	7.4	4.4	4.8	1.3
1978	147.6	15.0	29.5	25.1	9.0	4.5	7.4	4.6	4.7	1.3
1979	150.2	16.3	29.8	26.1	9.1	4.4	7.2	4.3	4.2	1.2
1980	148.5	17.1	29.7	25.3	8.6	4.6	6.8	4.2	3.7	1.2
1981	149.0	17.9	30.1	24.4	8.5	4.5	7.5	4.1	3.9	1.3
1982	149.3	19.6	29.7	23.5	8.8	4.9	6.7	4.1	3.9	1.5
1983	149.4	19.9	30.4	23.1	8.2	4.9	6.5	4.2	3.9	1.5
1984	151.9	22.2	30.7	23.8	8.7	4.7	5.7	4.0	3.5	1.5
1985	154.8	23.8	31.8	23.7	8.5	5.0	6.0	3.8	3.3	1.6
1986	154.4	24.0	32.0	23.5	8.2	5.1	6.1	3.6	3.2	1.3
1987	154.0	25.3	31.3	23.0	8.2	5.2	5.7	4.1	3.0	1.5
1988	155.3	26.9	31.4	22.7	8.4	5.0	5.1	3.6	3.0	1.3
1989	153.1	27.0	31.2	21.3	8.1	5.5	5.5	3.7	2.9	1.4
1990	153.0	27.6	31.3	21.3	8.1	5.5	5.0	3.9	3.0	1.2
1991	153.5	29.5	30.1	20.7	7.8	5.7	4.9	3.5	2.8	1.4
1992	153.1	29.6	30.4	20.2	7.8	5.5	4.9	3.5	2.4	1.5
1993	154.8	31.7	29.4	20.3	8.0	5.5	4.5	3.4	2.6	1.5
1994	155.0	31.9	30.0	19.9	8.1	5.7	4.5	3.2	2.7	1.5
1995	151.9	31.3	28.7	19.8	7.7	5.9	4.6	3.6	2.4	1.6
1996	155.1	33.6	28.9	19.7	8.2	5.8	4.4	3.4	2.6	1.5
1997	150.2	32.6	27.7	18.8	7.7	5.8	3.9	3.4	2.5	1.5
1998	151.0	34.5	26.4	19.2	7.7	6.0	3.8	3.4	2.3	1.5
1999	149.4	34.8	25.2	18.5	7.5	5.7	4.0	3.3	2.4	1.5
2000	149.3	34.3	25.0	18.1	7.3	6.1	3.9	3.2	2.2	1.5
2001*	150.4	36.8	25.6	17.9	7.5	6.0	3.7	3.3	2.2	1.5
2002*	150.1	37.8	25.2	17.6	7.5	6.1	3.6	3.3	2.1	1.6
2003*	149.8	38.7	24.8	17.4	7.5	6.1	3.5	3.3	2.1	1.6
2004*	149.6	39.8	24.5	17.1	7.4	6.2	3.4	3.2	2.0	1.6

* Estimated rates

Note: Rates are standardized to the age distribution of the 1991 Canadian population.**Source:** Surveillance and Risk Assessment Division, CCDPC, Health Canada

Table 9

Average Annual Percent Change (AAPC) in Age-Standardized Incidence and Mortality Rates for Selected Cancer Sites, Canada 1993-2000

	AAPC in Incidence 1993-2000		AAPC in Mortality 1993-2000	
	Males	Females	Males	Females
All Cancers	-1.0*	0.3	-1.1**	-0.6**
Thyroid	3.7*	4.6**	-0.2	-2.3
Melanoma	2.5**	1.7**	1.8*	-0.2
Testis	0.9	–	-0.7	–
Non-Hodgkin's Lymphoma	0.6**	1.0*	2.1**	0.9
Breast	–	0.6	–	-2.7**
Kidney	0.3	0.5	-0.6	-0.9
Colorectal	0.4	0.0	-0.9**	-1.5**
Multiple Myeloma	0.0	0.2	-1.2	-1.1
Body of Uterus	–	-0.1	–	-0.5
Leukemia	-0.2	-0.3	-0.6	-1.6
Brain	-0.1	-0.5	0.2	0.1
Lung	-2.4**	1.4**	-2.2**	1.5**
Pancreas	-0.8	-0.9	-1.2*	-0.9*
Hodgkin's Disease	-1.0	-0.8	-3.4	-4.4
Bladder	-1.2	-1.5	0.2	-1.1
Prostate	-1.4	–	-2.5**	–
Ovary	–	-1.7*	–	-1.3*
Oral	-2.9**	-1.0	-4.1**	-0.1
Cervix	–	-2.4**	–	-2.6**
Stomach	-2.3**	-2.6**	-2.8**	-2.8**
Larynx	-3.2**	-3.2*	-2.7**	-2.4

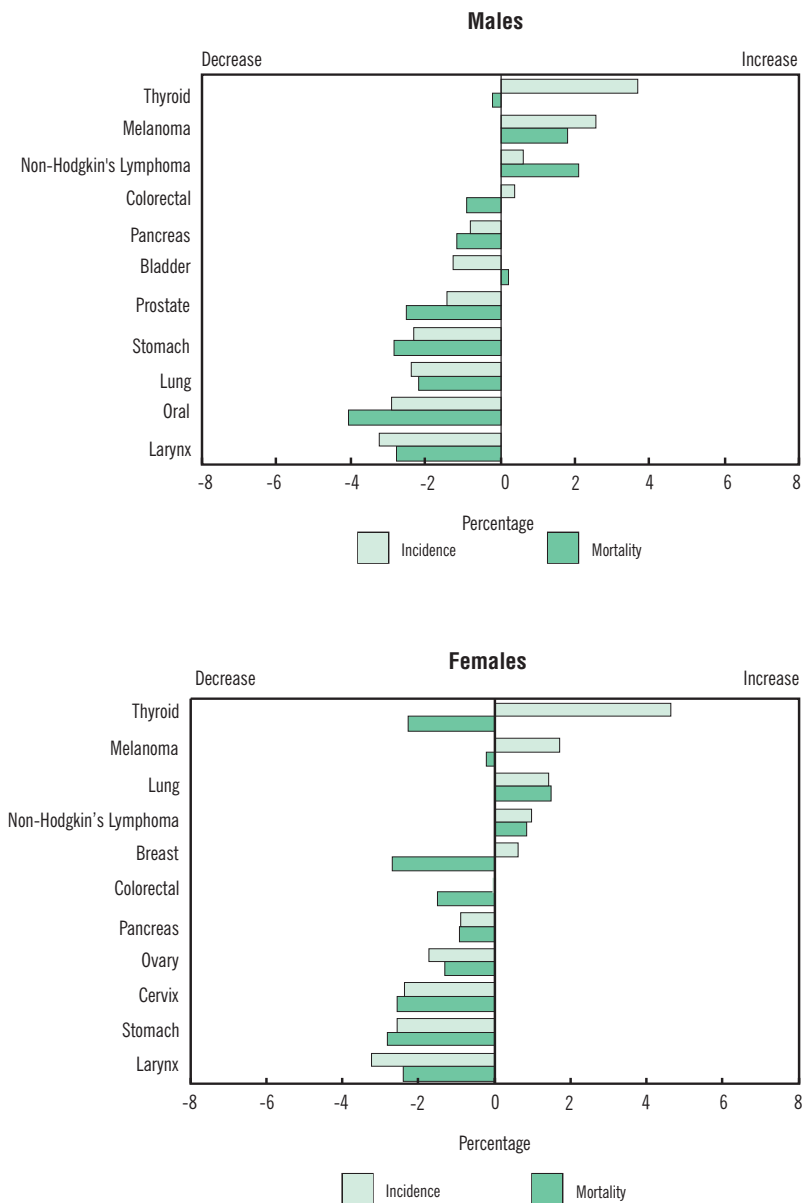
– Not applicable
 * Significant at p = 0.05
 ** Significant at p = 0.01

Note: Average Annual Percent Change is calculated assuming a log linear model; incidence rates exclude non-melanoma (basal and squamous) skin cancer. Sites are ranked in decreasing order of combined annual percent change for incidence.

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Figure 6

Average Annual Percent change (AAPC) in Age-Standardized Incidence and Mortality Rates for Selected Cancer Sites, Canada, 1993-2000

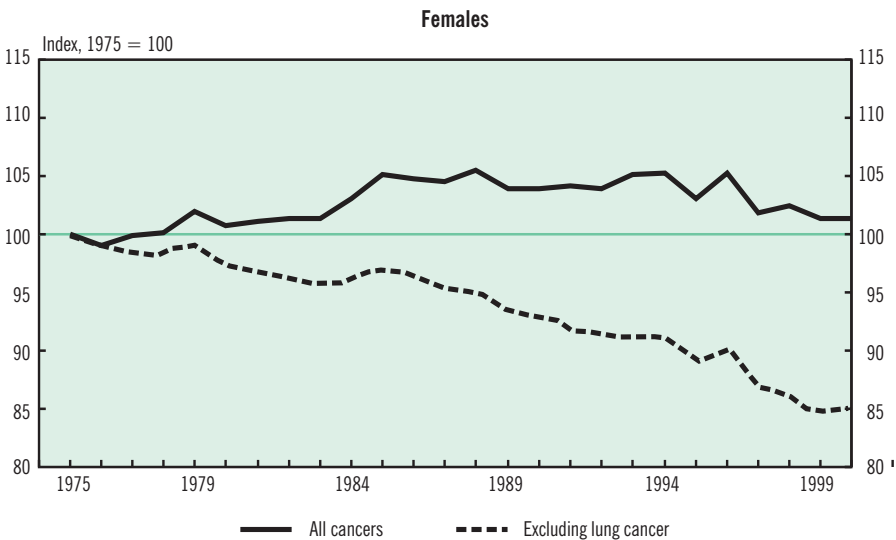
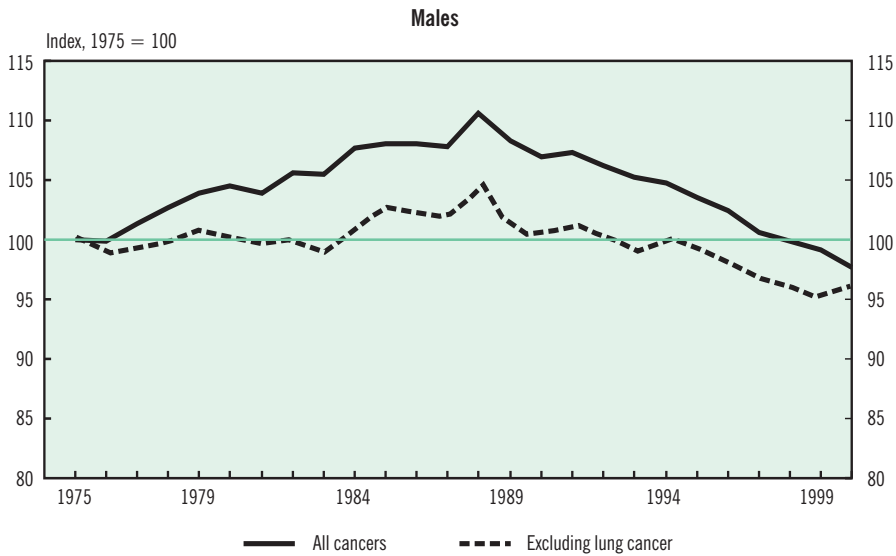


Note: See Table 9 for percent change for all sites. Sites are ranked in decreasing order of combined percent change of incidence.

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Figure 7

Index of Age-Standardized Mortality Rates Including and Excluding Lung Cancer, Canada, 1975-2000



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

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

This section shows estimates for 2004 by 10-year age groups for all sites combined (Table 10) and for the four leading types of cancer (Table 11). Cancer is primarily a disease of the elderly. The estimates for 2004 shown in Table 10 indicate that 63,500 new cases (44%) and 40,500 cancer deaths (59%) occur in Canadians aged 70 years or more, while an additional 35,800 new cases (25%) and 14,400 deaths (21%) occur in those aged 60-69. In contrast, less than 1% of new cases and only 0.3% of deaths occur prior to age 20. Estimates of the distribution by leading site for people aged 20 or more are presented in Table 11 and show that about 49% of all newly diagnosed cancers of the lung, prostate, colon and rectum occur among Canadians aged 70 or more. For example, for prostate cancer, 46% of cases and 85% of deaths occur in men over 70. In the case of breast cancer, 21% of cases occur in women under age 50, 49% occur in women aged 50 to 69, and 30% in women aged 70 and over.

Trends in age-standardized rates of incidence and mortality since 1971 for all cancers are plotted for four specific age groups in Figure 8 (in which each age group has a different scale for the y axis because of the wide range in age-specific rates). Since 1981, absolute increases in cancer incidence rates have occurred primarily in Canadians aged 50 or over. The sex differences seen in incidence after age 50 are almost certainly due to changes in prostate cancer, which increased rapidly in the early 1990s with the introduction of the prostate-specific antigen (PSA) test. As expected, there was an initial rapid increase in incidence through detection of prevalent cases, followed by a return to the pre-existing time trend.

Most encouraging is the fairly steady decline in overall cancer mortality that has occurred since 1988 among both men and women in all age groups under 70 years. Figure 9 displays age-specific rates of cancer incidence and mortality by 5-year age groups, plotted using actual data for cancer incidence and mortality in 2000, the most recent year for which complete data are available. Mortality rates have generally declined substantially since 1970 among Canadians aged 0 to 19 with more moderate declines in the 20-49 age group. Among men and women 50 to 69 years old, decreases in mortality rates have occurred primarily since the late 1980s.

Cancer incidence and mortality increase substantially with age in both sexes, 20 times as many new cases occurring in those over age 80 as in those under age 20. Although incidence rates were somewhat higher among women than men between 20 and 54 years of age, for all other age groups incidence was higher among men. This is because of the higher incidence of cancers of the breast and genital organs in women of reproductive age, and the higher incidence of most types of cancer in older men. Mortality rates were higher among men than women for all age groups with the exception of those aged 35 to 54.

