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Canadian Cancer Statistics 2006

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On the Internet this report is available at http://www.cancer.ca and http://www.ncic.cancer.ca

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

La version française de cette publication est disponible sur demande.

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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.
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FOR FURTHER INFORMATION

For general information regarding cancer statistics or any other aspect of cancer (such as cancer prevention, screening, diagnosis, treatment and care, etc.), contact the **Canadian Cancer Society's (CCS) Cancer Information Service at 1 888 939-3333**. A list of the offices of the CCS – the National Office and the Divisional offices – is provided on page 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 Public Health Agency of Canada:
More detailed information on methodology is available from the Surveillance Division, Public Health Agency of Canada, 120 Colonnade Road, Ottawa, Ontario, K1A 0K9. Tel. (613) 952-3335, Fax. (613) 941-2057.

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

For Information from Statistics Canada:
Detailed standard tables are available on the Statistics Canada website listed below. Custom tabulations are available on a cost recovery basis upon request from the Health Statistics Division, Statistics Canada, National Enquiries Line: 1-800-263-1136; Health Statistics Division: (613) 951-1746. Analytical articles appear regularly in Health Reports, Statistics Canada, Catalogue 82-003, quarterly.

For Information from the Provincial/Territorial Cancer Registries:
Cancer incidence data are supplied to Statistics Canada by provincial/territorial cancer registries. Detailed information regarding the statistics for each province or territory is available from the relevant registry. (See pages 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
- Public Health Agency of Canada
  http://www.phac-aspc.gc.ca/ (select surveillance)
- Statistics Canada
  http://www.statcan.ca/english/freepub/84-601-XIE/free.htm
- Canadian Strategy for Cancer Control
  http://www.cancercontrol.org
- Canadian Association of Provincial Cancer Agencies (CAPCA)
  http://www.capca.ca
- Progress Report on Cancer Control in Canada
  http://www.phac-aspc.gc.ca/publicat/prccc-relccc/index.html

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INTRODUCTION

This monograph is published by the Canadian Cancer Society and the National Cancer Institute of Canada in collaboration with Public Health Agency of Canada, Statistics Canada, provincial/territorial cancer registries and the Canadian Association of Provincial Cancer Agencies, 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 incidence and mortality of the most common types of cancer by age, sex, time period and province or territory. Beginning in 2006 a new section entitled *Five-year Relative Survival* will be regular part of this publication. 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.

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

Details of the statistical methods, data sources and terminology used to produce the projections are provided in *Appendix II: Methods*. **It is important to emphasize that the figures provided for 2006 are estimates, rather than actual data**. Because the most current available data on cancer occurrence/deaths are always a few years old (e.g., actual national data now available are only to 2001), this publication presents estimates for the current year, using projections based on past numbers of cancers and trends.

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

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

Related information can also be found in other publications, including reports from provincial and territorial cancer registries; *Cancer Statistics*,[1] and *Health Reports*, published by Statistics Canada; *Chronic Diseases in Canada* and the *Canadian Cancer Incidence Atlas*,[2] published by Health Canada/Public Health Agency of Canada; a collaborative monograph entitled *Cancer in North America, 1997-2001*,[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.

INTRODUCTION

The development of this publication over the years has benefited considerably from the comments and suggestions of readers. **The Steering Committee appreciates and welcomes such comments, including ideas on how the report can be improved** (an *Order and Evaluation Form* is included on page 111). Finally, **readers can be included on the mailing list for next year's publication** by completing the *Order and Evaluation Form*.

Current Incidence and Mortality

- An estimated 153,100 new cases of cancer and 70,400 deaths from cancer will occur in Canada in 2006.
- The total number of lung cancer cases (men and women combined) is greater than the number of either prostate or breast cancer cases.
- Lung cancer remains the leading cause of cancer death for both men and women.
- Overall, colorectal cancer is the second leading cause of death from cancer.

Geographic Patterns of Cancer Occurrence

- Generally, both incidence and mortality rates are higher in Atlantic Canada and Quebec and lowest in British Columbia.
- Lung cancer incidence and mortality rates continue to be higher in Atlantic Canada and Quebec and lowest in British Columbia.

Trends in Incidence and Mortality

- The increased number of new cases of cancer is primarily due to an increasing and aging population.
- Mortality rates due to prostate cancer are dropping.
- Lung cancer incidence and mortality rates continue to climb among women.
- Excluding lung cancer, mortality rates have dropped 20% in women since 1979.
- Non-Hodgkin lymphoma incidence and mortality rates continue to rise.

Age and Sex Distribution of Cancer

- 43% of new cancer cases and 60% of deaths due to cancer occur among those who are at least 70 years old.
- Cancer incidence and mortality rates are higher in females than males during the reproductive years although males have higher rates at all other stages of life.
- Mortality is declining for males at all ages and for females under 70. Declines are most rapid in children and adolescents (ages 0-19).

Probability of Developing/Dying from Cancer

- On the basis of current incidence rates, 38% of Canadian women and 44% of men will develop cancer during their lifetimes.
- On the basis of current mortality rates, 24% of women and 29% of men, or approximately 1 out of every 4 Canadians, will die from cancer.

Potential Years of Life Lost Due to Cancer

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

HIGHLIGHTS

Prevalence

- 2.4% of Canadian men and 2.7% of Canadian women have had a diagnosis of cancer in the previous 15 years.
- 1.0% of the female population are survivors of breast cancer, and 0.7% of the male population are survivors of prostate cancer, diagnosed within the previous 15 years.

Five-year Relative Survival, 1995-1997

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

Cancer in Children

- About 1,300 Canadian children develop cancer each year, but due to the successful treatment of the most common cancers, the number of deaths is less than one-fifth the number of cases.

Progress in Cancer Control: Screening

- Despite evidence to support population-based screening for cervical, breast and colorectal cancers, participation in screening for these 3 cancers remains suboptimal, particularly for colorectal cancer.
- Although screening is most effective if offered within the context of an organized program, such programs exist in all provinces and territories (except Nunavut) only for breast cancer screening.
- Largely as a result of long-standing opportunistic screening for cervical cancer with the Pap test, incidence and mortality rates have declined by about 50% and 60%, respectively, since 1977.
- Although breast cancer screening with mammography and clinical breast examination could reduce mortality by nearly one-third if most women aged 50-69 were regularly screened, only 34% participate in organized screening nationally, while about 60% report recent screening either within or outside of an organized program.
- Colorectal cancer screening using biennial fecal occult blood testing (FOBT) can result in reductions to both incidence and mortality rates. In spite of this, there is no organized colorectal cancer screening program in Canada and very few Canadians report having had recent FOBT.
- There is insufficient scientific evidence to support population-based prostate cancer screening, yet more men are being screened for prostate cancer than for colorectal cancer.
- Research is ongoing to evaluate screening for prostate and lung cancer, which together account for nearly 24,000 deaths in Canada annually.

The importance of different types of cancer in Canada in 2006 can be measured in two ways, as shown in Table 1. Incidence is expressed as the number of new cases of a given type of cancer diagnosed per year. Mortality is expressed as the number of deaths attributed to a particular type of cancer during the year. Frequencies listed in Tables 1 to 11 are estimates based on modeling trends in cancer and population data since 1986 for both cancer incidence and mortality (an exception was made for prostate cancer; see *Appendix II* for details). These estimates are rounded to the nearest 5, 10, 50 or 100. Readers requiring actual data or information on less common sites of cancer may refer to Tables A1 and A6 in *Appendix I* or to source publications.[1,4]

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

Data Sources

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

Every effort is made to count all newly diagnosed cases of cancer among people who reside in a given province/territory at the time of diagnosis, and to accurately and consistently record, for each case, the 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 often treated successfully without requiring hospitalization. **For this reason, all tables of cancer incidence in this monograph exclude the estimated 68,000 cases of non-melanoma skin cancer for Canada in 2006**.* Registration levels for cancer have become more comparable across the country, particularly in the period starting in the early 1980s, as registries standardized their procedures for case-finding, including linkage to provincial mortality data files.

* The number of new cases of non-melanoma skin cancer is calculated using estimates from the B.C. Cancer Agency, CancerCare Manitoba and the Department of Health and Community Services, New Brunswick. Please refer to *Appendix II: Methods* for further details.

CURRENT INCIDENCE AND MORTALITY

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

Although these procedures have been standardized both nationally and internationally, some lack of specificity and uniformity is inevitable. The description of the type of cancer provided on the death certificate is usually less accurate than that obtained by the cancer registries from hospital and pathology records. These facts may help to account, in part, for the 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, 2006

An estimated 153,100 new cases of cancer and 70,400 deaths from cancer will occur in Canada in 2006. Men outnumber women for both new cases and deaths, by 5% for incidence and 11% for mortality (Table 1).

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

Lung cancer will continue as the leading cause of cancer death in Canadian women in 2006, increasing to an estimated 8,600 deaths, compared with the 5,300 deaths expected for breast cancer. This reflects the rapid increase in lung cancer mortality rates among women over the past three decades, while age-standardized breast cancer mortality rates declined slightly. Lung cancer incidence among women also continues to rise. With an estimated 10,600 new cases, lung cancer is the second leading type of cancer in women, ahead of the 9,100 new cases expected for colorectal cancer, which ranks third. Breast cancer continues to lead in incidence among Canadian women, with slightly more than twice as many new cases as lung cancer.

In Canadian men in 2006, prostate cancer will continue as the leading form of cancer diagnosed, with an estimated 20,700 newly diagnosed cases, compared with 12,000 lung cancers. Prostate cancer estimates were produced by a variation on the methods employed for other cancers (see *Appendix II: Methods*). Lung cancer will remain the leading cause of cancer death in Canadian men in 2006; the estimated 10,700 lung cancer deaths far exceed the 4,600 deaths due to colorectal cancer, the second leading cause of cancer death in men. Prostate cancer is third in mortality, causing 4,200 deaths.

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

Table 1
Estimated New Cases and Deaths for Cancer Sites by Sex, Canada, 2006

	New Cases 2006 Estimates			Deaths 2006 Estimates		
	Total	M	F	Total	M	F
All Cancers	**153,100**	**78,400**	**74,700**	**70,400**	**37,000**	**33,400**
Lung	22,700	12,000	10,600	19,300	10,700	8,600
Breast	22,300	160	22,200	5,300	45	5,300
Prostate	20,700	20,700	–	4,200	4,200	–
Colorectal	20,000	10,800	9,100	8,500	4,600	3,900
Non-Hodgkin Lymphoma	6,600	3,600	3,000	3,000	1,650	1,350
Bladder[1]	6,400	4,700	1,650	1,700	1,200	500
Kidney	4,600	2,900	1,700	1,550	970	590
Melanoma	4,500	2,400	2,100	880	550	330
Leukemia	4,100	2,400	1,700	2,200	1,300	930
Body of Uterus	3,900	–	3,900	720	–	720
Pancreas	3,500	1,700	1,800	3,400	1,650	1,750
Thyroid	3,400	750	2,600	160	55	100
Oral	3,200	2,100	1,050	1,100	720	360
Stomach	2,800	1,750	990	1,850	1,100	720
Brain	2,500	1,400	1,100	1,650	950	720
Ovary	2,300	–	2,300	1,600	–	1,600
Multiple Myeloma	1,900	1,050	850	1,300	700	620
Esophagus	1,500	1,050	420	1,650	1,250	430
Cervix	1,350	–	1,350	390	–	390
Larynx	1,150	940	220	510	420	90
Hodgkin Lymphoma	850	460	390	110	65	50
Testis	840	840	–	30	30	–
All Other Sites	12,200	6,700	5,600	9,200	4,900	4,300

– Not applicable

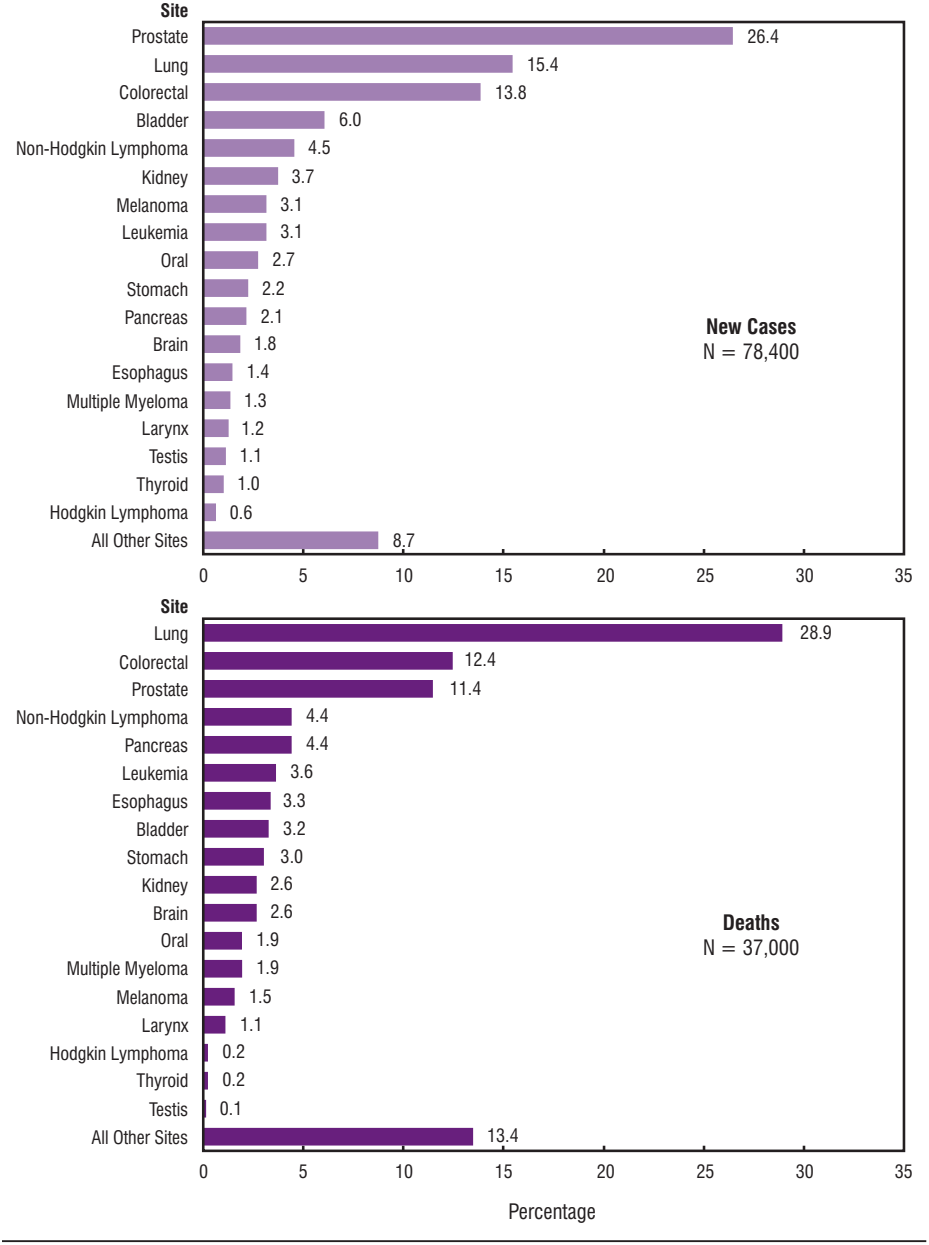
[1] The substantial increase in incidence of bladder cancer as compared with previous years reflects the decision to include in situ carcinomas (excluding Ontario) this year.

Note: Incidence figures exclude an estimated 68,000 new cases of non-melanoma skin cancer (basal and squamous). All cancer deaths include about 240 deaths with underlying cause other malignant neoplasms of skin (ICD-10 code C44). Total of rounded numbers may not equal rounded total number. Please refer to *Appendix II: Methods* for further details.

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

Figure 1.1

Percentage Distribution of Estimated New Cases and Deaths for Selected Cancer Sites, Males, Canada, 2006

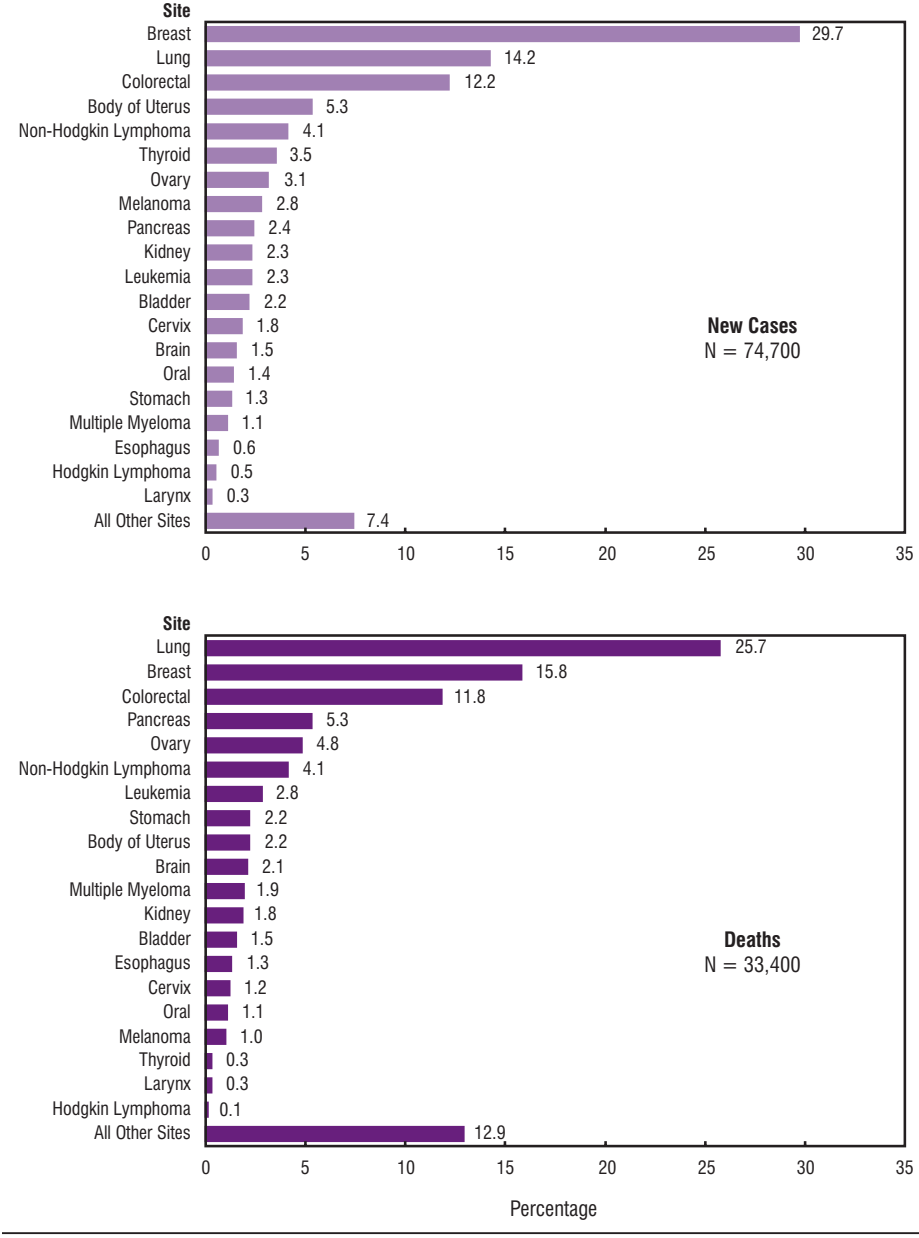


Note: Incidence figures exclude an estimated 68,000 new cases of non-melanoma (basal cell and squamous cell) skin cancer among both sexes combined. Mortality figures for all other sites include about 240 deaths with underlying cause other malignant neoplasms of skin among both sexes combined.

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

Figure 1.2

Percentage Distribution of Estimated New Cases and Deaths for Selected Cancer Sites, Females, Canada, 2006



Note: Incidence figures exclude an estimated 68,000 new cases of non-melanoma (basal cell and squamous cell) skin cancer among both sexes combined. Mortality figures for all other sites include about 240 deaths with underlying cause other malignant neoplasms of skin among both sexes combined.

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

GEOGRAPHIC PATTERNS OF CANCER OCCURRENCE

Table 2 presents population projections and estimates of new cases and deaths for all cancer sites combined, by sex and province or territory for 2006. 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 2006. 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 2006. 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.

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

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

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

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

Third, for many cancers there is a long interval between exposure to a risk factor and the occurrence of disease, and often the information on the prevalence of risk factors from previous decades is inadequate.

Fourth, the availability of and the completeness of coverage in target populations of screening programs (e.g., for breast and cervical cancer), or of screening behaviours in the absence of formal screening programs (e.g., prostate cancer) differ among provinces/territories. This will result in cancer incidence rates that will be temporarily elevated (e.g., breast cancer) through the identification of previously undiagnosed cases in

asymptomatic individuals or reduced, through the identification and treatment of pre-malignant lesions (e.g., cervical cancer) or permanently elevated by the identification of cancers which would otherwise never be detected (e.g., prostate cancer). As well, the availability of diagnostic procedures may differ regionally.

Finally, there are differences in the reporting procedures used in cancer registration (e.g., registration of second primary cancers and use of death certificates – see *Appendix II* regarding cancer registry methodology). For example, death certificate information has not been available for registry purposes in Newfoundland until now, and this falsely lowers the number of incident cases with short life expectancy, such as cases of lung and pancreatic cancer. The degree to which death certificate information is actively followed back to hospital records also varies in different provinces/territories, and this affects the accuracy of incidence data. In Quebec, because of the registry's dependence on hospital data, the numbers of prostate, melanoma and bladder cases have been estimated to be underreported by 32%, 35% and 14% respectively.[5] Those who maintain the Quebec tumour registry are aware of this and are taking steps to correct the problem. The large interprovincial differences seen in bladder cancer incidence rates are likely due to differences in reporting in situ cases, particularly in Ontario, where *in situ* cases are not reported.

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

Overall cancer mortality rates are higher in Atlantic Canada and Quebec, and lowest in British Columbia. A similar pattern was observed for incidence, after discounting the effects of undercounting in Newfoundland and Labrador, and omitting prostate cancer (which shows large provincial differences due to differences in PSA screening).

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

Table 2

Estimated Population, New Cases and Deaths for All Cancers by Sex and Geographic Region, Canada, 2006

	Population (000s) 2006 Estimates[1]			New Cases 2006 Estimates[2]			Deaths 2006 Estimates		
	Total	M	F	Total	M	F	Total	M	F
Canada	**32,125**	**15,889**	**16,236**	**153,100**	**78,400**	**74,700**	**70,400**	**37,000**	**33,400**
Newfoundland and Labrador*	515	254	261	2,300	1,250	1,050	1,350	750	580
Prince Edward Island	140	69	72	790	410	370	330	180	150
Nova Scotia	942	460	482	5,400	2,800	2,500	2,500	1,300	1,200
New Brunswick	761	376	384	4,000	2,100	1,900	1,850	990	840
Quebec	7,482	3,689	3,793	38,300	19,200	19,100	19,100	10,100	8,900
Ontario	12,588	6,213	6,374	57,200	28,900	28,300	25,900	13,400	12,500
Manitoba	1,163	576	587	5,900	3,000	2,900	2,600	1,350	1,250
Saskatchewan	982	485	497	4,800	2,600	2,200	2,300	1,250	1,050
Alberta	3,268	1,647	1,621	14,200	7,400	6,700	5,600	2,900	2,700
British Columbia	4,185	2,069	2,116	20,000	10,700	9,400	8,800	4,600	4,200
Yukon	30	15	15	95	50	45	50	30	20
Northwest Territories	40	21	20	95	45	50	50	25	25
Nunavut	32	16	16	70	30	35	45	20	20

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

[1] 2006 population projections were provided by the Census and Demographics Branch, Statistics Canada.

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

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

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

Table 3

Estimated New Cases for Major Cancer Sites by Sex and Province, Canada, 2006

	New Cases										
	Canada[1]	N.L.*	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Males											
All Cancers	**78,400**	**1,250**	**410**	**2,800**	**2,100**	**19,200**	**28,900**	**3,000**	**2,600**	**7,400**	**10,700**
Prostate	20,700	330	130	730	560	3,600*	8,400	740	800	2,400	3,000
Lung	12,000	170	70	470	390	4,000	3,900	420	340	900	1,350
Colorectal	10,800	250	50	410	260	2,800	4,000	410	330	920	1,350
Bladder**	4,700	80	25	200	140	1,550	1,150	200	170	430	760
Non-Hodgkin Lymphoma	3,600	40	20	120	100	860	1,350	140	110	300	500
Kidney	2,900	40	15	110	85	710	1,150	140	85	250	290
Melanoma	2,400	40	15	120	75	380	1,050	85	55	240	390
Leukemia	2,400	20	15	65	50	590	910	95	95	270	290
Oral	2,100	50	10	80	65	520	790	100	60	180	260
Stomach	1,750	45	5	55	50	460	650	65	50	150	230
Pancreas	1,700	10	10	55	50	480	570	70	55	160	230
Brain	1,400	30	5	45	35	370	510	45	40	130	170
Esophagus	1,050	15	5	45	25	240	390	35	30	100	160
Multiple Myeloma	1,050	10	5	30	25	270	400	35	30	80	130
Females											
All Cancers	**74,700**	**1,050**	**370**	**2,500**	**1,900**	**19,100**	**28,300**	**2,900**	**2,200**	**6,700**	**9,400**
Breast	22,200	350	100	700	540	6,000	8,400	810	620	2,000	2,700
Lung	10,600	110	55	400	300	3,100	3,700	450	270	870	1,300
Colorectal	9,100	180	50	350	240	2,300	3,500	370	290	700	1,150
Body of Uterus	3,900	60	20	130	90	890	1,550	180	120	380	510
Non-Hodgkin Lymphoma	3,000	40	10	95	85	730	1,250	110	85	260	400
Thyroid	2,600	30	5	45	60	510	1,400	65	50	250	190
Ovary	2,300	25	10	70	60	610	940	90	65	170	280
Melanoma	2,100	35	20	110	70	350	860	55	60	230	290
Pancreas	1,800	5	10	55	60	510	620	70	45	160	260
Kidney	1,700	30	10	75	60	430	660	75	55	150	170
Leukemia	1,700	15	5	50	35	440	640	70	60	170	200
Bladder**	1,650	25	5	75	45	540	420	65	60	160	260
Cervix	1,350	25	10	55	35	280	510	45	45	170	160
Brain	1,100	15	5	30	25	320	440	35	30	85	130
Oral	1,050	15	5	35	20	230	410	50	35	90	150

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

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

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

Note: Total of rounded numbers may not equal rounded total number. The Canada and provincial totals for all cancers exclude an estimated 68,000 cases of non-melanoma skin cancer (basal and squamous). Caution is needed if the 2006 estimates are compared to previously published estimates (see *Appendix II: Methods*). These estimates may vary from actual figures. Please see *Appendix I* for most current actual data or contact provincial cancer registries for further information.

