Canadian Cancer Society / Société canadienne du cancer
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Public Health Agency of Canada / Agence de santé publique du Canada
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Canadian Cancer Statistics 2005

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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 and Risk Assessment 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 button)
- 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. 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 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 2005 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 Prevention: Modifiable Risk Factors.

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

Related information can also be found in other publications, including reports from provincial and territorial cancer registries; *Cancer Statistics*,[1] and *Health Reports*, published by Statistics Canada; *Chronic Diseases in Canada* and the *Canadian Cancer Incidence Atlas*,[2] published by Health Canada/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 107). Finally, **readers can be included on the mailing list for next year's publication** by completing the *Order and Evaluation Form*.

Current Incidence and Mortality

- An estimated 149,000 new cases of cancer and 69,500 deaths from cancer will occur in Canada in 2005.
- 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 eastern provinces and lower in western provinces.
- Lung cancer incidence and mortality rates continue to be higher in eastern Canada than in western Canada.

Trends in Incidence and Mortality

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

Age and Sex Distribution of Cancer

- 44% of new cancer cases and 60% of deaths due to cancer occur among those who are at least 70 years old.
- 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 27% of potential years of life lost (PYLL) due to cancer.

Prevalence

- 2.4% of Canadian men and 2.7% of Canadian women have had a diagnosis of cancer in the previous 15 years.

HIGHLIGHTS

- 1.0% of the female population are survivors of breast cancer diagnosed within the previous 15 years, and 0.7% of the male population are survivors of prostate cancer.

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 Prevention: Modifiable Risk Factors

- Many risk factors for cancer are both common and preventable: tobacco use, unhealthy eating, excess body weight, physical inactivity and over-exposure to ultraviolet rays from the sun.
- 21% of Canadians over 12 smoked in 2002, and 18% of youth 15-19 years old.
- Tobacco use is declining but is still high in some groups.
- Most Canadians (60%) do not eat the recommended amounts of fruit and vegetables.
- About half of Canadians (54% of women and 44% of men) are physically inactive.
- Almost half of Canadians (56% of men, 39% of women) are at an unhealthy weight; 15% are obese.
- Rates of physical inactivity are declining slowly but rates of excess body weight are increasing, especially in children.
- 18% of Canadians over 12 are heavy drinkers.
- Progress in cancer prevention has been achieved through tobacco control. If the lessons from the tobacco control experience are applied in other areas, even greater gains can be made in cancer prevention.

The importance of different types of cancer in Canada in 2005 can be measured in three ways, as shown in Table 1. Incidence is expressed as the number of new cases of a given type of cancer diagnosed per year. Mortality is expressed as the number of deaths attributed to a particular type of cancer during the year. The deaths to cases ratio (the number of deaths divided by the number of new cases) is a crude indicator of disease severity. The closer a value is to 1.0, the poorer the prognosis for that cancer. Frequencies listed in Tables 1 to 11 are estimates based on modeling trends in cancer and population data since 1986 for both cancer incidence and mortality (an exception was made for prostate cancer; see *Appendix II* for details). These estimates are rounded to the nearest 5, 10, 50 or 100. Readers requiring actual data or information on less common sites of cancer may refer to Tables A1 and 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 in this monograph exclude the estimated 78,000 cases of non-melanoma skin cancer for Canada in 2005.*** Registration levels for cancer have become more comparable across the country, particularly in the period starting in the early 1980s, as registries standardized their procedures for case-finding, including linkage to provincial mortality data files.

* The number of new cases of non-melanoma skin cancer is estimated using incidence rates from the cancer registry in British Columbia, which is considered to have the most complete data. Please refer to *Appendix II: Methods* for further details.

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, 2005

An estimated 149,000 new cases of cancer and 69,500 deaths from cancer will occur in Canada in 2005. Men outnumber women for both new cases and deaths, by 4.7% for incidence and 11.9% for mortality (Table 1).

Three types of cancer account for at least 50% of new cases in each sex: prostate, lung, and colorectal cancers in males, and breast, lung, and colorectal cancers in females. Twenty nine percent of cancer deaths in men and 25% 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 2005, accounting for an estimated 8,300 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 10,200 new cases, lung cancer is the second leading form of cancer in women, ahead of the 9,000 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 2005, prostate cancer will continue as the leading form of cancer diagnosed, with an estimated 20,500 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 2005; the estimated 10,700 lung cancer deaths far exceed the 4,500 deaths due to colorectal cancer, the second leading cause of cancer death in men. Prostate cancer is third in mortality, causing 4,300 deaths.

Deaths to Cases Ratio

The ratio of deaths to new cases, at 47% overall, is slightly higher in males than in females. On the basis of these ratios, the cancer sites listed in Table 1 could be classified arbitrarily into three groups: those with a very good prognosis (a ratio of 30% or less – breast, prostate, melanoma, body of the uterus, cervix, thyroid, Hodgkin's disease and testis); those with a fairly good prognosis (a ratio greater than 30% but less than 50% – colorectal, non-Hodgkin's lymphoma, bladder, kidney, oral

and larynx); and those with a poor prognosis (ratio 50% or greater – lung, leukemia, pancreas, stomach, ovary, brain, multiple myeloma and esophagus).

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, 2005

	New Cases 2005 Estimates			Deaths 2005 Estimates			Deaths/Cases Ratio 2005 Estimates		
	Total	M	F	Total	M	F	Total	M	F
All Cancers	**149,000**	**76,200**	**72,800**	**69,500**	**36,700**	**32,800**	**0.47**	**0.48**	**0.45**
Lung	22,200	12,000	10,200	19,000	10,700	8,300	0.86	0.89	0.82
Breast	21,800	150	21,600	5,300	45	5,300	0.24	0.30	0.24
Prostate	20,500	20,500	–	4,300	4,300	–	0.21	0.21	–
Colorectal	19,600	10,600	9,000	8,400	4,500	3,900	0.43	0.42	0.43
Non-Hodgkin's Lymphoma	6,400	3,400	3,000	3,000	1,600	1,350	0.46	0.47	0.46
Bladder	5,000	3,700	1,250	1,650	1,150	500	0.34	0.32	0.40
Kidney	4,500	2,800	1,650	1,500	950	570	0.34	0.34	0.34
Melanoma	4,400	2,300	2,000	880	540	340	0.20	0.23	0.17
Leukemia	4,000	2,300	1,700	2,200	1,300	940	0.56	0.56	0.56
Body of Uterus	3,900	–	3,900	710	–	710	0.18	–	0.18
Pancreas	3,400	1,650	1,750	3,300	1,600	1,750	0.99	0.98	0.99
Oral	3,200	2,100	1,050	1,050	710	350	0.33	0.34	0.33
Thyroid	3,100	710	2,400	170	65	100	0.05	0.09	0.04
Stomach	2,800	1,800	1,000	1,900	1,150	730	0.68	0.65	0.72
Brain	2,500	1,350	1,100	1,650	940	720	0.67	0.69	0.65
Ovary	2,400	–	2,400	1,550	–	1,550	0.66	–	0.66
Multiple Myeloma	1,850	1,000	850	1,250	680	590	0.68	0.67	0.69
Esophagus	1,450	1,050	400	1,600	1,200	420	1.13[1]	1.16[1]	1.05[1]
Cervix	1,350	–	1,350	400	–	400	0.30	–	0.30
Larynx	1,150	960	210	510	420	85	0.43	0.44	0.41
Testis	850	850	–	30	30	–	0.04	0.04	–
Hodgkin's Disease	850	460	390	120	70	55	0.14	0.15	0.14
All Other Sites	12,000	6,400	5,600	8,900	4,800	4,100	0.75	0.75	0.74

– Not applicable

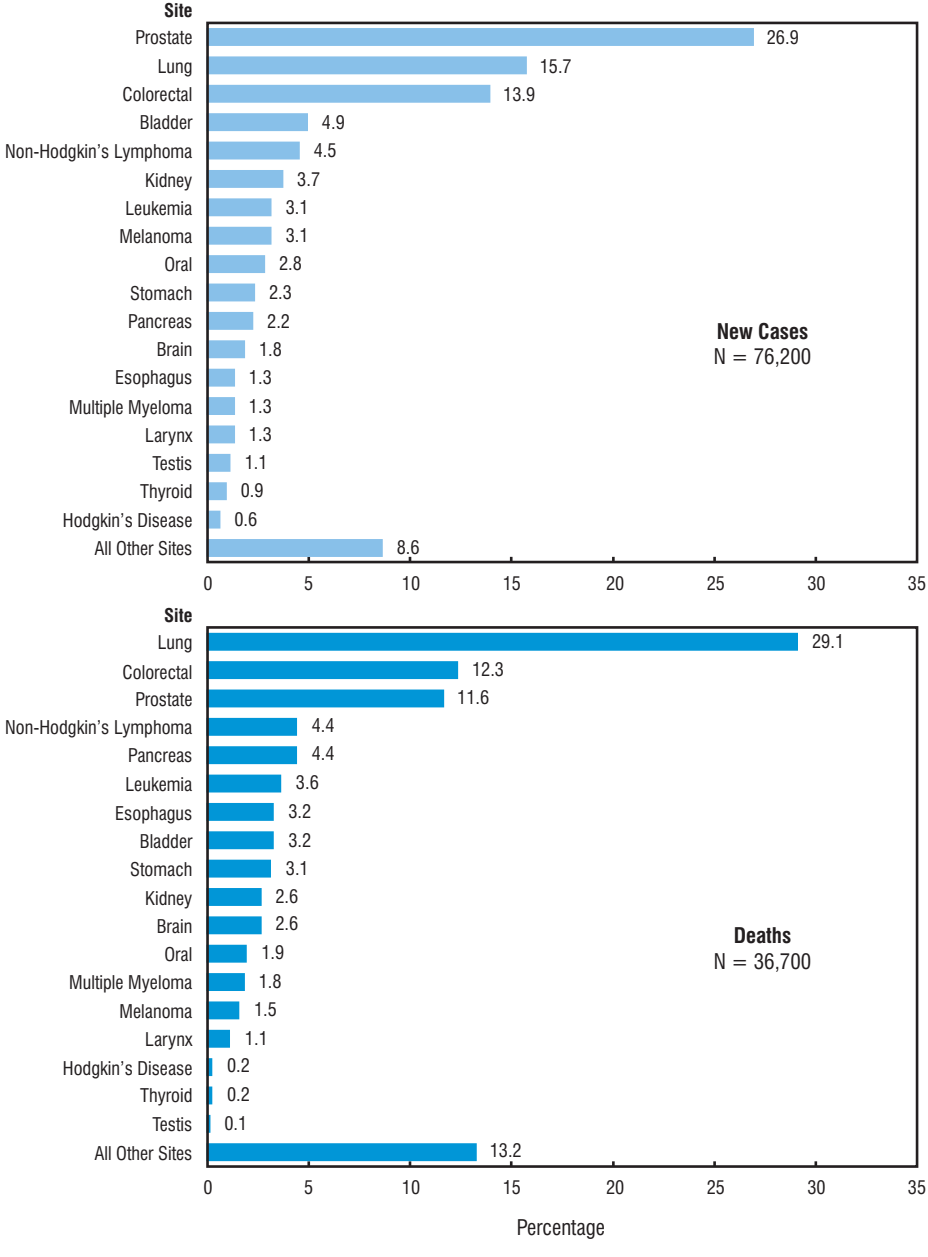
[1] The high ratio (in excess of 1.0) for cancer of the esophagus may result from incomplete registration of this cancer before death. Please refer to *Appendix II: Methods* for further details.