*Cancer is primarily a disease of older Canadians.
Mortality rate declines are most noted in
younger age groups.*

AGE AND SEX DISTRIBUTION OF CANCER

Table 10

Distribution for All Cancer Sites Combined by Age Group and Sex, Canada, 2004

Age Group	Population (000s) 2004 Estimates			New Cases 2004 Estimates			Deaths 2004 Estimates		
	Total	M	F	Total	M	F	Total	M	F
0-19	7,741	3,965	3,776	1,200	640	560	200	100	90
20-29	4,279	2,171	2,108	1,700	790	890	240	140	110
30-39	4,707	2,370	2,337	4,400	1,600	2,800	800	340	460
40-49	5,331	2,675	2,657	12,500	4,400	8,100	3,400	1,450	1,950
50-59	4,152	2,061	2,091	26,500	12,400	14,100	8,800	4,500	4,300
60-69	2,614	1,267	1,347	35,800	20,800	15,000	14,400	8,300	6,200
70-79	1,858	833	1,025	38,700	22,400	16,400	20,900	11,900	9,000
80+	1,076	373	703	24,800	11,800	13,000	19,600	9,500	10,000
All Ages	31,757	15,714	16,043	145,500	74,800	70,700	68,300	36,200	32,100

Note: Incidence figures exclude non-melanoma (basal and squamous) skin cancer. Total of rounded numbers may not equal rounded total number. Please refer to *Appendix II: Methods* for further details. The 2004 population projections were provided by the Census and Demographics Branch, Statistics Canada.

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

AGE AND SEX DISTRIBUTION OF CANCER

Table 11

Distribution by Selected Cancer Site, Age Group and Sex, Canada, 2004

Age Group	Lung			Colorectal			Prostate	Breast
	Total	M	F	Total	M	F	M	F
New Cases								
20-29	25	15	10	40	20	20	–	75
30-39	150	55	90	220	110	100	15	850
40-49	1,100	440	640	1,100	580	510	350	3,600
50-59	3,500	1,750	1,700	2,900	1,700	1,250	3,400	5,700
60-69	6,100	3,500	2,600	4,500	2,800	1,750	7,000	4,700
70-79	7,100	4,200	2,900	5,800	3,300	2,500	6,400	3,800
80+	3,700	1,950	1,750	4,500	1,900	2,600	2,900	2,500
Ages 20+	21,700	11,900	9,800	19,100	10,400	8,800	20,100	21,200
Deaths								
20-29	10	5	5	10	5	5	–	5
30-39	85	35	50	60	30	30	–	120
40-49	760	330	440	310	170	140	10	520
50-59	2,600	1,350	1,200	950	560	380	130	960
60-69	4,900	2,900	2,000	1,650	1,050	630	520	930
70-79	6,600	3,900	2,700	2,500	1,450	1,050	1,450	1,200
80+	4,000	2,200	1,800	2,800	1,200	1,650	2,100	1,500
Ages 20+	18,900	10,700	8,200	8,300	4,500	3,900	4,200	5,200

– Fewer than 3 cases or deaths.

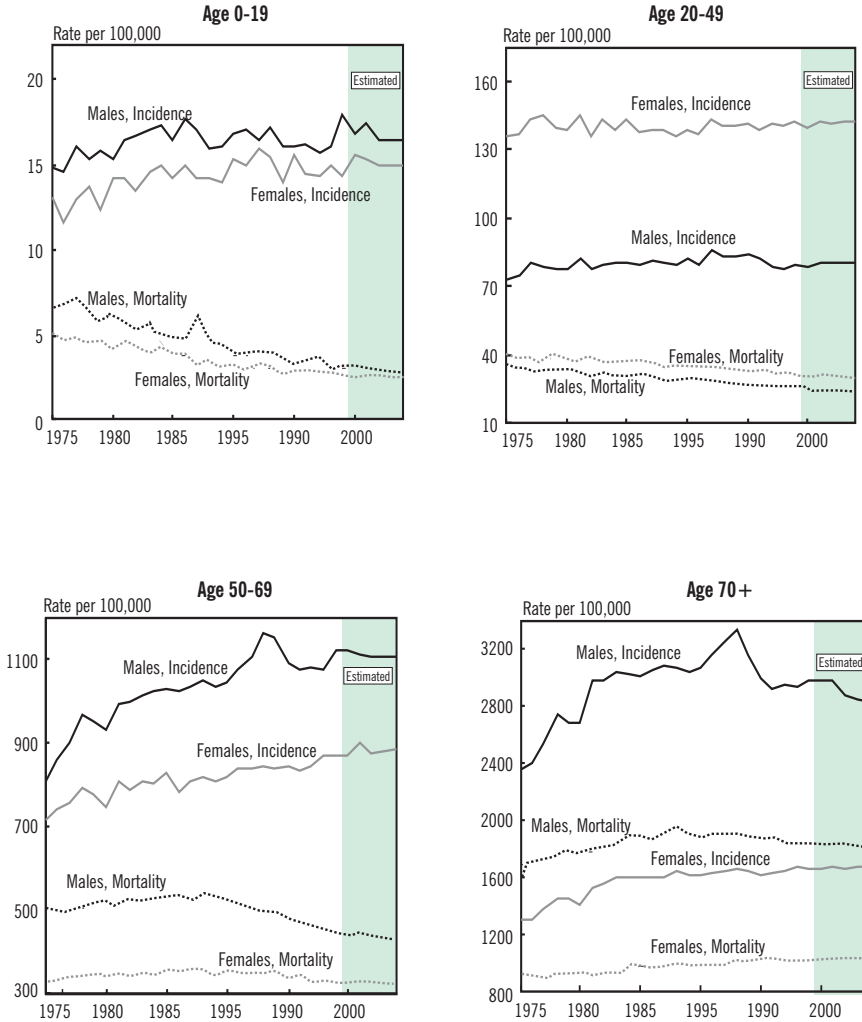
Note: Figures exclude non-melanoma (basal and squamous) skin cancer. Total of rounded numbers may not equal rounded total number. Please refer to Appendix II: Methods for further details.

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

AGE AND SEX DISTRIBUTION OF CANCER

Figure 8

Age-Standardized Incidence and Mortality Rates by Broad Age Group, All Cancers, Canada, 1975-2004

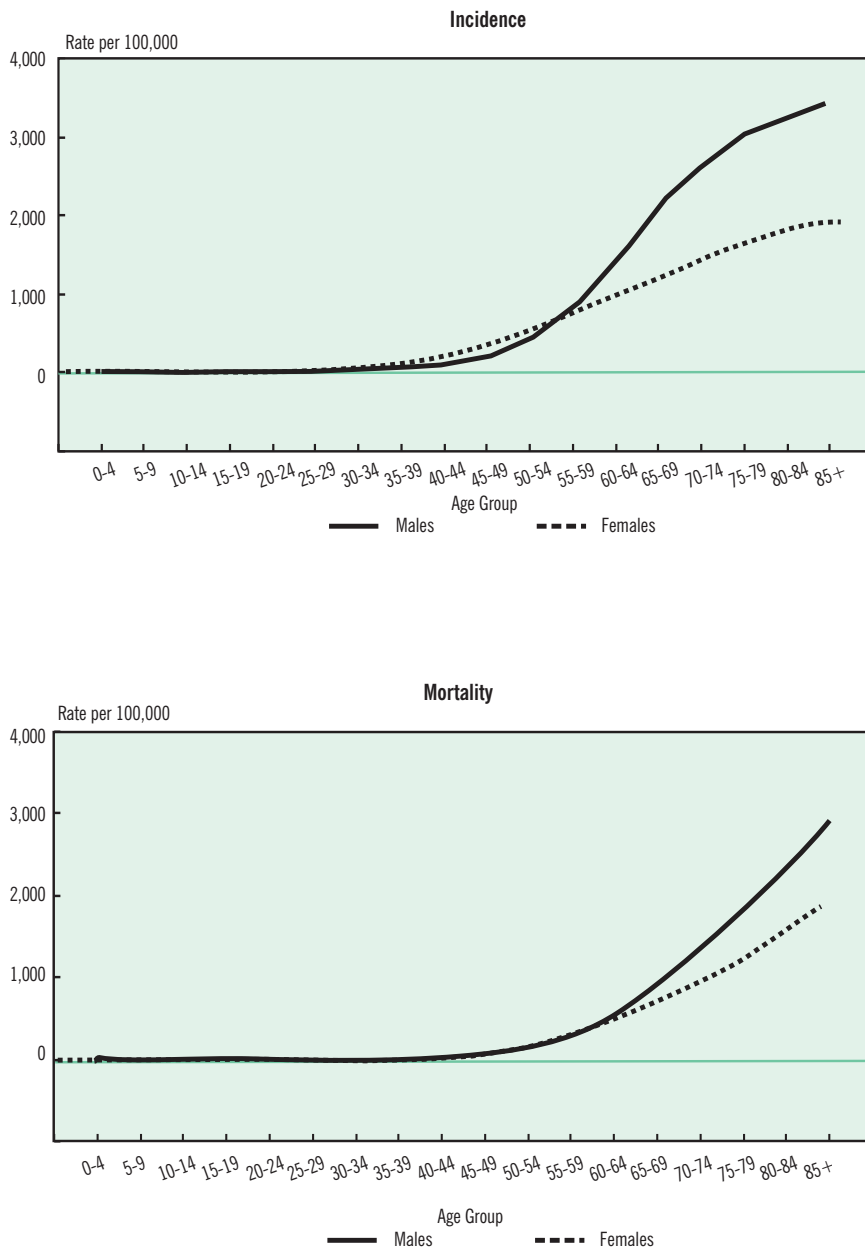


Note: The range of rate scales differs widely among the four age groups. Incidence figures exclude non-melanoma (basal and squamous) skin cancer. For 2001 Quebec incidence is estimated.

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Figure 9

Age-Specific Incidence and Mortality Rates for All Cancers by Sex, Canada, 2000



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

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

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, 64 of them, or 6.4% (1 in 15.6), 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 6.7) 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 0.43 (43%) of developing cancer, and the inverse of that probability is 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 3.6 men and 1 in 4.3 women, or approximately 1 in 4 of all Canadians, will die of cancer.

During their lifetimes, 1 in 8.8 women are expected to develop breast cancer, the most common cancer (excluding non-melanoma skin cancer) to afflict women, and 1 in 27.4 women are expected to die from it. One in 15 women will develop colorectal cancer, but only 1 in 31 will die from it. One in 17 will develop lung cancer, and 1 in 20 will die from this disease, making it the most likely cause of cancer death in Canadian women. Over their lifetimes, 1 in 7.6 men will develop prostate cancer, but only 1 in 26 will die from it. One in 12 men will develop lung cancer, and 1 in 13 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 11.3% (1 in 8.8), 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% (1 in 32.3); 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 6.8% (1 in 14.7) 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 during their lifetime, the risk being slightly greater among men than women.

PROBABILITY OF DEVELOPING/DYING FROM CANCER

Table 12

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

	Probability (%) of Developing Cancer in Next 10 Years by Age Group						Lifetime Probability (%) of Developing and Dying from Cancer			
	30-39	40-49	50-59	60-69	70-79	80-89	% One in:		% One in:	
Male										
All Cancers	0.6	1.7	5.9	15.0	22.0	19.8	43.1	2.3	28.1	3.6
Prostate	–	0.1	1.4	5.0	6.8	5.2	13.2	7.6	3.8	26
Lung	–	0.2	0.9	2.8	4.3	3.4	8.6	12	7.9	13
Colorectal	0.1	0.2	0.8	2.1	3.4	3.3	7.2	14	3.6	28
Lymphoma	0.1	0.2	0.4	0.7	1.1	1.1	2.9	35	1.6	63
Bladder	–	0.1	0.3	0.7	1.4	1.5	2.9	35	1.0	103
Kidney	–	0.1	0.3	0.5	0.7	0.5	1.6	61	0.7	145
Leukemia	–	0.1	0.2	0.3	0.6	0.7	1.5	66	1.0	99
Oral	–	0.1	0.3	0.5	0.5	0.4	1.4	69	0.5	185
Stomach	–	0.1	0.1	0.4	0.6	0.7	1.4	71	1.0	103
Melanoma	0.1	0.1	0.2	0.3	0.4	0.4	1.2	80	0.3	333
Pancreas	–	–	0.1	0.3	0.6	0.5	1.2	82	1.3	77
Female										
All Cancers	1.1	3.0	6.4	10.2	13.6	13.5	38.4	2.6	23.4	4.3
Breast	0.3	1.3	2.5	3.1	3.2	2.6	11.3	8.8	3.7	27
Colorectal	–	0.2	0.6	1.3	2.3	3.0	6.5	15	3.2	31
Lung	–	0.2	0.8	1.7	2.3	1.6	5.9	17	4.9	20
Lymphoma	0.1	0.1	0.3	0.6	0.8	0.8	2.5	40	1.4	70
Body of Uterus	–	0.1	0.5	0.7	0.7	0.5	2.4	42	0.5	200
Ovary	–	0.1	0.3	0.4	0.4	0.4	1.5	68	1.0	100
Pancreas	–	–	0.1	0.2	0.5	0.6	1.2	80	1.3	77
Leukemia	–	–	0.1	0.2	0.4	0.4	1.1	88	0.7	135
Kidney	–	0.1	0.1	0.3	0.4	0.4	1.1	93	0.4	250
Melanoma	0.1	0.1	0.2	0.2	0.2	0.2	1.1	94	0.2	500
Bladder	–	–	0.1	0.2	0.4	0.4	0.9	107	0.4	244
Stomach	–	–	0.1	0.1	0.3	0.4	0.8	118	0.7	152
Cervix	0.1	0.1	0.1	0.1	0.1	0.1	0.7	140	0.3	345
Oral	–	–	0.1	0.2	0.2	0.2	0.7	143	0.3	400

– Value less than 0.05

Note: The probability of developing cancer is calculated using age- and sex-specific cancer incidence and mortality rates for Canada in 2000 and life tables based on 1998-2000 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 2000. See *Appendix II: Methods* for details.