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

Table 4

Estimated Age-Standardized Incidence Rates for Major Cancer Sites by Sex and Province, Canada, 2006

	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	**451**	**421**	**516**	**529**	**518**	**468**	**438**	**478**	**457**	**479**	**442**
Prostate	119	113	163	136	129	83*	129	122	144	155	119
Lung	70	56	88	88	93	95	60	68	60	59	54
Colorectal	62	82	65	76	61	66	61	66	58	60	54
Bladder**	27	28	32	38	33	37	18	32	29	28	30
Non-Hodgkin Lymphoma	20	13	23	23	24	20	20	23	20	18	20
Kidney	16	13	16	20	19	16	17	21	16	15	11
Melanoma	14	13	20	21	17	9	15	13	10	15	15
Leukemia	14	7	20	13	12	15	14	15	17	17	12
Oral	12	16	10	14	14	12	11	15	10	10	10
Stomach	10	15	9	10	12	11	10	11	9	10	9
Pancreas	10	3	13	10	11	11	8	11	10	10	9
Brain	8	9	6	8	8	9	8	8	7	8	7
Esophagus	6	5	8	8	5	6	6	6	5	7	6
Multiple Myeloma	6	4	6	6	6	7	6	5	5	5	5
Females											
All Cancers	**357**	**310**	**404**	**387**	**368**	**364**	**356**	**381**	**346**	**371**	**329**
Breast	106	99	111	106	104	115	105	109	98	107	94
Lung	50	34	62	61	59	58	46	59	42	49	45
Colorectal	41	51	52	50	43	41	42	45	40	38	37
Body of Uterus	19	17	19	20	17	17	20	25	18	21	18
Non-Hodgkin Lymphoma	15	12	11	14	17	14	16	15	13	14	14
Thyroid	15	10	5	8	14	13	21	10	10	14	8
Ovary	11	7	9	11	12	12	12	12	10	9	10
Melanoma	11	11	23	17	15	7	11	8	10	13	11
Pancreas	8	2	8	8	11	9	7	8	6	8	8
Kidney	8	8	8	11	11	8	8	10	8	8	6
Leukemia	8	5	7	8	7	8	8	9	9	10	7
Bladder**	7	7	7	11	9	10	5	8	9	8	9
Cervix	8	8	10	11	8	7	7	7	9	10	7
Brain	6	4	6	5	6	7	6	5	6	5	5
Oral	5	5	5	5	4	4	5	6	5	5	5

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

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

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

Note: Rates exclude non-melanoma skin cancer (basal and squamous) and are adjusted to the age distribution of the 1991 Canadian population. Caution is needed if the 2006 estimates are compared to previously published estimates (see *Appendix II: Methods*). These estimates may vary from actual figures.

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

Table 5

Estimated Deaths for Major Cancer Sites by Sex and Province, Canada, 2006

	Deaths										
	Canada[1]	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Males											
All Cancers	**37,000**	**750**	**180**	**1,300**	**990**	**10,100**	**13,400**	**1,350**	**1,250**	**2,900**	**4,600**
Lung	10,700	230	65	410	330	3,500	3,500	350	330	750	1,200
Colorectal	4,600	120	25	160	110	1,250	1,650	190	160	340	540
Prostate	4,200	85	25	140	120	890	1,550	170	250	410	570
Pancreas	1,650	30	5	55	45	430	580	55	55	130	230
Non-Hodgkin Lymphoma	1,650	15	5	60	50	380	650	65	45	120	250
Leukemia	1,300	15	5	45	30	280	530	50	50	130	180
Esophagus	1,250	20	5	50	25	230	500	55	35	100	200
Bladder	1,200	25	5	40	30	280	460	45	40	90	170
Stomach	1,100	40	5	30	25	330	390	35	40	75	140
Kidney	970	20	5	35	30	250	330	45	30	90	130
Brain	950	20	–	30	25	280	330	35	30	85	110
Oral	720	15	5	30	20	190	270	25	15	55	95
Multiple Myeloma	700	10	5	30	20	170	270	30	25	45	95
Melanoma	550	5	–	20	10	100	270	20	15	40	70
Larynx	420	10	–	15	10	140	140	10	15	30	45
Females											
All Cancers	**33,400**	**580**	**150**	**1,200**	**840**	**8,900**	**12,500**	**1,250**	**1,050**	**2,700**	**4,200**
Lung	8,600	130	50	270	230	2,500	3,100	270	220	710	1,100
Breast	5,300	100	25	190	130	1,400	2,000	200	150	430	630
Colorectal	3,900	95	25	170	100	1,100	1,450	160	120	260	450
Pancreas	1,750	25	10	65	55	460	640	70	60	140	250
Ovary	1,600	30	5	55	40	370	630	60	55	140	230
Non-Hodgkin Lymphoma	1,350	20	5	50	40	320	550	60	45	110	170
Leukemia	930	15	5	25	20	220	370	40	35	75	120
Stomach	720	25	–	20	15	220	240	30	25	60	85
Body of Uterus	720	10	5	30	20	180	280	30	20	60	75
Brain	720	10	5	25	20	220	250	25	20	60	85
Multiple Myeloma	620	10	5	20	15	160	250	25	20	45	75
Kidney	590	15	5	25	20	170	180	25	20	55	75
Bladder	500	10	–	15	15	120	190	20	15	40	70
Esophagus	430	5	–	15	10	85	170	15	10	45	65
Cervix	390	15	5	20	10	75	150	15	15	40	50
Oral	360	–	–	10	5	90	140	15	10	30	45
Melanoma	330	5	–	10	5	60	160	10	10	25	45

– Fewer than 3 deaths

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

Note: Total of rounded numbers may not equal rounded total number. Caution is needed if the 2006 estimates are compared to previously published estimates (see *Appendix II: Methods*). These estimates may vary from actual figures.

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

Table 6

Estimated Age-Standardized Mortality Rates for Major Cancer Sites by Sex and Province, Canada, 2006

	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	**216**	**269**	**229**	**253**	**238**	**247**	**207**	**217**	**217**	**196**	**183**
Lung	62	77	80	79	81	85	53	55	57	50	48
Colorectal	27	40	31	30	26	31	26	30	26	23	21
Prostate	26	33	34	29	30	23	25	26	40	29	22
Pancreas	9	10	8	10	11	10	9	9	9	9	9
Non-Hodgkin Lymphoma	9	6	8	11	12	9	10	11	8	8	10
Leukemia	8	6	8	8	8	7	8	8	9	8	7
Esophagus	7	6	9	9	6	5	8	9	6	7	8
Bladder	7	9	5	8	7	7	7	7	7	6	7
Stomach	7	15	8	6	6	8	6	5	7	5	5
Kidney	6	7	8	7	6	6	5	7	6	6	5
Brain	5	6	2	6	5	7	5	6	6	5	5
Oral	4	6	6	6	5	4	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	4	3	3	3	3	2	2	2	2	2
Females											
All Cancers	**149**	**161**	**151**	**169**	**151**	**157**	**147**	**155**	**146**	**143**	**134**
Lung	40	37	51	41	44	46	38	35	33	40	37
Breast	23	27	27	26	23	25	23	24	22	23	20
Colorectal	17	26	22	22	16	18	16	18	15	13	14
Pancreas	8	7	8	9	9	8	7	8	8	7	8
Ovary	7	9	6	8	7	7	8	8	8	7	8
Non-Hodgkin Lymphoma	6	6	4	7	7	6	6	7	6	6	6
Leukemia	4	4	5	4	3	4	4	5	5	4	4
Stomach	3	7	1	3	3	4	3	3	3	3	3
Body of Uterus	3	3	3	4	4	3	3	3	3	3	2
Brain	4	4	4	4	4	4	3	3	4	3	3
Multiple Myeloma	3	3	3	3	3	3	3	3	2	2	2
Kidney	3	4	3	3	4	3	2	3	3	3	2
Bladder	2	2	1	2	2	2	2	2	2	2	2
Esophagus	2	1	2	2	2	1	2	2	1	2	2
Cervix	2	4	3	3	2	1	2	2	3	2	2
Oral	2	0	2	2	1	2	2	2	1	2	2
Melanoma	2	1	1	1	1	1	2	2	1	1	2

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

Note: Rates adjusted to the age distribution of the 1991 Canadian population. Caution is needed if the 2006 estimates are compared to previously published estimates (see *Appendix II: Methods*). These estimates may vary from actual figures.

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

TRENDS IN INCIDENCE AND MORTALITY

Trends in incidence and mortality for major types of cancer are assessed by comparing annual age-standardized rates. 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 1977 to 2003 and estimates to the year 2006. Quebec incidence is estimated for 2002 and 2003, and Ontario incidence is estimated for 2003. 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. Rarer sites are included where there is a 2% or more annual percentage change over time. The average annual percent changes in site-specific incidence from 1992 to 2001, and mortality rates from 1993 to 2002 are listed in Table 9, as 2001 is the most recent year of complete incidence data.

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, is declining slowly as a result of decreases in mortality rates for lung, colorectal and other cancers (Figure 2.2, Table 7.2). In contrast, the cancer incidence rate rose slightly in the early 1990s because of the sharp increase in incidence of prostate cancer, then declined only to start increasing again due primarily to increasing rates of prostate cancer (Figure 2.1, Table 7.1). The projection is that the incidence rate of prostate cancer is dropping, but such estimates for prostate cancer are highly variable. Among women, the rising cancer incidence rate may be stabilizing, whereas mortality rates have declined slightly (Figures 2.1 and 2.2, Tables 8.1, 8.2).

Figures 2.1 and 2.2 show that despite relative stability in age-standardized rates, the numbers of new cancer cases and deaths continue to rise steadily as the Canadian population 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 2006, the number of new cases is estimated to be 153,100 and the number of deaths to be 70,400. This is an additional 4,100 new cases over the estimate for 2005. Approximately one third of these additional cases are carcinoma in situ of the bladder which are being included for the first time in this publication. The number of new cases and deaths 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 1977 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 solid line 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 1977. The middle line represents the number of cases (or deaths) that would have occurred each year if the annual rates were applied to a population that grew larger but maintained the same age distribution as in 1977. 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. Decreasing mortality from cardiovascular disease as the major competing cause of death contributes to the increasing numbers of patients with cancer.

Figure 7 plots an index (see definition in *Glossary*) of age-standardized mortality rates from 1977 to 2006 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 2001; however, cancer mortality for all sites other than lung cancer dropped by nearly 20% 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 the net percent change in Figures 6.1 and 6.2. 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 have tripled since 1977. From 1992-2001 there has been a 1.4% annual increase in incidence, and a 1.3% annual increase in mortality (Table 9). However, estimated rates of lung cancer incidence and mortality among women in 2006 are only slightly more than half of those among men. Among men, lung cancer rates leveled off in the mid-1980s and have since consistently declined, reflecting a 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 testing (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 of 3.4% annually (Table 9).[8] This pattern, dramatically illustrated in Fig. 4.1, is typical of what happens when widespread screening is introduced: there is a sharp increase in incidence with the detection of prevalent cases, after which incidence returns to the pre-existing trend. 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 (see *Appendix II: Methods*). Until recently, no significant

change in mortality had been associated with the increased detection rate; however, there has now been a significant drop in mortality from 1994 to 2002 (2.5% average annual percent decline as shown in Table 9). It is not clear whether the declining mortality is due to earlier detection, improved treatment, or both.

Breast cancer incidence among women over 50 also rose steadily, but gradually, between 1977 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 at a rate of 2.7% annually (Table 9). The most recent actual data for 2002 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] There is evidence for improved survival due to both organized mammography screening and adjuvant therapies following breast cancer surgery.[12,13,14]

Using actual data from eight provinces and projections for Ontario and Quebec for 2002 and 2003, the recent increasing incidence trend in colorectal cancer has reverted back to the previous longer time trend showing declining incidence rates for both men and women (Tables 7.1 and 8.1). This is not yet reflected in the average annual percent change (+1.7% for men, and +1.2% for women) in Table 9 as the data there are based on a slightly earlier time period. Mortality has continued to decline for both sexes but more so among women, -1.1% and -1.6% respectively annually (Table 9). Some informal screening is already occurring in Canada and may have contributed to the increased incidence rates reported for 1998-2000 and to the decreased mortality rates. Colorectal cancer screening is discussed further in some detail in the special topic.

Of all the cancers analyzed in this report, the incidence of just two cancers (other than prostate) 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 (+5.1%) and melanoma (+2.4%) in men, and thyroid cancer (+5.2%) 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 more time spent outdoors particularly during vacations, and to improvements in the detection of the disease.

Other cancers showing a significant increase, but of less than 2%, were non-Hodgkin lymphoma and testis cancer in men, and melanoma among women.

The mortality rate increase was greatest for non-Hodgkin lymphoma and melanoma among men at 1.3% per year. A significant increase in mortality rates for cancer of the esophagus was also seen among men (0.9%). Among women, the mortality rate increase was greatest for lung cancer at 1.3% per year.

Table 9 shows continuing declines in the incidence of stomach cancer (-2.3% annually among men and -2.7% among women) and mortality (-3.3% among men and -3.2% among women), which may reflect improved diets and the role of infectious agents and their treatment (e.g., *Helicobacter pylori*). Significantly declining rates of invasive cervical cancer (-2.0% incidence and -3.2 % mortality) likely reflects the impact of early detection and treatment of earlier detected cancers and pre-malignant lesions as a result of Pap smear screening. Statistically significant declines in incidence also

occurred for Hodgkin lymphoma, laryngeal, oral, bladder and pancreas cancer among men, and Hodgkin lymphoma, ovarian, esophagus and larynx cancer among women.

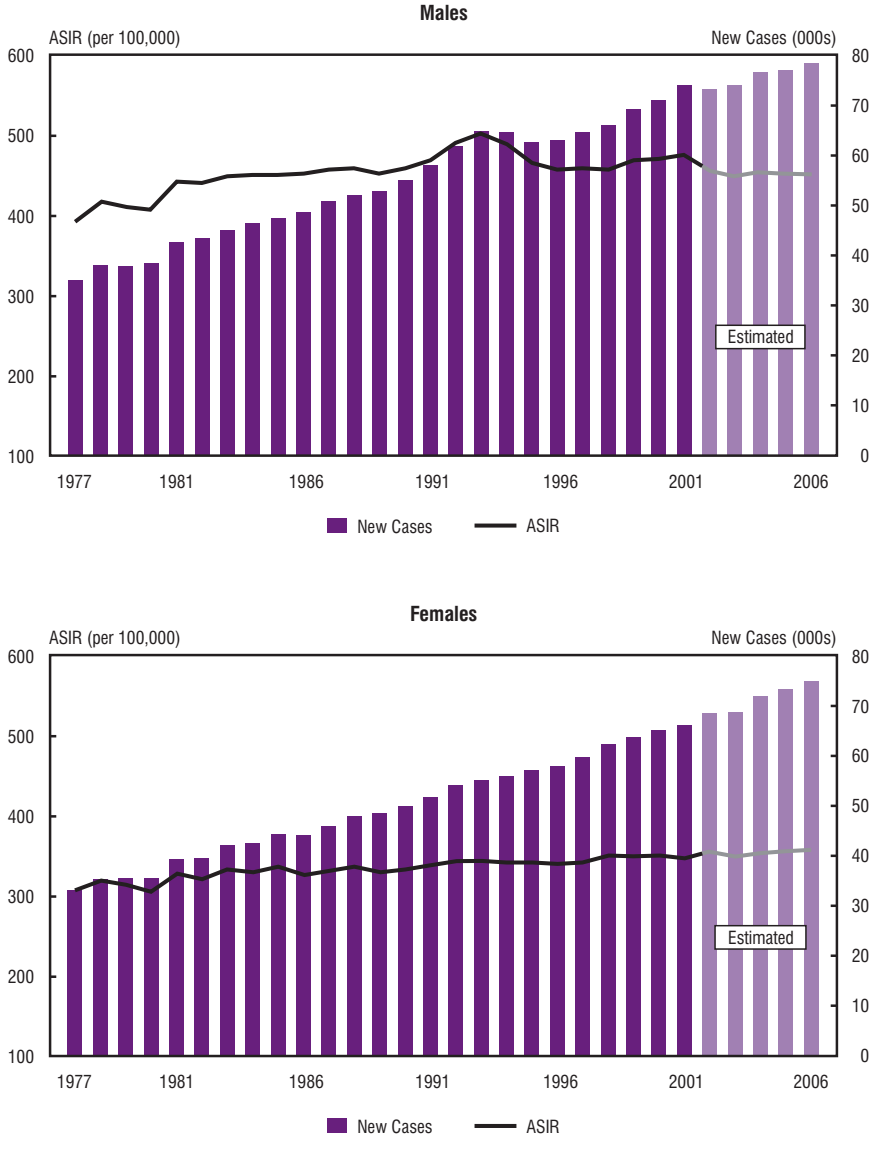
The largest decline in mortality rates has been in Hodgkin lymphoma in men (-4.5%), and women (-3.9%), (Table 9). Statistically significant declines in mortality rates have also occurred in leukemia, oral, pancreas, and larynx cancer among men, and in leukemia and pancreas and stomach cancer among women.

Figures 6.1 and 6.2 show why we cannot be complacent about the declining rates described here. Figure 6.1 shows the percent change in numbers of cancers compared to percent change in cancer rates between 1992 and 2001. It is not surprising to see increased numbers of cancers when we know rates are rising, as for example, in the case of thyroid cancer, but it is surprising to many people to see more cases or deaths from cancers which are showing declining rates, as in the case of colorectal and pancreatic cancer, and leukemia. Fig. 6.2 showing numbers of deaths versus mortality rates is even more dramatic, since most sites displayed are showing declining rates. This underscores the need for adequate palliative care services for these patients. The two lessons from this underlie some key messages from the Canadian Strategy for Cancer Control: we have to plan for that part of the increasing number of cancer cases which is unavoidable, and we must do a much better job of primary prevention of those cancers which are amenable to it.

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

Figure 2.1

New Cases and Age-Standardized Incidence Rates (ASIR) for All Cancers, Canada, 1977-2006

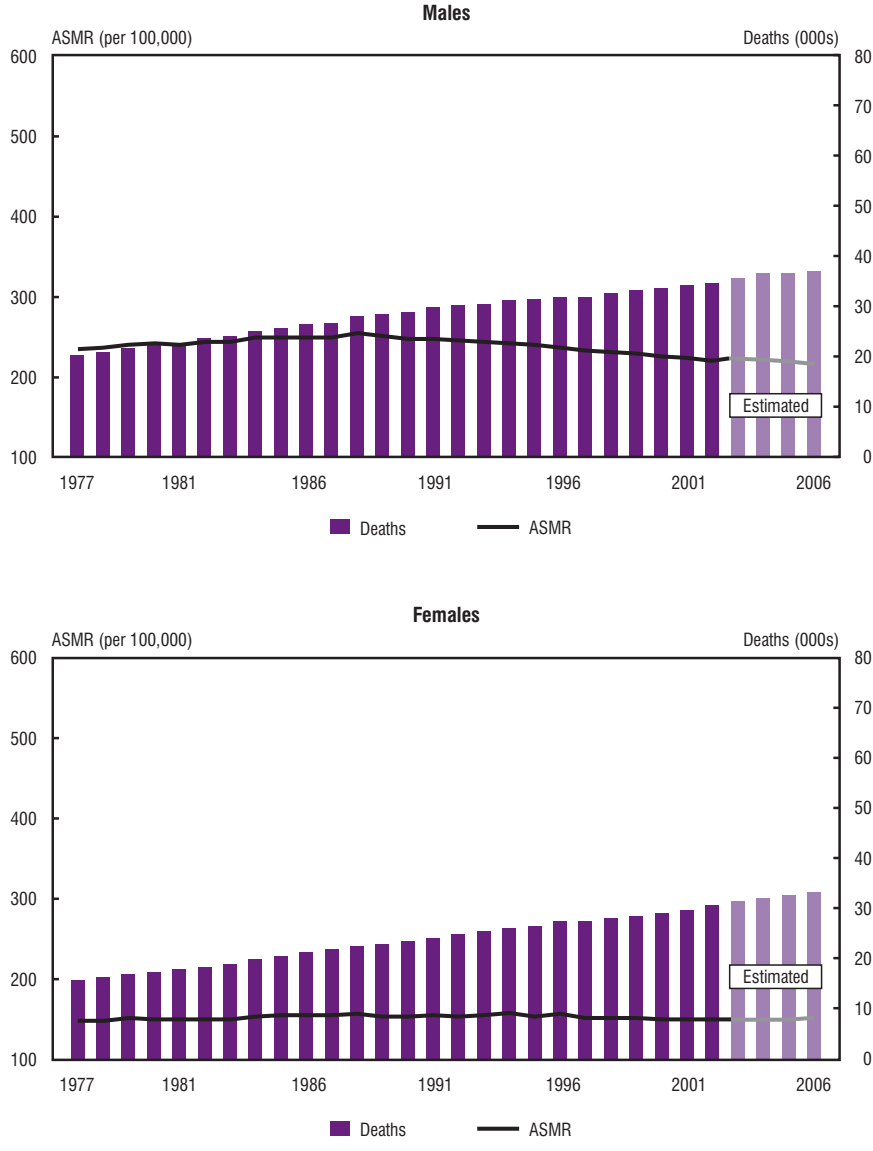


Note: All cancers exclude non-melanoma skin cancer. Rates are standardized to the 1991 Canadian population. For Quebec 2002 to 2003 and Ontario 2003 incidence is estimated.