Note: Incidence figures exclude an estimated 78,000 new cases of 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 and Risk Assessment Division, CCDPC, Public Health Agency of Canada

Figure 1.1

Percentage Distribution of Estimated New Cases and Deaths for Selected Cancer Sites, Males, Canada, 2005

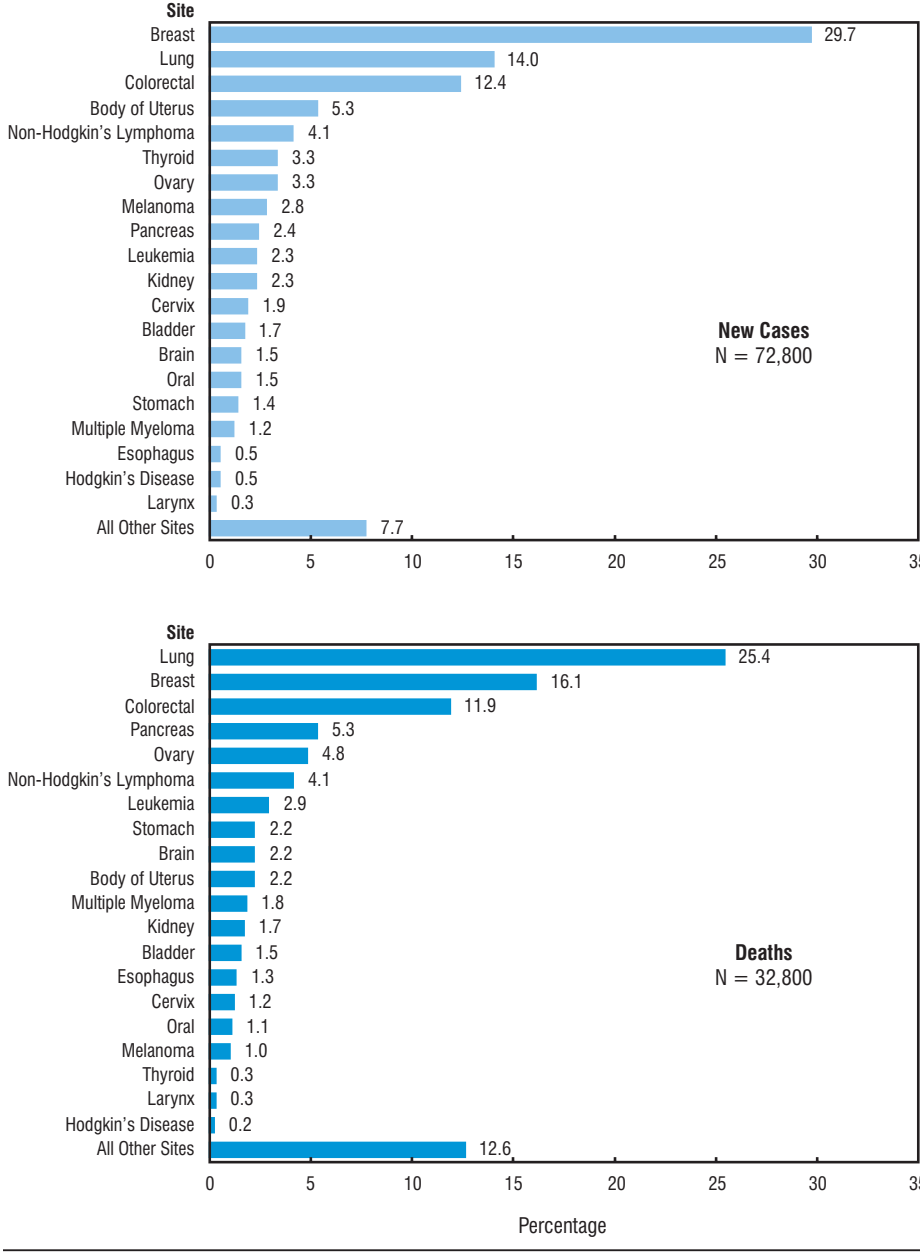


Note: Incidence figures exclude an estimated 78,000 new cases of non-melanoma (basal cell and squamous cell) skin cancer among both sexes combined.

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

Figure 1.2

Percentage Distribution of Estimated New Cases and Deaths for Selected Cancer Sites, Females, Canada, 2005



Note: Incidence figures exclude an estimated 78,000 new cases of non-melanoma (basal cell and squamous cell) skin cancer among both sexes combined.

Source: Surveillance and Risk Assessment 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 2005. 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 2005. 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 2005. 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) differ among provinces/territories. The year of initiation of screening programs differs by province/territory, and cancer rates will be altered temporarily through identification of previously undiagnosed cases in asymptomatic individuals. As well, the availability of diagnostic procedures may differ regionally.

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.

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 smoking rates in Quebec and Atlantic Canada). Where true differences in cancer risk and causal associations are demonstrated in subsequent epidemiologic studies, these findings can be used in planning cancer control programs that aim to reduce the burden of cancer.

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

Table 2

Estimated Population, New Cases and Deaths for All Cancers by Sex and Geographic Region, Canada, 2005

	Population (000s) 2005 Estimates[1]			New Cases 2005 Estimates[2]			Deaths 2005 Estimates		
	Total	M	F	Total	M	F	Total	M	F
Canada	**31,949**	**15,806**	**16,144**	**149,000**	**76,200**	**72,800**	**69,500**	**36,700**	**32,800**
Newfoundland and Labrador	519	256	263	2,200	1,200	990	1,300	750	560
Prince Edward Island	140	68	72	770	420	350	340	190	150
Nova Scotia	943	461	482	5,200	2,700	2,500	2,500	1,300	1,200
New Brunswick	760	376	384	3,900	2,100	1,850	1,800	1,000	830
Quebec	7,475	3,687	3,789	37,400	18,800	18,700	18,800	10,000	8,700
Ontario	12,457	6,149	6,308	56,200	28,500	27,700	25,600	13,300	12,300
Manitoba	1,161	575	586	5,800	2,900	2,900	2,600	1,350	1,250
Saskatchewan	989	489	500	4,800	2,600	2,200	2,300	1,250	1,050
Alberta	3,234	1,630	1,604	13,100	6,800	6,400	5,500	2,900	2,600
British Columbia	4,172	2,064	2,108	19,300	10,200	9,100	8,700	4,600	4,100
Yukon	27	14	14	90	45	45	50	30	20
Northwest Territories	40	21	20	90	45	45	50	25	20
Nunavut	31	16	15	65	30	35	45	20	20

[1] 2005 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 and Risk Assessment Division, CCDPC, Public Health Agency of Canada

Table 3

Estimated New Cases for Major Cancer Sites by Sex and Province, Canada, 2005

	New Cases										
	Canada[1]	N.L.*	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Males											
All Cancers	**76,200**	**1,200**	**420**	**2,700**	**2,100**	**18,800**	**28,500**	**2,900**	**2,600**	**6,800**	**10,200**
Prostate	20,500	330	150	720	550	3,500*	8,300	750	840	2,200	3,200
Lung	12,000	160	65	470	380	4,000	3,900	430	350	850	1,350
Colorectal	10,600	230	50	400	260	2,700	4,000	420	330	880	1,350
Bladder**	3,700	30	10	110	130	1,450	1,150	110	130	210	350
Non-Hodgkin's Lymphoma	3,400	45	20	120	85	840	1,300	140	110	280	490
Kidney	2,800	40	15	110	75	700	1,100	120	85	240	300
Melanoma	2,300	25	15	110	60	360	1,000	90	55	240	370
Leukemia	2,300	20	10	65	50	580	900	85	95	260	280
Oral	2,100	55	10	80	55	520	790	100	60	180	250
Stomach	1,800	45	5	50	50	460	650	65	50	160	230
Pancreas	1,650	10	10	50	45	470	560	65	50	150	230
Brain	1,350	30	5	40	35	360	510	45	40	120	170
Multiple Myeloma	1,000	10	5	30	25	270	390	40	30	80	130
Larynx	960	25	5	30	30	340	310	25	30	65	100
Females											
All Cancers	**72,800**	**990**	**350**	**2,500**	**1,850**	**18,700**	**27,700**	**2,900**	**2,200**	**6,400**	**9,100**
Breast	21,600	350	90	710	500	5,800	8,200	770	620	1,950	2,700
Lung	10,200	110	45	400	240	2,900	3,600	430	260	810	1,300
Colorectal	9,000	160	60	360	250	2,300	3,500	370	290	680	1,100
Body of Uterus	3,900	60	20	130	90	880	1,550	180	110	360	480
Non-Hodgkin's Lymphoma	3,000	40	10	90	75	710	1,200	110	85	250	380
Ovary	2,400	30	10	75	60	620	960	90	70	170	290
Thyroid	2,400	30	5	40	55	480	1,300	65	50	220	180
Melanoma	2,000	30	15	95	65	330	840	60	55	230	280
Pancreas	1,750	5	10	55	55	490	610	70	45	140	250
Leukemia	1,700	10	5	50	35	430	640	70	60	170	200
Kidney	1,650	30	5	70	55	430	640	75	55	150	170
Cervix	1,350	25	10	55	35	290	510	50	40	170	170
Bladder**	1,250	5	5	35	45	480	420	40	45	50	120
Brain	1,100	15	5	30	25	320	430	35	35	85	130
Oral	1,050	15	5	40	20	230	410	50	35	85	160
Stomach	1,000	20	5	30	30	280	360	35	35	95	130
Multiple Myeloma	850	5	5	25	20	220	340	30	25	60	110

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

** Inter-provincial variation. 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 78,000 cases of non-melanoma skin cancer (basal and squamous). Caution is needed if the 2005 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 and Risk Assessment Division, CCDPC, Public Health Agency of Canada

Table 4

Estimated Age-Standardized Incidence Rates for Major Cancer Sites by Sex and Province, Canada, 2005

	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	**448**	**404**	**525**	**520**	**500**	**457**	**442**	**471**	**458**	**450**	**422**
Prostate	121	115	179	137	134	84*	129	124	151	149	133
Lung	71	56	86	90	93	97	61	70	61	58	55
Colorectal	62	79	65	75	62	66	61	68	57	59	54
Bladder**	22	11	15	21	33	35	18	19	24	14	14
Non-Hodgkin's Lymphoma	20	14	23	23	20	20	20	23	19	18	20
Kidney	16	13	16	20	17	16	17	19	15	15	12
Leukemia	14	7	13	13	13	15	14	14	17	17	12
Melanoma	13	8	22	20	14	9	15	14	10	15	15
Oral	12	18	11	14	13	12	12	16	11	11	10
Stomach	10	17	8	10	12	11	10	10	9	11	9
Pancreas	10	3	13	10	11	11	9	10	9	10	9
Brain	8	10	6	8	8	9	8	8	7	8	7
Multiple Myeloma	6	4	6	6	6	6	6	6	5	5	5
Larynx	5	7	8	6	7	8	5	4	5	4	4
Females											
All Cancers	**355**	**292**	**386**	**388**	**369**	**361**	**356**	**382**	**342**	**361**	**326**
Breast	106	100	98	110	99	113	105	104	98	109	96
Lung	49	34	50	62	48	56	46	58	42	47	46
Colorectal	41	47	59	52	46	41	42	45	40	37	37
Body of Uterus	19	17	19	20	17	17	20	25	18	21	17
Thyroid	14	10	5	8	13	12	19	11	9	13	8
Non-Hodgkin's Lymphoma	14	12	11	14	15	14	15	15	13	14	14
Ovary	12	9	10	12	12	12	12	12	11	10	10
Melanoma	10	8	19	16	14	7	11	9	10	13	11
Pancreas	8	2	8	8	10	9	7	8	6	8	8
Cervix	8	8	10	11	8	7	7	8	8	10	7
Kidney	8	8	8	11	10	8	8	10	8	8	6
Leukemia	8	4	7	8	7	8	8	10	9	10	7
Bladder**	6	2	3	5	8	9	5	5	7	3	4
Brain	6	4	6	6	6	7	6	5	6	5	5
Oral	5	5	5	6	4	5	5	6	5	5	6
Stomach	5	6	3	4	5	5	4	4	4	5	4
Multiple Myeloma	4	2	4	4	4	4	4	4	3	3	4

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

** Inter-provincial variation. 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 2005 estimates are compared to previously published estimates (see Appendix II: Methods). These estimates may vary from actual figures.