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Figure 10 shows the rank order of 12 causes of premature death in Canada in 2000 as represented by potential years of life lost (PYLL). This illustrates that cancer was the leading cause of PYLL for men and women: 954,000 potential years were lost as a result of cancer (Table 13), representing 31% of the PYLL resulting from all causes of death. Diseases of the heart were the second leading cause. Among children and youth aged 0 to 19, cancer ranked as the sixth leading cause of PYLL after perinatal causes, congenital anomalies, motor vehicle accidents, other accidents and suicide. The total PYLL due to cancer deaths among Canadian children and youth (ages 0-19) in 2000 was 15,000 years.

The PYLL due to specific types of cancer (Table 13) show that lung cancer was responsible for 247,000 PYLL, representing 26% of the premature mortality caused by cancer. For men in 2000, 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 53% 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.

Premature mortality 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 (93,000) far exceed the PYLL from prostate cancer (34,000), reflecting the relatively young age at which women die from breast cancer. In contrast, the PYLL for Hodgkin's disease, at 3000, reflect 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 (494,000) are slightly higher than the PYLL for men (460,000). This is because women generally live longer than men, and some of the deaths due to female cancers occur at younger ages.

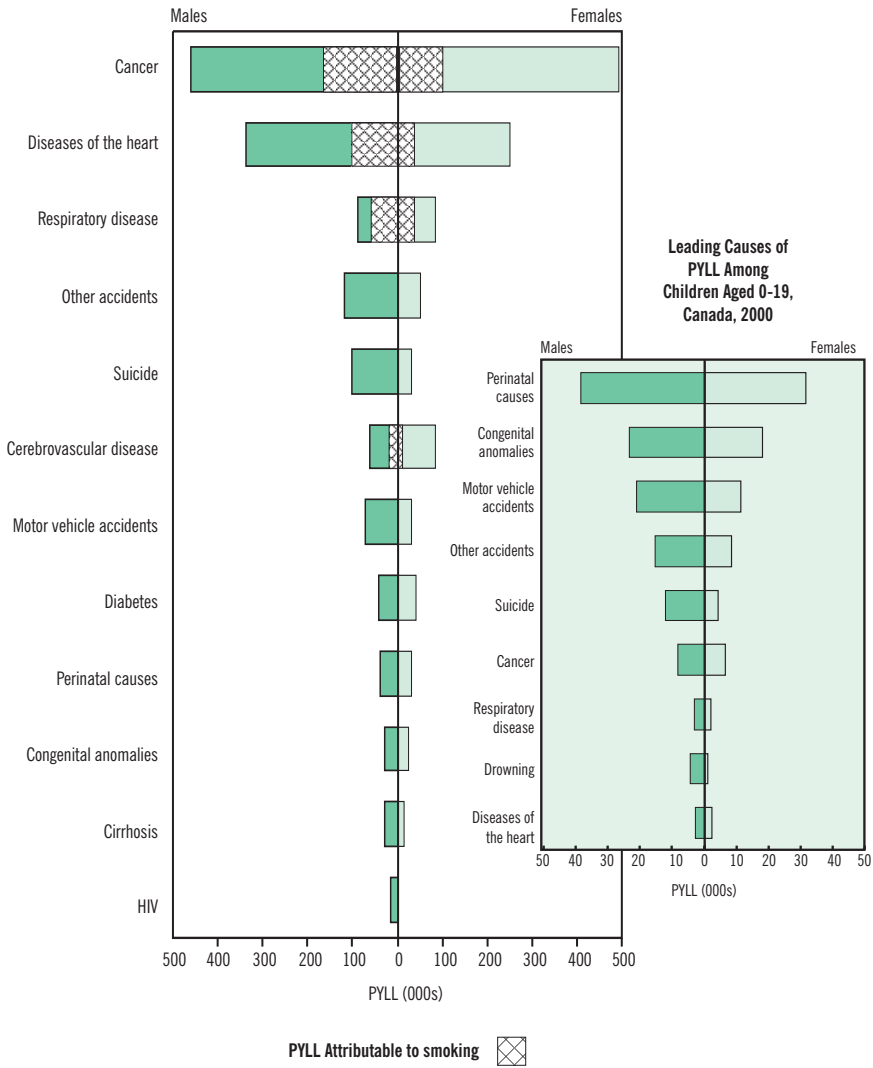
The use of tobacco products is the single most important cause of preventable, premature cancer deaths. Many deaths from other diseases also occur because of smoking (Figure 10). Among men, smoking is responsible for more than one-third of PYLL due to all cancers, about 30% of PYLL due to diseases of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

POTENTIAL YEARS OF LIFE LOST DUE TO CANCER

Figure 10

Selected Causes of Potential Years of Life Lost (PYLL), Canada, 2000



Note: Figures are ranked in order of total PYLL for both males and females combined and are calculated on the basis of life expectancy. Count and percentage totals may not add because of rounding and the exclusion of other sites. Childhood cancers are also included within the relevant sites. Smoking attributable PYLL are based on relative risk estimates from follow-up of CPS-II cohort and 1996 Canadian smoking prevalence estimates. See *Appendix II: Methods* for details.

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

POTENTIAL YEARS OF LIFE LOST DUE TO CANCER

Table 13

Potential Years of Life Lost Due to Cancer, Canada, 2000

	Potential Years of Life Lost (PYLL)					
	Total		Males		Females	
	Years	%	Years	%	Years	%
ALL CAUSES	3,048,000	–	1,634,000	–	1,415,000	–
All Cancers	954,000	100	460,000	100	494,000	100
Childhood Cancer (Ages 0-19)	15,000	1.6	8,100	1.8	6,700	1.4
Cancer Site						
Lung	247,000	25.9	133,000	28.9	114,000	23.2
Colorectal	108,000	11.3	56,000	12.1	52,000	10.6
Breast	93,000	9.7	–	–	93,000	18.8
Pancreas	44,000	4.6	21,000	4.6	23,000	4.6
Non-Hodgkin's Lymphoma	41,000	4.3	22,000	4.7	20,000	4.0
Leukemia	35,000	3.7	20,000	4.4	15,000	3.0
Brain	35,000	3.7	20,000	4.4	15,000	3.1
Prostate	34,000	3.5	34,000	7.3	–	–
Stomach	28,000	2.9	16,000	3.5	12,000	2.4
Ovary	25,000	2.7	–	–	25,000	5.2
Kidney	21,000	2.2	12,000	2.7	9,000	1.7
Bladder	17,000	1.8	12,000	2.6	5,000	1.0
Oral	15,000	1.6	10,000	2.2	5,000	1.0
Multiple Myeloma	14,000	1.5	7,000	1.5	7,000	1.5
Melanoma	14,000	1.5	8,000	1.7	6,000	1.2
Cervix	10,000	1.1	–	–	10,000	2.0
Body of Uterus	10,000	1.0	–	–	10,000	2.0
Larynx	7,000	0.8	6,000	1.3	1,000	0.3
Hodgkin's Disease	3,000	0.2	2,000	0.5	1,000	0.3
Testis	1,000	0.1	1,000	0.3	–	–

– Not applicable

Note: Figures are ranked in order of total PYLL for both sexes combined and are calculated on the basis of life expectancy. Count and percentage totals may not add because of rounding and the exclusion of other sites. Childhood cancers are also included within the relevant sites.

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Prevalence rates and 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 2000 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 2000. 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 2.4% among men and 2.6% among women. In the year 2000, there were an estimated 359,800 male and 411,000 female cancer survivors, for a total of approximately 771,000 Canadians (or about 2.5% overall). That means that 1 in 42 Canadian men and 1 in 38 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 107,300 prevalent cases or 0.7% of the male population, followed by colorectal (40,700) and lung (17,900) cancers. Breast cancer is the most common site in women (151,100 cases or 1.0% of the female population), which is also followed by colorectal (42,600 cases) and lung (16,200) 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 among whom survival rates are more favourable. In the case of lung cancer, survival rates are lower, so even though incidence is high, prevalence is relatively low.

National survival rates 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, 2.0% of respondents to the Canadian Community Health Survey (CCHS 2002) reported a personal history of cancer, which, as expected, is slightly lower than the prevalence estimate for all Canadians (2.5%), because this method would yield a slight under-estimate of true prevalence.¹² 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 often persist beyond the point of physical recovery from the cancer itself, often requiring extensive use of rehabilitation and supportive care resources. Cancer survivors are also at risk of recurrence or of

PREVALENCE

developing a second primary cancer and therefore may place increased demands on health services. This increased demand and the complexity of survivors' health needs must be considered in the planning and development of interdisciplinary health services.

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

Table 14

Prevalence of the Most Common Cancers, by Sex, Canada, 2000

	Prevalence Count 15 Year		Prevalence Percentage of 2000 Population		Ratio of Cases per Population	
	Males	Females	Males	Females	Males	Females
Colorectal	40,700	42,600	0.3	0.3	1:380	1:370
Lung	17,900	16,200	0.1	0.1	1:850	1:960
Prostate	107,300	–	0.7	–	1:160	–
Breast	–	151,100	–	1.0	–	1:100
Other Cancers	193,900	201,100	1.3	1.3	1:79	1:77
All Cancers	359,800	411,000	2.4	2.6	1:42	1:38

Note: Survival rates are based on Saskatchewan data from 1986 to 2001 with follow-up to 2002.

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Table 15 shows the number of new cases of cancer with age-standardized incidence rates (1996-2000), and the number of deaths due to cancer with age-standardized mortality rates (1996-2000) for Canadian children and youth aged 0-19. For these periods, cancer was diagnosed in an average of 1,289 children every year, and 231 died each year from their disease. Leukemia accounted for 26% of new cases and 30% of deaths due to cancer in children, and remains the most common of the childhood cancers. Cancers of the brain and spinal cord, the second most common group of childhood cancers, constituted approximately 17% of new cases and 25% of deaths, and lymphomas accounted for 16% of new cases and 7% 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 15. The deaths to cases ratio for all childhood cancers combined was approximately 0.18. 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 tumours of the brain and spinal cord. The high ratio for neuroblastoma reflects the advanced stage at which this disease is frequently diagnosed. Soft tissue sarcomas (0.22), particularly rhabdomyosarcoma (0.27), also have a relatively poor prognosis. The ratio for acute non-lymphocytic leukemia (0.30) was much higher than that observed for acute lymphocytic leukemia (0.12), resulting in a relatively high overall ratio for leukemia. Although the lymphomas have a relatively good prognosis overall, Hodgkin's disease (0.02) has a very low death to cases ratio compared with non-Hodgkin's lymphoma (0.16). The low ratios observed for retinoblastoma and germ cell tumours indicate the low fatality 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. 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 40 years ago,¹³ currently, approximately 80% of Canadian children and teenagers with acute lymphoblastic leukemia are alive five years after diagnosis.¹⁴ 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.

Since the early 1950s mortality rates of childhood cancer have declined by more than 50%.

Table 15

New Cases and Age-Standardized Incidence Rates, and Deaths and Age-Standardized Mortality Rates by Histologic Cell Type for Children and Youth Aged 0-19 Years, Canada, 1996-2000

Diagnostic Group ²	New cases (1996-2000) ¹		ASIR per 1,000,000 per year	Deaths (1996-2000)		ASMR per 1,000,000 per year	Deaths/ Cases Ratio
	Number	%		Number	%		
Leukemia	1,700	26.4	43.31	352	30.5	8.83	0.21
Acute lymphocytic	1,304	20.2	33.21	159	13.8	3.97	0.12
Acute non-lymphocytic	277	4.3	7.06	83	7.2	2.09	0.30
Brain and Spinal	1,071	16.6	26.99	290	25.1	7.28	0.27
Astrocytoma	493	7.6	12.33	70	6.1	1.73	0.14
Primitive neuroectodermal	243	3.8	6.18	76	6.6	1.92	0.31
Ependymoma	89	1.4	2.29	33	2.9	0.83	0.37
Lymphoma	1,050	16.3	25.78	86	7.4	2.12	0.08
Hodgkin's disease	585	9.1	14.26	14	1.2	0.34	0.02
Non-Hodgkin's lymphoma	457	7.1	11.30	72	6.2	1.78	0.16
Carcinoma	536	8.3	13.12	32	2.8	0.79	0.06
Thyroid	222	3.4	5.41	1	0.1	0.02	0.00
Melanoma	138	2.1	3.37	6	0.5	0.15	0.04
Germ Cell and Other Gonadal	441	6.8	10.93	24	2.1	0.59	0.05
Gonadal germ cell tumours	272	4.2	6.67	2	0.2	0.05	0.01
Soft Tissue	397	6.2	9.99	86	7.4	2.18	0.22
Rhabdomyosarcoma	158	2.5	4.01	43	3.7	1.08	0.27
Fibrosarcoma	61	0.9	1.51	6	0.5	0.15	0.10
Bone	357	5.5	8.75	101	8.7	2.47	0.28
Osteosarcoma	184	2.9	4.49	58	5.0	1.41	0.32
Ewing's sarcoma	118	1.8	2.91	38	3.3	0.93	0.32
Sympathetic Nervous System	319	4.9	8.61	92	8.0	2.33	0.29
Neuroblastoma	299	4.6	8.11	92	8.0	2.33	0.31
Renal Tumours	290	4.5	7.60	34	2.9	0.84	0.12
Wilms' tumour	269	4.2	7.06	29	2.5	0.72	0.11
Retinoblastoma	114	1.8	3.14	2	0.2	0.05	0.02
Hepatic Tumours	74	1.1	1.97	26	2.3	0.67	0.35
Other Cancers	97	1.5	2.53	30	2.6	0.77	0.31
Total (5 years)	6,446	100.0	162.71	1,155	100.0	28.92	0.18
Average Per Year	1,289			231			

¹ Data are shown for the most recent five-year period available and exclude non-melanoma (basal and squamous) skin cancer and in-situ carcinomas. 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 because of disease rarity are expressed per million per year.