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

Figure 2.2

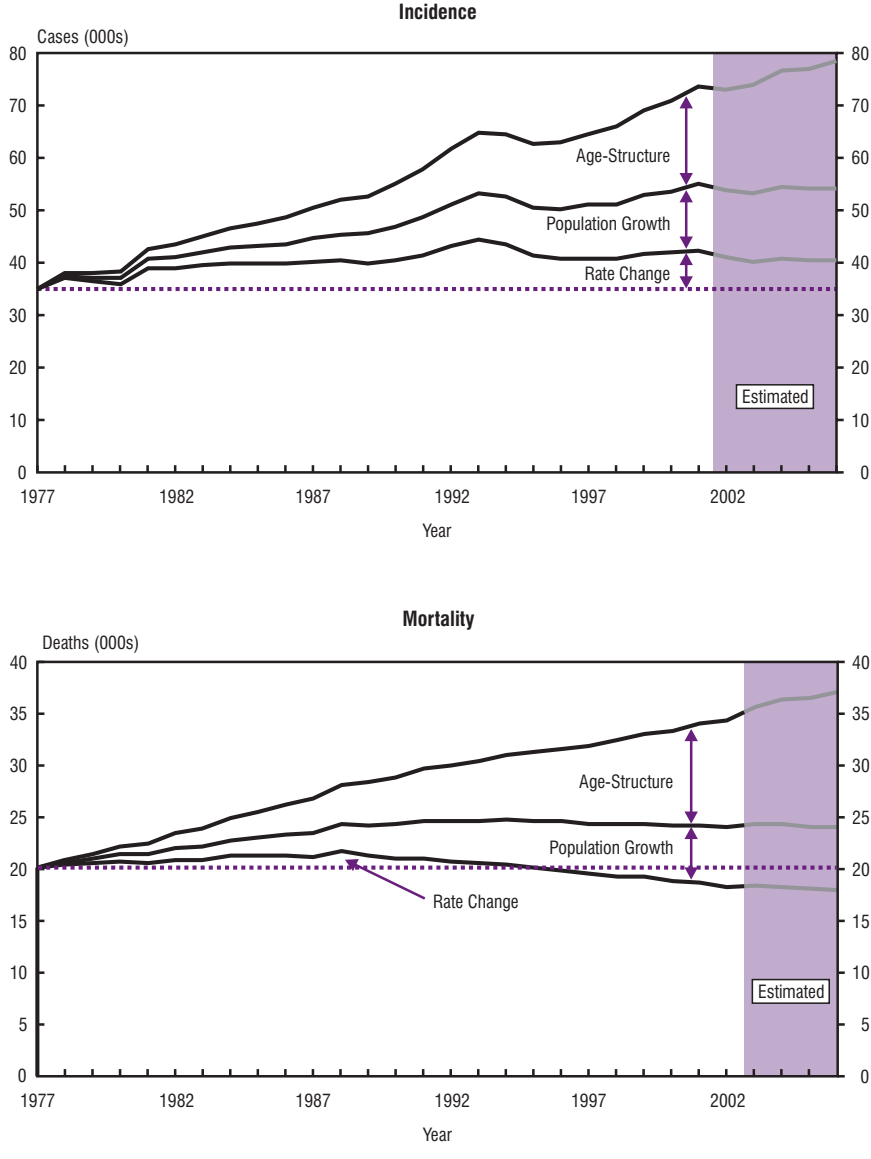
Deaths and Age-Standardized Mortality Rates (ASMR) for All Cancers, Canada, 1977-2006



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

Figure 3.1

Trends in New Cases and Deaths, Attributed to Cancer Rate, Population Growth, and Population Age-Structure, All Cancers, All Ages, Males, Canada, 1977-2006

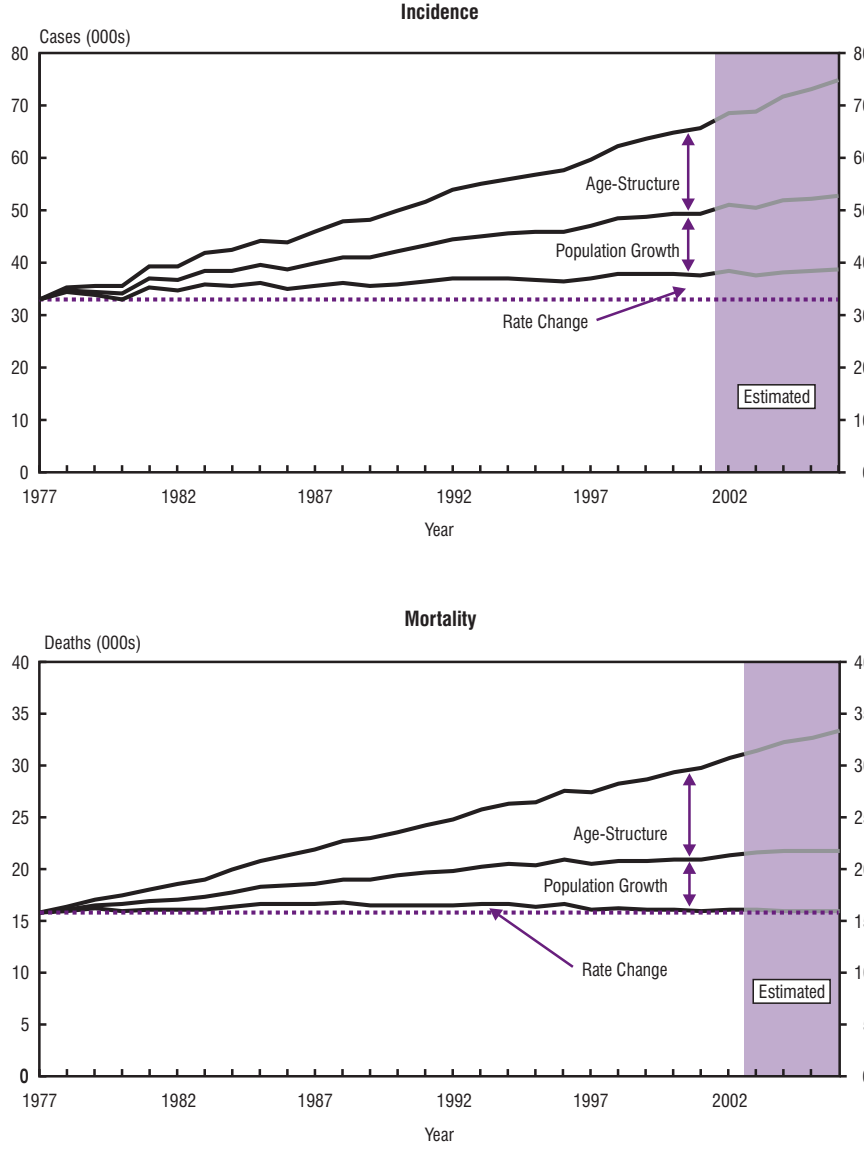


Note: Incidence figures exclude non-melanoma (basal and squamous) skin cancer. Magnitude of area represents the number of cases/death due to each change. Actual incidence data are available to 2003 except for Quebec 2002 to 2003 and Ontario 2003 incidence is estimated. Please refer to *Appendix II: Methods* for further details.

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

Figure 3.2

Trends in New Cases and Deaths, Attributed to Cancer Rate, Population Growth, and Population Age-Structure, All Cancers, All Ages, Females, Canada, 1977- 2006

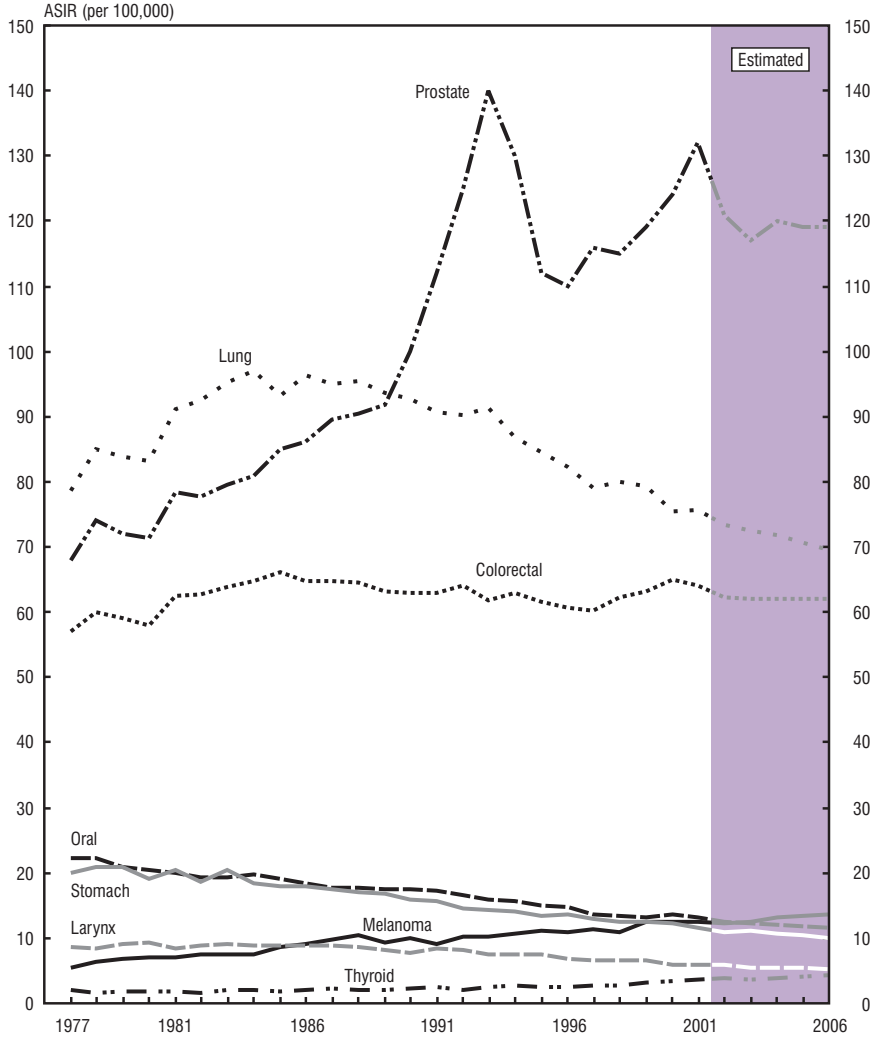


Note: Incidence figures exclude non-melanoma (basal and squamous) skin cancer. Magnitude of area represents the number of cases/death due to each change. Actual incidence data are available to 2003 except for Quebec 2002 to 2003 and Ontario 2003 incidence is estimated. Please refer to *Appendix II: Methods* for further details.

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

Figure 4.1

Age-Standardized Incidence Rates (ASIR) for Selected Cancer Sites, Males, Canada, 1977-2006

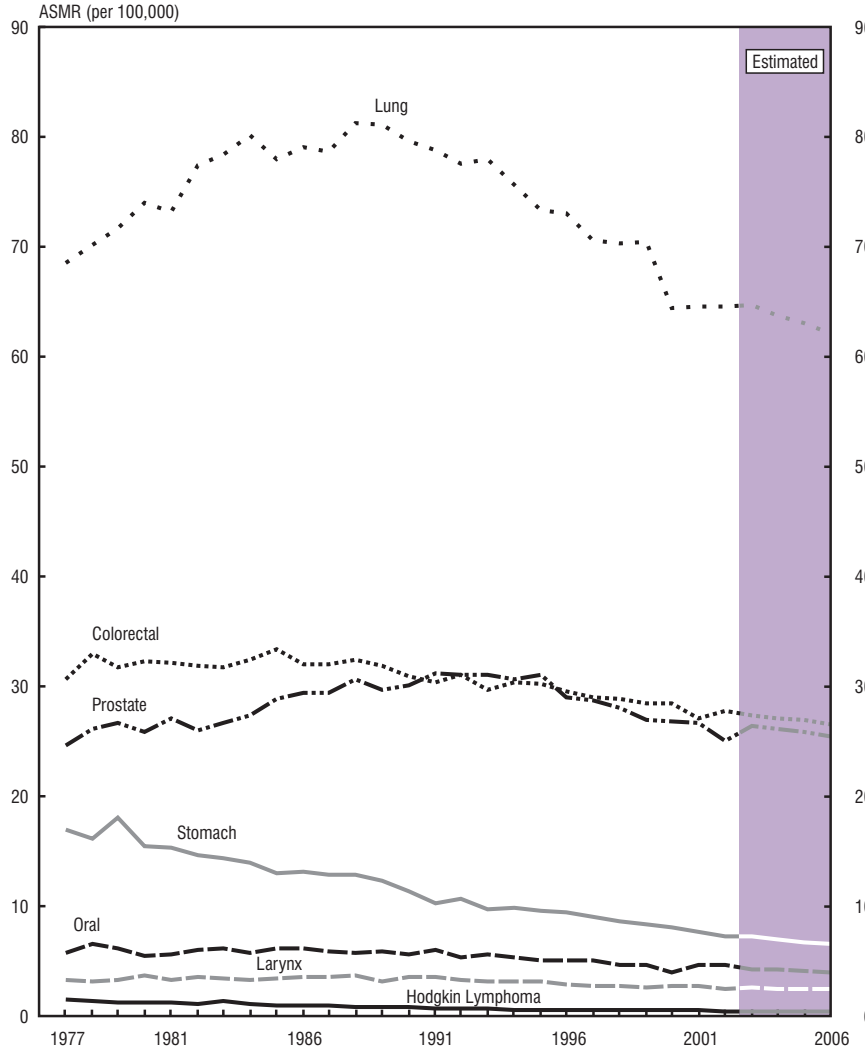


Note: Rates are standardized to the age distribution of the 1991 Canadian population. See Table 7.1 for data points. Actual incidence data are available to 2003 except for Quebec 2002 to 2003 and Ontario 2003 incidence is estimated. Please refer to *Appendix II: Methods* for further details.

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

Figure 4.2

Age-Standardized Mortality Rates (ASMR) for Selected Cancer Sites, Males, Canada, 1977-2006

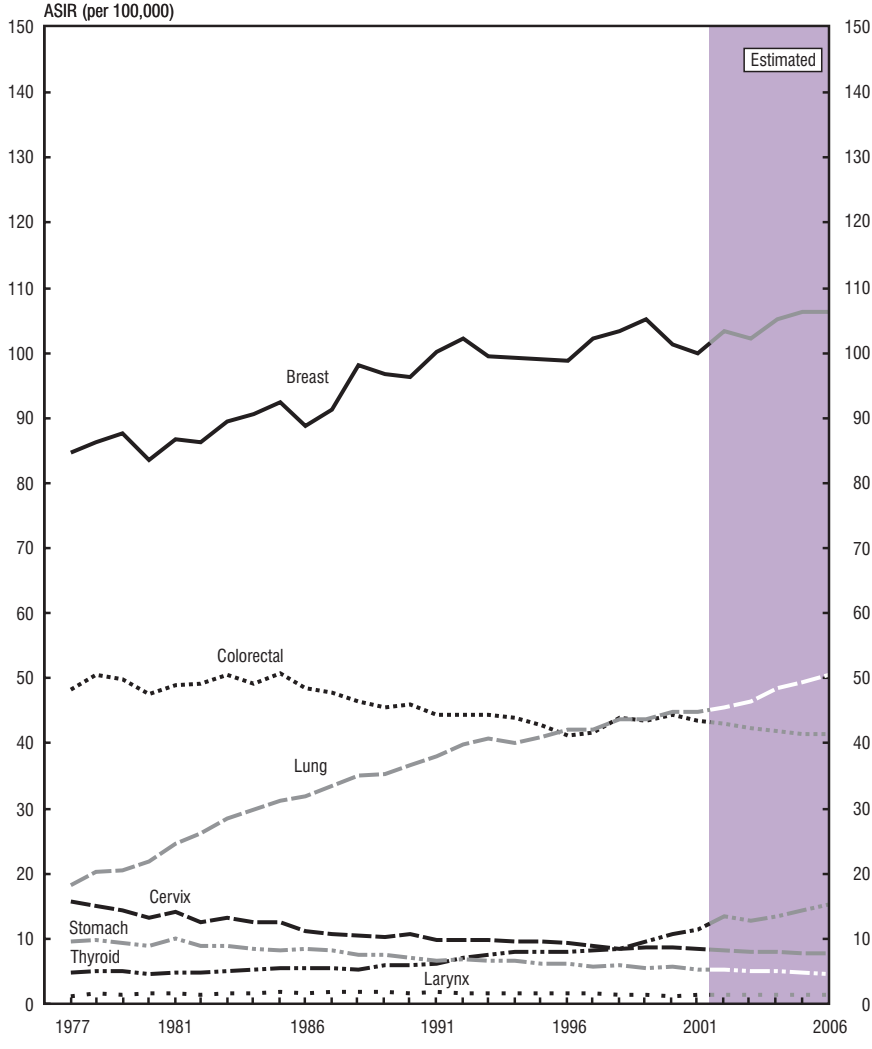


Note: Rates are standardized to the age distribution of the 1991 Canadian population. See Table 7.2 for data points.

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

Figure 5.1

Age-Standardized Incidence Rates (ASIR) for Selected Cancer Sites, Females, Canada, 1977-2006

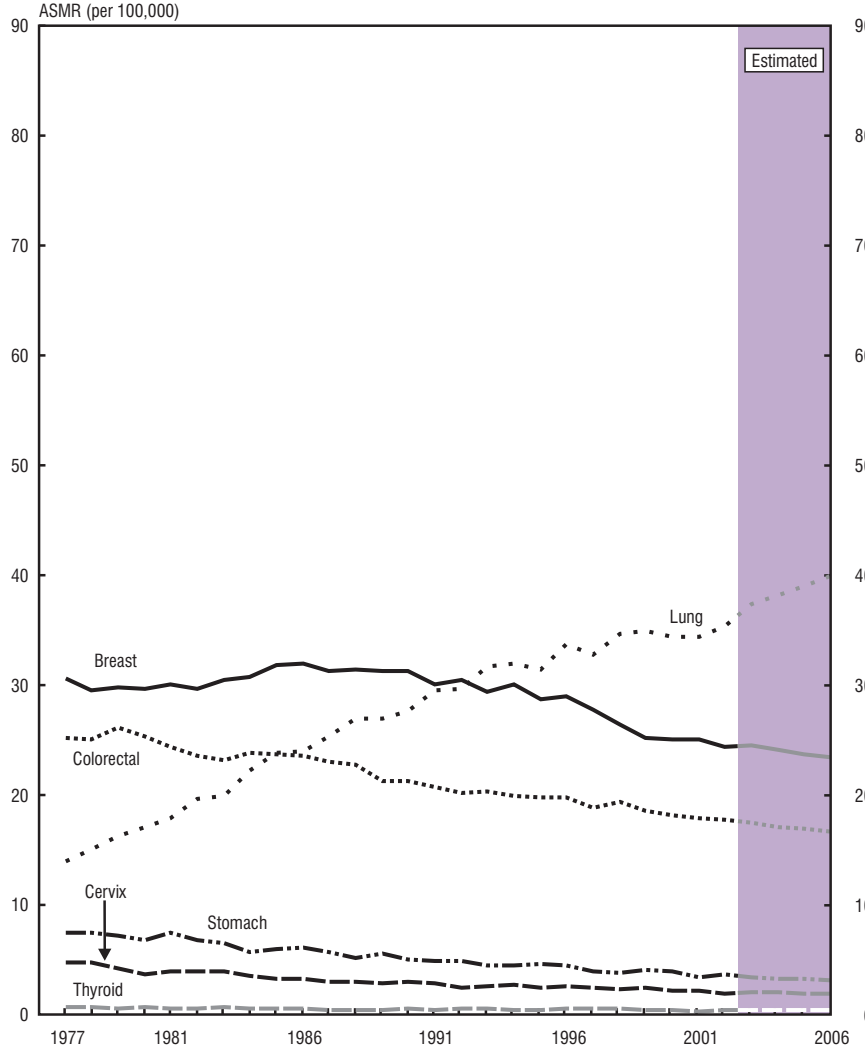


Note: Rates are standardized to the age distribution of the 1991 Canadian population. See Table 8.1 for data points. Actual incidence data are available to 2003 except for Quebec 2002 to 2003 and Ontario 2003 incidence is estimated. Please refer to *Appendix II: Methods* for further details.

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

Figure 5.2

Age-Standardized Mortality Rates (ASMR) for Selected Cancer Sites, Females, Canada, 1977-2006



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

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

Table 7.1

Age-Standardized Incidence Rates for Selected Cancer Sites, Males, Canada, 1977-2006

Year	Rate per 100,000								
	All Cancers	Prostate	Lung	Colorectal	Melanoma	Oral	Stomach	Larynx	Thyroid
1977	391.4	67.9	78.6	57.0	5.5	22.3	20.1	8.6	2.1
1978	417.2	74.0	85.1	59.9	6.4	22.2	20.9	8.4	1.7
1979	409.8	72.0	83.9	59.2	6.8	20.9	20.8	9.0	1.8
1980	406.1	71.4	83.2	57.9	7.0	20.4	19.0	9.3	1.9
1981	442.2	78.5	91.2	62.6	7.0	20.0	20.5	8.4	1.9
1982	440.7	77.8	92.6	62.7	7.5	19.3	18.7	8.8	1.7
1983	448.4	79.6	95.2	63.9	7.6	19.3	20.4	9.0	2.1
1984	450.1	80.9	97.1	64.7	7.5	19.7	18.4	8.9	2.0
1985	449.8	85.1	93.2	66.2	8.7	19.1	18.0	8.8	1.8
1986	451.9	86.1	96.4	64.7	9.0	18.5	18.0	8.8	2.0
1987	456.3	89.6	95.0	64.7	9.7	17.7	17.4	8.8	2.2
1988	458.5	90.4	95.5	64.6	10.4	17.7	17.0	8.6	2.1
1989	451.6	91.9	93.6	63.1	9.3	17.5	16.8	8.1	2.1
1990	457.7	99.9	92.7	63.0	10.1	17.5	15.8	7.7	2.2
1991	469.0	112.3	90.7	62.9	9.1	17.2	15.6	8.3	2.4
1992	489.2	125.4	90.2	64.2	10.3	16.7	14.6	8.1	2.0
1993	502.2	140.5	91.3	61.8	10.3	16.0	14.3	7.4	2.6
1994	488.8	129.7	86.8	63.0	10.7	15.7	14.1	7.5	2.7
1995	464.8	111.7	84.5	61.5	11.1	15.1	13.3	7.4	2.6
1996	456.6	110.0	82.2	60.6	11.0	14.7	13.6	6.9	2.6
1997	458.7	115.5	79.1	60.2	11.3	13.6	13.0	6.6	2.7
1998	457.5	114.7	80.0	62.2	10.9	13.4	12.5	6.6	2.7
1999	468.6	119.3	79.3	63.2	12.6	13.2	12.5	6.6	3.2
2000	469.4	124.1	75.5	65.0	12.4	13.6	12.2	5.8	3.5
2001	474.9	132.3	75.6	64.1	12.6	13.2	11.7	5.9	3.6
2002**	457.2	121.1	73.3	62.2	12.2	12.5	10.9	5.8	3.9
2003**	450.2	117.4	72.4	62.1	12.5	12.3	11.1	5.5	3.7
2004*	454.8	119.7	71.9	62.1	13.1	12.1	10.7	5.5	3.9
2005*	452.7	119.3	70.7	62.0	13.4	11.8	10.4	5.4	4.1
2006*	450.7	118.9	69.6	62.0	13.7	11.5	10.1	5.3	4.3

* Estimated rates

** Incidence is an estimate for Quebec 2002 and 2003 and for Ontario 2003

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

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

Table 7.2

Age-Standardized Mortality Rates for Selected Cancer Sites, Males, Canada, 1977-2006

Year	Rate per 100,000								
	All Cancers	Lung	Colorectal	Prostate	Stomach	Oral	Larynx	Hodgkin Lymphoma	Testis
1977	233.5	68.5	30.7	24.6	17.0	5.7	3.3	1.5	0.8
1978	236.4	70.1	32.9	26.1	16.1	6.5	3.1	1.3	0.6
1979	239.4	71.7	31.8	26.7	18.0	6.2	3.3	1.2	0.4
1980	240.7	74.0	32.3	25.8	15.5	5.5	3.7	1.2	0.4
1981	239.2	73.2	32.2	27.1	15.3	5.6	3.3	1.2	0.4
1982	243.5	77.4	31.9	26.0	14.6	6.0	3.6	1.1	0.4
1983	242.9	78.4	31.8	26.7	14.3	6.1	3.4	1.3	0.4
1984	247.9	80.2	32.4	27.4	13.9	5.8	3.3	1.1	0.4
1985	249.0	78.0	33.4	28.9	13.0	6.2	3.4	0.9	0.4
1986	249.0	79.0	32.0	29.4	13.1	6.2	3.5	1.0	0.3
1987	248.2	78.6	32.0	29.4	12.9	5.9	3.6	0.9	0.4
1988	254.8	81.3	32.4	30.7	12.8	5.8	3.7	0.8	0.4
1989	249.6	81.1	31.9	29.7	12.3	5.9	3.2	0.8	0.4
1990	246.5	79.6	30.9	30.1	11.3	5.6	3.6	0.8	0.3
1991	247.2	78.8	30.4	31.2	10.3	6.0	3.5	0.7	0.3
1992	244.7	77.6	31.1	31.0	10.7	5.4	3.3	0.7	0.2
1993	242.8	77.9	29.7	31.1	9.7	5.6	3.1	0.7	0.2
1994	241.8	75.6	30.3	30.7	9.8	5.3	3.2	0.6	0.4
1995	239.0	73.3	30.2	31.0	9.6	5.1	3.1	0.6	0.3
1996	236.5	73.0	29.5	29.0	9.5	5.0	2.9	0.5	0.3
1997	232.3	70.6	29.0	28.7	9.0	5.0	2.8	0.6	0.3
1998	230.5	70.3	28.9	28.0	8.6	4.7	2.7	0.5	0.3
1999	229.4	70.4	28.5	26.9	8.4	4.7	2.6	0.6	0.3
2000	225.4	64.4	28.5	26.8	8.1	3.9	2.8	0.5	0.2
2001	224.0	64.6	27.1	26.7	7.6	4.6	2.7	0.5	0.2
2002	219.9	64.5	27.7	25.0	7.3	4.7	2.5	0.4	0.2
2003*	221.3	64.7	27.4	26.4	7.2	4.3	2.6	0.4	0.2
2004*	219.5	63.8	27.1	26.1	7.0	4.2	2.5	0.4	0.2
2005*	217.6	63.0	26.9	25.8	6.7	4.1	2.5	0.4	0.2
2006*	215.9	62.1	26.6	25.5	6.5	4.0	2.4	0.4	0.2

* Estimated rates

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

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

Table 8.1

Age-Standardized Incidence Rates for Selected Cancer Sites, Females, Canada, 1977-2006

Year	Rate per 100,000							
	All Cancers	Breast	Lung	Colorectal	Thyroid	Cervix	Stomach	Larynx
1977	306.0	84.4	17.9	48.0	4.6	15.4	9.3	1.0
1978	319.4	86.1	20.1	50.2	4.8	14.7	9.5	1.3
1979	313.8	87.3	20.3	49.7	4.7	14.2	9.2	1.1
1980	305.5	83.3	21.7	47.4	4.4	13.0	8.6	1.4
1981	328.1	86.5	24.3	48.6	4.6	13.9	9.8	1.3
1982	321.0	86.0	25.9	48.9	4.5	12.3	8.7	1.1
1983	332.8	89.3	28.3	50.2	4.8	12.9	8.7	1.3
1984	329.5	90.4	29.6	48.9	4.9	12.2	8.1	1.4
1985	335.6	92.2	30.9	50.6	5.3	12.3	8.0	1.5
1986	324.9	88.6	31.7	48.2	5.2	10.9	8.3	1.4
1987	330.7	91.1	33.2	47.6	5.2	10.4	8.0	1.5
1988	336.1	97.8	34.8	46.1	5.1	10.2	7.2	1.5
1989	330.0	96.4	35.0	45.3	5.6	10.0	7.2	1.6
1990	333.2	96.0	36.5	45.7	5.8	10.4	6.9	1.4
1991	337.1	100.1	37.7	44.1	5.9	9.6	6.4	1.6
1992	343.5	102.0	39.7	44.2	6.9	9.6	6.5	1.3
1993	343.3	99.2	40.6	44.2	7.2	9.5	6.3	1.3
1994	342.1	99.0	39.8	43.6	7.7	9.4	6.3	1.4
1995	340.8	98.8	40.8	42.5	7.7	9.3	6.0	1.4
1996	338.8	98.6	41.9	41.0	7.8	9.2	6.0	1.3
1997	342.1	101.9	41.8	41.5	7.9	8.6	5.5	1.3
1998	349.6	103.0	43.4	43.8	8.2	8.3	5.6	1.2
1999	350.7	105.0	43.4	43.2	9.4	8.4	5.3	1.2
2000	350.3	101.0	44.5	44.1	10.4	8.4	5.4	1.0
2001	347.3	99.6	44.5	43.2	11.2	8.1	5.1	1.1
2002**	354.8	103.4	45.2	42.7	13.1	8.0	5.0	1.1
2003**	347.4	101.9	46.1	42.0	12.5	7.7	4.7	1.1
2004*	354.3	104.9	48.2	41.6	13.2	7.7	4.7	1.1
2005*	355.8	105.6	49.2	41.3	14.1	7.6	4.6	1.1
2006*	357.2	106.3	50.3	41.1	15.0	7.5	4.4	1.1