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

Table 5

Estimated Deaths for Major Cancer Sites by Sex and Province, Canada, 2005

	Deaths										
	Canada[1]	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.
Males											
All Cancers	**36,700**	**750**	**190**	**1,300**	**1,000**	**10,000**	**13,300**	**1,350**	**1,250**	**2,900**	**4,600**
Lung	10,700	220	60	420	340	3,500	3,500	360	330	740	1,200
Colorectal	4,500	110	25	150	120	1,250	1,600	180	160	340	530
Prostate	4,300	80	25	150	120	900	1,600	170	250	400	580
Pancreas	1,600	30	5	60	45	430	580	55	50	130	230
Non-Hodgkin's Lymphoma	1,600	15	5	50	50	370	640	75	45	120	250
Leukemia	1,300	15	5	35	30	290	530	50	45	120	170
Stomach	1,150	40	5	30	35	340	400	35	45	80	140
Bladder	1,150	30	5	40	30	270	450	45	40	95	160
Kidney	950	20	5	35	25	240	330	50	30	90	130
Brain	940	15	–	30	25	280	320	35	30	85	110
Oral	710	15	5	30	20	190	260	25	15	55	90
Multiple Myeloma	680	10	5	30	15	170	260	30	25	40	95
Melanoma	540	5	–	20	10	95	260	20	10	40	75
Larynx	420	10	–	15	15	150	140	10	15	20	45
Females											
All Cancers	**32,800**	**560**	**150**	**1,200**	**830**	**8,700**	**12,300**	**1,250**	**1,050**	**2,600**	**4,100**
Lung	8,300	120	45	270	180	2,400	3,000	330	200	670	1,100
Breast	5,300	95	25	200	130	1,400	2,000	200	150	430	630
Colorectal	3,900	90	25	170	110	1,100	1,450	150	120	260	440
Pancreas	1,750	25	10	65	45	450	620	70	65	140	250
Ovary	1,550	25	5	55	40	350	610	60	55	130	220
Non-Hodgkin's Lymphoma	1,350	15	5	40	45	310	550	55	45	100	170
Leukemia	940	15	5	30	20	220	370	40	35	75	130
Stomach	730	25	–	25	20	220	240	20	30	60	80
Brain	720	10	5	25	20	220	250	25	20	60	95
Body of Uterus	710	10	5	30	20	180	280	30	20	60	75
Multiple Myeloma	590	10	5	20	15	150	230	25	20	45	70
Kidney	570	10	5	20	20	170	180	25	25	45	75
Bladder	500	10	–	15	10	130	190	20	15	40	70
Cervix	400	10	5	20	15	80	160	15	15	40	50
Oral	350	–	–	10	5	90	130	15	10	30	45
Melanoma	340	5	–	10	5	70	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 2005 estimates are compared to previously published estimates (see *Appendix II: Methods*). These estimates may vary from actual figures.

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

Table 6

Estimated Age-Standardized Mortality Rates for Major Cancer Sites by Sex and Province, Canada, 2005

	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	**219**	**273**	**249**	**257**	**244**	**250**	**210**	**221**	**216**	**198**	**187**
Lung	63	77	80	82	83	86	55	58	59	51	50
Colorectal	27	40	31	30	29	31	26	29	26	23	22
Prostate	26	33	34	31	30	24	26	27	40	29	23
Pancreas	9	10	9	12	11	10	9	9	8	9	9
Non-Hodgkin's Lymphoma	9	6	8	10	12	9	10	12	8	8	10
Leukemia	8	6	8	7	8	7	9	8	8	8	7
Stomach	7	15	8	6	8	8	6	6	7	5	6
Bladder	7	11	5	8	7	7	7	7	7	7	7
Kidney	6	7	8	7	6	6	5	8	5	6	5
Brain	5	6	2	6	5	7	5	6	6	5	5
Oral	4	6	6	5	4	4	4	4	3	3	4
Multiple Myeloma	4	4	5	6	4	4	4	5	4	3	4
Melanoma	3	1	3	4	2	2	4	3	2	2	3
Larynx	2	3	3	3	4	3	2	2	2	1	2
Females											
All Cancers	**149**	**159**	**151**	**170**	**152**	**157**	**148**	**154**	**146**	**146**	**135**
Lung	40	35	50	41	35	45	38	43	31	39	38
Breast	24	27	28	27	24	25	24	25	22	23	21
Colorectal	17	26	22	22	19	19	17	17	15	14	14
Pancreas	8	7	9	9	8	8	7	8	8	7	8
Ovary	7	7	7	8	7	7	8	8	8	8	7
Non-Hodgkin's Lymphoma	6	4	7	6	8	6	7	7	6	6	6
Brain	4	4	4	4	4	4	3	3	4	4	4
Leukemia	4	4	5	4	3	4	4	5	5	4	4
Stomach	3	7	2	3	3	4	3	2	4	3	3
Body of Uterus	3	3	2	4	4	3	3	3	3	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	2	2
Oral	2	0	2	2	1	2	2	2	1	2	1
Melanoma	2	1	1	1	1	1	2	2	1	1	2
Cervix	2	4	3	3	3	2	2	2	3	2	2
Bladder	2	2	1	2	2	2	2	2	2	2	2

[1] Canada totals include provincial and territorial estimates. 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 2005 estimates are compared to previously published estimates (see *Appendix II: Methods*). These estimates may vary from actual figures.

Source: Surveillance and Risk Assessment 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 1976 to 2002 (for 2002 Quebec incidence is estimated) and estimates to the year 2005. Figures 3.1 and 3.2 show the relative contribution to the change in the total number of new cases and deaths that can be attributed to changes in cancer rates, population size and the aging of the population. Detailed depictions of the trends in annual rates for selected sites over the past 30 years are presented in Figures 4.1, 4.2 and 5.1, 5.2 with the data points provided in Tables 7.1, 7.2 and 8.1, 8.2. The average annual percent changes in site-specific incidence and mortality rates from 1992 to 2001 are listed in Table 9.

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. 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 2005, the number of new cases is estimated to be 149,000 and the number of deaths to be 69,500. This is an additional 3,500 new cases over the estimate for 2004. These numbers can be used to plan patient services and health care facilities to meet the increasing demand. Figures 3.1 and 3.2 show how changes since 1971 in the total population and in the age structure of the population have affected trends in the total number of cases and deaths. The lowest 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 1971. 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 1971. The top line represents the number of cases (or deaths) that actually occurred and thus reflects the combined impact of rate change, population growth and the aging of the population. These figures demonstrate that changes in population size and age structure have been the major determinants of the increasing burden of cancer among Canadians. An important implication is that as the Canadian population continues to age and grow in size, there will be a concordant increase in the numbers of new cases and deaths each year unless a major drop in the

rate occurs. 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 1976 to 2001 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 15% during that period.

Trends by Selected Sites

Time trends of incidence and mortality rates over a 30-year period for selected cancer sites are shown for men in Figures 4.1 and 4.2 and for women in Figures 5.1 and 5.2, with the corresponding data points tabulated in Tables 7.1, 7.2, 8.1 and 8.2. Average annual percent changes are summarized in Table 9 and 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 1976. However, estimated rates of lung cancer incidence and mortality among women in 2005 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 (determination of the prostate-specific antigen level).[7] That early detection has now exhausted the pool of prevalent cancer in the population that was screened, and the trend has reverted to its previous more gradual rate of increase.[8] 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 1992 to 2001 (2% 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 1975 and 1992. This increase may be due, in part, to the rising use of mammography since the mid-1980s, but may also be affected by reproductive

patterns.[9,10] However, since 1993 actual incidence rates have stabilized, and mortality rates for breast cancer have declined steadily. The most recent actual data for 2001 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]

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 1992 (Table 9). These were cancers of the thyroid (+5%) and melanoma (+2.4%) in men, and thyroid cancer (+5.1%) in women. The increasing rate of thyroid cancer has also been noted in Europe and parts of the United States. It is postulated that improved early detection practices (ultrasound and needle biopsy) are identifying early stage cancers more frequently than was possible in the past. As modern treatment is effective for most patients it is unlikely that the mortality rate will increase. An increase in melanoma incidence may be related to intense sunlight exposure and to improvements in the detection of the disease. Other cancers showing a significant increase, but of less than 2%, were non-Hodgkin's lymphoma and testis cancer in men; lung cancer and melanoma among women.

The mortality rate increase was greatest for non-Hodgkin's lymphoma among men, at 1.7% per year. A significant increase in mortality rates for melanoma and cancer of the esophagus were also seen among men (1.3% and 0.7%, respectively). Among women, the mortality rate for lung cancer increased significantly, at 1.3% per year.

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

Table 9 shows continuing declines in the incidence of stomach cancer (-2.3% annually among men and -2.7% among women) and mortality (-3.2% among men and -3.4% 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 (-2.1% incidence and -1.9 % mortality) likely reflect the impact of early detection and treatment of pre-malignant lesions as a result of Pap smear screening. Statistically significant declines in incidence also occurred for Hodgkin's disease, laryngeal, oral, bladder and pancreas cancer among men, and Hodgkin's disease, ovarian, bladder, pancreas, lung and laryngeal cancer among women. Likewise, statistically significant declines in mortality rates have occurred in Hodgkin's disease, oral, pancreas, and laryngeal cancer among men, and in leukemia, stomach, pancreatic and ovarian cancer among women.