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

Source: Surveillance and Risk Assessment Division and Chronic Disease Control and Management Division, CCDPC, Health Canada and Health Statistics Division, Statistics Canada

International Variation in Cancer Incidence, 1993-1997

It is instructive to compare cancer incidence rates among populations. Such comparisons reveal similarities or differences that may provide the first step in developing hypotheses about the causation of particular cancers, through the discovery of associations between the incidence of the cancer and the prevalence of putative causative factors. Examples of important hypotheses that emerged from international comparison of incidence rates include sun exposure as a risk factor for melanoma and hepatitis B infection as a risk factor for primary liver cancer.

The data presented in this section are extracted from Volume VIII of *Cancer Incidence in Five Continents*, published by the International Agency for Research on Cancer (IARC).¹ The age-standardized incidence rates (ASIRs) presented here, including those from Canada, are generally for the period 1993-1997 and are adjusted according to the age distribution of the World Standard Population.¹ The ASIRs for Canada in this section differ considerably from those elsewhere in this publication; the latter include estimates up to 2004 and are adjusted to the age distribution of the 1991 Canadian population, which is older than the World Standard Population.

Geographic areas included in this section were chosen to represent a spectrum of populations on as many continents as possible. There are large areas of the world that could not be included because they do not have any high-quality, population-based registries, notably Africa. Canada is one of the few countries in the world having a system of population-based cancer registries covering the entire population. Many of the selected areas represent regions or urban areas within a country. Although all included areas have cancer registries that meet IARC quality criteria, methods of registration, completeness and accuracy vary considerably and undoubtedly account for some of the international variation. However, the amount of international variation is too large to be related solely to data quality. Because only a few specific regions are represented in this section, inferences cannot be made about Canada's rank among countries worldwide.

The cancers selected for comparison are the most common worldwide; these top eight together account for an estimated 60% of the world's cancers.² The cancers that are most common in Canada, namely lung, breast, prostate and colorectal cancers, rank first, second, sixth and third respectively in the world (Figure 11.1). Stomach, liver, cervical and esophageal are the other most common types of cancer worldwide.

The Western world (North America, Europe and Australia) generally has higher cancer incidence rates for all cancers combined than Asia or Latin America (Figures 11.2 and 11.3). The United States, as represented by the SEER (Surveillance, Epidemiology and End Results) group of registries covering about 10% of the population, has the highest incidence, which is more than triple that for males and double that for females in Mumbai, India.

Summaries of the variation in specific types of cancer and possible explanations follow.

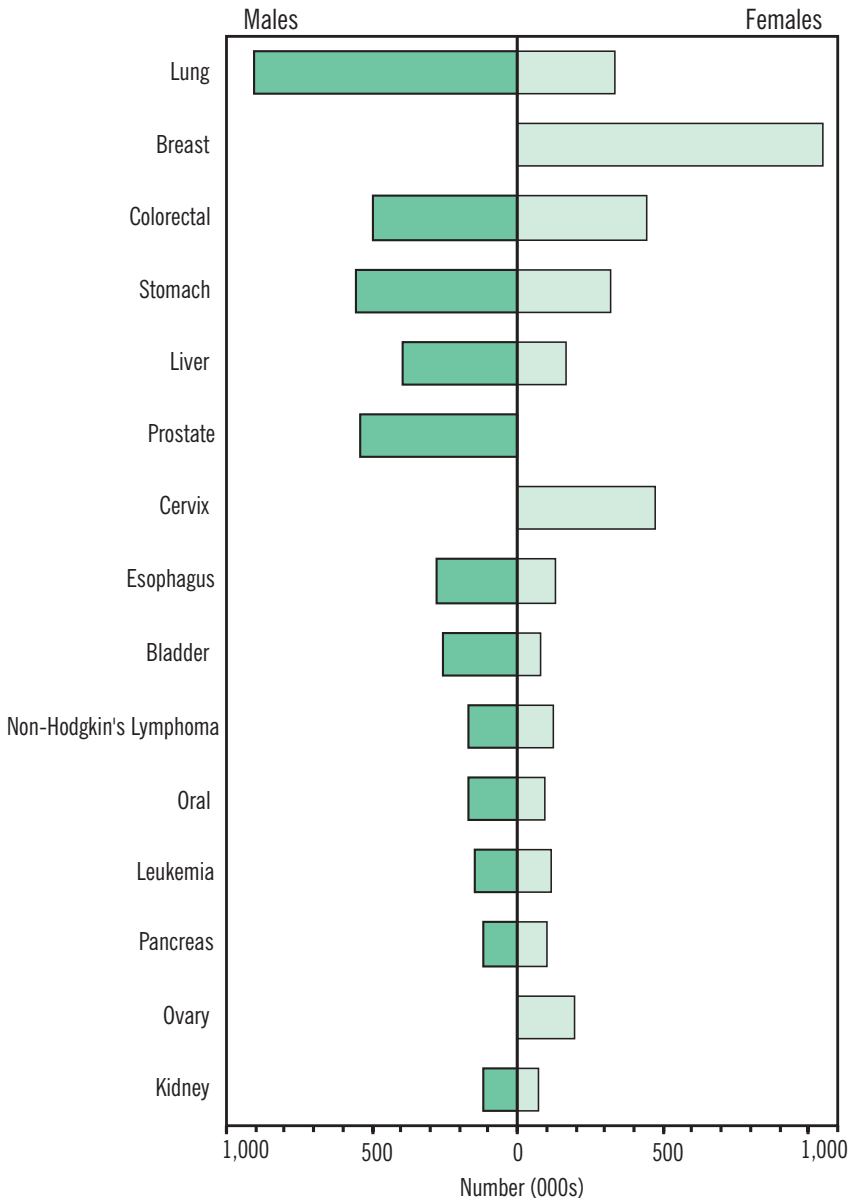
INTERNATIONAL VARIATION

- ◆ Lung cancer varies six-fold in men and nine-fold in women between highest and lowest incidence areas. Rates are highest in Eastern Europe and China for men (Figure 11.4) but are highest in North America for women (Figure 11.5), whereas rates are low in Latin America (Cali, Columbia) and Mumbai, India. These reflect cigarette smoking patterns of 20 to 30 years earlier.
- ◆ Female breast cancer is a disease seen more commonly in North America and Europe (Figure 11.6) and is relatively uncommon in Asia and Latin America, with a 3-fold difference between high and low risk areas. Possible explanations include differences in diet, body size, physical activity and reproductive patterns.
- ◆ Prostate cancer incidence varies dramatically around the world (Figure 11.7) and is over 10 times higher among US whites and in Australia and Canada than in Mumbai, India; U.S. black men have the highest incidence in the world, at a rate 70% higher than that among U.S. whites. During this time period (1993-1997), countries such as the U.S. and Canada were undergoing an “epidemic” of prostate cancer, related largely to increased uptake of PSA testing for early detection.³ Incidence has since returned to a lower level, presumably as the pool of prevalent cases was depleted. However, there is still considerable variation in the true underlying incidence of prostate cancer. Some of this is likely related to the level of clinical suspicion and intensity of diagnostic work-ups, since this disease can remain asymptomatic for many years, while some is undoubtedly related to race or ethnicity.³
- ◆ Colorectal cancer has similar incidence in many regions, including North America, Western Europe and parts of Asia (Singapore, China and Japan) (Figures 11.8 and 11.9). This is in contrast to the picture in *Canadian Cancer Statistics 1998*, when international comparisons for 1988-1992 showed strikingly lower incidence in all parts of Asia, including Japan and China. Differences in diet, the prevalence of obesity and levels of physical activity may explain the variation in incidence around the world.
- ◆ Stomach cancer has a very different international pattern, with high rates in Latin America, most of Asia and Eastern Europe and low rates in more Western areas (Figures 11.10 and 11.11). Stomach cancer incidence has been declining in the Western world in large part as a result of reduced consumption of preserved meats and increased availability of fresh fruits and vegetables.⁴ Recently, infection with *Helicobacter pylori* has been revealed as an important cause of stomach cancer. *H. pylori* is one of the most common bacterial infections worldwide, with a particularly high prevalence in developing countries.⁵
- ◆ Primary liver cancer (i.e. cancer originating in the liver, rather than spread to the liver from other sites) is striking by its extremely low incidence in Western countries, Latin America and India, and its high incidence in east and southeast Asia, particularly among men (Figures 11.12 and 11.13). Likely explanations include endemic hepatitis B and C and greater intake of aflatoxin-contaminated foods in these parts of Asia.

- ◆ The incidence of cervical cancer is highest in Latin America, India and Eastern Europe and lowest in the US, Canada and Japan (Figure 11.14). Variation is likely due to differences in the prevalence of sexually transmitted infection with oncogenic forms of the human papillomavirus (HPV), and in the extent and quality of Pap test screening for cancer precursors.
- ◆ Esophageal cancer is relatively rare in Canada but is relatively common in China, India, Japan and England (Figures 11.15 and 11.16). Incidence is much higher still in the “esophageal cancer belt”, which crosses central Asia (a region not covered by cancer registries).⁵ Incidence is generally much higher among men than women. Esophageal cancer is caused by excessive consumption of alcohol and tobacco, particularly together, and low intake of fresh fruit, vegetables and meat. Highly localized dietary habits, such as oral consumption of opium by-products around the Caspian Sea, are likely responsible for the very high incidence in specific geographic areas.⁵

Figure 11.1

Estimates of the Incidence of the Most Common Cancers Worldwide, 2000



Reference: Globocan 2000.²

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Figure 11.2

International Comparison of Age-Standardized Incidence Rates for All Cancers, Canada and Selected Registries, Males, 1993-1997

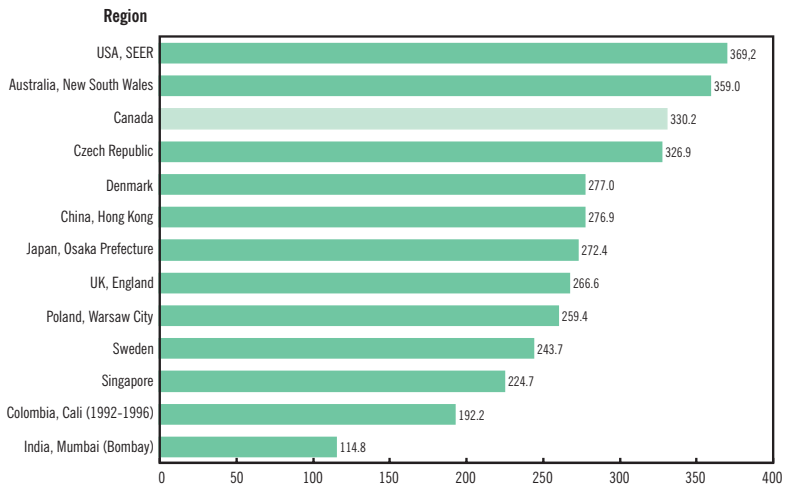
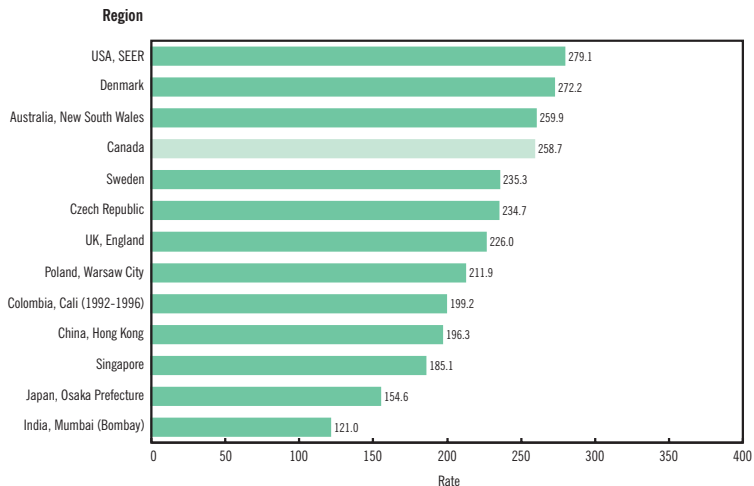


Figure 11.3

International Comparison of Age-Standardized Incidence Rates for All Cancers, Canada and Selected Registries, Females, 1993-1997



Note: Rates are per 100,000 standardized to the World population and exclude non-melanoma skin cancer. Sites are ranked in decreasing order.