* Estimated rates

** Incidence is an estimate for Quebec 2002 and 2003 and for Ontario 2003

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

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

Table 8.2

Age-Standardized Mortality Rates for Selected Cancer Sites, Females, Canada, 1977-2006

Year	Rate per 100,000								
	All Cancers	Lung	Breast	Colorectal	Stomach	Cervix	Thyroid	Larynx	Hodgkin Lymphoma
1977	147.1	13.9	30.6	25.2	7.4	4.8	0.7	0.4	0.7
1978	147.6	15.0	29.5	25.1	7.4	4.7	0.7	0.3	0.8
1979	150.2	16.3	29.8	26.1	7.2	4.2	0.6	0.4	0.7
1980	148.5	17.1	29.7	25.3	6.8	3.7	0.7	0.5	0.6
1981	149.0	17.9	30.1	24.4	7.5	3.9	0.6	0.6	0.6
1982	149.3	19.6	29.7	23.5	6.7	3.9	0.6	0.5	0.6
1983	149.4	19.9	30.4	23.1	6.5	3.9	0.7	0.4	0.6
1984	151.9	22.2	30.7	23.8	5.7	3.5	0.6	0.5	0.6
1985	154.8	23.8	31.8	23.7	6.0	3.3	0.5	0.5	0.5
1986	154.4	24.0	32.0	23.5	6.1	3.2	0.5	0.6	0.5
1987	154.0	25.3	31.3	23.0	5.7	3.0	0.4	0.6	0.5
1988	155.4	26.9	31.4	22.7	5.1	3.0	0.4	0.6	0.5
1989	153.1	27.0	31.2	21.3	5.5	2.9	0.4	0.5	0.5
1990	153.1	27.6	31.3	21.3	5.0	3.0	0.5	0.5	0.4
1991	153.5	29.5	30.1	20.7	4.9	2.8	0.4	0.7	0.5
1992	153.1	29.6	30.4	20.2	4.9	2.4	0.5	0.4	0.4
1993	154.8	31.7	29.4	20.3	4.5	2.6	0.6	0.5	0.5
1994	155.1	31.9	30.0	19.9	4.5	2.7	0.4	0.6	0.3
1995	152.0	31.4	28.7	19.8	4.6	2.4	0.4	0.6	0.4
1996	155.2	33.7	28.9	19.7	4.4	2.6	0.5	0.4	0.3
1997	150.3	32.7	27.7	18.8	3.9	2.5	0.5	0.5	0.3
1998	151.3	34.6	26.4	19.3	3.8	2.3	0.5	0.4	0.3
1999	149.8	34.9	25.2	18.6	4.0	2.4	0.4	0.5	0.3
2000	149.8	34.4	25.1	18.2	3.9	2.2	0.4	0.5	0.3
2001	148.2	34.4	25.0	17.8	3.4	2.1	0.3	0.4	0.3
2002	149.3	35.3	24.4	17.7	3.6	1.9	0.4	0.4	0.2
2003*	149.5	37.3	24.5	17.4	3.4	2.0	0.4	0.4	0.3
2004*	149.2	38.1	24.1	17.1	3.3	2.0	0.4	0.4	0.3
2005*	149.0	39.0	23.7	16.9	3.2	1.9	0.4	0.4	0.3
2006*	148.7	39.9	23.4	16.6	3.1	1.9	0.4	0.4	0.3

* Estimated rates

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

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

Table 9

Average Annual Percent Change (AAPC) in Age-Standardized Incidence Rates 1992-2001 and Mortality Rates 1993-2002 for Selected Cancer Sites, Canada

	Incidence 1992-2001				Mortality 1993-2002			
	Males		Females		Males		Females	
	AAPC	Change-point†	AAPC	Change-point†	AAPC	Change-point†	AAPC	Change-point†
All Cancers	**0.8****	**1996**	**0.3***		**-1.1****		**-0.5***	
Bladder	-0.7*	**1993**	-0.4		-0.1		-1.2	
Body of Uterus	–		-0.1		–		-0.5	
Brain	-0.1		0.4		-0.5		-0.3	
Breast	–		0.2		–		-2.7**	**1994**
Cervix	–		-2.0**		–		-3.2**	
Colorectal	1.7	**1997**	1.2	**1996**	-1.1**		-1.6**	
Esophagus	0.3		-1.4*		0.9*		-0.6	
Hodgkin Lymphoma	-1.1*		-1.0*		-4.5**		-3.9*	
Kidney	0.5		0.8		-0.5		-0.7	
Larynx	-3.3**		-2.7**		-2.3**		-2.6	
Leukemia	-0.2		-0.5		-0.8*		-1.7**	
Lung	-1.6*	**1996**	1.4**		-2.1**		1.3**	
Melanoma	2.4**		1.8**		1.3*		-0.5	
Multiple Myeloma	-0.1		0.4		-0.9		-0.4	
Non-Hodgkin Lymphoma	0.9**		-1.0	**1997**	1.3*		0.3	
Oral	-2.7**		-0.9		-2.6**		-0.5	
Ovary	–		-1.1*		–		-0.6	
Pancreas	-0.7*		-0.7		-1.1**		-0.8**	
Prostate	3.4**	**1996**	–		-2.5**	**1994**	–	
Stomach	-2.3**		-2.7**		-3.3**		-3.2**	
Testis	1.8*		–		-4.2		–	
Thyroid	5.1**		5.2**		-0.4		-3.2	

– Not applicable

* Significant at p=0.05

** Significant at p=0.01

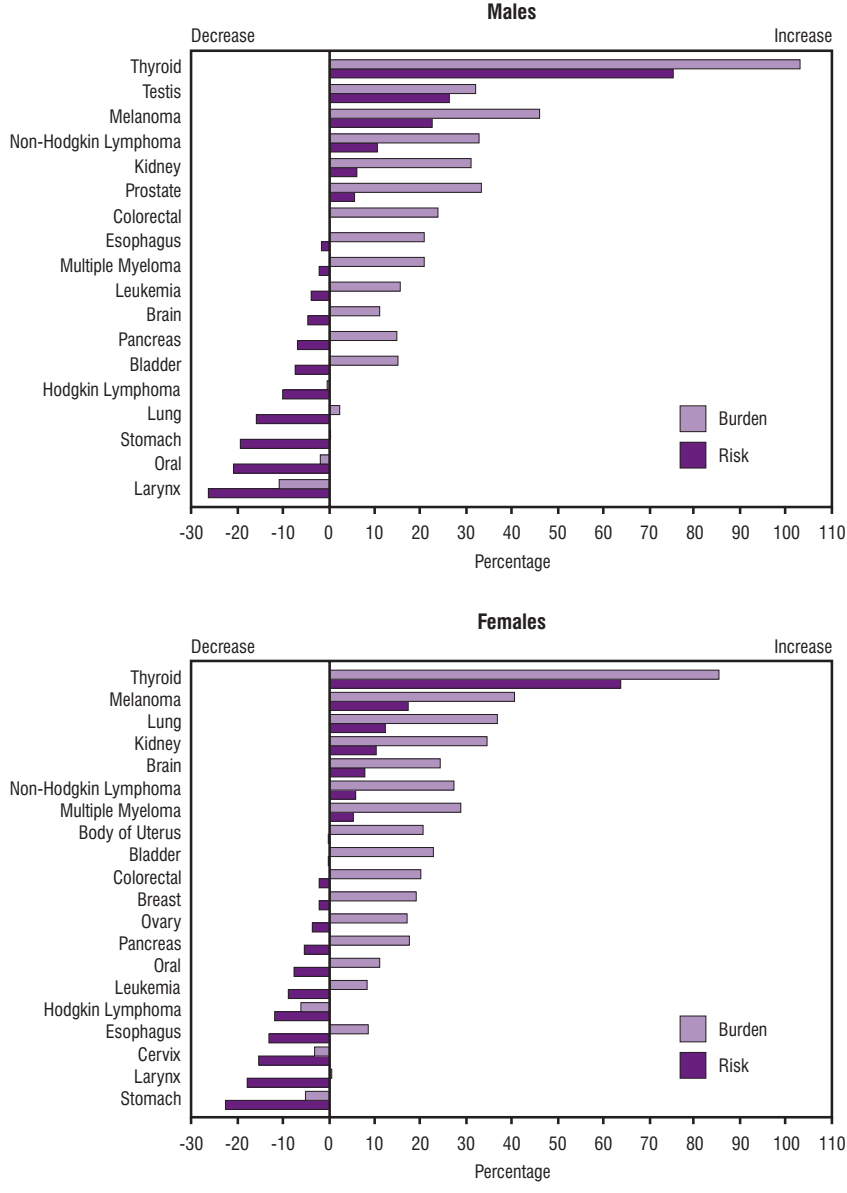
† Where there is a changepoint it is used as the baseline rather than 1992 for incidence or 1993 for mortality. Please refer to *Appendix II: Methods* for further details.

Note: Average Annual Percent Change is calculated assuming a log linear model; incidence rates exclude non-melanoma (basal and squamous) skin cancer. Changepoints were fit to rates from 1986 to 2001 for incidence and 1986 to 2002 for mortality.

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

Figure 6.1

Percent Change in Cancer Incidence Burden (total number of cases) and Risk (age-standardized incidence rates), Incidence for Selected Cancer Sites, Canada, over the Decade from 1992-2001

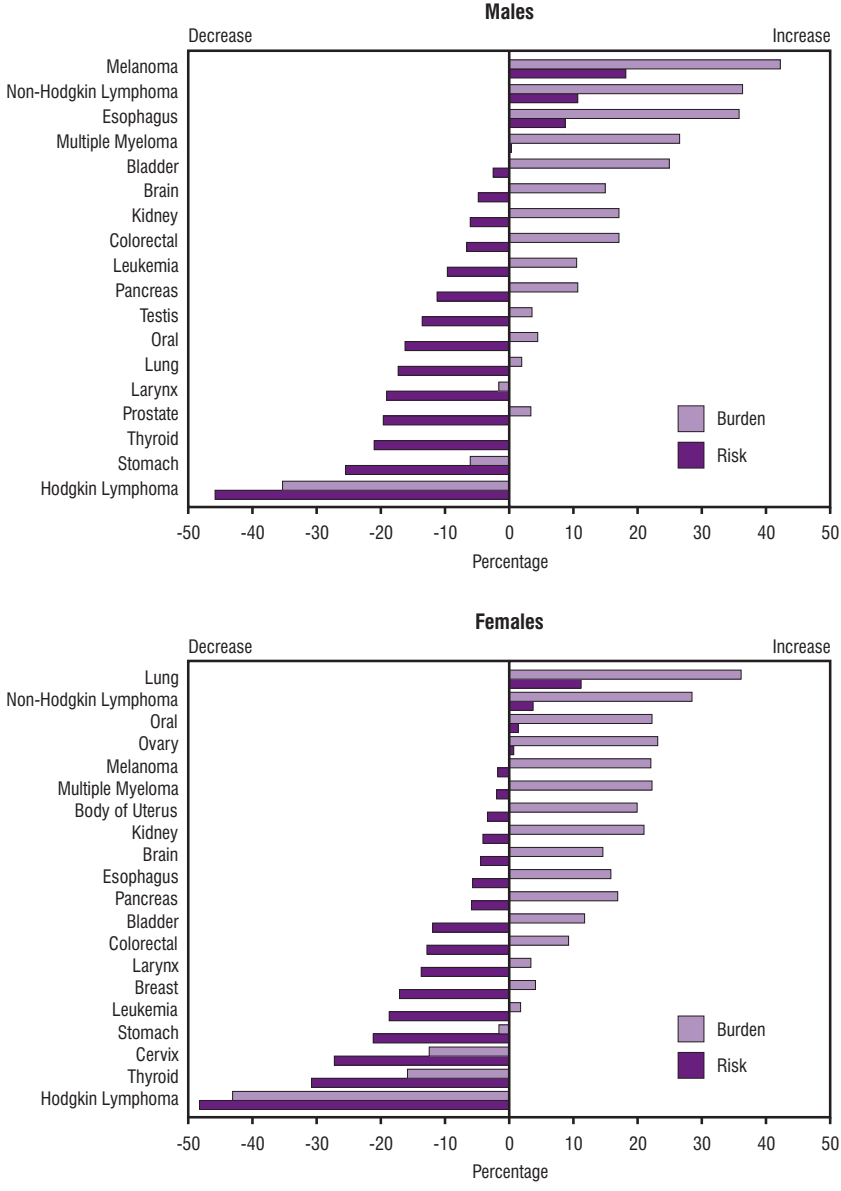


Note: See Table 9 for average annual percent change for all sites. Sites are ranked in decreasing order of percent change of rates.

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

Figure 6.2

Percent Change in Cancer Mortality Burden (total number of deaths) and Risk of Death (age-standardized mortality rates), Mortality for Selected Cancer Sites, Canada, over the Decade from 1993-2002

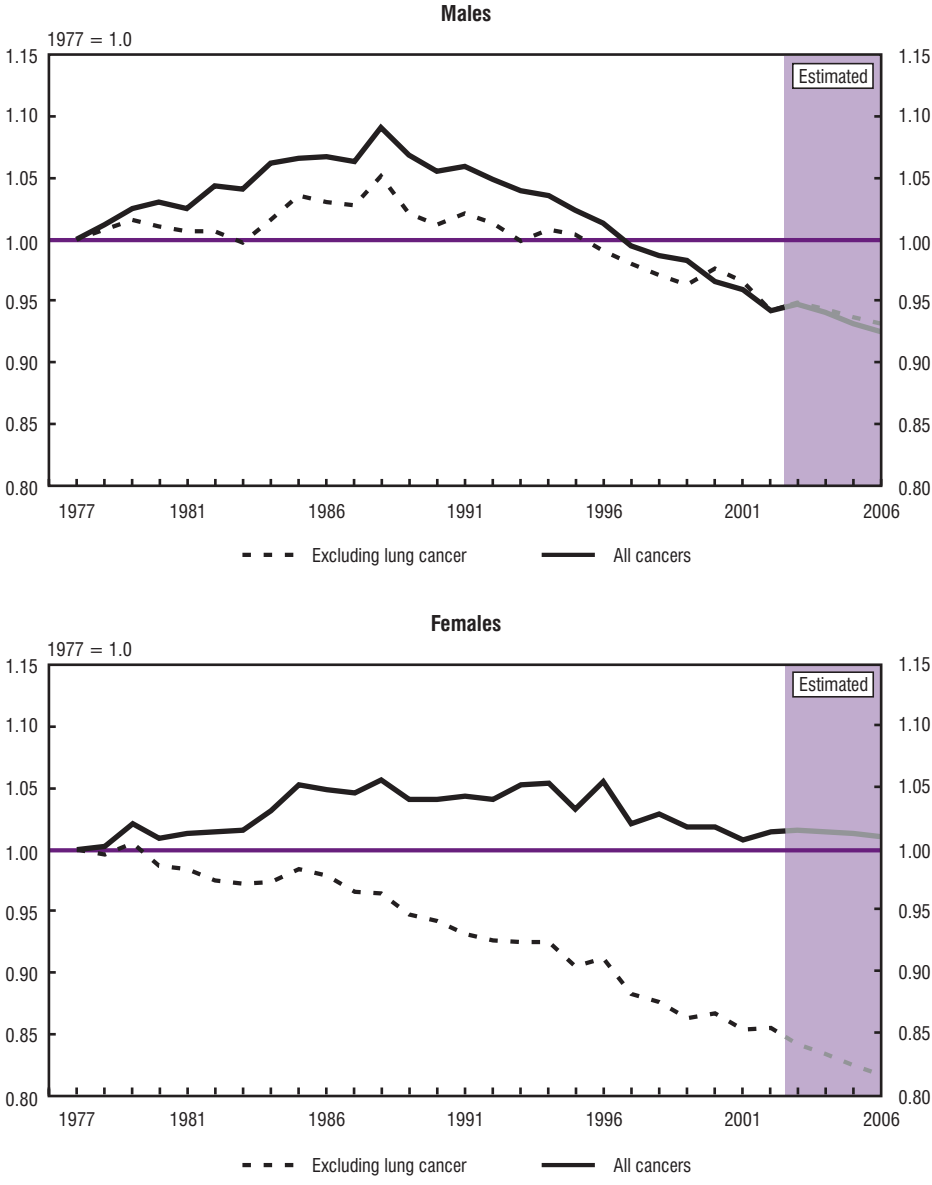


Note: See Table 9 for average annual percent change for all sites. Sites are ranked in decreasing order of percent change of rates.

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

Figure 7

Relative Change in Age-Standardized Mortality Rates Including and Excluding Lung Cancer, Canada, 1977-2006*



* Rates are relative to 1977 (current year divided by 1977 rate).

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

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

AGE AND SEX DISTRIBUTION OF CANCER

Cancer is primarily a disease of the elderly. The estimates for 2006 shown in Table 10 indicate that 66,000 new cases (43%) and 42,200 cancer deaths (60%) occur in Canadians aged 70 years or more, while an additional 38,400 new cases (25%) and 15,000 deaths (21%) occur in those aged 60- 69. In contrast, less than 1% of new cases and of deaths occur prior to age 20. The median age at cancer diagnosis is between 65 and 69 years of age and at death between 70 and 74 for both sexes. Figure 8 displays age-specific rates of cancer incidence and mortality by 5-year age groups for 2001, the most recent year for which complete data are available. Cancer incidence and mortality rates increase substantially with age in both sexes. The incidence rates for age 85+ are about 100 times those for age 0-4 in both sexes, while mortality rates rise about 800-fold over the lifespan. Cancer incidence rates are higher for men than women, except between the ages of 15 and 54; mortality rates for men are higher except between ages 25 to 54. The male excess is particularly great at older ages.

The age and sex distributions for the most common cancers in people aged 20 or more are presented in Table 11. More than half of all newly diagnosed lung and colorectal cancers and 45% of prostate cancers occur among Canadians aged 70 or more. In contrast, only 29% of breast cancers are diagnosed at age 70 or later, while 20% occur in women under age 50.

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

Sustained increases in incidence rates are confined to the older age groups (50-69 and 70+), although rates may have stabilized or decreased in recent years for men aged 70+. The impact of increased use of the prostate-specific antigen (PSA) test to identify early prostate cancers in the late 1980s and early 1990s is clearly evident for men in the two oldest age groups (see “Trends in incidence and mortality”). In younger age groups, incidence has been either stable (ages 0-19, both sexes and ages 20-49, females) or declining (20-49 year old men) during the most recent decade. The latter is likely due in part to the long-term decline in smoking among young men.

In the most recent decade, mortality rates have dropped by 3% per year in 0-19 year olds and 2% annually in those aged 20-49. Smaller but statistically significant declines are also observed in middle-aged men and women (1.8% and 0.9% per year, respectively) and in older men (0.5% decline per year in men aged 70+). Only for older women (aged 70+) are mortality rates continuing to rise, reflecting their increasing rate of death due to lung cancer.

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

Table 10

Distribution for All Cancer Sites Combined by Age Group and Sex, Canada, 2006

Age Group	Population (000s) 2006 Estimates			New Cases 2006 Estimates			Deaths 2006 Estimates		
	Total	M	F	Total	M	F	Total	M	F
0-19	7,595	3,887	3,707	1,250	680	590	180	95	80
20-29	4,309	2,187	2,122	1,800	810	960	230	120	100
30-39	4,623	2,326	2,298	4,400	1,550	2,800	740	300	430
40-49	5,367	2,696	2,671	12,700	4,500	8,200	3,200	1,400	1,850
50-59	4,429	2,198	2,231	28,500	13,300	15,200	8,800	4,400	4,400
60-69	2,791	1,352	1,439	38,400	22,100	16,300	15,000	8,400	6,500
70-79	1,868	844	1,023	39,200	22,600	16,600	20,900	11,900	9,000
80+	1,143	399	744	26,800	12,900	14,000	21,300	10,400	11,000
All Ages	**32,125**	**15,889**	**16,236**	**153,100**	**78,400**	**74,700**	**70,400**	**37,000**	**33,400**

Note: Incidence figures exclude non-melanoma skin cancer (basal and squamous). Total of rounded numbers may not equal rounded total number. Please refer to *Appendix II: Methods* for further details. 2006 population projections were provided by the Census and Demographics Branch, Statistics Canada.

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

Table 11
Distribution by Selected Cancer Site, Age Group and Sex, Canada, 2006

Age Group	Lung			Colorectal			Prostate	Breast
	Total	M	F	Total	M	F	M	F
New Cases								
0-19	10	5	5	10	5	5	5	10
20-29	20	15	10	40	20	20	–	75
30-39	140	55	85	220	110	100	5	850
40-49	1,050	410	660	1,100	570	510	360	3,600
50-59	3,500	1,650	1,800	3,100	1,800	1,300	3,600	6,200
60-69	6,400	3,500	2,900	4,800	3,000	1,850	7,400	5,100
70-79	7,300	4,200	3,100	5,900	3,300	2,500	6,300	3,800
80+	4,200	2,200	2,000	4,800	2,000	2,800	3,000	2,600
All Ages	**22,700**	**12,000**	**10,600**	**20,000**	**10,800**	**9,100**	**20,700**	**22,200**
Deaths								
0-19	–	–	–	5	5	–	–	–
20-29	10	5	5	10	5	5	–	5
30-39	75	25	45	55	25	30	–	110
40-49	740	300	430	300	170	140	15	480
50-59	2,600	1,300	1,250	960	570	390	130	950
60-69	5,100	2,900	2,200	1,700	1,050	640	520	950
70-79	6,500	3,800	2,700	2,400	1,400	1,000	1,400	1,150
80+	4,300	2,300	2,000	3,100	1,300	1,750	2,200	1,600
All Ages	**19,300**	**10,700**	**8,600**	**8,500**	**4,600**	**3,900**	**4,200**	**5,300**

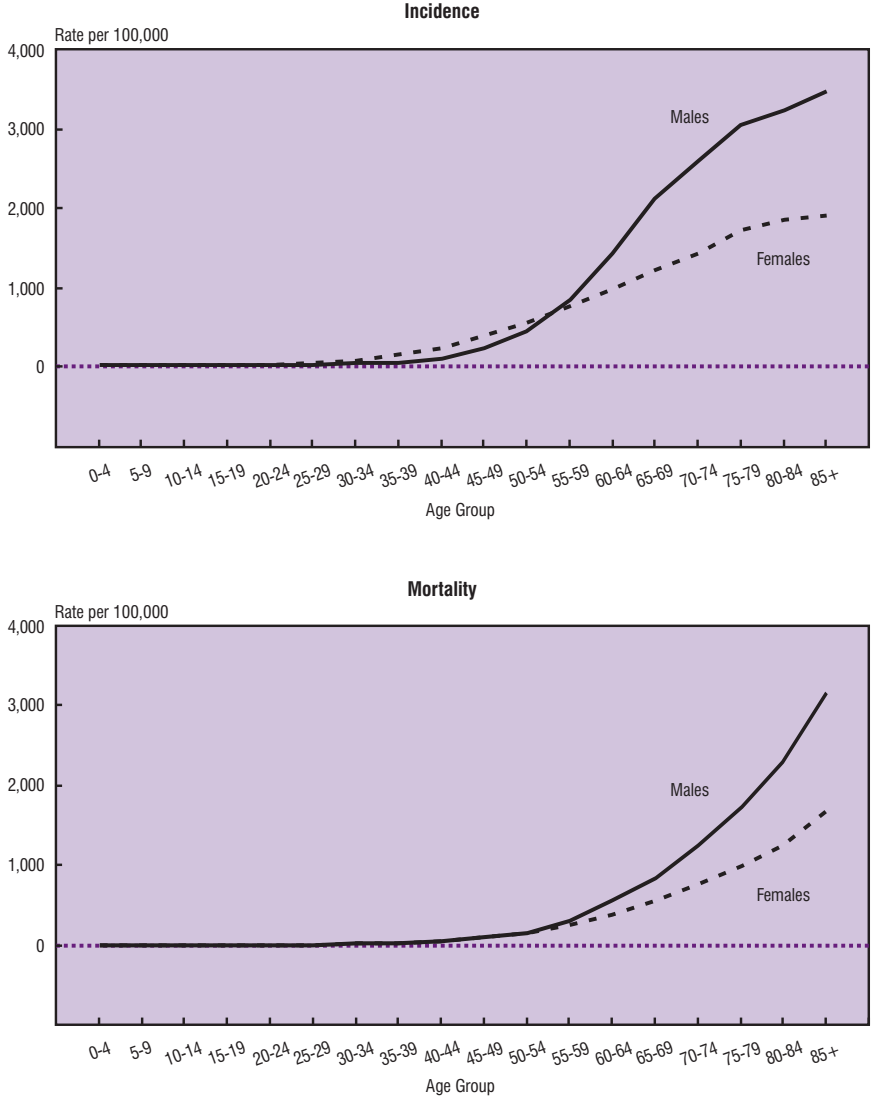
– Fewer than 3 cases or deaths.