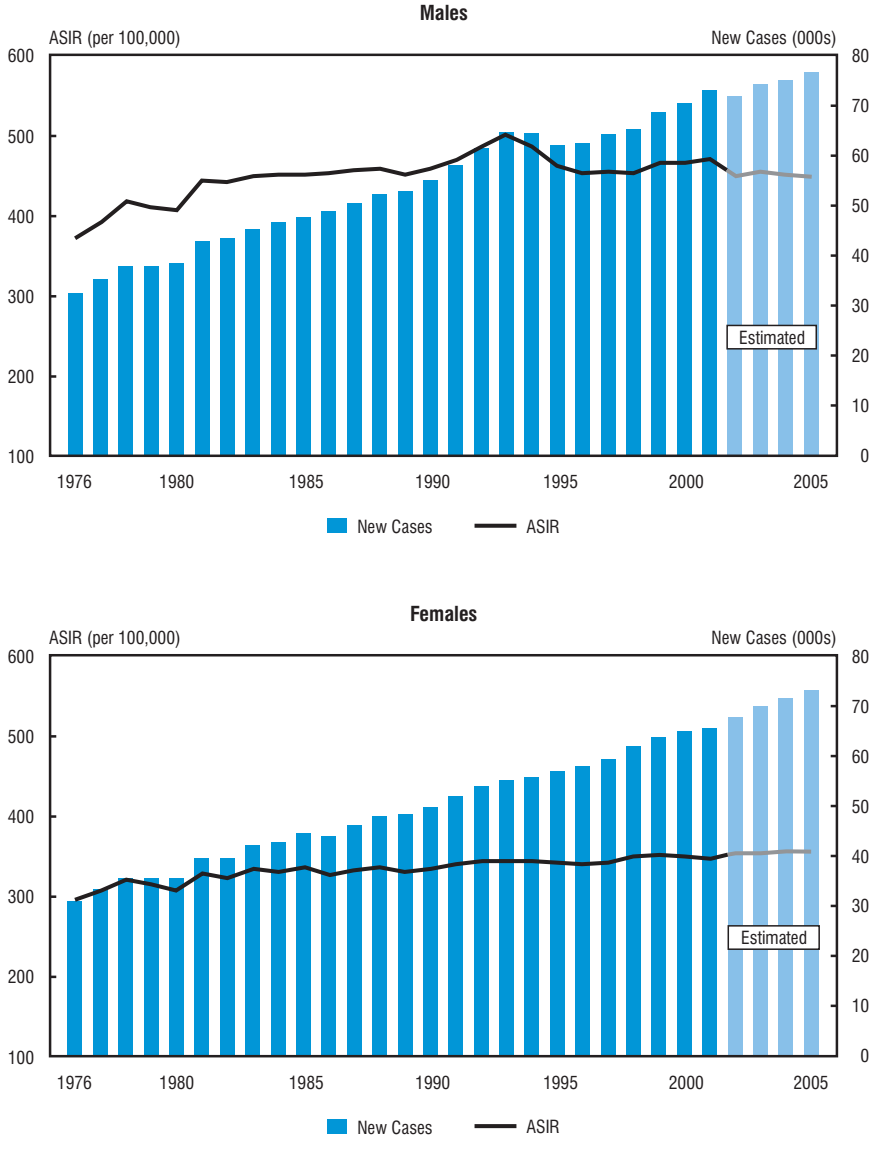
Figures 6.1 and 6.2 show why we cannot be complacent about the declining rates described here. Figure 6.1 shows the percent change in numbers of cancers compared to percent change in cancer rates between 1992 and 2001. It is not surprising to see

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 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, 1976-2005

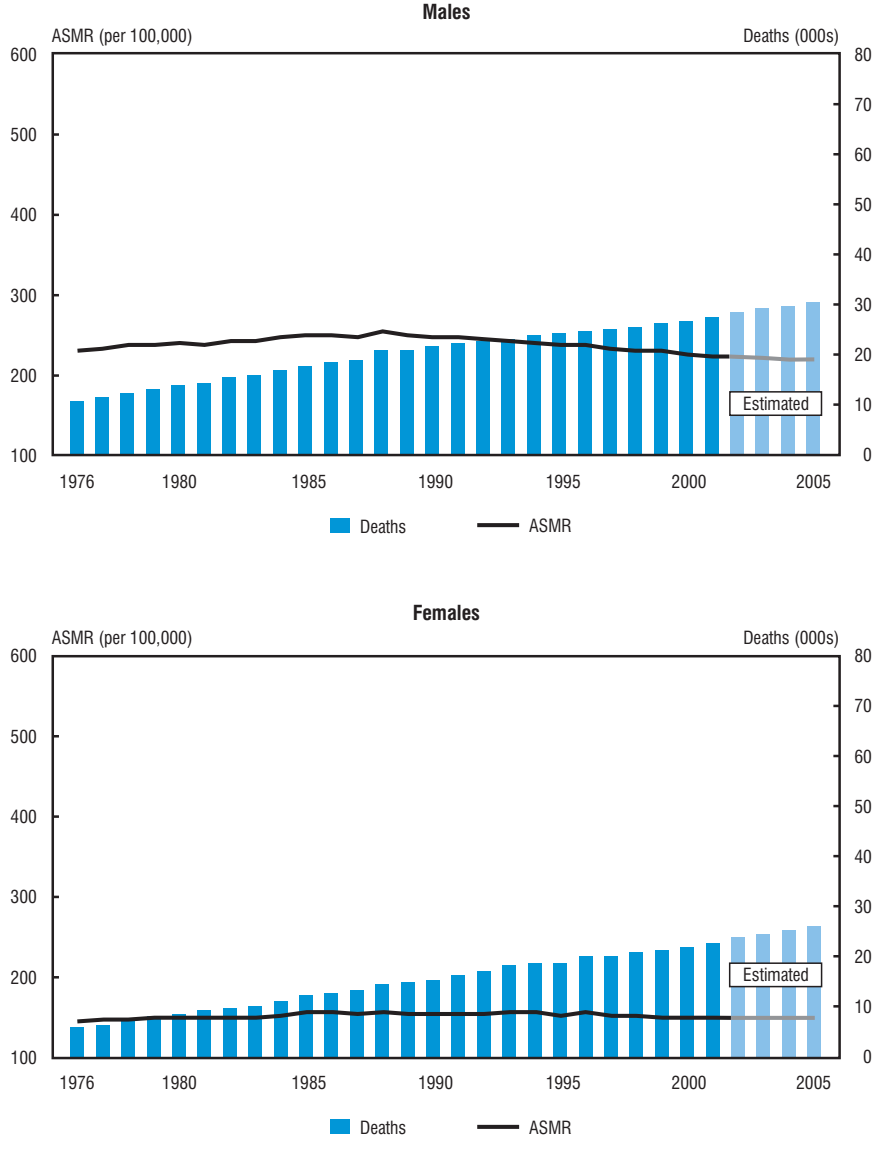


Note: All cancers exclude non-melanoma skin cancer. Rates are standardized to the 1991 Canadian population. For 2002 Quebec incidence is estimated.

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

Figure 2.2

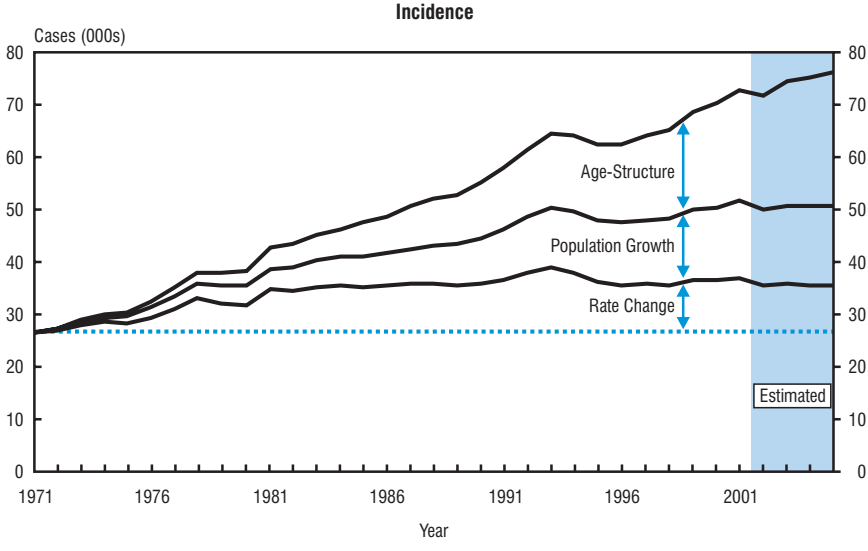
Deaths and Age-Standardized Mortality Rates (ASMR) for All Cancers, Canada, 1976-2005

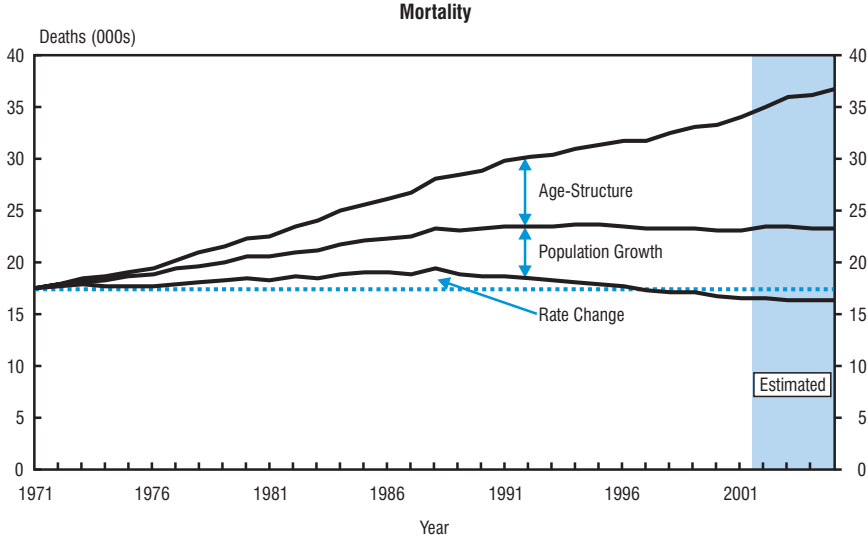


Note: Rates are standardized to the 1991 Canadian population.
Source: Surveillance and Risk Assessment Division, CCDPC, Public Health Agency of Canada

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,1971-2005



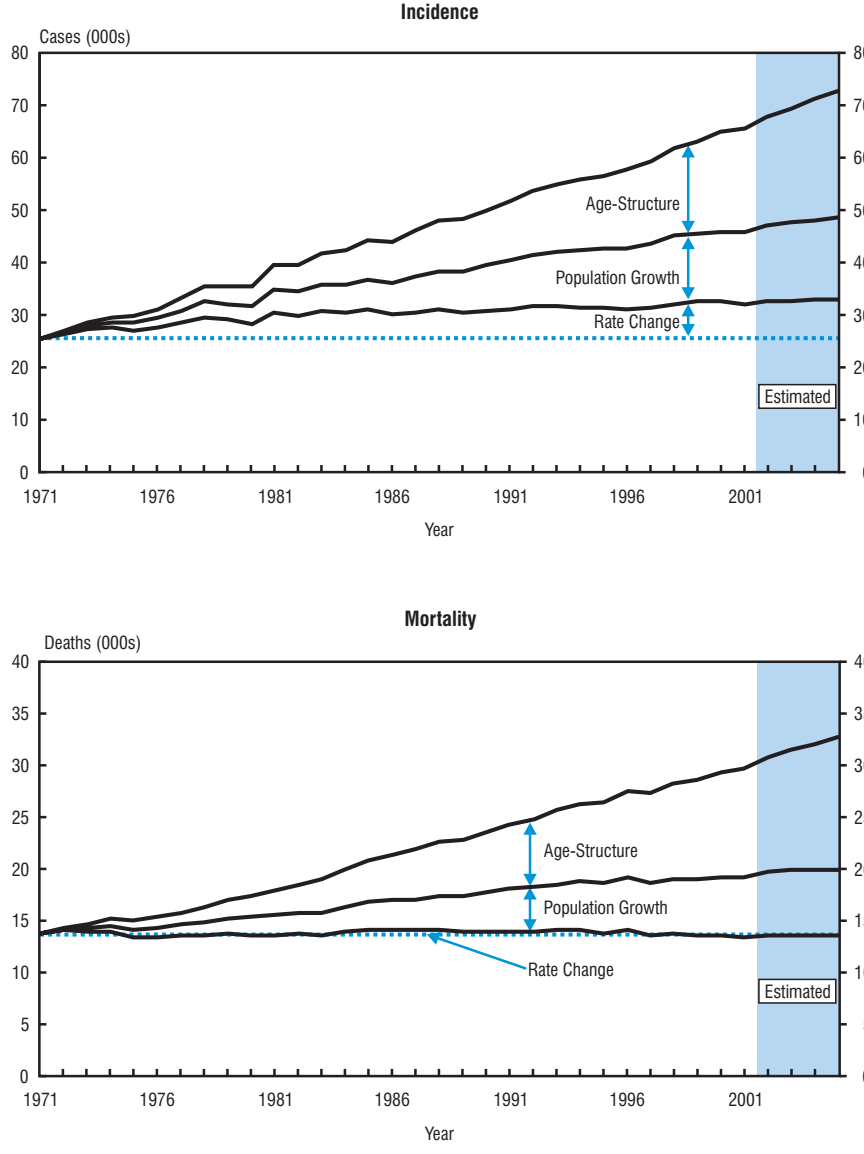


Note: Incidence figures exclude non-melanoma (basal and squamous) skin cancer. Magnitude of area represents the number of cases/deaths due to each change. For 2002 Quebec incidence is estimated. Please refer to *Appendix II: Methods* for further details.