Reference: Cancer Incidence in Five Continents Vol. VIII: Lyon, IARC, 2002.¹

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Figure 11.4

International Comparison of Age-Standardized Incidence Rates for Lung Cancer, Canada and Selected Registries, Males, 1993-1997

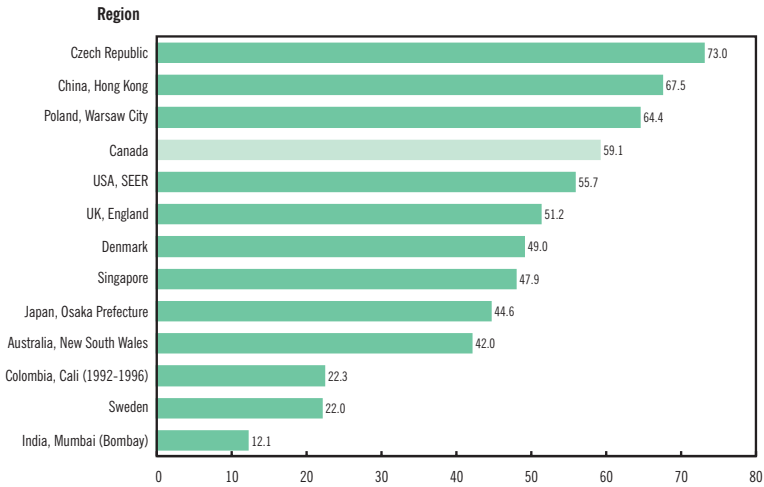
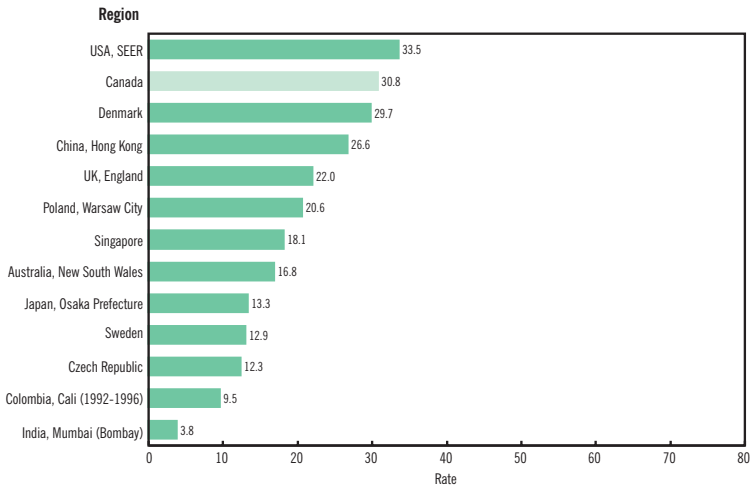


Figure 11.5

International Comparison of Age-Standardized Incidence Rates for Lung Cancer, Canada and Selected Registries, Females, 1993-1997



Note: Rates are per 100,000 and standardized to World population. Sites are ranked in decreasing order.
Reference: Cancer Incidence in Five Continents Vol. VIII: Lyon, IARC, 2002.¹

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Figure 11.6

International Comparison of Age-Standardized Incidence Rates for Breast Cancer, Canada and Selected Registries, Females, 1993-1997

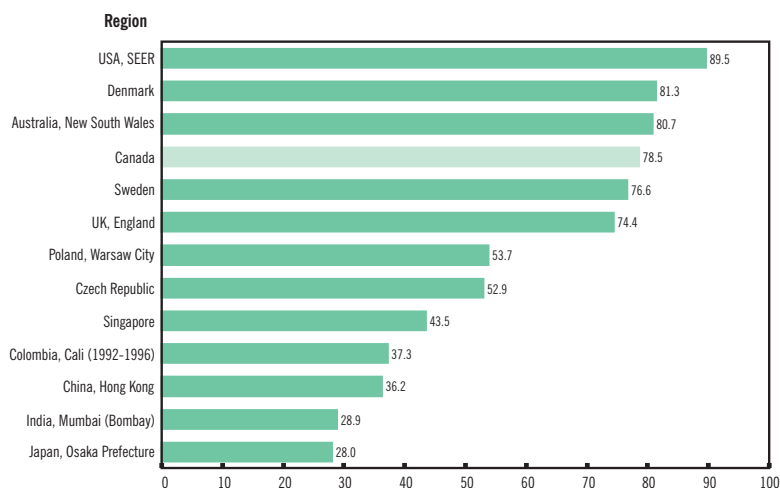
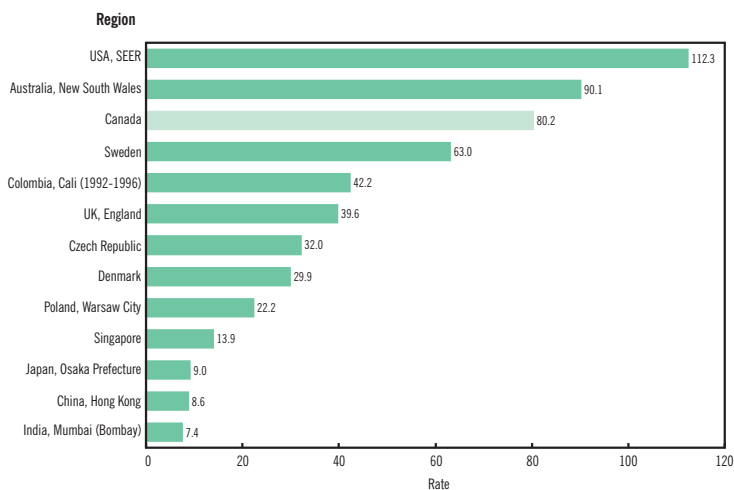


Figure 11.7

International Comparison of Age-Standardized Incidence Rates for Prostate Cancer, Canada and Selected Registries, Males, 1993-1997



Note: Rates are per 100,000 standardized to the World population. Sites are ranked in decreasing order. Reference: Cancer Incidence in Five Continents Vol. VIII: Lyon, IARC, 2002.¹

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Figure 11.8

International Comparison of Age-Standardized Incidence Rates for Colorectal Cancer, Canada and Selected Registries, Males, 1993-1997

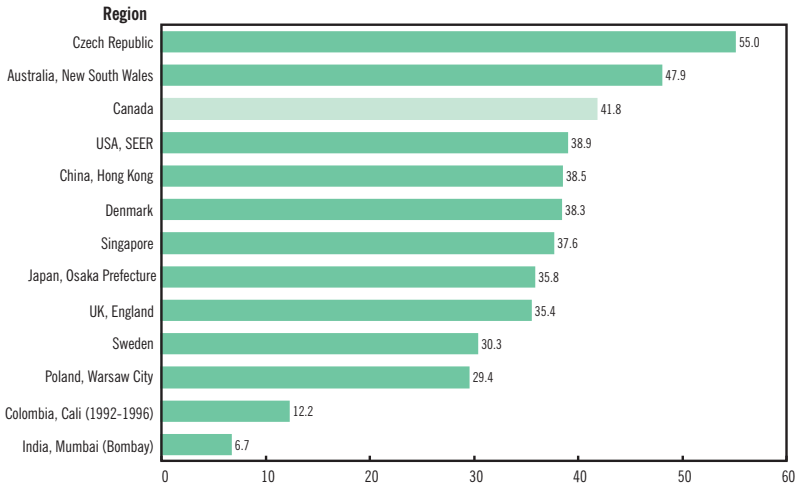
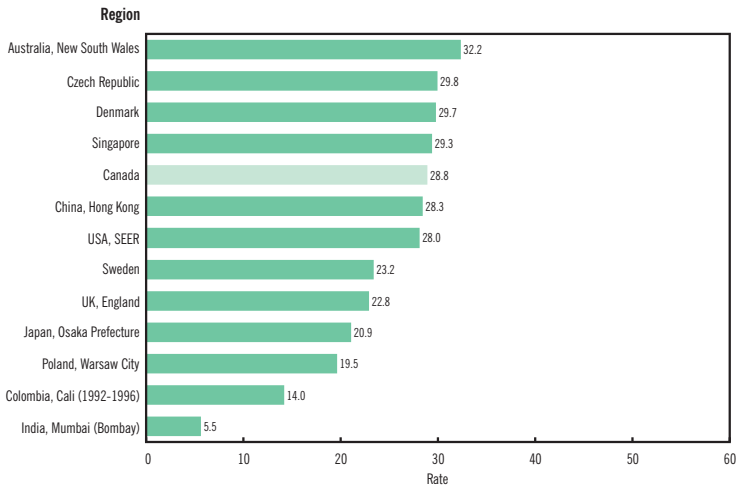


Figure 11.9

International Comparison of Age-Standardized Incidence Rates for Colorectal Cancer, Canada and Selected Registries, Females, 1993-1997



Note: Rates are per 100,000 and standardized to World population. Colorectal includes sites C18-C21. Sites are ranked in decreasing order.

Reference: Cancer Incidence in Five Continents Vol. VIII: Lyon, IARC, 2002.¹

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Figure 11.10

International Comparison of Age-Standardized Incidence Rates for Stomach Cancer, Canada and Selected Registries, Males, 1993-1997

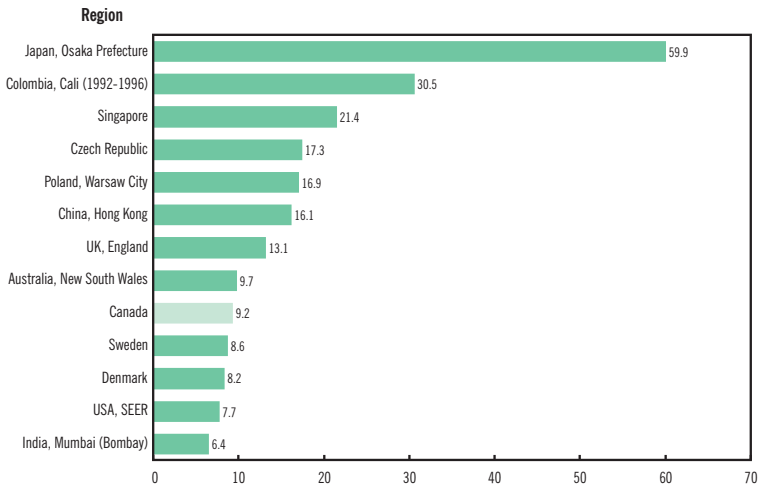
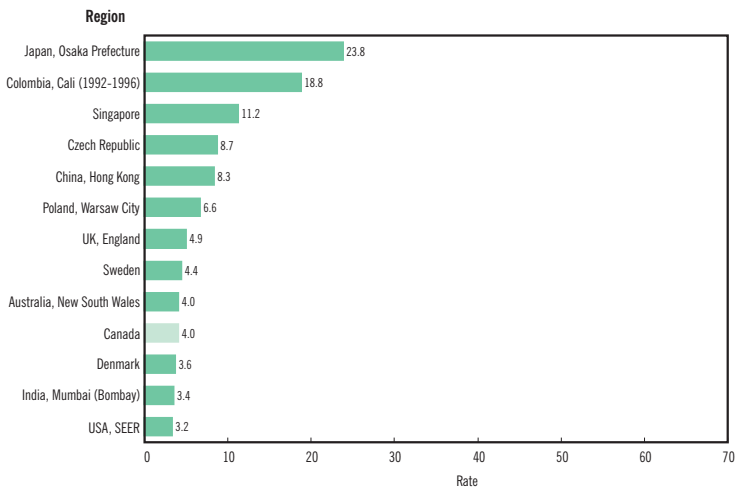


Figure 11.11

International Comparison of Age-Standardized Incidence Rates for Stomach Cancer, Canada and Selected Registries, Females, 1993-1997



Note: Rates are per 100,000 and standardized to World population. Sites are ranked in decreasing order. Reference: Cancer Incidence in Five Continents Vol. VIII: Lyon, IARC, 2002.¹

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Figure 11.12

International Comparison of Age-Standardized Incidence Rates for Liver Cancer, Canada and Selected Registries, Males, 1993-1997

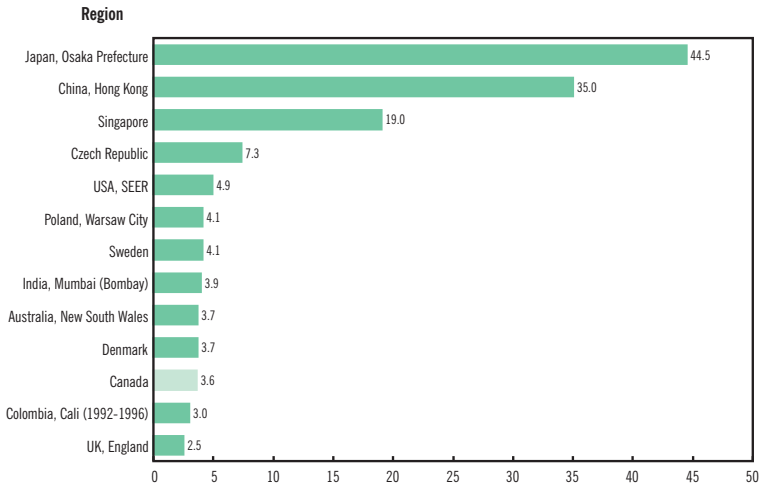
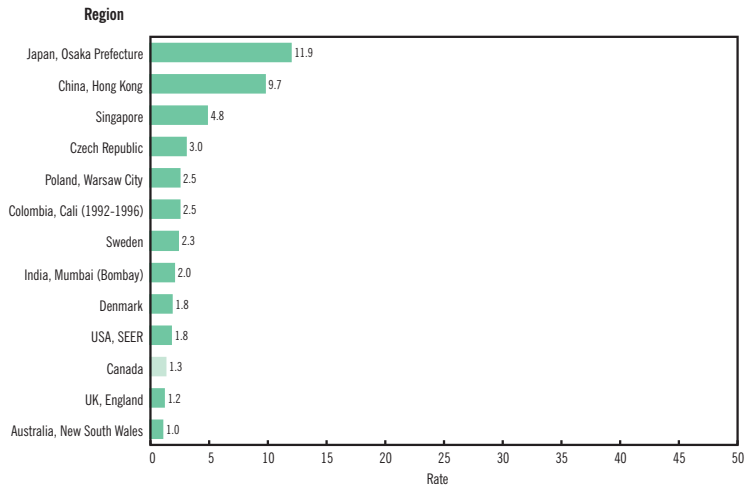


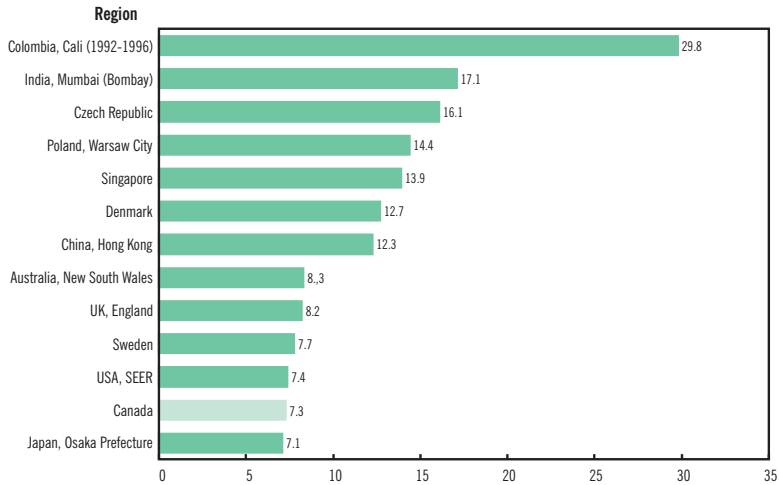
Figure 11.13

International Comparison of Age-Standardized Incidence Rates for Liver Cancer, Canada and Selected Registries, Females, 1993-1997