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

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

Figure 8

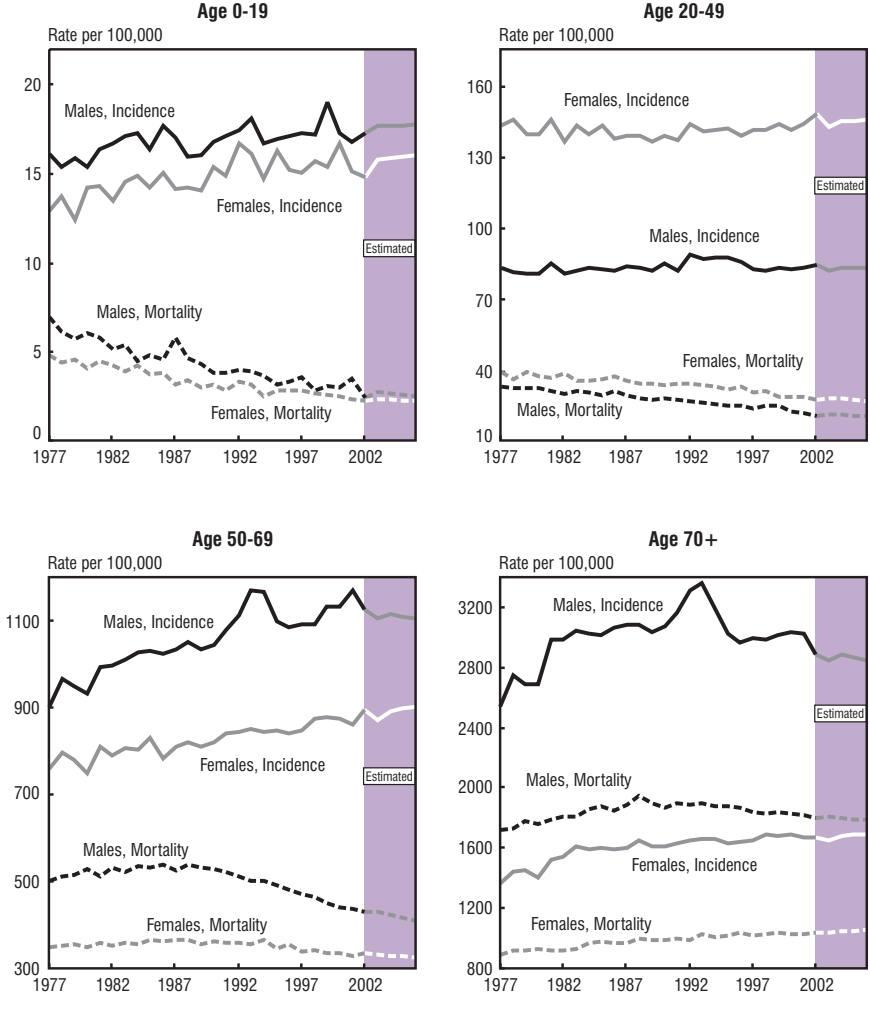
Age-Specific Incidence and Mortality Rates for All Cancers by Sex, Canada, 2001



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

Figure 9

Age-Standardized Incidence and Mortality Rates by Broad Age Group, All Cancers, Canada, 1977-2006



Note: The range of rate scales differ widely between the four age groups. Incidence figures exclude non-melanoma (basal and squamous) skin cancer. For Quebec 2002 to 2003 and Ontario 2003 incidence is estimated.

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

PROBABILITY OF DEVELOPING/DYING FROM CANCER

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

The calculation of these probabilities models the occurrence of cancer in a hypothetical cohort. For example, if a cohort of 1,000 women of age 50 is followed until the end of age 59, 63 of them, or 6.3% (1 in 15.9), 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 15.5% (1 in 6.5) chance of developing some type of cancer before age 70. For the lifetime probability of developing cancer, the data are presented both as the probability of developing cancer expressed as a percentage and as the inverse of that probability. For example, men have a lifetime probability of 0.44 (44%) of developing cancer, and the inverse of that probability is 1 in 2.3. Thus, approximately 2 of every 5 men are expected to develop cancer of some type during their life. Similarly, 1 in 2.6 women (slightly more than 1 of every 3 women) will develop cancer during their life. One in 3.5 men and 1 in 4.3 women, or approximately 1 in 4 of all Canadians, will die of cancer.

During their lifetimes, 1 in 8.9 women are expected to develop breast cancer, the most common cancer (excluding non-melanoma skin cancer) to afflict women, and 1 in 27 women are expected to die from it. One in 16 women will develop colorectal cancer, but only 1 in 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 men will develop prostate cancer, but only 1 in 26 will die from it. One in 11 men will develop lung cancer, and 1 in 12 will die from this condition. Lung cancer is thus by far the leading cause of cancer deaths in Canadian men.

The probability of developing cancer within the next 10 years gives a useful indication of the short-term risk of cancer. Although the lifetime risk of developing breast cancer is 11.2% (1 in 8.9), and although the risk increases with age, the chance of a 60-year-old woman developing breast cancer before age 70 is only 3.1% (1 in 32); 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 6.9% (1 in 14) 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.

Table 12

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

	Lifetime Probability of Developing		Lifetime Probability of Dying		Probability (%) of Developing Cancer in next 10 years by age group					
	%	One in:	%	One in:	30-39	40-49	50-59	60-69	70-79	80-89
Male										
All Cancers	**44.0**	**2.3**	**28.7**	**3.5**	**0.6**	**1.7**	**6.1**	**15.5**	**21.9**	**20.3**
Prostate	14.1	7.1	3.9	25.8	–	0.1	1.7	5.6	6.9	5.3
Lung	8.8	11.4	8.1	12.3	–	0.2	0.9	2.7	4.3	3.7
Colorectal	7.3	13.7	3.5	28.4	–	0.2	0.9	2.1	3.3	3.4
Bladder	2.7	37.1	1.0	100.0	–	0.1	0.3	0.7	1.3	1.5
Non-Hodgkin Lymphoma	2.0	49.3	1.1	94.3	0.1	0.1	0.3	0.5	0.8	0.8
Kidney	1.7	57.8	0.7	140.8	–	0.1	0.3	0.5	0.7	0.6
Leukemia	1.5	65.0	1.0	98.0	–	0.1	0.1	0.4	0.6	0.7
Oral	1.4	70.8	0.6	181.8	–	0.1	0.3	0.4	0.5	0.4
Stomach	1.4	72.4	1.0	103.1	–	–	0.1	0.4	0.6	0.7
Melanoma	1.3	77.1	0.3	303.0	0.1	0.1	0.2	0.3	0.4	0.4
Pancreas	1.2	81.6	1.3	76.9	–	–	0.1	0.3	0.5	0.6
Brain	0.8	130.9	0.6	179.2	–	0.1	0.1	0.2	0.2	0.2
Multiple Myeloma	0.7	146.2	0.6	181.8	–	–	0.1	0.2	0.3	0.3
Esophagus	0.7	149.5	0.8	119.0	–	–	0.1	0.2	0.3	0.3
Female										
All Cancers	**38.4**	**2.6**	**23.5**	**4.3**	**1.2**	**3.0**	**6.3**	**10.1**	**13.6**	**13.5**
Breast	11.2	8.9	3.7	26.8	0.4	1.3	2.4	3.1	3.2	2.5
Colorectal	6.4	15.7	3.3	30.6	–	0.2	0.6	1.3	2.3	2.9
Lung	5.9	16.8	5.0	20.0	–	0.2	0.8	1.7	2.3	1.8
Body of Uterus	2.3	43.4	0.5	185.2	–	0.1	0.5	0.7	0.7	0.5
Non–Hodgkin Lymphoma	1.7	58.3	0.9	108.7	–	0.1	0.2	0.4	0.6	0.6
Ovary	1.5	66.7	1.1	90.9	–	0.1	0.3	0.4	0.5	0.4
Pancreas	1.3	78.5	1.3	75.2	–	–	0.1	0.2	0.5	0.6
Leukemia	1.1	89.0	0.7	135.1	–	–	0.1	0.2	0.4	0.5
Kidney	1.1	89.9	0.4	227.3	–	0.1	0.2	0.3	0.4	0.4
Melanoma	1.1	92.8	0.2	526.3	0.1	0.1	0.2	0.2	0.3	0.2
Bladder	0.9	106.6	0.4	256.4	–	–	0.1	0.2	0.3	0.4
Thyroid	0.9	107.6	0.1	1,428.6	0.2	0.2	0.2	0.1	0.1	0.1
Cervix	0.7	138.2	0.3	384.6	0.1	0.1	0.1	0.2	0.2	0.2
Oral	0.7	148.2	0.3	400.0	–	–	0.1	0.2	0.2	0.2
Brain	0.7	152.6	0.4	232.6	–	–	0.1	0.2	0.2	0.1
Esophagus	0.3	362.1	0.3	312.5	–	–	–	–	0.1	0.1

– Value less than 0.05

Note: The probability of developing cancer is calculated based on age- and sex-specific cancer incidence and mortality rates for Canada in 2001 and on life tables based on 1999-2001 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 2001. See *Appendix II: Methods* for details.

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

POTENTIAL YEARS OF LIFE LOST DUE TO CANCER

Figure 10 shows the rank order of 12 causes of premature death in Canada in 2002 as represented by potential years of life lost (PYLL). This illustrates that cancer was the leading cause of PYLL for men and women: 990,000 potential years were lost as a result of cancer (Table 13), representing 32% of the PYLL resulting from all causes of death. Diseases of the heart were the second leading cause.

The PYLL due to specific types of cancer (Table 13) show that lung cancer was responsible for 264,000 PYLL, representing 27% of the premature mortality caused by cancer. For men in 2002, the three leading cancers were lung, colorectal and prostate, accounting for 49% 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.

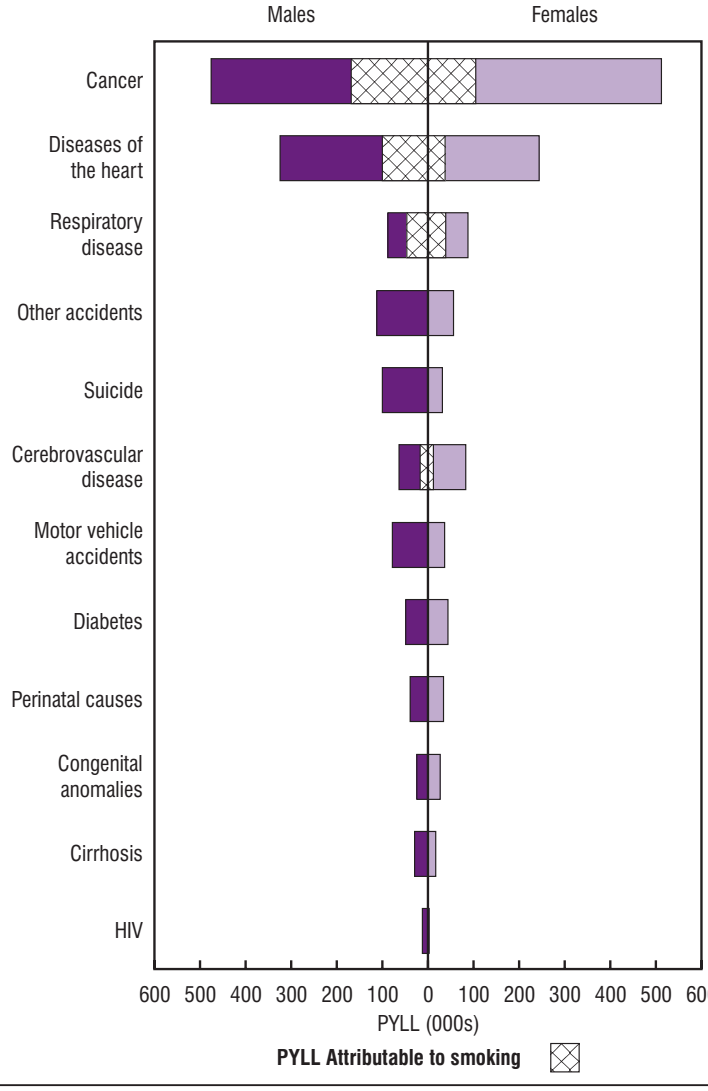
Potential years of life lost is higher for cancers that are more common, have an earlier age of onset, and more quickly lead to death. With regard to the most common cancers in women and men, the PYLL from breast cancer (94,000) far exceed the PYLL from prostate cancer (34,000), reflecting the relatively young age at which women die from breast cancer. In contrast, the PYLL for Hodgkin lymphoma, at 3,000, reflects a cancer that is less common and relatively curable.

Although the number of men who die from cancer each year exceeds the number of women, the PYLL for women (514,000) are slightly higher than the PYLL for men (476,000). 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 over 50% of PYLL due to respiratory disease. Among women, smoking is responsible for about one-fifth of PYLL due to all cancers.

Cancer is the leading cause of premature death in Canada.

Figure 10
Selected Causes of Potential Years of Life Lost (PYLL), Canada, 2002



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

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

Table 13
Potential Years of Life Lost Due to Cancer, Canada, 2002

	Potential Years of Life Lost (PYLL)					
	Total		Males		Females	
	Years	%	Years	%	Years	%
ALL CAUSES	3,131,000	–	1,665,600	–	1,465,400	–
All Cancers	989,800	100	476,000	100	513,800	100
Cancer Site						
Lung	264,300	26.7	142,100	29.9	122,200	23.8
Colorectal	112,000	11.3	58,200	12.2	53,800	10.5
Breast	94,200	9.5	–	–	94,200	18.3
Pancreas	45,900	4.6	21,700	4.6	24,200	4.7
Non-Hodgkin Lymphoma	40,000	4.0	21,100	4.4	18,900	3.7
Brain	34,400	3.5	18,700	3.9	15,700	3.1
Prostate	34,400	3.5	34,400	7.2	–	–
Leukemia	33,600	3.4	18,700	3.9	14,900	2.9
Ovary	28,900	2.9	–	–	28,900	5.6
Stomach	27,000	2.7	15,700	3.3	11,300	2.2
Kidney	21,900	2.2	13,500	2.8	8,400	1.6
Esophagus	20,000	2.1	16,300	3.4	5,500	1.1
Oral	18,400	1.9	12,700	2.7	5,700	1.1
Bladder	17,000	1.7	11,900	2.5	5,100	1.0
Multiple Myeloma	16,500	1.7	8,200	1.7	8,300	1.6
Melanoma	15,300	1.5	8,800	1.8	6,500	1.3
Body of Uterus	10,300	1.0	–	–	10,300	2.0
Cervix	9,300	0.9	–	–	9,300	1.8
Larynx	7,200	0.7	5,700	1.2	1,600	0.3
Hodgkin Lymphoma	2,800	0.3	1,500	0.3	1,300	0.3
Testis	1,000	0.1	1,000	0.2	–	–

– Not applicable

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

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

Prevalence 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 2001 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 2001. 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 2.7% among women. In the year 2001, there were an estimated 369,800 male and 421,600 female cancer survivors, for a total of approximately 791,400 Canadians (2.6% overall). That means that 1 in 42 Canadian men and 1 in 37 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 113,600 prevalent cases or 0.7% of the male population, followed by colorectal (51,000) and lung (18,000) cancers. Breast cancer is the most common site in women (155,100 cases or 1.0% of the female population), which is also followed by colorectal (51,500 cases) and lung (18,200) 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. 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 (2.6%), because this method would yield a slight under-estimate of true prevalence.[15] Another approach, employed at the Ontario Cancer Registry, counted the number of cancer patients not known to be deceased, which for colorectal cancer gave a prevalence of 0.3% (i.e., identical to the results reported in Table 14). Thus, it is reassuring that estimates obtained by other means produced similar prevalence results.

Prevalence is a useful indicator of the burden cancer poses both at the personal level and at the level of the health care system. Although many individuals who survive cancer continue to live productive and rewarding lives, the cancer experience is difficult and presents many physical, emotional and spiritual challenges to patients and to their families and loved ones. These challenges may persist beyond the point of physical recovery from the cancer itself, often requiring extensive use of rehabilitation and supportive care resources. Cancer survivors are also at risk of recurrence or of 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.

PREVALENCE

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

Table 14
Prevalence of the Most Common Cancers, by Sex, Canada, 2001

	Prevalence Count 15 Year			Prevalence Percentage of 2001 Population			Prevalence one in		
	Both	Males	Females	Both	Males	Females	Both	Males	Females
Breast	155,100	–	155,100	1.0	–	1.0	101	–	101
Prostate	113,600	113,600	–	0.7	0.7	–	135	135	–
Colorectal	102,500	51,000	51,500	0.3	0.3	0.3	303	301	304
Lung	36,200	18,000	18,200	0.1	0.1	0.1	857	854	860
Other Cancers	384,000	187,200	196,800	1.2	1.2	1.3	81	82	80
All Cancers	**791,400**	**369,800**	**421,600**	**2.6**	**2.4**	**2.7**	**39**	**42**	**37**

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

FIVE-YEAR RELATIVE SURVIVAL, 1995-1997

Population-based cancer survival rates provide one indication of the burden of cancer and in particular indicate the variation in severity of the different types of cancer. It should be noted, however, that differences in survival across geographic areas and across time might arise from variations in diagnostic techniques or in the use of early detection strategies, the availability and effectiveness of treatments, and differences in the cancers that occur in a specific population.

The prognosis of a cancer patient is influenced by host factors (e.g., age, sex, ethnicity, risk of death from other diseases), tumour-related factors (e.g., extent of disease, histologic subtype) and factors related to the cancer control program for that population (e.g., availability and quality of diagnosis and treatment services, quality and coverage of screening services). Because population-based survival estimates are based on the experiences of a heterogeneous group of people, they are useful "average" outcome indicators of the efficiency of health services and can be used for comparative purposes between populations or over time.[16] Comparison of survival estimates can help to identify gaps, establish priorities and suggest measures to improve patients' survival.[17] They do not necessarily reflect a person's chances of surviving for a given time (e.g., five years) after diagnosis nor do the accompanying confidence intervals represent the range of possible prognoses for individual patients.

Canadian five-year relative survival ratios (RSR) based on cases diagnosed from 1995 to 1997 and the cohort method of analysis are given in Table 15. The data are presented for all invasive cancers combined and for selected cancer sites in alphabetical order. Provincial age-standardized and national age-specific RSRs for colorectal, lung, breast, and prostate cancer (i.e., the four most commonly diagnosed cancer sites) are provided in Table 16 and Table 17 respectively.

The methodology for these analyses and the data presented here are a summary of more detailed survival analysis results published by Statistics Canada.[18] Data from Quebec have been excluded because its method of ascertaining the date of cancer diagnosis differs from the method for other registries; this makes it difficult to estimate the survival times. The territories are included in the national ratios but are not presented with the provincial RSRs because the numbers were too small to permit reliable age-standardization of RSRs. Some estimates for Prince Edward Island were also suppressed for this reason.

Relative survival is the preferred method for analyzing the survival of cancer patients in population-based studies. The five-year RSR for all invasive cancers combined was 59%. This implies that those diagnosed with cancer from 1995 to 1997 were 59% as likely to live for another five years as were comparable members of the general population. The corresponding five-year observed survival estimate (i.e., proportion of cases alive five years after diagnosis) was determined to be 51% (data not shown). Observed survival is not used as a parameter here because deaths from causes other than the disease of interest lower the observed survival proportion and preclude comparison of results between groups experiencing different general mortality.[19]

Five-year RSRs for ages 15–99 were highest for thyroid (95%) and testicular (95%) cancer followed by prostate (91%) and melanoma skin (90%) cancer (Table 15). Among men, the cancer sites with the best prognosis were testicular (95%), thyroid (91%), and prostate (91%); among women, thyroid (96%) and melanoma skin cancer (93%) were best. The lowest RSR was observed among those diagnosed with pancreatic cancer (6%) followed by cancers of the esophagus (13%) and lung and

bronchus (16%). While there was some variation in the actual RSRs, these sites and their relative order were the same among both sexes. For all invasive cancers combined, five-year relative survival was better among women (62%) than men (57%). For all of the sites analysed, survival was similar or superior for women with the notable exceptions of laryngeal (men: 68%; women 63%) and bladder cancer (men: 78%; women 74%).

Age-standardized RSRs for prostate cancer ranged from a low of 83% in Saskatchewan to a high of 92% in Ontario and British Columbia, estimates for Newfoundland and Labrador were considered to be artefactually high in general and such have been disregarded for all provincial comparisons (Table 16). The highest provincial age-standardized RSR for colorectal cancer was observed for Prince Edward Island (66%) and the lowest for Nova Scotia (56%); otherwise the RSRs ranged from 58% to 60%. Lung and bronchus cancer age-standardized RSRs were highest for Prince Edward Island and Ontario at 16%; lowest in Nova Scotia and New Brunswick at 13%. The highest provincial age-standardized RSR for breast cancer was observed for Prince Edward Island (91%); otherwise RSRs ranged from 85% to 88%.

Five-year RSRs were consistent across age groups for colorectal and breast cancer with one exception: at 78%, breast cancer relative survival was lowest among those diagnosed under the age of 40 (Table 17). The best prognosis after a diagnosis of prostate cancer, approximately 94%, was observed among those 50 to 69 years of age. For lung cancer, relative survival was highest in the youngest age group studied then decreased with increasing age. The five-year RSR for lung cancer decreased from 25% among those 20 to 39 years at diagnosis to 12% among those aged 70 to 99.

Relative survival is poorer, for many forms of cancer, among those diagnosed at an older age.[20,21] Potential explanations include less therapy as a result of a higher level of co-morbidity, a less favourable stage distribution, and less aggressive treatment (independent of co-morbidity) among older patients.[21]

There are several possible explanations for the observed variation in the provincial survival ratios. These include differential patterns of use and diffusion of screening and early detection technologies; varying patterns of diagnosis; availability and access to cancer treatment; and variations in registry reporting methods. Because of the lack of data on stage of disease at diagnosis and detailed information on methods of diagnosis, the extent to which these differences affected five-year relative survival ratios is not known. The possibility also exists that the inter-provincial differences are an artefact due to screening and/or early diagnosis, which may have inflated five-year survival ratios without any impact on the actual mortality from the cancer itself.[22] For example, it is likely that at least some of the variation in prostate cancer survival ratios among the provinces was due to differing ratios of PSA testing for prostate cancer screening, which will diagnose men at an earlier stage of the illness. Similarly, the use of mammography screening for breast cancer may be the source of some of the inter-provincial variation in breast cancer survival.

The inter-provincial differences must, therefore, be interpreted with caution. A recent study demonstrated that population-based, relative survival ratios are more closely associated with cancer incidence than mortality.[22] This implies that variation in relative survival ratios is more likely an indicator of variation in the disease that occurs and how it is detected, rather than how its outcomes are affected (for example, by treatment). This is of particular concern in the above survival comparisons, because disease stage was not available in the Canadian databases, thus the impact of the most

important prognostic factor could not be accounted for. Accordingly, an appropriate role for these results is that they serve to demonstrate the wide variation in disease severity. Even though the Canadian cancer surveillance system is one of the best in the world, the limitations of the available information also indicate that further improvements in data quality, completeness and access are needed. Only with such developments can the survival patterns be better understood and explained, which in turn can support the planning of an enhanced cancer control system.

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

Table 15

Five-year Relative Survival Ratio (%) (and 95% confidence interval) by Site and Sex, Canada excluding Quebec, Cases Diagnosed 1995 to 1997

	Relative Survival Ratio (%) (and 95% confidence interval)		
	Both Sexes	Males	Females
All Invasive Cancers	**59 (59-60)**	**57 (57-57)**	**62 (61-62)**
Bladder (including in situ)*	77 (76-79)	78 (77-80)	74 (72-76)
Brain	23 (22-25)	22 (20-24)	25 (23-27)
Breast	86 (85-86)	89 (82-95)	86 (85-86)
Cervix Uteri	72 (70-74)	–	72 (70-74)
Colorectal	60 (59-60)	59 (58-60)	60 (60-61)
Corpus Uteri	87 (86-88)	–	87 (86-88)
Esophagus	13 (11-14)	12 (10-14)	15 (12-18)
Hodgkin Lymphoma	85 (83-87)	85 (82-88)	86 (83-88)
Kidney and Renal Pelvis	65 (63-66)	64 (62-66)	66 (64-68)
Larynx	67 (64-69)	68 (65-70)	63 (57-69)
Leukemia	46 (45-47)	46 (44-48)	45 (43-48)
Lung and Bronchus	16 (15-16)	14 (14-15)	18 (17-18)
Multiple myeloma	31 (29-33)	31 (28-33)	32 (29-35)
Non-Hodgkin Lymphoma	56 (55-58)	53 (52-55)	60 (59-62)
Oral (buccal cavity and pharynx)	62 (61-63)	61 (60-63)	63 (61-66)
Ovary	38 (37-40)	–	38 (37-40)
Pancreas	6 (6-7)	6 (5-7)	7 (6-8)
Prostate	91 (91-92)	91 (91-92)	–
Skin Melanomas	90 (89-91)	87 (85-88)	93 (92-95)
Stomach	23 (22-24)	20 (19-22)	27 (25-30)
Testis	95 (94-96)	95 (94-96)	–
Thyroid	95 (94-96)	91 (88-93)	96 (95-97)

– Not applicable

* Ontario does not currently report in situ bladder cases.

Note: The differences in site definitions with other sections can be found in *Appendix II: Methods*.

Source: Statistics Canada. Cancer Statistics - Cancer Survival Statistics.Ottawa: Health Statistics Division,Catalogue 84-601-XIE – No. 001,2005. (Available at: http://www.statcan.ca/english/freepub/84-601-XIE/2005001.htm).