Source: Surveillance and Risk Assessment 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,1971-2005

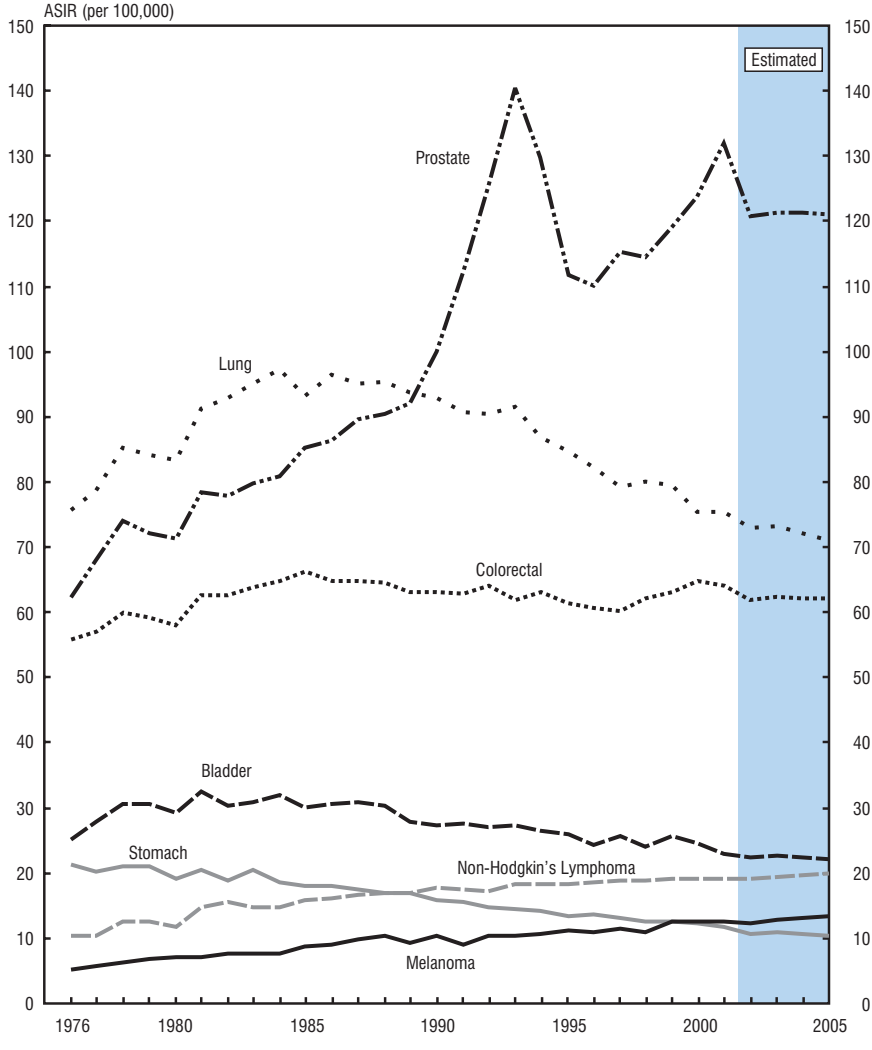


Note: Incidence figures exclude non-melanoma (basal and squamous) skin cancer. Magnitude of area represents the number of cases/deaths due to each change. For 2002 Quebec incidence is estimated. Please refer to *Appendix II: Methods* for further details.

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

Figure 4.1

Age-Standardized Incidence Rates (ASIR) for Selected Cancer Sites, Males, Canada, 1976-2005

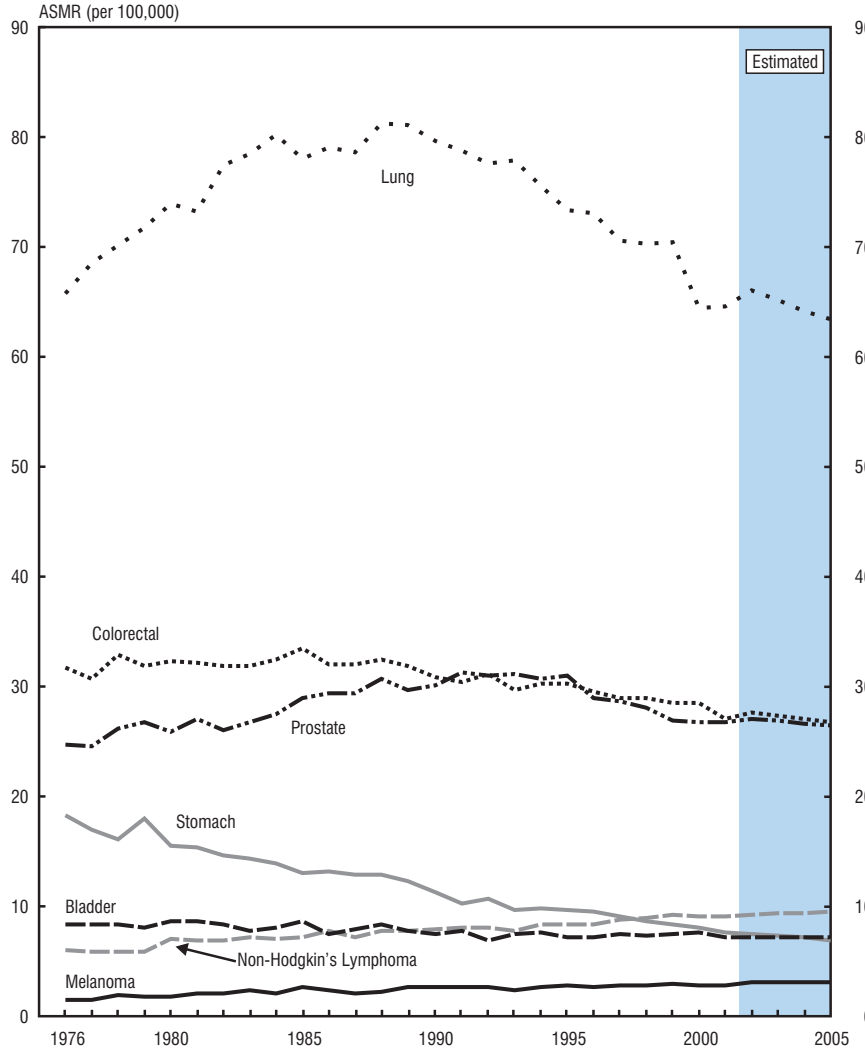


Note: Rates are standardized to the age distribution of the 1991 Canadian population. See Table 7.1 for data points. For 2002 Quebec is estimated.

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

Figure 4.2

Age-Standardized Mortality Rates (ASMR) for Selected Cancer Sites, Males, Canada, 1976-2005

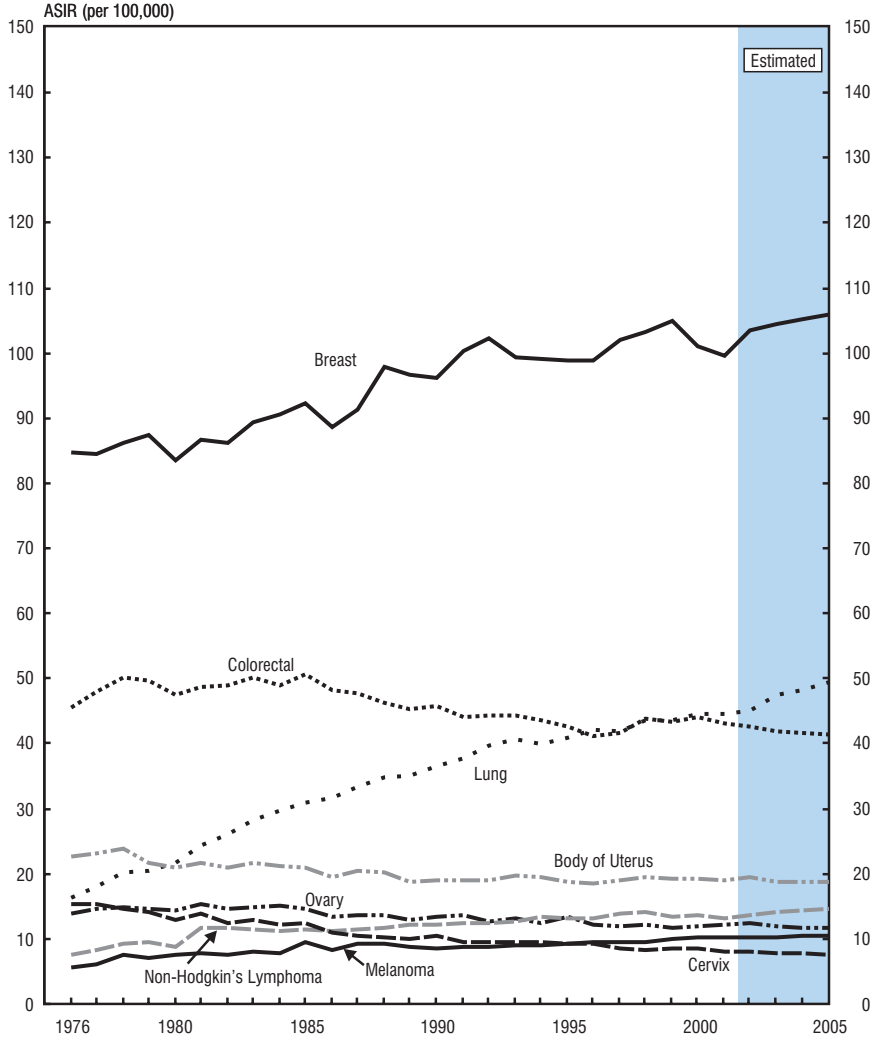


Note: Rates are standardized to the age distribution of the 1991 Canadian population. See Table 7.2 for data points.