Note: Rates are per 100,000 and standardized to World population. Sites are ranked in decreasing order. Reference: Cancer Incidence in Five Continents Vol. VIII: Lyon, IARC, 2002.¹

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Figure 11.14**International Comparison of Age-Standardized Incidence Rates for Cancer of the Cervix, Canada and Selected Registries, Females, 1993-1997**

Note: Rates are per 100,000 and standardized to World population. Sites are ranked in decreasing order. Reference: Cancer Incidence in Five Continents Vol. VIII: Lyon, IARC, 2002.¹

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Figure 11.15

International Comparison of Age-Standardized Incidence Rates for Cancer of the Esophagus, Canada and Selected Registries, Males, 1993-1997

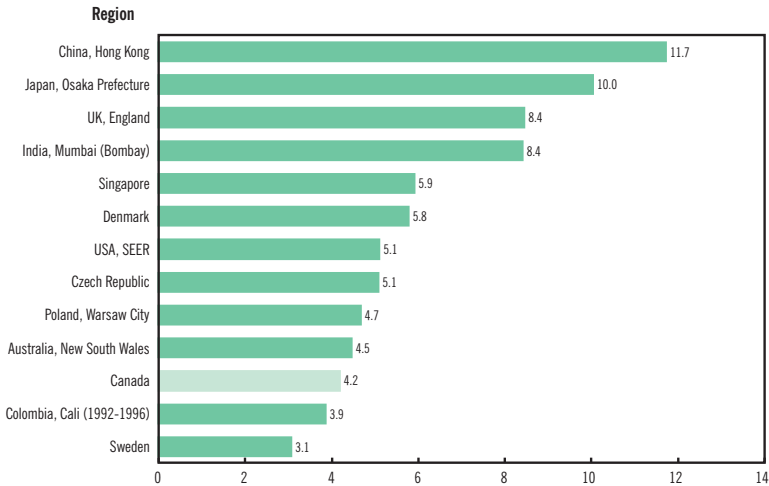
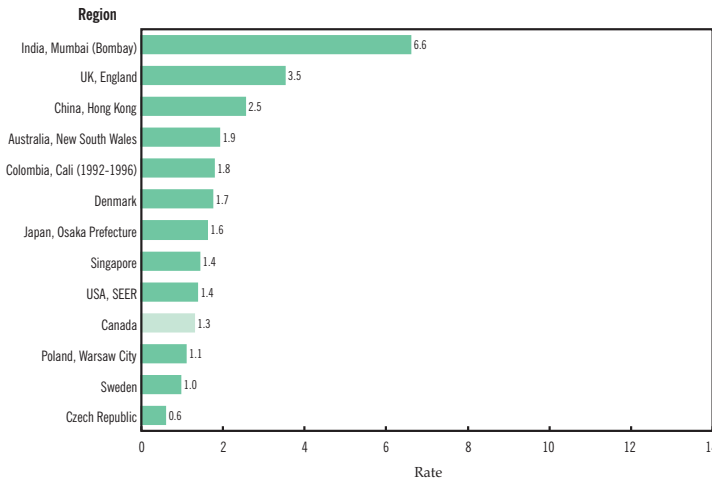


Figure 11.16

International Comparison of Age-Standardized Incidence Rates (per 100,000) for Cancer of the Esophagus, Canada and Selected Registries, Females, 1993-1997



Note: Rates are per 100,000 and standardized to World population. Sites are ranked in decreasing order. Reference: Cancer Incidence in Five Continents Vol. VIII: Lyon, IARC, 2002.³

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Economic Burden of Cancer in Canada, 1998

Cancer has a significant economic impact in Canada, as measured by direct and indirect costs together. Direct costs refer to the value of goods and services for which payment was made and resources used in treatment, care and rehabilitation directly related to illness or injury. Indirect costs are defined as the value of economic output lost because of illness, injury-related work disability or premature death.

The data presented in this section are from a report entitled *Economic Burden of Illness in Canada, 1998* (Health Canada, 2002).¹ The assumptions underlying the costs provided along with further information are available in the original publication. Direct costs include care provided in hospitals and other institutions, physician services, drugs and other (including other health professionals, capital expenditures, public health and research). Indirect costs include estimates of the value of life lost due to premature death (mortality costs) and the value of activity days lost due to disability (morbidity costs).

Overall, the total cost of illness in 1998 in Canada was \$159 billion, of which \$84 billion (53%) were direct costs and \$75 billion (47%) indirect costs. Just over one-half (55%) of these total costs could be attributed to a specific disease (Figure 12.1). Of these disease-specific costs, \$14.2 billion (9% of the total cost of illness), was related to cancer, which is ranked third in terms of attributable total cost, after cardiovascular (12%) and musculoskeletal (10%) diseases.

Cancer accounted for \$2.5 billion in direct costs, hospital care costing \$1.8 billion and representing 74% of this amount (Figure 12.2). Of the hospital care costs, 53% was expended for those 65 years and older, although this group accounts for 58% of cancer patients. In contrast, children with cancer accounted for 2.5% of hospital costs but made up less than 1% of the cancer population.

Physician services to treat cancer cost \$333 million, or 14% of the direct costs of cancer; this represents 3% of the total cost in Canada of all medical services provided by physicians. Approximately \$210 million, or 9% of direct cancer costs, were spent on drugs for cancer treatment. Seventeen percent and 12% of the total drug costs spent on cancer treatment were accounted for by breast and prostate cancer respectively. Cancer research funding, at a cost of \$80 million, represents only 3% of the direct costs of cancer but 19% of the total funding for medical research in Canada that could be attributed to a specific type of disease.

The estimated direct costs of cancer in the *Economic Burden of Illness in Canada, 1998* are conservative, since almost one-half of the total direct cost of illness in Canada could not be attributed to specific diseases. The costs identified are reasonably complete for physician office and hospital-related treatment of cancer; however, many cancer services are offered through provincial cancer agencies, which operate independently of these systems in most provinces. Thus, it is possible that expenditures for outpatient care and other programs of provincial cancer agencies were not consistently or completely captured by the *Economic Burden of Illness in Canada, 1998*. It is equally unclear whether all cancer prevention and screening activities undertaken by governments and by non-government organizations were identified.

ECONOMIC BURDEN OF CANCER

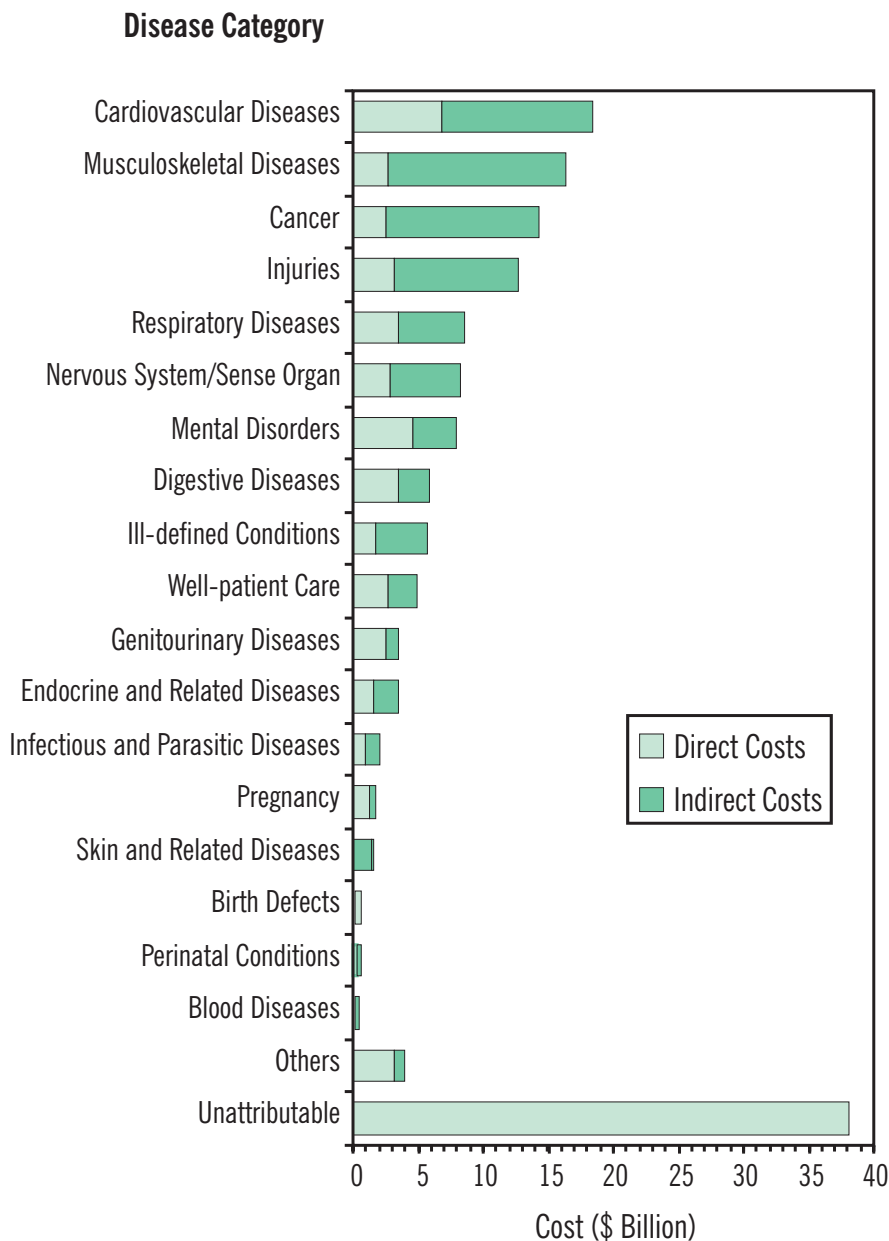
Of the total indirect costs of illness in Canada in 1998 (\$75 billion), cancer accounted for \$11.8 billion (16%), ranking second only to musculoskeletal diseases (Figure 12.1). Cancer accounted for almost one-third of premature mortality costs (32%), reflecting the fact that cancer is the leading cause of premature mortality in Canada. Eight percent of the costs of premature mortality due to all diseases was accounted for by lung cancer alone (or 26% of the total due to cancer).

Long-term disability costs attributable to cancer (\$962 million) accounted for only 3% of the total long-term disability costs of all illnesses/injuries. Short-term disability costs for cancer were estimated at \$174 million, or 2% of the total short-term disability costs.

Although differences in how data were collected and in data quality make comparisons difficult across different volumes of the *Economic Burden of Illness in Canada*,^{2,3} interesting patterns are suggested. In constant 1998 dollars, the total costs of cancer in Canada increased from \$12.7 billion in 1986 to \$13.9 billion in 1993, and to \$14.2 billion in 1998 (Figure 12.3). While direct costs attributable to cancer rose from \$2.8 billion in 1986 to \$3.4 billion in 1993, in 1998 they were reported to have declined to \$2.5 billion. This decline in direct costs was also seen for diseases other than cancer between 1993 and 1998, while direct costs that could not be attributed to specific diseases increased (data not shown). Figure 12.3 also shows that indirect costs increased steadily, from \$9.9 billion in 1986 to \$11.8 billion in 1998 (in constant 1998 dollars). Given the need to interpret cautiously the trends that appear in a comparison of different volumes of the report, the recent decline in cancer-related direct costs may, in part, reflect changes in the delivery of cancer services or incomplete capture of all costs, particularly in primarily ambulatory venues such as provincial cancer agencies.

Figure 12.1

Economic Burden of Illness by Disease Category, Canada, 1998



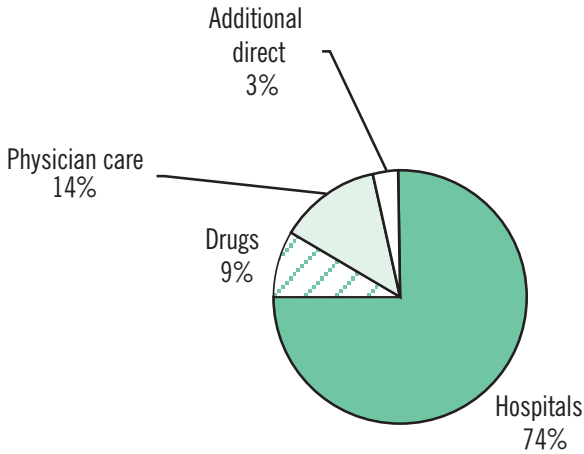
Note: See Appendix 1: Methodology – *Economic Burden of Illness in Canada* for further explanation of assumptions calculations. Based on a total cost of \$159.4 billion.