Table 16

Age-Standardized Five-year Relative Survival Ratio (%) (and 95% confidence interval) by Sex and Province for Selected Sites, Cases Diagnosed 1995 to 1997

		Relative Survival Ratio (%) (and 95% confidence interval)			
		Colorectal	Lung	Breast	Prostate
Both Sexes	**Canada**	**60 (59-61)**	**15 (15-16)**	**86 (86-87)**	**91 (90-91)**
	N.L.*	69 (65-74)	20 (16-23)	87 (83-90)	92 (87-97)
	P.E.I.**	66 (57-73)	16 (12-21)	91 (85-97)	90 (84-96)
	N.S.	56 (52-59)	13 (12-15)	85 (83-88)	90 (87-93)
	N.B.	58 (55-62)	13 (11-15)	85 (82-87)	91 (88-94)
	Ont.	60 (59-61)	16 (16-17)	86 (85-87)	92 (91-93)
	Man.	58 (55-61)	15 (13-17)	87 (85-89)	89 (87-91)
	Sask.	60 (57-63)	14 (12-16)	88 (86-90)	83 (80-85)
	Alta.	59 (57-61)	14 (13-15)	85 (83-86)	88 (86-89)
	B.C.	60 (58-62)	14 (13-15)	87 (86-88)	92 (91-94)
Males	**Canada**	**59 (58-60)**	**14 (13-15)**	**–**	**91 (90-91)**
	N.L.*	72 (66-78)	18 (15-22)	–	92 (87-97)
	P.E.I.**	–	11 (6-19)	–	90 (84-96)
	N.S.	58 (53-62)	12 (10-15)	–	90 (87-93)
	N.B.	58 (53-63)	12 (10-14)	–	91 (88-94)
	Ont.	60 (59-61)	15 (15-16)	–	92 (91-93)
	Man.	56 (52-60)	12 (10-15)	–	89 (87-91)
	Sask.	58 (54-62)	12 (10-15)	–	83 (80-85)
	Alta.	59 (56-62)	12 (11-14)	–	88 (86-89)
	B.C.	58 (55-60)	13 (12-14)	–	92 (91-94)
Females	**Canada**	**61 (60-62)**	**17 (17-18)**	**86 (86-87)**	**–**
	N.L.*	67 (61-72)	23 (17-30)	87 (83-90)	–
	P.E.I.**	–	22 (14-31)	91 (85-96)	–
	N.S.	54 (50-58)	14 (12-17)	85 (83-88)	–
	N.B.	59 (54-64)	14 (11-17)	85 (82-87)	–
	Ont.	61 (60-62)	18 (17-19)	86 (85-87)	–
	Man.	59 (55-63)	18 (15-21)	87 (85-89)	–
	Sask.	62 (57-66)	16 (13-20)	88 (86-90)	–
	Alta.	61 (57-64)	17 (15-19)	85 (83-86)	–
	B.C.	63 (60-65)	16 (14-17)	87 (85-88)	–

– Not applicable or estimates not available

* NL suvival ratios were considered to be artefactually high in general. The reason for this bias is not apparent.

** All expected survival proportions for Prince Edward Island were derived from Canadian life tables as stable estimates for single ages could not be produced for these areas because of small population counts. Relative survival estimates for Prince Edward Island may be biased to the extent and direction that general population expected survival differed between this province and Canada as a whole.

Note: The differences in site definitions with other sections can be found in *Appendix II: Methods*.

Source: Statistics Canada. Cancer Statistics - Cancer Survival Statistics. Ottawa: Health Statistics Division, Catalogue 84-601-XIE – No. 001, 2005. (Available at: http://www.statcan.ca/english/freepub/84-601-XIE/2005001.htm).

Table 17

Five-year Relative Survival Ratio (%) (and 95% confidence interval) by Age Group for Selected Sites, Cases Diagnosed 1995 to 1997, Canada excluding Quebec

	Relative Survival Ratio (%) (and 95% confidence interval)				
	20-39	40-49	50-59	60-69	70-99
Colorectal	61 (57-65)	61 (59-64)	61 (59-62)	61 (59-62)	59 (58-60)
Lung	26 (22-30)	20 (18-22)	19 (18-20)	17 (16-17)	12 (12-13)
Breast	78 (76-79)	85 (84-86)	87 (86-88)	88 (87-89)	86 (85-87)
Prostate	–	85 (81-89)	93 (92-94)	95 (94-95)	88 (87-89)

– Estimates not available

Note: The differences in site definitions with other sections can be found in *Appendix II: Methods*.

Source: Statistics Canada. Cancer Statistics - Cancer Survival Statistics. Ottawa: Health Statistics Division, Catalogue 84-601-XIE – No. 001, 2005. (Available at: http://www.statcan.ca/english/freepub/84-601-XIE/2005001.htm).

CANCER IN CHILDREN AND YOUTH

Table 18 shows the number of new cases of cancer with age-standardized incidence rates, and the number of deaths due to cancer with age-standardized mortality rates (1997-2001) for Canadian children and youth aged 0-19. For these periods, cancer was diagnosed in an average of 1,285 children every year, and 227 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 17% of new cases and 8% of deaths.

Figure 11 shows the rank order of nine causes of premature death among Canadian children and youth in 2002, in terms of the number of potential years of life lost (PYLL). 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 2002 was 12,878 years.

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, indicating that the number of deaths was less than the one-fifth the number of cases. The highest ratios (> 0.25) were found in children with liver (hepatic) cancer, tumours of the sympathetic nervous system (primarily neuroblastoma), tumours of bone, and 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 (0.20), particularly rhabdomyosarcoma (0.25), also have a relatively poor prognosis. The ratio for acute non-lymphocytic leukemia (0.37) was much higher than that observed for acute lymphocytic leukemia (0.11), 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 50 years ago,[23] currently, approximately 80% of Canadian children and teenagers with acute lymphoblastic leukemia are alive five years after diagnosis.[24] 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.

Table 18

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, 1997-2001

Diagnostic Group[2]	New cases (1997-2001)[1]		ASIR per 1,000,000 per year	Deaths (1997-2001)		ASMR per 1,000,000 per year	Deaths/ Cases Ratio
	Number	%		Number	%		
Leukemia	**1,653**	**25.7**	**42.5**	**337**	**29.6**	**8.49**	**0.20**
Acute lymphocytic	1,255	19.5	32.3	138	12.1	3.45	0.11
Acute non-lymphocytic	264	4.1	6.8	97	8.5	2.44	0.37
Brain and Spinal	**1,086**	**16.9**	**27.4**	**285**	**25.1**	**7.17**	**0.26**
Astrocytoma	498	7.7	12.5	75	6.6	1.85	0.15
Primitive neuroectodermal	246	3.8	6.3	74	6.5	1.88	0.30
Ependymoma	87	1.4	2.3	29	2.6	0.74	0.33
Lymphoma	**1,082**	**16.8**	**26.4**	**91**	**8.0**	**2.22**	**0.08**
Hodgkin lymphoma	587	9.1	14.2	14	1.2	0.34	0.02
Non-Hodgkin lymphoma	486	7.6	12.0	77	6.8	1.88	0.16
Carcinoma	**554**	**8.6**	**13.4**	**31**	**2.7**	**0.77**	**0.06**
Thyroid	221	3.4	5.3	1	0.1	0.02	0.00
Melanoma	151	2.3	3.7	2	0.2	0.05	0.01
Germ Cell and Other Gonadal	**440**	**6.8**	**10.9**	**26**	**2.3**	**0.64**	**0.06**
Gonadal germ cell tumours	274	4.3	6.7	5	0.4	0.12	0.02
Soft Tissue	**386**	**6.0**	**9.7**	**77**	**6.8**	**1.95**	**0.20**
Rhabdomyosarcoma	150	2.3	3.8	38	3.3	0.96	0.25
Fibrosarcoma	68	1.1	1.7	5	0.4	0.12	0.07
Bone	**346**	**5.4**	**8.4**	**103**	**9.1**	**2.50**	**0.30**
Osteosarcoma	170	2.6	4.1	57	5.0	1.38	0.34
Ewing's sarcoma	130	2.0	3.2	40	3.5	0.97	0.31
Sympathetic Nervous System	**325**	**5.1**	**8.9**	**90**	**7.9**	**2.29**	**0.28**
Neuroblastoma	307	4.8	8.5	90	7.9	2.29	0.29
Renal Tumours	**286**	**4.4**	**7.6**	**42**	**3.7**	**1.05**	**0.15**
Wilm's tumour	263	4.1	7.0	35	3.1	0.87	0.13
Retinoblastoma	**105**	**1.6**	**2.9**	**2**	**0.2**	**0.05**	**0.02**
Hepatic Tumours	**72**	**1.1**	**1.9**	**26**	**2.3**	**0.67**	**0.36**
Other Cancers	**92**	**1.4**	**2.4**	**27**	**2.4**	**0.70**	**0.29**
Total (5 years)	**6,427**	**100.0**	**162.4**	**1,137**	**100.0**	**28.50**	**0.18**
Average Per Year	**1,285**			**227**			

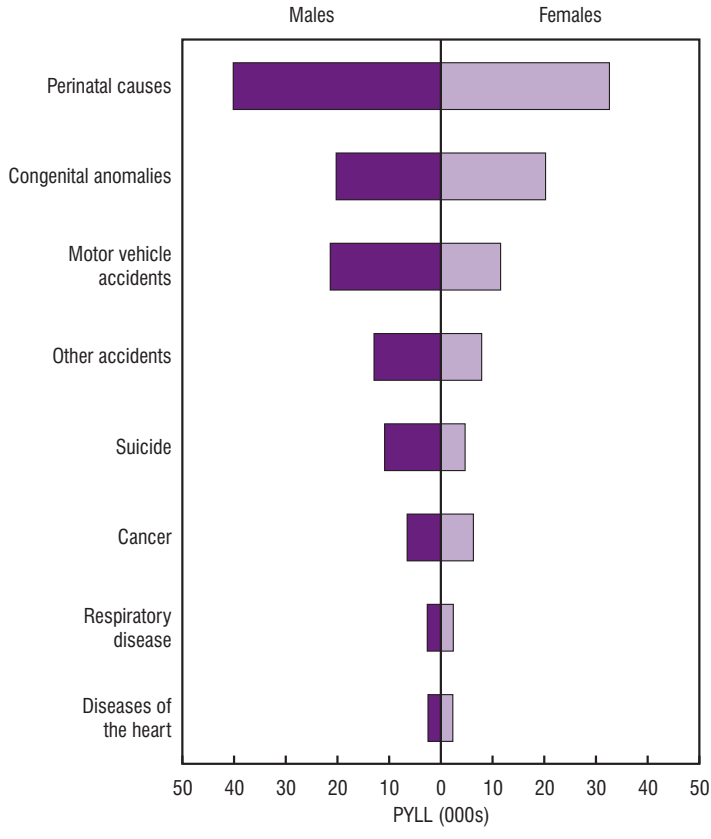
[1] Data are shown for the most recent five-year period available and exclude non-melanoma (basal and squamous) skin cancer and in-situ carcinomas except bladder. Data are grouped according to the International Classification Scheme for Childhood Cancer, World Health Organization (1996) and ranked by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

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

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

Figure 11

Leading Causes of Potential Years of Life Lost (PYLL) Among Children and Youth Aged 0-19, Canada, 2002



Note: Figures are ranked in order of total PYLL for both males and females combined and are calculated based on life expectancy. See *Appendix II: Methods* for details.

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

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

Introduction

This special topic builds on existing knowledge about population–based cancer screening programs in Canada. The information is presented in two sections that differentiate population-based screening interventions for which scientific evidence exists to support a reduction in mortality, from those where evidence is insufficient at present. It also provides information, where available, about current *organized* and *opportunistic* (less coordinated, or ad hoc, screening) and builds on information provided by Health Canada's publication, *Progress Report on Cancer Control in Canada,* as well as peer-reviewed, published literature, screening program reports and national surveys. Because surveys rely on self-report, estimates of screening participation from surveys may be higher than those from provincial screening program databases. This can happen if individuals with symptoms suggestive of cancer mistakenly report having had a screening rather than a diagnostic test, or if a screening test is done outside of the provincial organized screening program and is thus not included in a provincial screening database. There is also evidence that survey respondents underestimate the time since last test (e.g., they might report that their last test was within the past 2 years when it was actually 3 years ago).[1] This would also lead to overestimation of screening participation using survey data.

Population-based cancer screening programs are intended to detect cancer or precancerous conditions in asymptomatic individuals. The goal of cancer screening is to reduce the cancer death rate and, by detecting cancer early before signs or symptoms of cancer appear, improve the likelihood of successful treatment. However, because screening involves subjecting apparently healthy individuals to potential risk, population-based screening programs are recommended only when: a) the screening test has been shown to reduce mortality; b) the screening test is able to detect the disease in a pre-clinical phase; c) the test is able to accurately predict when cancer does exist (high sensitivity) and when it does not exist (high specificity); d) the test is considered safe and does not subject an individual to an unacceptable level of risk; and e) if a cancer is identified through screening, effective treatment is available. Once these criteria have been met, other factors may be considered before evidence-based population level screening is implemented, such as the acceptability of the test, the cost of the intervention, and the extent to which there is sufficient capacity in the system to not only perform the screening test, but to also provide follow-up diagnostic confirmation and treatment for those with abnormal test results.

Population-based screening is most effective and cost-efficient when offered through an *organized* screening program that incorporates all elements of the screening process, including evidence-based screening and follow-up guidelines and recruitment and retention strategies to maximize participation, as well as comprehensive quality assurance and information systems that support optimal program operation, monitoring and evaluation. Screening provided outside the context of an *organized* screening program is often referred to as "opportunistic" or "ad hoc" screening, and in Canada would involve at least some of the components of an organized program. However, lack of full organization may result in suboptimal program operation, performance and resource efficiency.

PROGRESS IN CANCER CONTROL: SCREENING

Scientific evidence currently supports population-based screening for cervical, breast and colorectal cancers (Table 19). Although there is some variation around screening interval and target population, all Canadian jurisdictions adhere to the basic breast and cervical recommendations. There are no provincial colorectal cancer screening programs. Although screening is generally recommended for all average risk individuals in the specified target population (i.e., men and women aged 50 and over for colorectal cancer), some population subgroups are less likely to participate than others. While the specific determinants of screening participation may vary among these three cancers, in general those who are of lower socioeconomic status, live in rural areas or are recent immigrants are less likely to be screened.[2,3]

Cancers with sufficient evidence for population-based screening

Cervical cancer

In 2006, there will be an estimated 1,350 new cases of cervical cancer and 390 cervical cancer-related deaths in Canada. Although cervical cancer incidence rates in Canada have decreased from 15.4 per 100,000 in 1977 to an estimated 7.5 per 100,000 in 2006, it remains the 11th most common cancer diagnosis in Canadian women and the 13th most common cancer-related cause of death (Table 8.1).

The Pap test, which involves scraping some cells from the surface of the cervix with a spatula and/or brush, placing them on a slide and examining the slide under a microscope, has been available in Canada as a screening test for cervical cancer for over 50 years. The Pap test can identify both precancerous lesions, which can then be treated so that cancer does not develop, and cancers at an early presymptomatic stage when treatment is most effective. Screening for cervical cancer has resulted in substantial reductions in both incidence and mortality rates, as noted above, as well as slight improvements in survival.

British Columbia launched the country's first cervical cancer screening program in 1949 with many of the components of an organized program.[4] Other provinces vary considerably in the extent of organization, but all are moving towards having more organized programs. An expert review conducted by the International Agency for Research on Cancer (IARC) concluded that even without a fully organized screening program, there is sufficient evidence of effectiveness of cervical cancer screening when offered within a high quality program. The IARC report noted, however, that screening in well-organized programs is more cost-effective, with less harm due to over-screening and over-treatment, compared to opportunistic screening.[5]

Some jurisdictions in Canada are now recommending use of liquid-based cytology (LBC), a variant of the conventional Pap test which offers some advantages over it. LBC has greater sensitivity, equivalent specificity and a higher proportion of satisfactory specimens, and offers the potential to test for human papilloma virus (HPV) DNA as well as precancerous lesions.[6] High risk (oncogenic) types of HPV represent the primary cause of cervical cancer. HPV DNA analysis is increasingly recommended for triage of women whose initial test result is equivocal (e.g., atypical cells of unknown significance), especially if the initial test used LBC.[6,7] This test helps to differentiate women who might benefit from additional examination of the cervix from those who might not.

The proportion of Canadian women aged 18-69 who have not had a hysterectomy (and are therefore at risk of cervical cancer) who reported in 2003 that they had had a Pap test within the previous three years is 79% (Figure 12.1). This ranges from lows of 70% in Nunavut and 76% in Quebec to highs of 85% and 88% in New Brunswick and Yukon, respectively (Figure 12.1). It is possible that because of the long history of high quality cervical cancer screening in Canada, the benefit achieved to date may be close to maximal. However, there is room for some improvement in screening implementation (e.g., inclusion of more components of an organized program, use of better technology, and reduction of overscreening) that could translate into still lower incidence and mortality rates. Much of any additional benefit would be expected to accrue to those at highest risk of cervical cancer.

Breast Cancer

Breast cancer is the most common cancer diagnosed in Canadian women and is second only to lung cancer as the most common cause of cancer death among women in this group. In 2006, an estimated 22,200 women will be diagnosed with the disease and 5,300 will die from breast cancer (Table 1). Just over 50% of all breast cancer cases occur in women between the ages of 50 and 69 (Table 11).

Screening recommendations in Canada include a biennial mammogram (usually a two-view X ray) of the breast and clinical breast examination (CBE) in asymptomatic women aged 50-69 years of age.[8,9] Current evidence suggests that such screening could reduce breast cancer mortality by as much as 25%[10] when participation is high and when all programmatic elements are implemented over a prolonged period of time. Since the majority of studies evaluating mammography have included CBE, it is difficult to know the precise contribution of CBE to the reduction in mortality that has been observed. There is insufficient evidence to indicate that mammography screening in women younger than 50 or over 69 has a significant mortality benefit. As a result, screening recommendations for women in these age groups remain controversial. The value of screening mammography in women 40-49 is currently being investigated in a large trial in the United Kingdom. Preliminary results suggest that there may be a mortality reduction associated with screening in this age group but it is likely considerably less than that for 50-69 year old women.[11]

By 2003, every province and territory (with the exception of Nunavut) had an organized program offering biennial mammography screening to asymptomatic women between the ages of 50-69 with no previous history of breast cancer. Although none of the organized programs have achieved the nationally established target of 70% participation (Figure 12.2), the proportion of women in organized screening has increased over time, reaching 34% nationally by 2002.[12] Increased participation in organized screening programs is likely the result of more effective awareness and recruitment campaigns, and greater emphasis on providing access to screening, such as through mobile mammography units. About 61% of women aged 50-69 reported having recent* screening mammography in 2003 (Figure 12.3), a considerable increase from the 53% reported in 2000/01. Similar rises were noted in all provinces/territories except Nunavut. In some provinces, many more women report having had a screening test than are reported by the corresponding provincial programs in the same year (e.g., in 2000/01, 54% of Ontario women aged 50-69 reported having had a

* Within the last two years.

recent mammogram while the organized screening program included only 22% of women in the target age range). This is likely because screening mammography is also available through centres not affiliated with organized programs.

Women reporting health care barriers (e.g., not having a regular physician or any medical consultations during the year before the survey), who live in rural areas, have lower educational attainment, or were born in Asia are less likely to have had a mammogram.[13] Interestingly, longitudinal data suggest that previously underserved groups of Canadian women (e.g., those with lower educational levels or born outside of Canada) were most likely to initiate mammography use, particularly between 1994-1996.[14]

Colorectal Cancer

Colorectal cancer is the third most common cancer diagnosed in both men and women in Canada. It is the second most common cancer-related cause of death for men and the third most common for women, with an estimated 4,600 deaths in men and 3,900 deaths in women in 2006 (Table 1). Of the 20,000 new cases of colorectal cancer in 2006, approximately 90% will be diagnosed in men and women over the age of 50 (Table 11).

The fecal occult blood test (FOBT) involves placing a small sample of feces on a card, to which a chemical solution is added. If occult (which means "hidden" or "difficult to see") blood is identified, further testing is required to determine the source of the bleeding. Regular screening with FOBT can reduce colorectal cancer death rates by between 15% and 33%.[15-18] In Canada, an estimated 17% reduction in colorectal cancer mortality could be achieved if 7 of every 10 Canadians aged 50-74 had a biennial FOBT.[19] In addition, FOBT screening may reduce the incidence of colorectal cancer by detecting blood in the stool from precancerous polyps. Once identified, these polyps can be removed through colonoscopy or sigmoidoscopy before they become cancerous. Although other cancer screening interventions exist (i.e., colonoscopy and flexible sigmoidoscopy), the risks are higher than for FOBT screening. For example, colonoscopy is associated with a small but increased risk of serious complications, such as bowel perforation (10/10,000 procedures), major hemorrhage (30/10,000) and death (1-3/10,000).[20]

Data on the use of colorectal cancer screening are available from survey data for only a few regions, since Canadian Community Health Survey (cycle 2.1) questions regarding colorectal cancer were administered only in British Columbia, Newfoundland and Labrador (in both cases covering the entire population), Saskatchewan (63% of the population) and Ontario (27%; Toronto not included).[19] Given that the population demographics for surveyed regions may not be representative of the Canadian population, caution must be used when interpreting results nationally (or provincially for Saskatchewan and Ontario), since they may not accurately reflect average colorectal cancer screening practice across Canada.

The prevalence of recent* FOBT screening is low in Canadians aged 50 and over, especially women and residents of Newfoundland and Labrador (Figure 12.4), ranging from 4% of women in Newfoundland and Labrador to 13-14% of men in British Columbia, Saskatchewan and Ontario. Survey respondents were more likely to report a recent FOBT if they had a regular medical doctor, exercised regularly, and did not smoke.

* Within the last two years.

Cancers with insufficient evidence for population-based screening

Prostate Cancer

Prostate cancer is the most common cancer diagnosed in Canadian men and the third most common cancer-related death. In 2006, there will be an estimated 20,700 newly diagnosed cases and 4,200 deaths attributable to prostate cancer in Canada. Of these, more than 98% of prostate cancer cases are diagnosed in men 50 years of age or older (Table 11).

There is no evidence-based screening test recommended for the early detection of prostate cancer, although the prostate specific antigen (PSA) test is often used for this purpose. The PSA test involves measurement in blood of a substance produced by prostate cells. There are two reasons why screening with the PSA test remains controversial: first, it does not discriminate between cancers that require treatment from those that do not (as a result, once a cancer is diagnosed, men may face unnecessary treatment with known risks, including impotence, urinary incontinence and death); second, while early detection of prostate cancer may help to make treatment more effective, there is an insufficient body of scientific evidence to indicate that screening will reduce the number of prostate cancer deaths.

The U.S. Preventive Services Task Force recently concluded that there is insufficient evidence for or against routine prostate cancer screening with either the PSA test or digital rectal examination (DRE). The U.S. Task Force found good evidence that PSA testing helps to identify early prostate cancer, but did not find sufficient evidence to indicate that early detection improves health outcomes (most notably, mortality). However, a number of organizations in Canada have established prostate cancer screening recommendations that reflect the importance of shared, informed decision-making in light of ambiguous scientific data to support population-level interventions. The Prostate Cancer Forum's 1993 recommendation that men over the age of 50 should discuss with their doctor the potential benefits and risks of early detection of prostate cancer using the PSA test and DRE continues to reflect scientific opinion that definitive evidence about the value of testing for early prostate cancer is insufficient to recommend that average-risk men undergo regular screening. Two large screening trials in Europe and the United States are evaluating whether PSA screening reduces prostate cancer death rates.

As with colorectal cancer screening, only some regions collected data on use of the PSA test during the CCHS; caveats to interpretation as noted for FOBT screening therefore also apply. In spite of a lack of evidence to support population level prostate cancer screening, the life-time prevalence of PSA screening in men aged 50 and older was found to be greater than 47% in 2000-01.[21] In 2003, between 15% and 27% of men aged 40 and over, reported having had a screening PSA test in the previous 12 months (Figure 12.5). This varied by age as well as province/territory/region, from 9% of men aged 40-49, to about 35% of men aged 60-69 (Figure 12.6). An additional 10-20% of men had a recent PSA test to help diagnose or rule out prostate cancer or monitor disease treatment and progression.

Other cancers

There is insufficient evidence to indicate that population-based screening for other cancers using currently available screening tests will provide benefit via reduced mortality. Furthermore, performance of screening tests can result in harm.

For example, research suggests that population-based lung cancer screening using X-rays, with or without sputum cytology, is associated with a high false-positive rate (the incorrect identification of cancer which does not exist), that can result in unnecessary and invasive follow-up testing, and has not been shown to reduce lung cancer mortality.[22] Similarly, studies investigating the potential use of biomarkers (e.g., CA125) or routine clinical investigations (e.g., pelvic examinations, transvaginal ultrasound, or CT scans) for early detection of ovarian cancer have not been associated with a reduction in ovarian cancer mortality, but do increase the likelihood of invasive surgery.[23] Consequently, though there are a number of randomized controlled trials comparing screening modalities for lung cancer in particular, there are currently no national screening recommendations for either lung or ovarian cancer in healthy asymptomatic individuals.

Implications

Although there is continued progress in many aspects of organized population-based screening in Canada, participation remains sub-optimal. Less than 80% of women at risk of cervical cancer have had a Pap test within the last three years; none of the provincial organized mammography screening programs meet nationally accepted targets for recruitment of women between the ages of 50 and 69; and there was no organized population-based colorectal screening program anywhere in the country at the time this report was written. As a result, reductions in incidence and mortality for these cancers are not being fully realized. In contrast, more than three times more men have been screened for prostate cancer than for colorectal cancer, despite the equivocal recommendations for routine prostate cancer screening and the evidence-based recommendations supporting colorectal cancer screening.