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

Figure 5.1

Age-Standardized Incidence Rates (ASIR) for Selected Cancer Sites, Females, Canada, 1976-2005

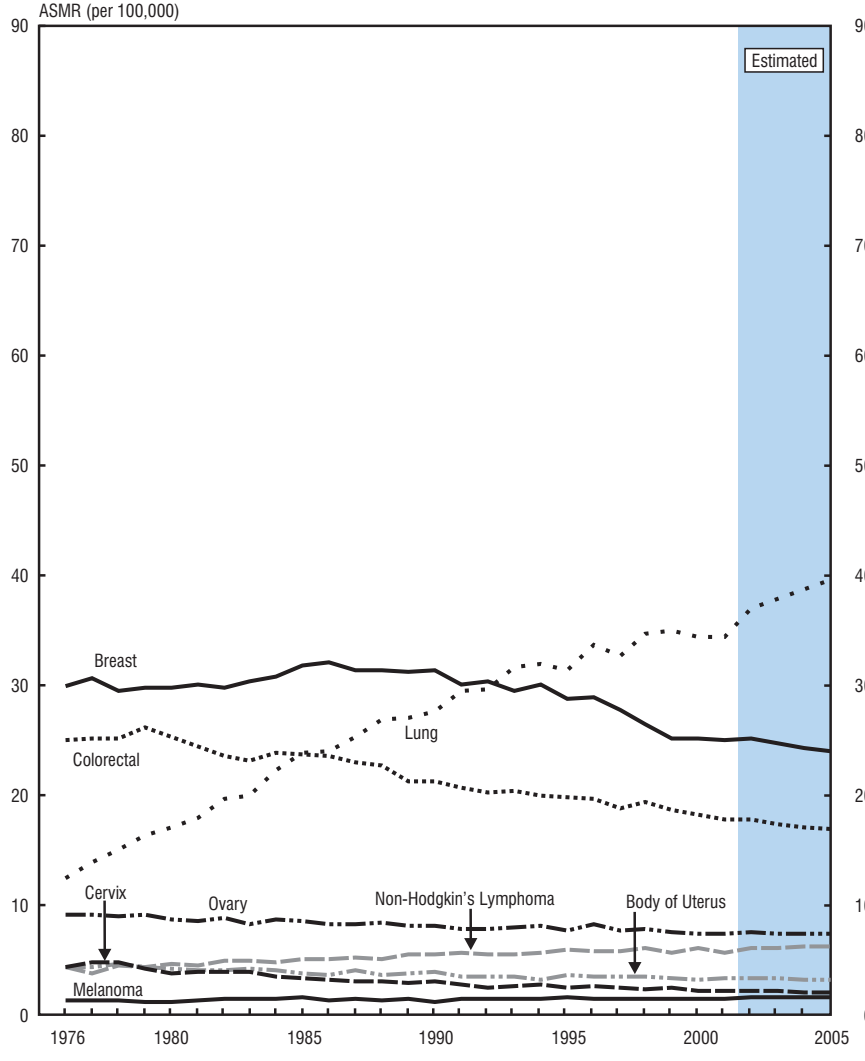


Note: Rates are standardized to the age distribution of the 1991 Canadian population. See Table 8.1 for data points. For 2002 Quebec is estimated.

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

Figure 5.2

Age-Standardized Mortality Rates (ASMR) for Selected Cancer Sites, Females, Canada, 1976-2005



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

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

Table 7.1

Age-Standardized Incidence Rates for Selected Cancer Sites, Males, Canada, 1976-2005

Year	Rate per 100,000							
	All Cancers	Prostate	Lung	Colorectal	Bladder	Non-Hodgkin's Lymphoma	Melanoma	Stomach
1976	371.9	62.1	75.7	55.9	25.1	10.1	5.1	21.2
1977	391.4	67.9	78.6	57.0	28.0	10.5	5.5	20.1
1978	417.2	74.0	85.1	59.9	30.6	12.5	6.4	20.9
1979	409.8	72.0	83.9	59.2	30.6	12.4	6.8	20.8
1980	406.1	71.4	83.2	57.9	29.2	11.6	7.0	19.0
1981	442.2	78.5	91.2	62.6	32.5	14.7	7.0	20.5
1982	440.7	77.8	92.6	62.7	30.3	15.6	7.5	18.7
1983	448.4	79.6	95.2	63.9	30.9	14.9	7.6	20.4
1984	450.1	80.9	97.1	64.7	31.7	14.9	7.5	18.4
1985	449.8	85.1	93.2	66.2	30.2	15.7	8.7	18.0
1986	451.9	86.1	96.4	64.7	30.6	16.0	9.0	18.0
1987	456.3	89.6	95.0	64.7	30.8	16.6	9.7	17.4
1988	458.5	90.4	95.5	64.6	30.3	17.0	10.4	17.0
1989	451.6	91.9	93.6	63.1	27.9	16.7	9.3	16.8
1990	457.7	99.9	92.7	63.0	27.2	17.7	10.1	15.8
1991	469.0	112.3	90.7	62.9	27.5	17.4	9.1	15.6
1992	485.8	125.4	90.4	64.1	27.0	17.2	10.3	14.6
1993	498.9	140.5	91.6	61.9	27.1	18.1	10.3	14.3
1994	484.9	129.7	87.0	63.0	26.4	18.2	10.7	14.1
1995	460.9	111.6	84.7	61.5	25.9	18.3	11.1	13.3
1996	452.1	110.0	82.3	60.6	24.3	18.4	11.0	13.7
1997	454.2	115.4	79.2	60.1	25.6	18.8	11.3	13.0
1998	452.5	114.5	80.1	62.2	24.0	18.8	10.9	12.5
1999	463.8	119.1	79.4	63.2	25.8	18.9	12.6	12.5
2000	464.1	123.9	75.6	64.9	24.5	18.9	12.4	12.2
2001	468.5	132.1	75.5	64.0	22.7	19.0	12.6	11.7
2002**	448.6	120.6	72.7	61.9	22.3	18.9	12.2	10.8
2003*	452.5	121.4	73.2	62.3	22.6	19.5	12.8	11.0
2004*	450.3	121.3	72.0	62.2	22.3	19.7	13.1	10.7
2005*	448.2	121.2	70.8	62.1	22.0	19.9	13.4	10.4

* Estimated rates

** For 2002 Quebec incidence is estimated

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

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

Table 7.2

Age-Standardized Mortality Rates for Selected Cancer Sites, Males, Canada, 1976-2005

Year	Rate per 100,000							
	All Cancers	Lung	Colorectal	Prostate	Non-Hodgkin's Lymphoma	Bladder	Stomach	Melanoma
1976	230.2	65.8	31.7	24.7	6.0	8.3	18.2	1.5
1977	233.5	68.5	30.7	24.6	5.9	8.4	17.0	1.5
1978	236.4	70.1	32.9	26.1	5.9	8.4	16.1	1.9
1979	239.4	71.7	31.8	26.7	5.9	8.1	18.0	1.7
1980	240.7	74.0	32.3	25.8	7.0	8.6	15.5	1.7
1981	239.2	73.2	32.2	27.1	6.9	8.6	15.3	2.1
1982	243.5	77.4	31.9	26.0	6.8	8.4	14.6	2.1
1983	242.9	78.4	31.8	26.7	7.2	7.8	14.3	2.3
1984	247.9	80.2	32.4	27.4	7.0	8.1	13.9	2.1
1985	249.0	78.0	33.4	28.9	7.1	8.6	13.0	2.6
1986	249.0	79.0	32.0	29.4	7.7	7.4	13.1	2.3
1987	248.2	78.6	32.0	29.4	7.1	7.9	12.9	2.0
1988	254.8	81.3	32.4	30.7	7.8	8.3	12.8	2.2
1989	249.6	81.1	31.9	29.7	7.7	7.8	12.3	2.6
1990	246.5	79.6	30.9	30.1	7.9	7.5	11.3	2.6
1991	247.2	78.8	30.4	31.2	8.1	7.7	10.3	2.6
1992	244.7	77.6	31.1	31.0	8.1	6.9	10.7	2.6
1993	242.8	77.9	29.7	31.1	7.7	7.4	9.7	2.4
1994	241.8	75.6	30.3	30.7	8.4	7.6	9.8	2.7
1995	239.0	73.3	30.2	31.0	8.4	7.2	9.6	2.8
1996	236.5	73.0	29.5	29.0	8.4	7.2	9.5	2.6
1997	232.3	70.6	29.0	28.7	8.7	7.5	9.0	2.8
1998	230.5	70.3	28.9	28.0	8.9	7.3	8.6	2.8
1999	229.4	70.4	28.5	26.9	9.2	7.5	8.4	2.9
2000	225.4	64.4	28.5	26.8	9.0	7.6	8.1	2.8
2001	224.0	64.6	27.1	26.7	9.1	7.2	7.6	2.8
2002*	224.2	66.0	27.6	27.1	9.2	7.2	7.5	3.0
2003*	222.5	65.1	27.3	26.9	9.3	7.2	7.3	3.0
2004*	220.7	64.2	27.0	26.6	9.4	7.2	7.1	3.0
2005*	219.0	63.4	26.8	26.4	9.5	7.2	6.9	3.1

* Estimated rates

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

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

Table 8.1

Age-Standardized Incidence Rates for Selected Cancer Sites, Females, Canada, 1976-2005

Year	Rate per 100,000									
	All Cancers	Breast	Lung	Colorectal	Body of Uterus	Non-Hodgkin's Lymphoma	Ovary	Melanoma	Cervix	Stomach
1976	294.9	84.6	16.3	45.4	22.7	7.5	13.9	5.6	15.2	9.3
1977	306.0	84.4	17.9	48.0	23.0	8.3	14.5	6.1	15.4	9.3
1978	319.4	86.1	20.1	50.2	23.9	9.2	14.9	7.6	14.7	9.5
1979	313.8	87.3	20.3	49.7	21.7	9.6	14.5	7.1	14.2	9.2
1980	305.5	83.3	21.7	47.4	20.8	8.8	14.4	7.5	13.0	8.6
1981	328.1	86.5	24.3	48.6	21.6	11.6	15.4	7.8	13.9	9.8
1982	321.0	86.0	25.9	48.9	21.0	11.7	14.7	7.5	12.3	8.7
1983	332.8	89.3	28.3	50.2	21.6	11.5	14.9	8.0	12.9	8.7
1984	329.5	90.4	29.6	48.9	21.2	11.3	15.0	7.7	12.2	8.1
1985	335.6	92.2	30.9	50.6	20.8	11.4	14.6	9.5	12.3	8.0
1986	324.9	88.6	31.7	48.2	19.5	11.3	13.3	8.3	10.9	8.3
1987	330.7	91.1	33.2	47.6	20.5	11.5	13.7	9.3	10.4	8.0
1988	336.1	97.8	34.8	46.1	20.1	11.7	13.6	9.2	10.2	7.2
1989	330.0	96.4	35.0	45.3	18.7	12.2	13.0	8.7	10.0	7.2
1990	333.2	96.0	36.5	45.7	19.0	12.1	13.4	8.5	10.4	6.9
1991	337.1	100.1	37.7	44.1	18.9	12.4	13.6	8.8	9.6	6.4
1992	342.6	102.0	39.7	44.2	18.9	12.5	12.6	8.7	9.6	6.5
1993	342.2	99.2	40.7	44.2	19.7	12.7	13.2	8.9	9.5	6.3
1994	341.0	99.0	39.8	43.6	19.5	13.3	12.5	9.1	9.4	6.3
1995	339.5	98.8	40.8	42.5	18.6	13.1	13.3	9.3	9.3	6.0
1996	337.6	98.6	42.0	41.0	18.5	13.1	12.2	9.5	9.2	6.0
1997	340.7	101.9	41.9	41.5	18.9	13.8	12.0	9.5	8.6	5.5
1998	348.2	103.0	43.5	43.8	19.4	14.0	12.1	9.5	8.3	5.6
1999	349.1	104.9	43.4	43.2	19.1	13.4	11.6	10.0	8.4	5.3
2000	348.7	101.0	44.5	44.1	19.3	13.7	11.9	10.3	8.4	5.4
2001	345.1	99.5	44.5	43.1	18.9	13.2	12.1	10.2	8.1	5.0
2002**	351.6	103.3	44.9	42.5	19.4	13.7	12.4	10.1	8.0	5.0
2003*	351.8	104.4	47.3	41.8	18.8	14.1	11.8	10.2	7.9	4.8
2004*	353.1	105.1	48.2	41.6	18.8	14.3	11.7	10.4	7.7	4.7
2005*	354.5	105.8	49.3	41.4	18.8	14.5	11.6	10.5	7.6	4.6