Source: *Economic Burden of Illness in Canada 1998*, Health Canada

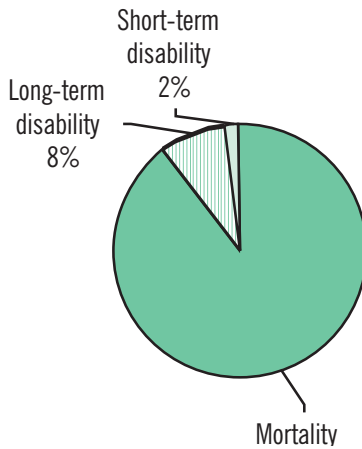
Figure 12.2

Direct and Indirect Costs of Cancer, Canada, 1998

Direct costs



Indirect costs

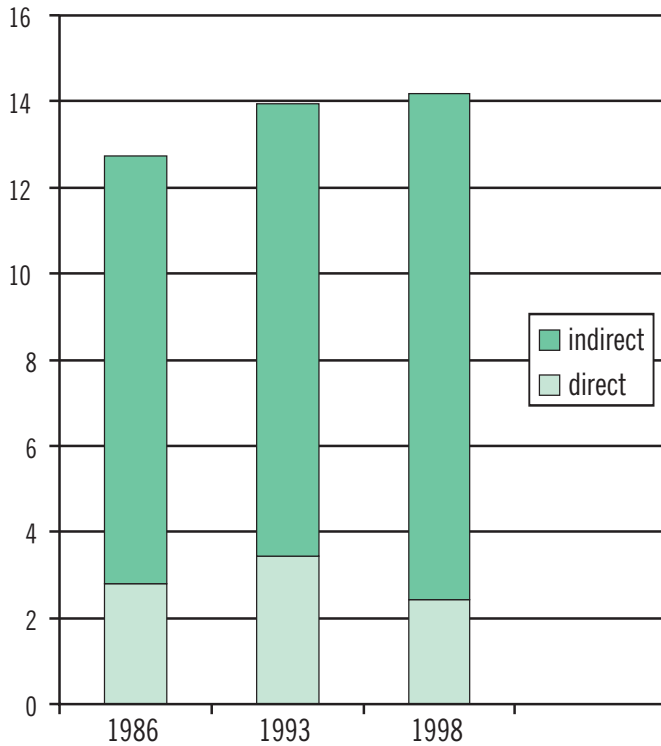


Note: See Appendix 1: Methodology – *Economic Burden of Illness in Canada* for further explanation of assumptions and calculations. Based on a total cost of \$159.4 billion .

Source: Economic Burden of Illness in Canada, 1998, Health Canada

Figure 12.3

Direct and Indirect Costs of Cancer, Canada, 1986, 1993 and 1998
(in 1998 \$ billion)



Note: See Appendix 1: Methodology – *Economic Burden of Illness in Canada* for further explanation of assumptions and calculations. Based on a total cost of \$159.4 billion.

Source: Economic Burden of Illness in Canada 1998, Health Canada

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. ¹⁵
ICD-10	International Statistical Classification of Diseases and Related Health Problems, Tenth Revision. ¹⁶
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.
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.
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, 1975, is set at 100. Index values for subsequent years are derived by multiplying the age-standardized rate for the year by 100 and then dividing by the 1975 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. ¹⁷

GLOSSARY

Site Definitions

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

Site	ICDO-3 Site/Type ¹ (Incidence)	ICD-10 (Mortality)
Oral	C00-C14	C00-C14
Esophagus/Oesophagus	C15	C15
Stomach	C16	C16
Colorectal	C18-C21,C26.0	C18-C21,C26.0
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,C57.0-.4	C56,C57.0-.4
Prostate	C61	C61
Testis	C62	C62
Bladder	C67	C67
Kidney	C64-C66,C68	C64-C66,C68
Brain	C70-C72	C70-C72
Thyroid	C73	C73
Lymphoma	Type 9590-9596, 9650-9729 Type 9823, all sites except C42.0.,1.,4 Type 9827, all sites except C42.0.,1.,4	C81-C90,C96.3
Hodgkin's Disease	Type 9650-9667	C81
Non-Hodgkin's Lymphoma	Type 9590-9596,9670-9719,9727-9729 Type 9823, all sites except C42.0.,1.,4 Type 9827, all sites except C42.0.,1.,4	C82-C85,C96.3
Multiple Myeloma	Type 9731,9732,9734	C88,C90
Leukemia	Type 9733,9742,9800-9801,9805,9820, 9826,9831-9837,9840,9860-9861,9863, 9866-9867,9870-9876,9891,9895-9897, 9910,9920,9930-9931,9940,9945-9946, 9948,9963-9964 Type 9823 and 9827, sites C42.0.,1.,4	C91-C95
All Other Sites	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 sites(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,C46,C76-C80,C96.0-.2, C96.7-.9,C97
All Cancer Sites	All invasive sites	All invasive sites

¹ Histology types 9590-9989 (leukemias and other blood and lymph tissues), 9050-9055 (mesothelioma) and 9140 (Kaposi's sarcoma) are excluded from other sites.

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 (2000) and deaths (2000) 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 August 2003 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 Health 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 Site and Sex, Canada, 2000

Site	ICDO-3 Site/Type ¹	Total	Males	Females
All Cancer Sites	All invasive sites	134,413	69,978	64,435
Oral (Buccal Cavity and Pharynx)	C00-C14	3,155	2,146	1,009
Lip	C00	455	362	93
Tongue	C01-C02	655	429	226
Salivary Gland	C07-C08	330	185	145
Mouth	C03-C06	677	400	277
Nasopharynx	C11	247	163	84
Oropharynx	C10	97	75	22
Other and Unspecified	C09,C12-C14	694	532	162
Digestive Organs	C15-C26,C48	28,907	15,871	13,036
Esophagus	C15	1,328	974	354
Stomach	C16	2,906	1,824	1,082
Small Intestine	C17	468	261	207
Large Intestine	C18,C26.0	12,228	6,120	6,108
Rectum	C19-C21	6,165	3,677	2,488
Liver	C22	1,237	837	400
Gallbladder	C23	381	116	265
Pancreas	C25	3,163	1,577	1,586
Other and Unspecified	C24,C26.1-.9,C48	1,031	485	546
Respiratory System	C30-C36,C38.1-.9,C39	20,998	12,455	8,543
Larynx	C32	1,087	901	186
Lung	C33-C34	19,648	11,401	8,247
Other and Unspecified	C30-31,C35-36,C38.1-.9,C39	263	153	110
Bone	C40-C41	297	168	129
Soft Tissue (including Heart)	C38.0,C47,C49	831	471	360
Skin (Melanoma)	Type 8720-8790	3,719	1,935	1,784
Breast	C50	18,661	127	18,534
Genital Organs	C51-C63	27,001	19,396	7,605
Cervix	C53	1,362	-	1,362
Body of Uterus	C54	3,417	-	3,417
Uterus, Part Unspecified	C55	115	-	115
Ovary	C56,C57.0-.4	2,184	-	2,184
Prostate	C61	18,477	18,477	-
Testis	C62	760	760	-
Other and Unspecified	C51-52,C57.5-.9,C58,C60,C63	686	159	527
Urinary Organs	C64-C68	8,737	6,004	2,733
Bladder	C67	4,841	3,636	1,205
Kidney and Other Urinary	C64-C66,C68	3,896	2,368	1,528
Eye	C69	265	141	124
Brain and Central Nervous System	C70-C72	2,197	1,242	955
Endocrine Glands	C37,C73-C75	2,450	657	1,793
Thyroid	C73	2,240	550	1,690
Other Endocrine	C37,C74-C75	210	107	103
Leukemia	See Glossary	3,666	2,110	1,556
Other Blood and Lymph Tissues	See 3 components below	7,907	4,279	3,628
Hodgkin's Disease	Type 9650-9667	811	456	355
Non-Hodgkin's Lymphoma	See Glossary	5,444	2,932	2,512
Multiple Myeloma	Type 9731,9732,9734	1,652	891	761
All Other and Unspecified Sites	See Glossary	5,287	2,706	2,581
Mesothelioma	Type 9050-9055	335	270	65

- Not applicable

¹ Histology types 9590-9989 (leukemias and other blood and lymph tissues), 9050-9055 (mesothelioma) and 9140 (Kaposi's sarcoma) are excluded from other sites.

Note: ICDO-3 refers to the Third Edition of the International Classification of Diseases for Oncology. Figures are for invasive sites and exclude non-melanoma skin cancer. Further information is available at: <http://www.hc-sc.gc.ca/pphb-dgspss> (select Disease Surveillance On-Line button).

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

APPENDIX I: ACTUAL DATA FOR NEW CASES AND DEATHS

Table A2

Actual Data for Cancer Deaths by Site and Sex, Canada, 2000

Site	ICD-10	Total	Males	Females
All Cancer Sites	C00-C97	62,672	33,360	29,312
Oral (Buccal Cavity and Pharynx)	C00-C14	901	594	307
Lip	C00	25	17	83
Tongue	C01-C02	215	142	73
Salivary Gland	C07-C08	74	37	37
Mouth	C03-C06	170	94	76
Nasopharynx	C11	86	60	26
Oropharynx	C10	62	42	20
Other and Unspecified	C09,C12-C14	269	202	67
Digestive Organs	C15-C26,C48	16,636	9,170	7,466
Esophagus	C15	1,392	1,052	340
Stomach	C16	1,988	1,195	793
Small Intestine	C17	127	65	62
Large Intestine	C18,C26.0	6,526	3,356	3,170
Rectum	C19-C21	1,401	842	559
Liver	C22	1,291	816	475
Gallbladder	C23	259	78	181
Pancreas	C25	3,092	1,510	1,582
Other and Unspecified	C24,C26.1-.9,C48	560	256	304
Respiratory System	C30-C36,C38.1-.9,C39	16,749	10,134	6,615
Larynx	C32	506	416	90
Lung	C33-C34	16,134	9,650	6,484
Other and Unspecified	C30-31,C35-36,C38.1-.9,C39	109	68	41
Bone	C40-C41	147	81	66
Soft Tissue (including Heart)	C38.0,C47,C49	358	181	177
Skin (melanoma)	C43	709	432	277
Breast	C50	4,901	44	4,857
Genital Organs	C51-C63	6,394	3,791	2,603
Cervix	C53	398	-	398
Body of Uterus	C54	318	-	318
Uterus, Part Unspecified	C55	322	-	322
Ovary	C56,C57.0-.4	1,402	-	1,402
Prostate	C61	3,718	3,718	-
Testis	C62	37	37	-
Other and Unspecified	C51-52,C57.5-.9,C58,C60,C63	199	36	163
Urinary Organs	C64-C68	2,847	1,888	959
Bladder	C67	1,519	1,082	437
Kidney and Other Urinary	C64-C66,C68	1,328	806	522
Eye	C69	32	18	14
Brain and Central Nervous System	C70-C72	1,533	897	636
Endocrine Glands	C73,C74-C75	220	91	129
Thyroid	C73	124	47	77
Other Endocrine	C74,C75	96	44	52
Leukemia	C91-C95	2,048	1,190	858
Other Blood and Lymph Tissues	C81-C90,C96.3	3,770	2,006	1,764
Hodgkin's Disease	C81	128	78	50
Non-Hodgkin's Lymphoma	C82-C85,C96.3	2,537	1,348	1,189
Multiple Myeloma	C88,C90	1,105	580	525
All Other and Unspecified Sites	See Glossary	5,135	2,601	2,534
Mesothelioma	C45	292	242	50

- Not applicable

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

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

APPENDIX I: ACTUAL DATA FOR NEW CASES AND DEATHS

Table A3

Actual Data for New Cases for Major Cancer Sites by Sex and Geographic Region, Most Recent Year¹, Canada

	New Cases													
	Canada	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.	Nu.
Males														
All Cancers	70,000	1,200	350	2,600	1,950	17,200	27,600	2,700	2,700	6,100	9,300	35	40	20
Prostate	18,500	370	140	740	520	3,300	8,200	750	850	2,200	2,900	5	5	–
Lung	11,400	180	65	420	350	3,600	3,900	400	370	730	1,300	5	5	10
Colorectal	9,800	220	35	380	240	2,500	3,800	390	340	760	1,200	5	10	5
Bladder	3,600	30	5	110	130	1,300	1,200	100	160	140	350	–	–	–
Non-Hodgkin's Lymphoma	2,900	30	10	90	80	710	1,150	120	120	220	430	–	–	–
Kidney	2,400	35	10	100	75	590	1,000	110	85	190	240	–	–	–
Oral	2,100	45	10	85	65	520	820	95	60	170	260	–	–	–
Leukemia	2,100	10	10	50	55	530	840	75	90	190	240	–	–	–
Melanoma	1,950	25	10	80	60	290	910	65	55	190	350	–	–	–
Stomach	1,800	55	5	55	55	470	630	65	55	150	250	–	–	–
Pancreas	1,600	5	5	60	30	450	570	45	65	130	210	–	–	–
Brain	1,250	15	5	45	25	350	470	35	30	95	150	–	–	–
Larynx	900	25	10	40	20	320	300	25	30	60	100	–	–	–
Multiple Myeloma	890	10	5	20	25	230	360	40	35	60	120	–	–	–
Females														
All Cancers	64,400	940	310	2,300	1,650	16,700	24,900	2,700	2,100	5,200	8,100	35	35	25
Breast	18,500	320	75	600	460	5,000	7,000	730	600	1,550	2,400	15	15	–
Colorectal	8,600	170	55	350	230	2,200	3,300	330	280	600	1,050	5	5	5
Lung	8,200	85	40	340	230	2,300	3,100	370	250	570	1,100	5	5	10
Body of Uterus	3,500	55	25	120	75	830	1,400	180	110	300	420	–	–	–
Non-Hodgkin's Lymphoma	2,500	35	10	65	65	640	1,000	120	90	180	320	–	–	–
Ovary	2,200	25	10	65	70	580	940	90	55	150	300	–	–	–
Melanoma	1,800	20	20	80	45	300	770	65	65	190	300	–	–	–
Thyroid	1,700	20	5	35	50	360	930	50	50	170	160	–	–	–
Pancreas	1,600	10	5	50	45	460	540	65	55	110	240	–	–	–
Kidney	1,550	30	5	60	55	380	590	70	60	120	160	–	–	–
Leukemia	1,550	5	10	55	25	410	570	60	70	140	160	–	–	–
Cervix	1,350	30	5	60	30	300	500	60	45	150	140	–	–	–
Bladder	1,200	5	5	25	45	430	430	35	50	50	130	–	–	–
Stomach	1,100	20	5	35	20	310	370	40	35	75	130	–	–	–
Oral	1,000	10	10	45	30	220	380	50	40	85	140	–	–	–
Brain	960	10	5	30	15	270	410	35	35	70	130	–	–	–
Multiple Myeloma	760	5	5	20	15	190	340	30	20	50	95	–	–	–

– Fewer than 3 cases

¹ 2000 for Canada and Quebec; 2001 for Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, Ontario, Manitoba, Saskatchewan, Alberta, British Columbia; 1997-2001 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 and squamous) skin cancer.