Achieving maximal benefit from screening at the individual, organizational, and system levels will require a multi-pronged approach. First, Canada must strengthen its capacity to review scientific evidence and develop judicious health policy recommendations. Second, adequate funding and support must be provided for population-level screening programs that are based on a sufficient body of scientific evidence. For example, additional resources may be required to reach underserved populations, train health-care professionals (e.g., colonoscopists to provide follow-up for individuals with positive FOBT's), or to more efficiently and effectively coordinate screening and follow-up testing. Third, there is a need to identify effective screening tests for those cancers for which insufficient evidence exists to support a population-level program. The ongoing evaluation of prostate cancer screening with PSA testing and lung cancer screening with CT scans is particularly warranted, nearly 24,000 Canadian men and women die every year from these two cancers. An integrated approach, including a greater emphasis on the translation of scientific evidence into policy in a supportive and sufficiently resourced environment, may reduce overall costs through appropriate screening (e.g., neither too often nor not often enough) and by identifying disease at an earlier stage when treatment tends to be more effective.

The complexity of the effort required to augment Canada's screening programs would be best served if addressed collaboratively, comprehensively, and in consideration of the needs of individuals in communities across Canada. The Canadian Strategy for Cancer Control will bring provincial and federal leaders, members of the Canadian public, and organizations with a mandate in cancer control together to address these

issues. Complementary efforts within provincial programs will enhance the impact of cancer screening, and offer the potential to significantly reduce the burden of cancer in Canada.

Cancer screening offered in the context of an organized program has the potential to significantly reduce incidence (cervical and colorectal cancer) and mortality rates (cervical, breast and colorectal cancers). However, participation is low in existing screening programs and there is not yet an organized screening program for colorectal cancer anywhere in Canada. More effective utilization of evidence-based screening, and additional research to identify effective screening tests for which none currently exist (lung and ovarian cancer) will enhance our ability to reduce the burden of cancer in Canada.

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Table 19

Evidence-based Recommendations for Population-based Cancer Screening[1]

Cancer	Screening intervention[2]	Target population[2]	Source of evidence review	Comments
Cervix	Pap test or liquid based cytology[3] annually until two normal test results, then every 1-3 years.	Women, from onset of sexual activity until age 69.	Canadian Task Force on Preventive Health Care (1994); U.S. Preventive Services Task Force (2003)	
Breast	Mammography and clinical breast examination every 2 years.	Women aged 50-69	Canadian Task Force on Preventive Health Care (1994), U.S. Preventive Services Task Force (2002)	Evidence does not support inclusion or exclusion of women aged 40-49 or over 70 in population-based screening program.
Colorectal	Fecal Occult Blood Testing at least every two years	Men and Women aged 50+	Canadian Task Force on Preventive Health Care (2001), Canadian National Committee on Colorectal Cancer Screening (2002); U.S. Preventive Services Task Force (2002);	

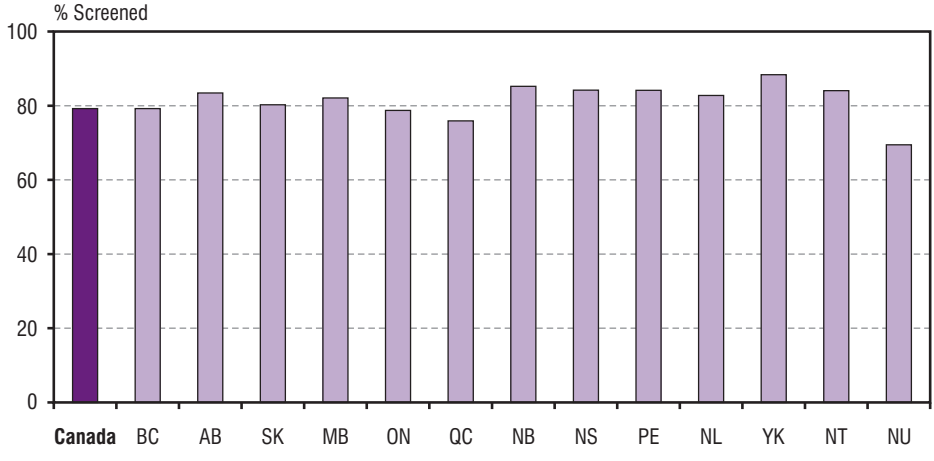
[1] Recommendations apply to those at average risk of the disease; for diseases where subgroups have been identified as having significantly higher than average risk, different screening ages, manoeuvres and/or intervals may be recommended.

[2] Specific programmatic recommendations for screening interval and target population may vary slightly among provinces/territories and sources.

[3] Liquid-based cytology is a variant of the Pap test that has some advantages, such as improved sensitivity, equivalent specificity and higher rate of satisfaction specimens. As well, it facilitates triage HPV DNA testing.

Figure 12.1

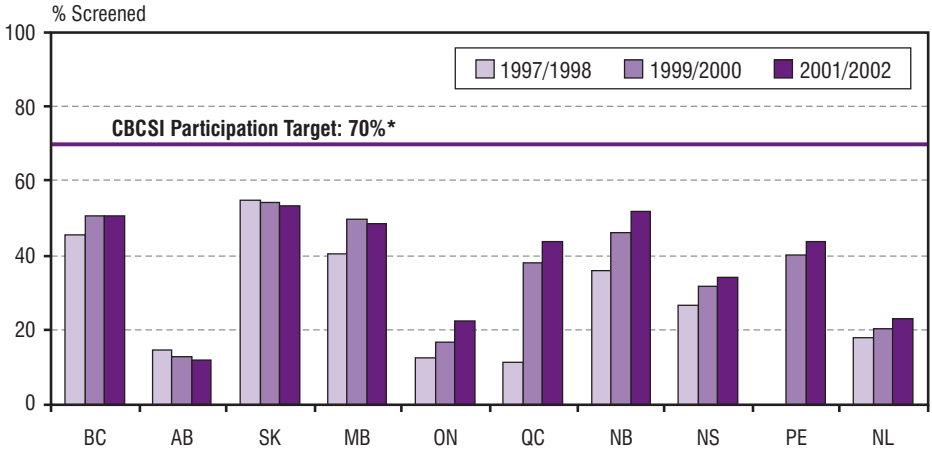
Cervical Cancer Screening: Percentage of Women Aged 18-69 Years Reporting a Screening Pap Test Within the Last 3 Years, by Province/Territory, 2003



Source: 2003 Canadian Community Health Survey (CCHS) cycle 2.1, Statistics Canada.
Directly age-standardized to the 2003 CCHS female population aged 18-69.
Respondents reporting hysterectomy were excluded.

Figure 12.2

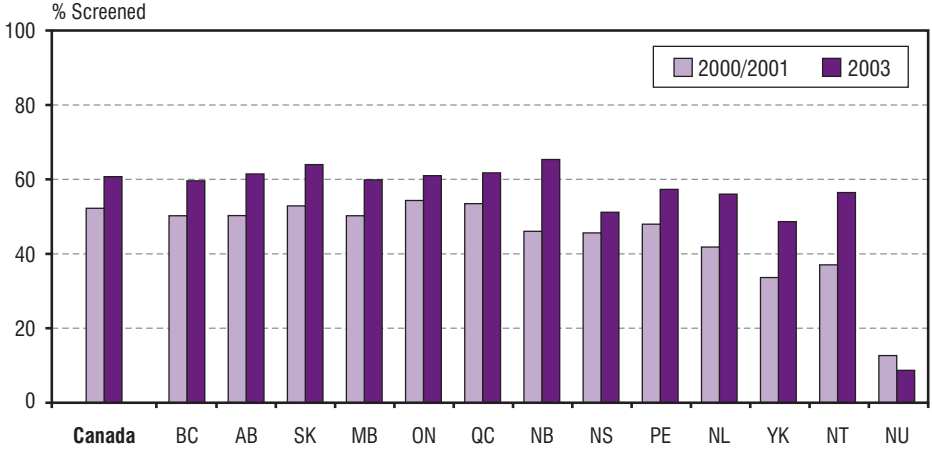
Breast Cancer Screening: Percentage of Women Aged 50-69 Years Participating in an Organized Program, by Province/Territory, 1997/1998 to 2001/02



Source: Organized Breast Cancer Screening Programs in Canada, 1997/1998, 1999/2000 & 2001/2002 reports
* Canadian Breast Cancer Screening Initiative (CBCSI)
Note: Organized screening program is also available in YK and NT but data were not available.

Figure 12.3

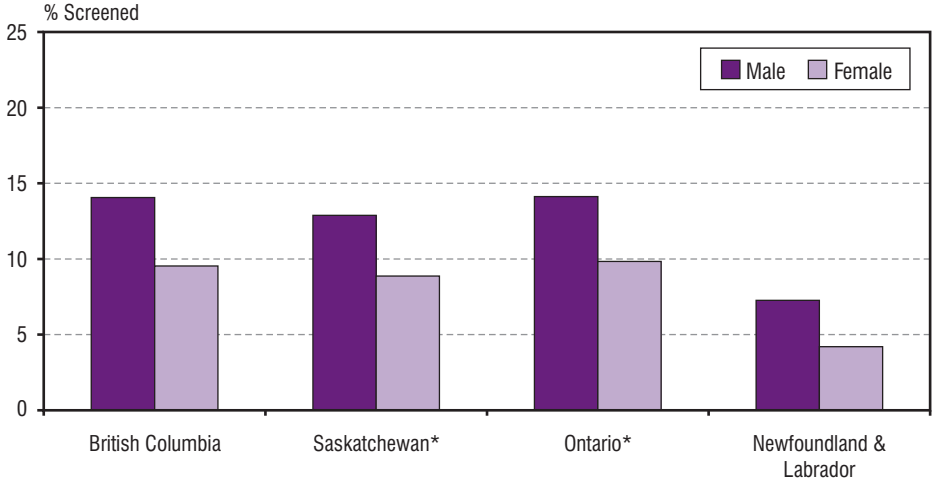
Breast Cancer Screening: Percentage of Women Aged 50-69 Years Reporting a Screening Mammogram Within the Last 2 Years, by Province/Territory, 2000/2001 and 2003



Source: 2000/2001 & 2003 Canadian Community Health Surveys (cycles 1.1 & 2.1), Statistics Canada

Figure 12.4

Colorectal Cancer Screening: Percentage of Men and Women Aged 50 Years and Over Reporting a Screening Fecal Occult Blood Test (FOBT) Within the Last 2 Years, by Province (BC, NL) or Selected Regions (Within SK, ON)*, 2003

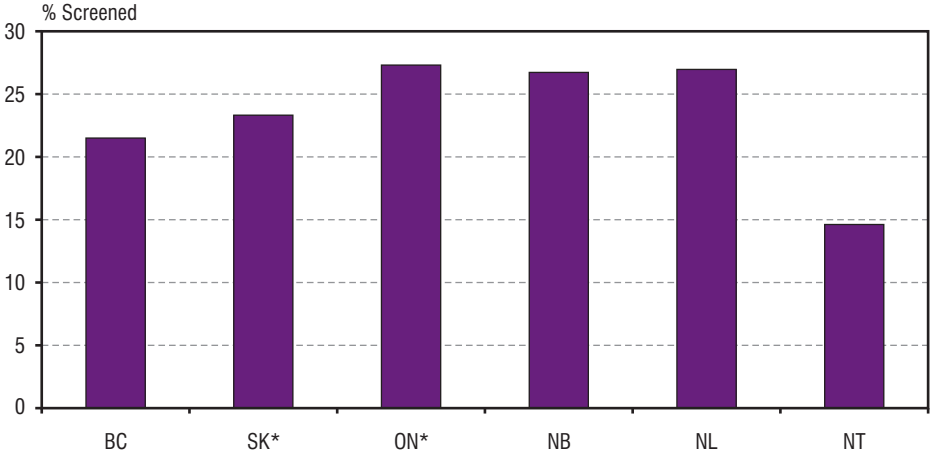


Source: 2003 Canadian Community Health Survey (CCHS) cycle 2.1, Statistics Canada.
Directly age-standardized to the 2003 CCHS population aged 50+.
Respondents reporting colorectal cancer were excluded.

* Based on selected sampling units (regions) where relevant data were collected: 7 of 11 units in Saskatchewan (63% of SK population) and 14 of 37 units in Ontario (27% of ON population; Toronto not included)

Figure 12.5

Prostate Cancer Screening: Percentage of Men Aged 40 Years and Over Reporting a Screening Prostate Specific Antigen (PSA) Test Within the Past 12 Months, by Province/Territory (BC, NB, NL, NT) or Selected Regions (SK, ON)*, 2003

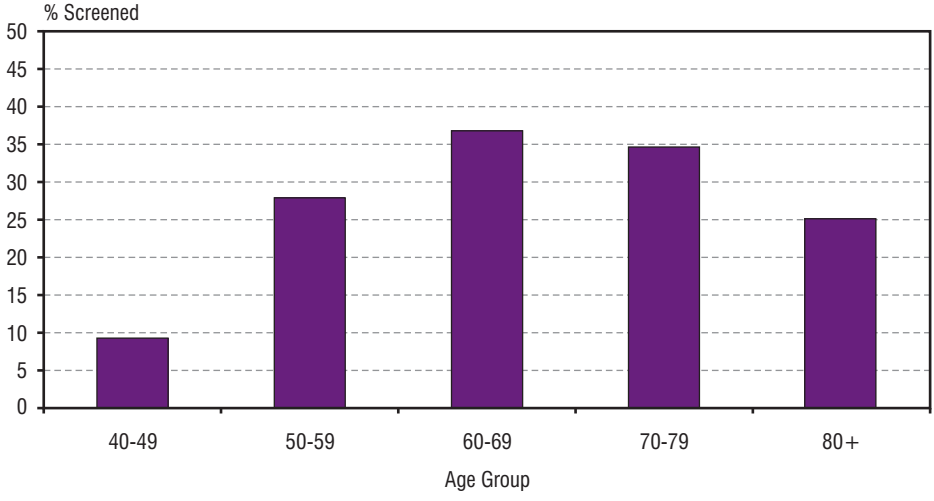


Source: 2003 Canadian Community Health Survey (CCHS) cycle 2.1, Statistics Canada.
Directly age-standardized to the 2003 CCHS male population aged 40+.
Respondents reporting prostate cancer were excluded.

* Based on selected sampling units (regions) where relevant data were collected: 1 of 11 units in Saskatchewan (Regina Health Region only, 25% of SK population) and 24 of 37 units in Ontario (51% of ON population; Toronto not included)

Figure 12.6

Prostate Cancer Screening: Percentage of Men Aged 40 Years and Over Reporting a Screening Prostate Specific Antigen (PSA) Test in the Past 12 Months, by Age Group*, 2003



Source: 2003 Canadian Community Health Survey, cycle 2.1, Statistics Canada.
Respondents reporting prostate cancer were excluded.

* Based on all respondents in BC, NB, NL and NT and on those in selected sampling units in SK and ON (see Figure 12.5)

GLOSSARY

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

ICDO-3 International Classification of Diseases for Oncology, Third Edition.[25]

ICD-10 International Statistical Classification of Diseases and Related Health Problems, Tenth Revision.[26]

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

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

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

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

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

Relative survival ratio The ratio of the observed survival for a group of cancer patients to the survival that would have been expected for members of the general population, assumed to be practically free of the cancer of interest, who have the same main factors affecting patient survival (e.g., sex, age, area of residence) as the cancer patients. Estimates of the relative survival ratio greater than 100% are possible and indicate that the observed survival of the cancer patients is better than that expected from the general population.

Sensitivity The proportion of truly diseased persons in the screened population who are identified as diseased by the screening test. Sensitivity is a measure of the probability of correctly diagnosing a case, or the probability that any given case will be identified by the test.

Specificity The proportion of truly non-diseased persons who are so identified by the screening test. It is a measure of the probability of correctly identifying a non-diseased person with a screening test.

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, 1977, is set at 1. Index values for subsequent years are derived by dividing the age-standardized rate for that year by the 1977 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.[27]

1991 Canadian Population/World Standard Population

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

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

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

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	C15	C15
Stomach	C16	C16
Colorectal	C18-C21,C26.0	C18-C21,C26.0
Pancreas	C25	C25
Larynx	C32	C32
Lung	C34	C34
Melanoma	Type 8720-8790	C43
Breast	C50	C50
Cervix	C53	C53
Body of Uterus	C54-C55	C54-C55
Ovary	C56	C56
Prostate	C61	C61
Testis	C62	C62
Bladder (including in situ)	C67	C67
Kidney	C64-C66,C68	C64-C66,C68
Brain	C70-C72	C70-C72
Thyroid	C73	C73
Hodgkin Lymphoma[1]	Type 9650-9667	C81
Non-Hodgkin Lymphoma[1]	Type 9590-9596,9670-9719,9727-9729 Type 9823, all sites except C42.0,.1,.4 Type 9827, all sites except C42.0,.1,.4	C82-C85,C96.3
Multiple Myeloma[1]	Type 9731,9732,9734	C88,C90
Leukemia[1]	Type 9733,9742,9800-9801,9805, 9820, 9826,9831-9837,9840,9860-9861,9863, 9866-9867,9870-9876, 9891,9895-9897, 9910,9920,9930-9931,9940,9945-9946, 9948,9963-9964 Type 9823 and 9827, sites C42.0,.1,.4	C91-C95
All Other Sites	All sites C00-C80, C97 not listed above	All sites C00-C80, C97 not listed above
All Cancers excluding Lung	C00-C97 excluding C34	C00-C97 excluding C34
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 (leukemia, lymphoma and multiple myeloma), 9050-9055 (mesothelioma) are excluded from other specific organ sites.

Note: ICDO-3 refers to the Third Edition of the International Classification of Diseases for Oncology. Figures are for invasive sites including in situ bladder and excluding non-melanoma skin cancer.

APPENDIX I: ACTUAL DATA FOR NEW CASES AND DEATHS

The focus of this monograph is on current year estimates that are obtained by analyzing actual data and making short-term projections using statistical techniques (*see Appendix II*). For users who require *actual data* rather than current year *estimates*, the Tables in this Appendix provide a summary of actual incidence and mortality statistics based on the most recently available data for the nation. These data represent the most recent year in the long series of data used to derive the current year estimates. Appendix Tables A1 and A2 list the actual number of new cases (2001) and deaths (2002) 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 2005 when these analyses began). Furthermore, the data sources are dynamic files that are routinely updated as new data become available. Users who require more current, actual data for Canada may contact the Centre for Chronic Disease Prevention and Control at the Public Health Agency of Canada, or the Health Statistics Division at Statistics Canada. The most up-to-date data for individual provinces/territories can be obtained by contacting the provincial cancer registries (see section *For Further Information*).

APPENDIX I: ACTUAL DATA FOR NEW CASES AND DEATHS

Table A1

Actual Data for New Cases of Cancer by Site and Sex, Canada, 2001

Site	ICDO-3 Site/Type[1]	Total	Males	Females
All Cancer Sites	**All invasive sites**	**139,557**	**73,758**	**65,799**
Oral (Buccal Cavity and Pharynx)	**C00-C14**	**3,134**	**2,155**	**979**
Lip	C00	397	305	92
Tongue	C01-C02	666	427	239
Salivary Gland	C07-C08	335	195	140
Mouth	C03-C06	658	397	261
Nasopharynx	C11	233	175	58
Oropharynx	C10	130	100	30
Other and Unspecified	C09,C12-C14	715	556	159
Digestive Organs	**C15-C26,C48**	**29,171**	**16,156**	**13,015**
Esophagus	C15	1,247	903	344
Stomach	C16	2,838	1,819	1,019
Small Intestine	C17	455	255	200
Large Intestine	C18,C26.0	12,197	6,095	6,102
Rectum and Anus	C19-C21	6,386	3,867	2,519
Liver	C22.0	1,105	836	269
Gallbladder	C23	376	129	247
Pancreas	C25	3,230	1,602	1,628
Other and Unspecified	C22.1,C24,C26.1-.9,C48	1,337	650	687
Respiratory System	**C30-C36,C38.1-.9,C39**	**21,632**	**12,848**	**8,784**
Larynx	C32	1,144	945	199
Lung	C34	20,174	11,712	8,462
Other and Unspecified	C30-31,C33,C35-36,C38.1-.9,C39	314	191	123
Bone	**C40-C41**	**287**	**175**	**112**
Soft Tissue (including Heart)	**C38.0,C47,C49**	**781**	**417**	**364**
Skin (Melanoma)	**Type 8720-8790**	**3,849**	**2,025**	**1,824**
Breast	**C50**	**18,829**	**149**	**18,680**
Genital Organs	**C51-C63**	**29,064**	**21,360**	**7,704**
Cervix	C53	1,374	–	1,374
Body of Uterus	C54	3,423	–	3,423
Uterus, Part Unspecified	C55	101	–	101
Ovary	C56	2,196	–	2,196
Prostate	C61	20,376	20,376	–
Testis	C62	806	806	–
Other and Unspecified	C51-52,C57,C58,C60,C63	788	178	610
Urinary Organs	**C64-C68**	**9,936**	**6,821**	**3,115**
Bladder	C67	5,798	4,294	1,504
Kidney and Other Urinary	C64-C66,C68	4,138	2,527	1,611
Eye	**C69**	**233**	**126**	**107**
Brain and Central Nervous System	**C70-C72**	**2,284**	**1,237**	**1,047**
Endocrine Glands	**C37,C73-C75**	**2,623**	**666**	**1,957**
Thyroid	C73	2,417	566	1,851
Other Endocrine	C37,C74-C75	206	100	106
Leukemia[1]	**See Glossary**	**3,723**	**2,177**	**1,546**
Other Blood and Lymph Tissues[1]	**See 3 components below**	**7,989**	**4,327**	**3,662**
Hodgkin Lymphoma	Type 9650-9667	774	435	339
Non-Hodgkin Lymphoma	See Glossary	5,516	3,001	2,515
Multiple Myeloma	Type 9731,9732,9734	1,699	891	808
Mesothelioma[1]	**Type 9050-9055**	**399**	**320**	**79**
All Other and Unspecified Sites	**See Glossary**	**5,623**	**2,799**	**2,824**

– Not applicable

[1] Histology types 9590-9989 (leukemia, lymphoma and multiple myeloma), and 9050-9055 (mesothelioma) are excluded from other specific organ sites.

Note: ICDO-3 refers to the Third Edition of the International Classification of Diseases for Oncology. Figures are for invasive sites including in situ bladder and exclude non-melanoma skin cancer. Further information is available at: http://www.phac-aspc.gc.ca/dsol-smed/index.html.