* Estimated rates

** For 2002 Quebec incidence is estimated

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

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

Table 8.2

Age-Standardized Mortality Rates for Selected Cancer Sites, Females, Canada, 1976-2005

Year	Rate per 100,000									
	All Cancers	Lung	Breast	Colorectal	Ovary	Non-Hodgkin's Lymphoma	Stomach	Body of Uterus	Cervix	Melanoma
1976	146.0	12.4	29.9	25.0	9.1	4.4	8.5	4.4	4.4	1.3
1977	147.1	13.9	30.6	25.2	9.1	3.8	7.4	4.4	4.8	1.3
1978	147.6	15.0	29.5	25.1	9.0	4.5	7.4	4.6	4.7	1.3
1979	150.2	16.3	29.8	26.1	9.1	4.4	7.2	4.3	4.2	1.2
1980	148.5	17.1	29.7	25.3	8.6	4.6	6.8	4.2	3.7	1.2
1981	149.0	17.9	30.1	24.4	8.5	4.5	7.5	4.1	3.9	1.3
1982	149.3	19.6	29.7	23.5	8.8	4.9	6.7	4.1	3.9	1.5
1983	149.4	19.9	30.4	23.1	8.2	4.9	6.5	4.2	3.9	1.5
1984	151.9	22.2	30.7	23.8	8.7	4.7	5.7	4.0	3.5	1.5
1985	154.8	23.8	31.8	23.7	8.5	5.0	6.0	3.8	3.3	1.6
1986	154.4	24.0	32.0	23.5	8.2	5.1	6.1	3.6	3.2	1.3
1987	154.0	25.3	31.3	23.0	8.2	5.2	5.7	4.1	3.0	1.5
1988	155.4	26.9	31.4	22.7	8.4	5.0	5.1	3.6	3.0	1.3
1989	153.1	27.0	31.2	21.3	8.1	5.5	5.5	3.7	2.9	1.4
1990	153.1	27.6	31.3	21.3	8.1	5.5	5.0	3.9	3.0	1.2
1991	153.5	29.5	30.1	20.7	7.8	5.7	4.9	3.5	2.8	1.4
1992	153.1	29.6	30.4	20.2	7.8	5.5	4.9	3.5	2.4	1.5
1993	154.8	31.7	29.4	20.3	8.0	5.5	4.5	3.4	2.6	1.5
1994	155.1	31.9	30.0	19.9	8.1	5.7	4.5	3.2	2.7	1.5
1995	152.0	31.4	28.7	19.8	7.7	5.9	4.6	3.6	2.4	1.6
1996	155.2	33.7	28.9	19.7	8.2	5.8	4.4	3.4	2.6	1.5
1997	150.3	32.7	27.7	18.8	7.7	5.8	3.9	3.4	2.5	1.5
1998	151.3	34.6	26.4	19.3	7.8	6.0	3.8	3.4	2.3	1.5
1999	149.8	34.9	25.2	18.6	7.5	5.7	4.0	3.3	2.4	1.5
2000	149.8	34.4	25.1	18.2	7.3	6.1	3.9	3.2	2.2	1.5
2001	148.2	34.4	25.0	17.8	7.4	5.7	3.4	3.3	2.1	1.4
2002*	150.2	37.0	25.1	17.7	7.5	6.0	3.5	3.3	2.1	1.6
2003*	149.9	37.8	24.7	17.4	7.4	6.1	3.4	3.3	2.1	1.6
2004*	149.7	38.7	24.3	17.1	7.4	6.1	3.3	3.2	2.0	1.6
2005*	149.4	39.6	24.0	16.9	7.3	6.2	3.2	3.2	2.0	1.6

* Estimated rates

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

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

Table 9

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

	Incidence 1992-2001				Mortality 1992-2001			
	Males		Females		Males		Females	
	AAPC	Joinpoint†	AAPC	Joinpoint†	AAPC	Joinpoint†	AAPC	Joinpoint†
All Cancers	**0.8****	**1996**	**0.2**		**-1.0****		**-0.7***	**1996**
Oral	-2.7**		-0.9		-3.0**		-1.2	
Esophagus	0.2		-1.4*		0.7*		-0.9	
Stomach	-2.3**		-2.7**		-3.2**		-3.4**	
Colorectal	1.7*	1997	1.2	1996	-1.2**		-1.4**	
Pancreas	-0.7*		-0.7*		-1.0**		-0.6*	
Larynx	-3.3**		-2.7**		-2.4**		-1.5	
Lung	-2.2**	1993	1.4**		-2.1**		1.3**	1993
Melanoma	2.4**		1.8**		1.3*		-0.5	
Breast	–		0.2		–		-2.8**	1994
Body of Uterus	–		-0.1		–		-0.6	
Cervix	–		-2.1**		–		-1.9*	
Ovary	–		-1.1*		–		-0.9*	
Prostate	3.4**	1996	–		-2.2**	1993	–	
Testis	1.8*		–		-2.1		–	
Bladder	-1.6**		-1.4*		0.4		-0.4	
Kidney	0.5		0.8		-0.5		-0.7	
Brain	-0.2		0.4		-0.1		-0.2	
Thyroid	5.0**		5.1**		-0.2		-3.7	
Non-Hodgkin's Lymphoma	0.9**		-1.1	1997	1.7**		0.6	
Hodgkin's Disease	-1.1*		-1.0*		-3.9**		-3.5	
Multiple Myeloma	-0.1		0.4		-0.2		-0.9	
Leukemia	-0.3		-0.6		-0.4		-1.7**	

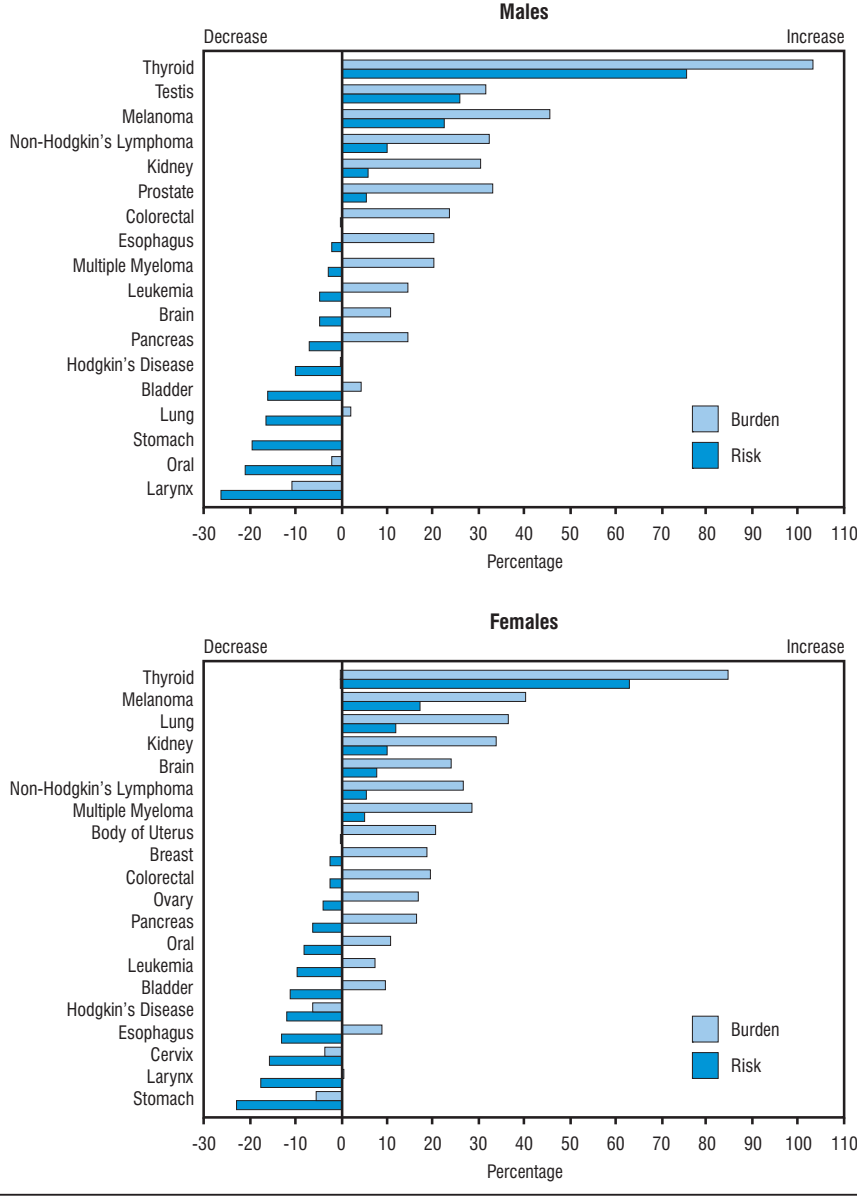
– Not applicable
* Significant at p=0.05
** Significant at p=0.01
† Joinpoint indicates the baseline year, if the slope of the trend changed after 1992. Please refer to *Appendix II: Methods* for further details.