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

APPENDIX I: ACTUAL DATA FOR NEW CASES AND DEATHS

Table A4

Actual Age-Standardized Incidence Rates for Major Cancer Sites by Sex and Geographic Region, Most Recent Year¹, Canada

	Rate per 100,000													
	Canada	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.	Nu.
Males														
All Cancers	462	429	494	524	502	477	467	460	481	457	429	341	375	412
Prostate	124	137	192	152	136	93	140	129	154	172	133	59	67	–
Lung	75	65	88	86	91	100	67	68	66	56	59	77	75	194
Colorectal	65	79	53	76	63	70	64	65	61	58	54	68	85	101
Bladder	24	11	10	21	33	36	21	16	28	11	16	–	–	–
Non-Hodgkin's Lymphoma	19	10	14	17	21	19	19	20	21	15	20	–	–	–
Kidney	15	11	12	21	17	16	17	18	15	13	11	–	–	–
Oral	14	17	13	17	16	13	13	15	11	12	11	–	–	–
Leukemia	14	4	13	11	15	15	14	13	17	14	11	–	–	–
Stomach	12	19	6	11	14	13	11	11	10	11	12	–	–	–
Melanoma	12	7	12	17	14	7	15	11	10	13	16	–	–	–
Pancreas	10	2	6	12	8	12	10	8	11	10	10	–	–	–
Brain	8	6	7	9	7	10	8	6	5	7	7	–	–	–
Larynx	6	8	10	8	6	8	5	4	6	4	5	–	–	–
Multiple Myeloma	6	3	6	4	6	6	6	7	6	5	5	–	–	–
Females														
All Cancers	346	296	360	366	344	357	346	376	336	333	317	325	327	519
Breast	101	98	88	99	96	107	98	102	98	99	93	101	102	–
Colorectal	44	52	59	53	44	45	44	42	39	38	38	35	72	135
Lung	44	28	46	56	48	48	42	52	40	38	42	28	56	223
Body of Uterus	19	18	29	19	16	18	20	26	19	20	17	–	–	–
Non-Hodgkin's Lymphoma	14	11	12	11	13	14	14	17	13	11	12	–	–	–
Ovary	12	8	9	11	15	13	13	13	9	10	12	–	–	–
Melanoma	10	7	20	13	10	7	11	11	11	12	12	–	–	–
Thyroid	10	7	8	7	11	9	15	8	9	11	7	–	–	–
Pancreas	8	3	6	8	9	9	7	8	7	7	8	–	–	–
Cervix	8	11	6	11	8	7	8	10	8	10	6	–	–	–
Kidney	8	10	4	10	11	8	8	9	9	8	6	–	–	–
Leukemia	8	3	11	9	5	9	8	9	10	9	7	–	–	–
Bladder	6	2	3	4	9	9	6	4	7	3	5	–	–	–
Oral	5	3	9	7	6	5	5	6	6	6	5	–	–	–
Stomach	5	6	7	5	4	6	5	5	4	5	5	–	–	–
Brain	5	3	10	6	3	6	6	5	6	5	5	–	–	–
Multiple Myeloma	4	1	6	3	3	4	5	4	3	3	4	–	–	–

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

¹ 2000 for Canada and Quebec; 2001 for Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, Ontario, Manitoba, Saskatchewan, Alberta, British Columbia; 1997-2001 average for Yukon, Northwest Territories, Nunavut

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

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

APPENDIX I: ACTUAL DATA FOR NEW CASES AND DEATHS

Table A5

Actual Data for Deaths for Major Cancer Sites by Sex and Geographic Region, Canada, 2000¹

	Deaths													
	Canada	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.	Nu.
Males														
All Cancers	33,400	650	170	1,250	930	9,100	12,200	1,400	1,150	2,500	4,000	20	20	15
Lung	9,700	190	55	390	340	3,000	3,200	370	280	630	1,100	10	5	5
Colorectal	4,200	110	25	160	100	1,100	1,600	180	140	280	500	-	5	-
Prostate	3,700	70	20	140	100	820	1,350	180	230	350	470	-	-	-
Pancreas	1,500	20	10	50	40	420	540	65	40	120	200	-	-	-
Non-Hodgkin's														
Lymphoma	1,350	10	5	50	40	320	510	65	45	110	180	-	-	-
Stomach	1,200	40	5	45	20	360	420	45	35	90	140	-	-	-
Leukemia	1,200	15	5	40	30	260	490	50	50	100	160	-	-	-
Bladder	1,100	30	5	35	30	250	430	40	40	95	120	-	-	-
Brain	900	20	-	30	20	270	320	30	30	70	100	-	-	-
Kidney	810	10	5	25	20	180	300	60	30	75	95	-	-	-
Oral	590	15	5	35	15	160	240	15	15	35	70	-	-	-
Multiple														
Myeloma	580	10	-	25	20	130	210	35	25	45	75	-	-	-
Melanoma	430	5	-	10	10	85	200	15	10	30	60	-	-	-
Larynx	420	5	-	15	15	140	150	15	15	15	45	-	-	-
Females														
All Cancers	29,300	510	150	1,100	730	7,600	11,100	1,200	1,050	2,300	3,600	15	20	15
Lung	6,500	85	40	230	160	1,700	2,400	260	220	510	850	5	5	5
Breast	4,900	90	25	180	130	1,250	1,950	190	160	330	550	5	-	-
Colorectal	3,700	75	30	160	90	1,000	1,400	160	140	240	450	-	5	-
Pancreas	1,600	20	10	65	45	430	580	45	60	110	220	-	-	-
Ovary	1,400	20	5	50	35	300	550	55	60	110	220	-	-	-
Non-Hodgkin's														
Lymphoma	1,200	15	-	40	35	320	440	40	50	95	150	-	-	-
Leukemia	860	10	5	25	20	210	330	40	45	85	90	-	-	-
Stomach	790	30	5	35	20	220	270	25	30	70	85	-	-	-
Body of Uterus	640	5	-	20	20	170	250	20	20	60	70	-	-	-
Brain	640	10	5	20	15	180	230	25	25	55	65	-	-	-
Multiple														
Myeloma	530	10	-	20	10	130	210	25	20	40	70	-	-	-
Kidney	520	15	-	20	15	140	180	30	30	40	60	-	-	-
Bladder	440	10	-	10	10	100	180	15	10	45	55	-	-	-
Cervix	400	10	-	20	10	80	160	15	20	35	50	-	-	-
Oral	310	-	-	10	5	75	120	20	10	20	45	-	-	-
Melanoma	280	5	-	5	5	45	130	15	10	25	40	-	-	-

- Fewer than 3 deaths

¹ 1997-2001 average for Yukon, Northwest Territories, Nunavut

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

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

APPENDIX I: ACTUAL DATA FOR NEW CASES AND DEATHS

Table A6

Actual Age-Standardized Mortality Rates for Major Cancer Sites by Sex and Geographic Region, Canada, 2000¹

	Rate per 100,000													
	Canada	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.	Nu.
Males														
All Cancers	225	250	240	261	245	259	217	238	203	203	189	235	235	360
Lung	64	71	81	81	88	84	57	63	50	51	52	97	78	158
Colorectal	28	43	32	32	27	32	28	31	25	23	24	-	42	-
Prostate	27	28	30	31	27	26	25	29	38	30	23	-	-	-
Pancreas	10	8	14	11	11	12	9	11	7	9	10	-	-	-
Non-Hodgkin's Lymphoma	9	4	10	10	10	9	9	11	8	8	9	-	-	-
Stomach	8	15	5	10	5	10	8	7	6	8	7	-	-	-
Bladder	8	13	6	8	9	8	8	7	7	8	6	-	-	-
Leukemia	8	6	7	8	7	7	9	9	8	8	8	-	-	-
Brain	6	7	-	6	4	7	5	5	6	5	5	-	-	-
Kidney	5	4	7	6	5	5	5	10	5	6	4	-	-	-
Oral	4	5	4	7	4	4	4	3	3	2	3	-	-	-
Multiple Myeloma	4	5	-	5	5	4	4	6	4	4	4	-	-	-
Larynx	3	3	-	3	4	4	3	3	3	1	2	-	-	-
Melanoma	3	1	-	2	3	2	4	2	2	2	3	-	-	-
Females														
All Cancers	149	161	152	163	147	155	150	150	151	146	136	176	203	314
Lung	34	28	47	36	33	36	33	35	33	34	34	40	39	181
Breast	25	28	24	28	26	26	26	25	24	22	21	34	-	-
Colorectal	18	23	28	23	17	19	18	18	17	15	16	-	41	-
Pancreas	8	6	7	10	9	9	8	6	8	7	8	-	-	-
Ovary	7	6	5	8	8	6	8	7	8	7	8	-	-	-
Non-Hodgkin's Lymphoma	6	5	-	7	7	7	6	5	7	6	5	-	-	-
Stomach	4	10	4	5	4	4	4	3	4	4	3	-	-	-
Brain	4	5	4	4	4	4	3	4	5	4	3	-	-	-
Leukemia	4	4	5	3	4	4	4	5	5	5	3	-	-	-
Body of Uterus	3	2	-	3	4	3	3	2	3	4	3	-	-	-
Multiple Myeloma	3	3	-	3	2	3	3	3	3	2	3	-	-	-
Kidney	3	5	-	3	3	3	2	4	4	2	2	-	-	-
Oral	2	-	-	1	1	2	2	2	1	1	2	-	-	-
Cervix	2	3	-	3	2	2	2	2	3	2	2	-	-	-
Bladder	2	3	-	1	2	2	2	1	1	3	2	-	-	-
Melanoma	1	1	-	1	1	1	2	2	1	2	2	-	-	-

- Age-standardized mortality rate is based on fewer than 3 cases per year.

¹ 1997-2001 average for Yukon, Northwest Territories, Nunavut

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

Source: Surveillance and Risk Assessment Division, CCDPC, Health Canada

Data Sources and Processing

The actual cancer incidence and mortality data used in this monograph were obtained from three sources: mortality data files (1950-2000),¹⁸ the National Cancer Incidence Reporting System (NCIRS, 1969-1991) and the Canadian Cancer Registry (CCR, 1992-2001)¹ (the Health Statistics Division at Statistics Canada maintains all these databases).

Actual incidence and mortality data were available at Health Canada for all the provinces and territories for the period 1969 to 2000. Incidence data were available for all the provinces and territories except Quebec for 2001.

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 1996,^{19,20} from postcensal estimates for the period 1997 to 2002²⁰ and from the Scenario 2 population projections for 2003 and 2004.²⁰ The population estimates from 1971 to 2002 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 2004 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 2000 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 Population²¹ 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.

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.²²

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 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 2004

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 2004 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 2004 were estimated (after consultation with the provinces/territories) by a five-year average of the most recent available data: Newfoundland and Labrador (male – prostate; female – ovary); Prince Edward Island (male – prostate; female – lung); Nova Scotia (male – prostate, non-Hodgkin's lymphoma; female – bladder, lung); New Brunswick (male – kidney, leukemia, melanoma; female – melanoma, cervix, colorectal, lung); Ontario (male – prostate); Manitoba (male – kidney, prostate, non-Hodgkin's lymphoma; female – kidney, melanoma, leukemia); and Saskatchewan (males – melanoma, prostate; female – lung).

A consequence of implementing the ICDO-3 classification 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 (2000 Quebec, otherwise 2001). The provinces for which this method was applied include New Brunswick, Alberta and British Columbia.

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 this 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 2004

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 2004 were estimated (after consultation with the provinces/territories) by a five-year average of the most recent available data: Prince Edward Island (male – all cancers, prostate; female – non-Hodgkin’s lymphoma, lung); Nova Scotia (female – lung); New Brunswick (male – all cancers, lung; female – lung); Manitoba (male – non-Hodgkin’s lymphoma); Saskatchewan (male – prostate, kidney; female – lung).

Estimated Age-Standardized Incidence Rates (ASIRs) and Mortality Rates (ASMRs) for 2004

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 2004 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 2004 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, the provinces for which this method of estimating rates was applied include Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario, Saskatchewan, Alberta and British Columbia.

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 a 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 Centre for Chronic Disease Prevention and Control, Health 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. Data from 1993 to 2000 were used for incidence and mortality. These series were long enough to create estimates of AAPCs that were both reliable and current.

Estimates of Non-Melanoma Skin Cancer for 2004 in Canada

The pathology laboratories in British Columbia send all diagnostic reports of non-melanoma skin cancer (basal and squamous) 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 1985-1994 (in 20-year age groups) have 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. A special study on non-melanoma skin cancer in British Columbia covered this period.

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 2000 and life tables based on 1998-2000 all-cause mortality rates. The methodology used was that of Zdeb²³ and Seidman et al.²⁴ 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 2000. 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 1971 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

APPENDIX II: METHODS

of the cancer events expected if the age distribution of the 1971 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 1971 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, $P_{F,1971}$ represents the total 1971 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 1971 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 1971 population times the age-standardized rate for year t or, in symbols, $P_{i,1971}ASR_{i,t}$.

Baseline: the observed number of Canadian cancer cases/deaths for sex i that occurred in 1971.

Potential Years of Life Lost (PYLL)

The indicator was calculated by obtaining deaths for ages < 1 , 1-4, 5-9, . . . 90+ for Canada in 2000 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.²⁵

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 Statistics Canada's General Social Survey,²⁶ and relative risk estimates were obtained using SAMMEC II.²⁷ Smoking-attributable mortality (SAM) was calculated²⁸ 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 (1992-2001), 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 8.1 (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 2001, 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.

In past years, other Special Topics included

- ◆ 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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