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

Table A2

Actual Data for Cancer Deaths by Site and Sex, Canada, 2002

Site	ICD-10	Total	Males	Females
All Cancer Sites	**C00-C97**	**65,103**	**34,415**	**30,688**
Oral (Buccal Cavity and Pharynx)	**C00-C14**	**1,088**	**755**	**333**
Lip	C00	12	11	1
Tongue	C01-C02	254	166	88
Salivary Gland	C07-C08	93	59	34
Mouth	C03-C06	201	127	74
Nasopharynx	C11	104	73	31
Oropharynx	C10	86	63	23
Other and Unspecified	C09,C12-C14	338	256	82
Digestive Organs	**C15-C26,C48**	**17,126**	**9,394**	**7,732**
Esophagus	C15	1,473	1,081	392
Stomach	C16	1,904	1,138	766
Small Intestine	C17	135	68	67
Large Intestine	C18,C26.0	6,593	3,410	3,183
Rectum and Anus	C19-C21	1,565	919	646
Liver	C22.0,C22.2-.9	1,073	712	361
Gallbladder	C23	269	94	175
Pancreas	C25	3,202	1,555	1,647
Other and Unspecified	C22.1,C24,C26.1-.9,C48	912	417	495
Respiratory System	**C30-C36,C38.1-.9,C39**	**17,782**	**10,660**	**7,122**
Larynx	C32	494	405	89
Lung	C34	17,173	10,185	6,988
Other and Unspecified	C30-31,C33,C35-36,C38.1-.9,C39	115	70	45
Bone	**C40-C41**	**129**	**72**	**57**
Soft Tissue (including Heart)	**C38.0,C47,C49**	**360**	**180**	**180**
Skin (Melanoma)	**C43**	**753**	**460**	**293**
Breast	**C50**	**5,017**	**40**	**4,977**
Genital Organs	**C51-C63**	**6,576**	**3,779**	**2,797**
Cervix	C53	362	–	362
Body of Uterus	C54	332	–	332
Uterus, Part Unspecified	C55	354	–	354
Ovary	C56	1,587	–	1,587
Prostate	C61	3,708	3,708	–
Testis	C62	28	28	–
Other and Unspecified	C51-52,C57,C58,C60,C63	205	43	162
Urinary Organs	**C64-C68**	**2,965**	**1,979**	**986**
Bladder	C67	1,525	1,090	435
Kidney and Other Urinary	C64-C66,C68	1,440	889	551
Eye	**C69**	**40**	**20**	**20**
Brain and Central Nervous System	**C70-C72**	**1,517**	**865**	**652**
Endocrine Glands	**C37,C73-C75**	**230**	**95**	**135**
Thyroid	C73	135	50	85
Other Endocrine	C37,C74-C75	95	45	50
Leukemia	**C91-C95**	**2,077**	**1,201**	**876**
Other Blood and Lymph Tissues	**C81-C90,C96.3**	**3,872**	**2,054**	**1,818**
Hodgkin Lymphoma	C81	100	59	41
Non-Hodgkin Lymphoma	C82-C85,C96.3	2,530	1,349	1,181
Multiple Myeloma	C88,C90	1,242	646	596
Mesothelioma	**C45**	**331**	**271**	**60**
All other and unspecified sites	**See Glossary**	**5,240**	**2,590**	**2,650**

– Not applicable

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

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

APPENDIX I: ACTUAL DATA FOR NEW CASES AND DEATHS

Table A3

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

	New Cases													
	Canada	N.L.*	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Yuk.	N.W.T.	Nu.
Males														
All Cancers	**73,800**	**1,150**	**420**	**2,600**	**2,000**	**18,000**	**27,500**	**2,700**	**2,600**	**6,700**	**9,400**	**45**	**40**	**25**
Prostate	20,400	260	140	670	500	3,600*	8,000	680	820	2,100	2,600	10	5	–
Lung	11,700	180	60	430	390	3,800	3,900	410	330	850	1,300	5	5	10
Colorectal	10,000	240	55	410	250	2,600	3,800	390	360	820	1,200	10	10	5
Bladder**	4,300	70	25	170	140	1,350	1,200	180	160	370	680	–	–	–
Non-Hodgkin Lymphoma	3,000	30	15	100	95	740	1,150	130	120	270	440	–	–	–
Kidney	2,500	40	10	95	65	670	1,000	110	95	220	260	–	–	–
Oral	2,200	45	5	85	60	540	780	85	70	160	290	–	–	–
Leukemia	2,200	20	20	50	45	560	910	95	90	220	240	–	–	–
Melanoma	2,000	35	10	100	55	280	890	55	55	190	350	–	–	–
Stomach	1,800	40	10	65	60	480	640	80	60	160	220	–	–	–
Pancreas	1,600	15	10	55	60	460	510	70	60	160	220	–	–	–
Brain	1,250	25	10	40	35	330	460	30	30	120	150	–	–	–
Larynx	950	20	5	20	20	330	300	30	20	55	95	–	–	–
Esophagus	900	15	5	50	30	220	370	35	25	95	160	–	–	–
Multiple Myeloma	890	10	5	25	25	210	390	25	30	70	100	–	–	–
Females														
All Cancers	**65,800**	**1,000**	**360**	**2,200**	**1,700**	**16,800**	**26,200**	**2,600**	**2,200**	**5,800**	**8,400**	**40**	**40**	**25**
Breast	18,700	290	110	590	480	4,900	7,400	720	590	1,700	2,400	15	20	5
Colorectal	8,600	200	50	330	230	2,200	3,300	340	310	680	1,050	5	5	5
Lung	8,500	85	40	310	220	2,300	3,000	390	270	690	1,150	5	5	10
Body of Uterus	3,500	50	15	100	75	820	1,550	170	120	370	510	5	–	–
Non-Hodgkin Lymphoma	2,500	35	15	85	60	610	1,050	110	90	210	360	–	–	–
Ovary	2,200	20	5	70	55	540	970	90	60	170	250	–	–	–
Thyroid	1,850	30	5	40	45	380	1,200	45	40	220	160	–	–	–
Melanoma	1,800	30	10	100	55	270	800	50	55	170	280	–	–	–
Pancreas	1,650	10	10	50	55	460	610	75	55	130	240	–	–	–
Kidney	1,600	30	10	75	55	440	600	60	45	120	130	–	–	–
Leukemia	1,550	20	5	40	40	420	660	65	60	140	170	–	–	–
Bladder**	1,500	20	5	75	50	470	440	55	65	170	220	–	–	–
Cervix	1,350	25	10	55	45	340	520	40	50	150	150	–	–	–
Brain	1,050	15	5	20	25	280	390	25	30	85	110	–	–	–
Stomach	1,000	35	5	25	30	270	370	40	25	90	95	–	–	–
Oral	980	15	5	30	20	200	430	45	35	85	130	–	–	–
Multiple Myeloma	810	10	5	20	15	220	300	30	20	55	80	–	–	–
Esophagus	340	5	–	10	10	75	150	20	10	30	70	–	–	–

– Fewer than 3 cases

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

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

[1] 2001 for Canada, Quebec; 2002 for Ontario; 2003 for Newfoundland, Prince Edward Island, Nova Scotia, New Brunswick, Manitoba, Saskatchewan, Alberta, British Columbia; 1999-2003 average for Yukon, Northwest Territories, Nunavut.

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

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

Table A4

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

	Rate per 100,000													
	Canada	N.L.*	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Yukon	N.W.T.	Nu.
Males														
All Cancers	**475**	**399**	**570**	**512**	**483**	**483**	**452**	**446**	**458**	**472**	**407**	**398**	**341**	**500**
Prostate	132	92	187	130	122	97*	132	113	147	154	111	92	59	–
Lung	76	63	84	83	94	103	64	67	60	62	56	73	59	249
Colorectal	64	82	69	79	61	69	62	63	65	58	52	78	99	82
Bladder**	28	25	35	33	34	36	20	28	28	27	29	–	–	–
Non-Hodgkin Lymphoma	19	9	22	19	22	19	18	21	21	19	19	–	–	–
Kidney	16	14	15	18	15	17	17	17	17	16	11	–	–	–
Leukemia	14	7	24	10	11	16	15	15	16	15	11	–	–	–
Oral	13	16	7	16	15	14	12	13	12	10	12	–	–	–
Melanoma	13	13	13	20	12	7	14	9	10	12	15	–	–	–
Stomach	12	15	13	13	14	13	11	13	10	11	9	–	–	–
Pancreas	10	5	13	10	15	12	8	12	10	12	9	–	–	–
Brain	8	8	12	8	9	9	8	5	6	8	7	–	–	–
Esophagus	6	5	7	9	7	6	6	6	4	7	7	–	–	–
Larynx	6	6	3	4	5	8	5	5	4	4	4	–	–	–
Multiple Myeloma	6	4	5	5	6	6	6	4	5	5	4	–	–	–
Females														
All Cancers	**347**	**310**	**399**	**355**	**339**	**350**	**359**	**348**	**337**	**348**	**316**	**324**	**348**	**653**
Breast	100	87	122	92	97	103	103	100	94	100	90	101	131	36
Lung	44	27	47	48	46	48	41	52	43	43	42	30	55	312
Colorectal	43	59	49	50	43	43	43	42	44	40	38	40	75	130
Body of Uterus	19	15	16	16	14	17	21	23	21	22	19	23	–	–
Non-Hodgkin Lymphoma	13	11	18	14	12	13	14	14	14	12	14	–	–	–
Ovary	12	6	7	11	11	11	13	12	9	10	9	–	–	–
Thyroid	11	10	5	8	11	9	19	8	9	14	7	–	–	–
Melanoma	10	8	15	17	12	6	11	6	9	10	12	–	–	–
Pancreas	8	2	9	8	10	9	8	8	7	8	9	–	–	–
Cervix	8	8	17	11	11	8	8	6	9	9	6	–	–	–
Bladder**	8	6	6	11	10	9	6	7	9	10	8	–	–	–
Kidney	8	9	9	12	11	9	8	9	7	7	5	–	–	–
Leukemia	8	7	7	7	8	9	9	9	10	8	7	–	–	–
Brain	6	5	7	3	5	7	6	4	6	5	5	–	–	–
Oral	5	5	7	5	4	4	6	5	5	5	5	–	–	–
Stomach	5	10	4	3	6	5	5	5	3	5	3	–	–	–
Multiple Myeloma	4	2	6	4	3	4	4	3	3	3	3	–	–	–
Esophagus	2	1	–	1	2	1	2	2	1	2	3	–	–	–

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

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

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

[1] 2001 for Canada, Quebec; 2002 for Ontario; 2003 for Newfoundland, Prince Edward Island, Nova Scotia, New Brunswick, Manitoba, Saskatchewan, Alberta, British Columbia; 1999-2003 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 Division, CCDPC, Public Health Agency of Canada

APPENDIX I: ACTUAL DATA FOR NEW CASES AND DEATHS

Table A5

Actual Data for Deaths for the Most Common Cancer Sites by Sex and Geographic Region, Canada, 2002[1]

	Deaths													
	Canada	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Yuk.	N.W.T.	Nu.
Males														
All Cancers	**34,400**	**670**	**160**	**1,250**	**910**	**9,400**	**12,600**	**1,300**	**1,300**	**2,600**	**4,200**	**25**	**20**	**15**
Lung	10,200	200	60	370	300	3,400	3,400	320	320	680	1,100	10	5	10
Colorectal	4,300	100	20	170	100	1,150	1,650	180	170	290	500	5	5	5
Prostate	3,700	60	20	130	110	790	1,400	170	210	350	490	–	–	–
Pancreas	1,550	25	5	50	35	430	560	50	65	140	200	–	–	–
Non-Hodgkin Lymphoma	1,350	15	5	35	40	330	520	55	50	110	190	–	–	–
Leukemia	1,200	25	5	45	30	260	460	50	50	110	160	–	–	–
Stomach	1,150	45	5	35	35	340	400	35	40	70	130	–	–	–
Esophagus	1,100	15	5	40	25	220	430	45	40	95	160	–	–	–
Bladder	1,100	20	5	45	25	260	430	50	35	75	140	–	–	–
Kidney	890	15	5	40	25	250	290	40	35	75	110	–	–	–
Brain	870	20	–	25	15	230	320	35	30	75	110	–	–	–
Oral	760	15	5	30	20	200	280	30	25	50	95	–	–	–
Multiple Myeloma	650	10	–	25	20	150	260	30	20	45	90	–	–	–
Melanoma	460	5	–	15	5	90	230	20	15	35	50	–	–	–
Larynx	410	15	–	20	10	130	130	10	10	35	40	–	–	–
Females														
All Cancers	**30,700**	**530**	**150**	**1,150**	**790**	**8,200**	**11,400**	**1,250**	**1,000**	**2,300**	**3,900**	**15**	**15**	**15**
Lung	7,000	90	40	260	160	2,000	2,500	280	240	550	900	5	5	10
Breast	5,000	110	20	170	130	1,300	1,900	200	160	400	590	5	–	–
Colorectal	3,800	75	30	160	85	1,100	1,450	180	110	240	440	–	–	–
Pancreas	1,650	25	5	60	50	420	610	65	50	130	240	–	–	–
Ovary	1,600	30	5	65	40	380	620	65	50	120	220	–	–	–
Non-Hodgkin Lymphoma	1,200	20	5	35	30	310	440	65	45	90	140	–	–	–
Leukemia	880	5	5	25	20	230	340	40	30	75	110	–	–	–
Stomach	770	20	–	20	20	230	240	35	30	60	110	–	–	–
Body of Uterus	690	10	5	25	20	180	270	30	20	50	65	–	–	–
Brain	650	10	5	25	15	190	240	20	15	50	75	–	–	–
Multiple Myeloma	600	10	–	20	15	150	240	15	25	40	75	–	–	–
Kidney	550	15	5	25	20	150	170	20	20	50	65	–	–	–
Bladder	430	10	–	15	20	100	170	15	10	35	50	–	–	–
Esophagus	390	5	5	15	10	70	170	15	10	25	65	–	–	–
Cervix	360	10	5	30	5	80	130	15	10	35	45	–	–	–
Oral	330	5	–	10	5	65	140	15	15	30	50	–	–	–
Melanoma	290	5	–	15	10	45	130	10	10	20	40	–	–	–

– Fewer than 3 deaths

[1] 1998-2002 average for Yukon, Northwest Territories, Nunavut

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

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

Table A6

Actual Age-Standardized Mortality Rates for the Most Common Cancer Sites by Sex and Geographic Region, Canada, 2002[1]

	Rate per 100,000													
	Canada	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Yukon	N.W.T.	Nu.
Males														
All Cancers	**220**	**249**	**217**	**247**	**227**	**253**	**213**	**212**	**221**	**198**	**186**	**261**	**216**	**362**
Lung	65	74	78	73	76	89	57	52	55	51	49	100	75	210
Colorectal	28	38	30	34	25	31	28	30	30	22	22	36	37	74
Prostate	25	23	25	26	28	24	25	27	34	28	23	–	–	–
Pancreas	10	10	6	10	8	11	9	8	11	11	9	–	–	–
Non-Hodgkin Lymphoma	9	5	5	7	9	9	9	8	8	8	8	–	–	–
Leukemia	8	9	7	9	7	7	8	8	9	8	7	–	–	–
Esophagus	7	6	8	7	6	6	7	8	7	7	7	–	–	–
Stomach	7	16	6	7	9	9	7	6	7	5	6	–	–	–
Bladder	7	8	6	9	7	8	8	8	6	6	6	–	–	–
Kidney	6	6	7	8	7	7	5	6	6	5	5	–	–	–
Oral	5	5	5	6	5	5	5	5	4	4	4	–	–	–
Brain	5	6	–	5	4	6	5	6	5	5	5	–	–	–
Multiple Myeloma	4	4	–	5	5	4	4	5	3	4	4	–	–	–
Larynx	3	5	–	4	2	4	2	2	2	3	2	–	–	–
Melanoma	3	2	–	3	2	2	4	3	3	2	2	–	–	–
Females														
All Cancers	**149**	**159**	**154**	**168**	**149**	**158**	**147**	**157**	**143**	**142**	**138**	**181**	**178**	**448**
Lung	35	29	42	41	33	40	33	37	37	35	34	34	36	260
Breast	24	33	21	25	23	25	25	25	24	24	21	39	–	–
Colorectal	18	22	27	22	15	20	18	21	14	14	15	–	–	–
Pancreas	8	6	4	8	9	8	8	7	7	8	8	–	–	–
Ovary	8	9	5	10	8	8	8	8	7	7	8	–	–	–
Non-Hodgkin Lymphoma	6	7	3	5	6	6	6	8	6	5	5	–	–	–
Stomach	4	6	–	3	4	4	3	3	4	4	4	–	–	–
Leukemia	4	2	4	4	4	4	4	5	3	4	4	–	–	–
Body of Uterus	3	3	5	4	4	3	3	4	3	3	2	–	–	–
Brain	3	4	8	4	3	4	3	3	3	3	3	–	–	–
Multiple Myeloma	3	3	–	3	3	3	3	2	3	2	3	–	–	–
Kidney	3	4	4	4	3	3	2	3	3	3	2	–	–	–
Oral	2	1	–	1	1	1	2	2	2	2	2	–	–	–
Esophagus	2	1	3	2	2	1	2	2	2	2	2	–	–	–
Cervix	2	4	3	4	1	2	2	2	2	2	2	–	–	–
Bladder	2	3	–	2	3	2	2	2	1	2	2	–	–	–
Melanoma	1	1	–	2	3	1	2	2	1	1	2	–	–	–

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

[1] 1998-2002 average for Yukon, Northwest Territories, Nunavut

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

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

Data Sources and Processing

The actual cancer incidence and mortality data used in this monograph were obtained from three sources: mortality data files (1950-2002),[28] the National Cancer Incidence Reporting System (NCIRS, 1969-1991) and the Canadian Cancer Registry (CCR, 1992-2003)[1] (the Health Statistics Division at Statistics Canada maintains all these databases).

Actual mortality data were available at the Public Health Agency of Canada for all the provinces and territories for the period 1969 to 2002. Incidence data were available for all the provinces and territories between 1969 and 2003 except for Quebec and Ontario. Incidence was reported up to 2001 for Quebec and up to 2002 for Ontario.

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

Population figures for Canada, the provinces and the territories were taken from intercensal estimates for the period 1971 to 2000,[29] from postcensal estimates for the **period 2001 to 2004**[29] and from the Scenario 2 population projections for **2005 to 2006**.[30] The population estimates from **1971 to 2004** 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 2006 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 2002 were used. For incidence estimates, data from 1986 to the latest year of available data were used.

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

Age-standardized incidence and mortality rates for each site were calculated using the age distribution of the 1991 Canadian population. The World Standard Population[31] was used in publications before 1995. It was replaced because it is much younger than the 1991 Canadian population. Consequently, estimates of age-standardized rates before 1995 are not comparable with later estimates.

APPENDIX II: METHODS

Commencing with the 2000 edition of *Canadian Cancer Statistics*, the Northwest Territories represent a different geographic area than in the past. Its geographic boundaries were redrawn, reducing the land area representing the Northwest Territories, and a new territory named Nunavut was incorporated.[32]

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 2006

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 2006 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 2006 were estimated (after consultation with the provinces/territories) by a five-year average of the most recent available data: Newfoundland and Labrador (male – prostate, bladder); Prince Edward Island (male – lung); Nova Scotia (male – prostate); Ontario (male – prostate); Manitoba (male – colorectal, multiple myeloma, prostate, leukemia; female – stomach, melanoma, leukemia); Saskatchewan (male – prostate, testis; female – brain, lung); Alberta (male – prostate); British Columbia (male – bladder; female – bladder); Northwest Territories (male – All Cancers, prostate; female – All Cancers); Yukon Territories (male – All Cancers, prostate; female – All Cancers) and Nunavut (male – All Cancers, prostate; female – All Cancers).

A consequence of implementing the ICDO-3 classification for the 2004 edition is an apparent drop compared with the previous edition of about 100 ovarian cancer cases to 2,184 cases for Canada in 2000. However, the ICDO-3 classification no longer considers borderline ovarian cancer as malignant. Based on the ICDO-3 definition for both 1998 and 2000 there were actually about 50 additional ovarian cancer cases in 2000.

Prostate cancer incidence projection methodology was modified for the 2003 edition, as the anticipated decline in age-standardized rates from a peak in 1993 was observed until 1995, at which point a new and increasing trend was established. This observation in the summary rates does not apply to the age-specific rates. Since 1981, the age-specific rates for Canada among men under 40 have revealed little change and shown no trend; among men aged 40-59 a steeply increasing trend started around 1991 and has yet to change course; among men aged 60-74 the rates follow the trends in the age-standardized rates from 1991 on; and among men over 75 years of age the brief spike in rates in the early to mid-1990s was followed by a steep decline to levels at or below the 1981 levels. Consequently, age-specific rate projections based on a Poisson regression model fit to data between 1981 and 1989 were abandoned in favour of Poisson regression models fit to data from 1991 to the most recent year of incidence data available (2001 Quebec, 2002 Ontario and elsewhere 2003). The provinces for which this method was applied include New Brunswick, Quebec 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 the 2004 edition, the incidence classification uses ICDO-3 for the data from 1992 onwards. This results in an additional 1,200 cases per year as compared with the number obtained previously using the ICD-9 definition in the other cancers category and the all cancers total.

Mortality Estimates (Deaths) for 2006

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 2006 were estimated (after consultation with the provinces/territories) by a five-year average of the most recent available data: Nova Scotia (male – colorectal; female – lung); Manitoba (male – multiple myeloma, kidney; female – stomach, lung); Saskatchewan (male –esophagus, stomach, kidney; female – lung, uterus, non-Hodgkin's lymphoma, kidney); British Columbia (male – colorectal); Northwest Territories (male – All Cancers; female – All Cancers); Yukon Territories (male – All Cancers; female – All Cancers) and Nunavut (male – All Cancers; female – All Cancers).

APPENDIX II: METHODS

Estimated Age-Standardized Incidence Rates (ASIRs) and Mortality Rates (ASMRs) for 2006

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 2006 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 2006 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 New Brunswick, Quebec 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 certain variability to it; one cannot "know" an estimate exactly, and therefore the estimate serves only to provide insight into the real, unknown value of interest.

The standard error and coefficient of variation as well as the confidence interval are calculated to evaluate the precision of each estimate. The standard error is an estimate of the extent to which an estimate will vary, while the coefficient of variation relates this variation to the actual size of the quantity being estimated. Confidence intervals use the standard error to create a range of plausible values for the quantity being estimated. These values are available upon request from the Surveillance Division, Centre for Chronic Disease Prevention and Control, Public Health Agency of Canada. Together, these quality measures assess the precision (or imprecision) of a particular estimate but not the accuracy of the estimate. Note that any estimates are subject to

error, and the degree of precision depends primarily on the number of observed cases and the population size for each site-sex-province combination, whereas the accuracy is related to the adequacy of the model used in the estimation process.

Estimates of incidence and mortality have been rounded as follows: counts between 0 and 99 to the nearest 5, counts between 100 and 999 to the nearest 10, counts between 1,000 and 1,999 to the nearest 50 and counts greater or equal to 2,000 to the nearest 100. Percentages, age-standardized and age-specific rates were rounded to the nearest tenth except in Tables 4 and 6 and Appendix Tables A4 and A6, where space restrictions forced rounding to the nearest whole number. Age- and sex-specific counts/rates are combined before rounding, so it is possible that the totals in the tables do not appear to add up. However, any of these discrepancies must be within the precision of the rounding units described above.

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

The AAPC values were calculated for each site by fitting a model that assumed a constant rate of change in the ASIRs or ASMRs, that is, a linear model applied to the ASIRs and ASMRs after logarithmic transformation. The estimated slope resulting from that fit was then transformed back to represent a percentage increase or decrease. Changepoint analysis was applied to search for the most recent linear trend using ASIR or ASMR data points from 1986 to 2001 for incidence and 1986 to 2002 in the investigation of mortality rates. A minimum of five data points were required to identify a new trend, so the latest a new trend would be detected was 1997 for the ASIR or 1998 for the ASMR. Data from 1992 to 2001/2 were used for incidence/mortality unless the changepoint analysis detected a new trend starting later than 1992 in which case the latest linear trend was used to estimate the AAPC.

Estimates of Non-Melanoma Skin Cancer for 2006 in Canada

For 2006 non-melanoma skin cancer estimates were the average of estimates obtained by applying British Columbia, Manitoba and New Brunswick rates to the Canadian population. The pathology laboratories in British Columbia send all diagnostic reports of non-melanoma 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 2003 has been projected to the current year and applied to the Canadian population estimates to generate a minimal estimate of the number of cases for Canada as a whole. These projections were based on 90 percent registration of the 2003 non-melanoma skin pathology reports and the assumption that cases are registered randomly with regard to age and sex distribution. For Manitoba data, estimates were obtained by applying projected 2006 sex- and age-specific rates from graphs in the paper by Demers et al. to the Canadian population.[33] For New Brunswick summary counts of new basal and squamous cell cases 1992 to 2004 by age group were provided by the Cancer Registry and rates were projected using linear regression to 2006.

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 2001 and life tables based on 1999-2001 all-cause mortality rates. The methodology used was that of Zdeb[34] and Seidman et al.[35] 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 2001. 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 1977 as the baseline. The uppermost series is a plot of the annual Canadian cancer cases/deaths observed or projected. The next to upper most series is an estimate of the cancer events expected if the age distribution of the 1977 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 1977 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, $P_{F,1977}$ represents the total 1977 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 1977 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 1977 population times the age-standardized rate for year t or, in symbols, $P_{i,1977}\ ASR_{i,t}$.

Baseline: the observed number of Canadian cancer cases/deaths for sex i that occurred in 1977.

Potential Years of Life Lost (PYLL)

The indicator was calculated by obtaining deaths for ages < 1, 1-4, 5-9, . . . 90+ for Canada in 2002 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.[36]

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,[37] and relative risk estimates were obtained using SAMMEC II.[38] Smoking-attributable mortality (SAM) was calculated[39] 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 (1992-2003), and survival data were obtained from the Information Management Division, Saskatchewan Cancer Agency. For each cancer site, data were stratified by month of diagnosis, age at diagnosis and sex. Expected prevalence was then calculated as the product of the age-specific crude survival rate and the number of incident cases. The stratum-specific estimates were aggregated by cancer site.

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

Annual national cancer incidence counts were stratified by year of diagnosis, cancer site, sex and age groups 0-1, 2-4, 5-9, 10-14 and so on by five-year age groups to age 85 and older. These data were then uniformly distributed to each month throughout the year by dividing the number of cases in each stratum by 12. Prevalence for 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.

Relative survival

Cancer cases were defined based on the International Classification of Diseases for Oncology, Third Edition.[40] Surveillance, Epidemiology, and End Results (SEER) groups, without mesothelioma and Kaposi sarcoma as separate groupings, were used to define cancer sites.[41] There are some differences with the site definitions compared to those in the Glossary (see reference [41]). Analyses were restricted to first primary invasive tumour records diagnosed between January 1, 1995 and December 31, 1997 inclusive. These incidence years were selected due to the fact that 2002 mortality data

were the most recent year of data available for analysis. The pre-1992 tumour history, if any, of persons on the CCR was obtained by linking the CCR data with its predecessor the National Cancer Incidence Reporting System, a fixed, tumour-oriented database containing cases as far back as 1969. Supplementary information available for the province of Ontario was also used.

Cases diagnosed in the province of Quebec were not included, in part, because the method of ascertaining the date of diagnosis of cancer cases in this province clearly differed from that of the other provincial cancer registries.[42] Records were excluded when the diagnosis was established either through autopsy only or death certificate only.

Survival time was calculated as the difference in days between the date of diagnosis and the date of last observation (date of death or December 31, 2002, whichever was earliest) to a maximum of five years. For a small percentage of subjects with missing information on day/month of diagnosis and/or day/month of death, the survival time was estimated.[42] Vital status during the first five years was determined through record linkage to the Canadian Mortality Data Base, or from information reported by provincial/territorial cancer registries. For deaths reported by a provincial registry but not confirmed by the record linkage process, it was assumed that the individual died on the date submitted by the reporting province.

The survival analysis was based on an algorithm written by Paul Dickman with some minor adaptations. Relative survival ratios were estimated as the ratio of the observed survival of persons with cancer to the expected survival for the general population of the same age, sex, province of residence, and time period. Observed survival proportions were estimated using the cohort method. Expected survival proportions were derived, from sex-specific complete and abridged provincial life tables produced by Statistics Canada, using the Ederer II approach.[43] All expected survival proportions for Prince Edward Island and the territories were derived from Canadian life tables as stable estimates for single ages could not be produced for these areas because of small population counts.

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

APPENDIX III: PREVIOUS SPECIAL TOPICS

In past years, other Special Topics included

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

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