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

Source: Surveillance and Risk Assessment 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

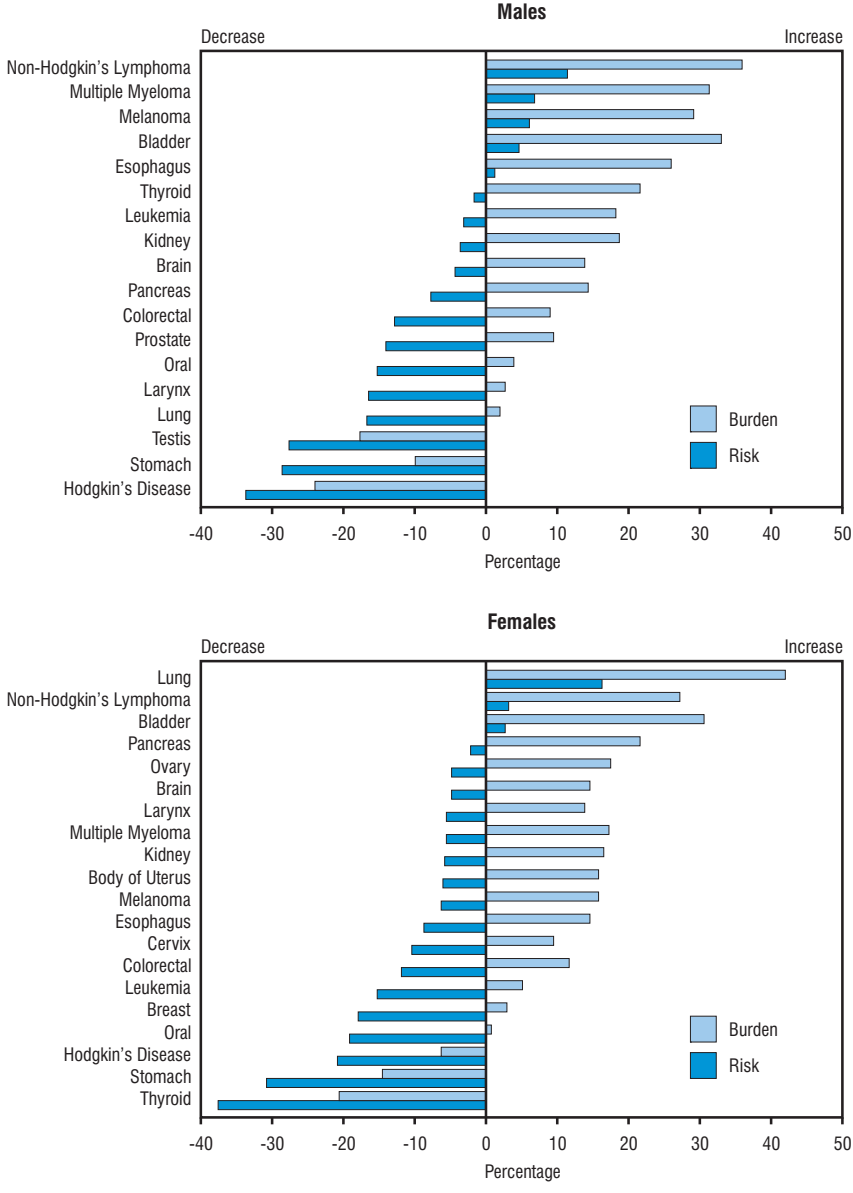


Note: See Table 9 for average annual percent change for all sites. Sites are ranked in decreasing order of percent change of rates.

Source: Surveillance and Risk Assessment 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 1992-2001

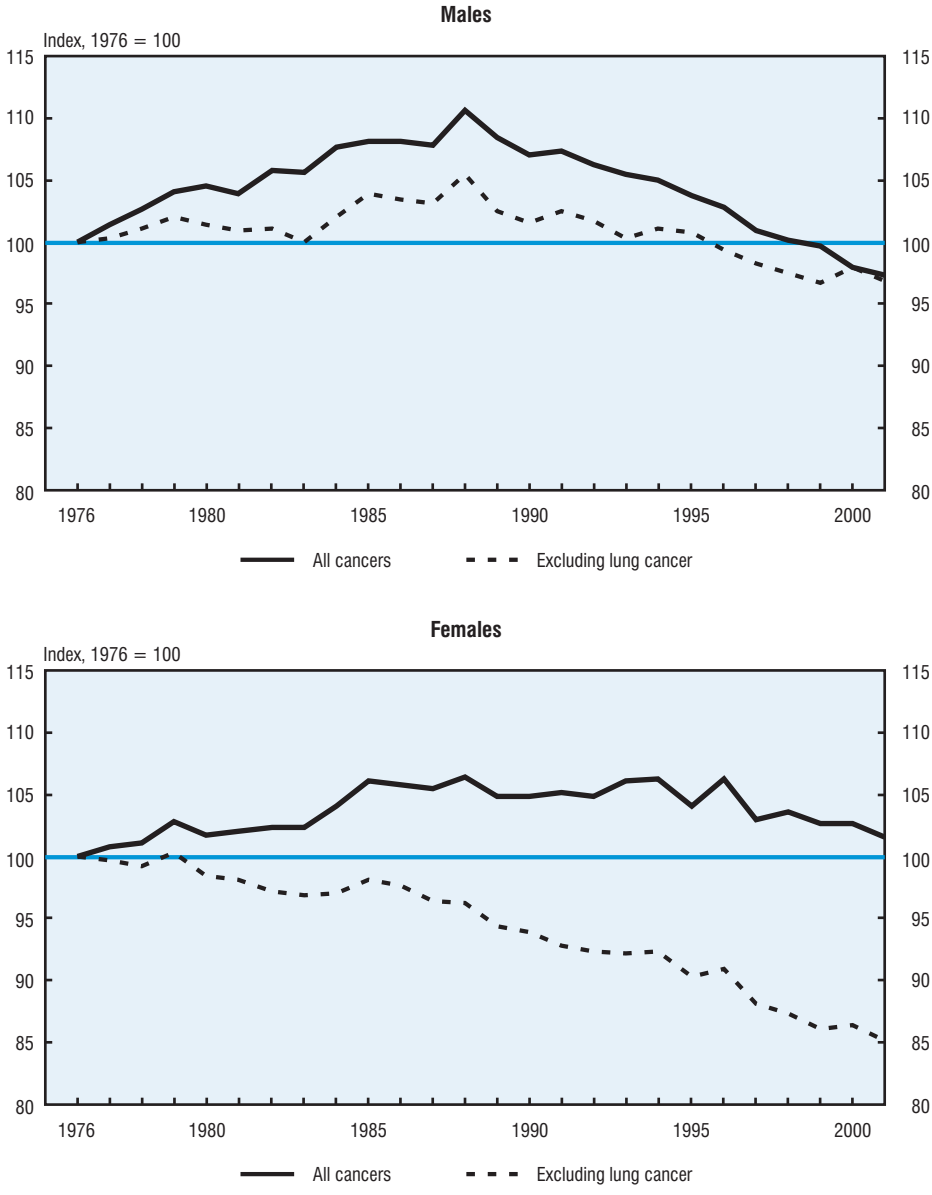


Note: See Table 9 for average annual percent change for all sites. Sites are ranked in decreasing order of percent change of rates.

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

Figure 7

Index of Age-Standardized Mortality Rates Including and Excluding Lung Cancer, Canada, 1976-2001



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

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

AGE AND SEX DISTRIBUTION OF CANCER

This section shows estimates for 2005 by 10-year age groups for all sites combined (Table 10) and for the four leading types of cancer (Table 11).

Cancer and cancer deaths affect more men than women, despite there being fewer men than women in the Canadian population. Cancer is primarily a disease of the elderly. The estimates for 2005 shown in Table 10 indicate that 64,900 new cases (44%) and 41,500 cancer deaths (60%) occur in Canadians aged 70 years or more, while an additional 36,800 new cases (25%) and 14,600 deaths (21%) occur in those aged 60-69. In contrast, less than 1% of new cases and 0.3% of deaths occur prior to age 20. The median age at cancer diagnosis is between 60 and 69 years of age and at death between 70 and 79.

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 47% of prostate cancers occur among Canadians aged 70 or more. In contrast, only 29% of breast cancers are diagnosed at age 70 or later, 50% between ages 50 and 69 and 21% occur in women under age 50.

Trends (since 1976) in age-standardized incidence and mortality rates for all cancers are plotted for four specific age groups in Figure 8 (Note that each age group has a different scale for the y axis because of the wide range in age-specific rates). Men have higher incidence and mortality rates than women in all age groups except 20-49; the male excess is particularly pronounced at ages 70 and over. The higher rates in women at ages 20-49 are largely due to breast cancer, which is by far the most common cancer in women in this age group; cancers of the female reproductive organs account for the remainder of the female excess.

Since 1981, absolute increases in cancer incidence rates have occurred primarily in Canadians aged 50 or over. The large increases in incidence that occurred in the early 1990s in males aged 50 and over are almost certainly due to prostate cancer, which increased rapidly following the introduction of the prostate-specific antigen (PSA) test. As expected, the initial rapid increase in incidence due to detection of prevalent cases was followed by a decline, then a return to the pre-PSA increasing trend.

Most encouraging are the fairly steady declines in overall cancer mortality rates that have occurred since at least 1988 among males in all age groups and females in all age groups except the oldest (70 and over). Mortality rates have declined by 3% per year since 1976 among Canadians aged 0 to 19 and by 1.3% annually in the 20-49 age group. Since the late 1980s, mortality has been dropping by 1.7% and 0.8% annually for men and women aged 50-69, respectively, and by 0.4% per year in men aged 70 and over. Mortality increased slightly in women 70 years and over.

Figure 9 displays age-specific rates of cancer incidence and mortality by 5-year age groups, plotted using actual data for cancer incidence and mortality in 2001, the most recent year for which complete data are available. Cancer incidence and mortality increase substantially with age in both sexes, 20 times as many new cases occurring in those over age 80 as in those under age 20. The higher incidence and mortality experienced by males at all ages outside of the female reproductive age range has been noted earlier.

Table 10

Distribution for All Cancer Sites Combined by Age Group and Sex, Canada, 2005

Age Group	Population (000s) 2005 Estimates			New Cases 2005 Estimates			Deaths 2005 Estimates		
	Total	M	F	Total	M	F	Total	M	F
0-19	7,671	3,928	3,743	1,250	670	580	190	110	85
20-29	4,297	2,180	2,116	1,800	830	950	230	130	100
30-39	4,647	2,338	2,309	4,400	1,550	2,800	770	320	460
40-49	5,368	2,695	2,673	12,600	4,400	8,200	3,300	1,450	1,900
50-59	4,301	2,135	2,167	27,300	12,600	14,700	8,800	4,400	4,400
60-69	2,693	1,305	1,388	36,800	21,200	15,600	14,600	8,300	6,300
70-79	1,862	838	1,023	38,900	22,400	16,400	20,900	12,000	9,000
80+	1,111	386	725	26,000	12,500	13,500	20,600	10,000	10,600
All Ages	**31,949**	**15,806**	**16,144**	**149,000**	**76,200**	**72,800**	**69,500**	**36,700**	**32,800**

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. 2005 population projections were provided by the Census and Demographics Branch, Statistics Canada.

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

Cancer is primarily a disease of older Canadians. Notable mortality rate declines have occurred in all age groups, especially the younger ones.

Table 11

Distribution by Selected Cancer Site, Age Group and Sex, Canada, 2005

Age Group	Lung			Colorectal			Prostate	Breast
	Total	M	F	Total	M	F	M	F
New Cases								
20-29	25	15	10	40	20	20	–	70
30-39	140	55	85	220	120	100	5	850
40-49	1,100	420	650	1,100	570	510	330	3,600
50-59	3,500	1,700	1,750	3,000	1,750	1,300	3,300	6,000
60-69	6,300	3,500	2,800	4,700	2,900	1,850	7,200	4,900
70-79	7,200	4,200	3,000	5,900	3,300	2,600	6,500	3,800
80+	4,000	2,100	1,900	4,700	1,950	2,700	3,100	2,500
Ages 20+	**22,200**	**12,000**	**10,200**	**19,600**	**10,600**	**9,000**	**20,500**	**21,600**
Deaths								
20-29	15	10	5	10	5	5	–	5
30-39	80	30	50	60	25	30	–	120
40-49	750	310	440	310	170	140	10	500
50-59	2,500	1,300	1,200	960	580	390	130	960
60-69	5,000	2,900	2,100	1,650	1,050	630	510	940
70-79	6,500	3,800	2,600	2,500	1,450	1,000	1,450	1,150
80+	4,200	2,300	1,900	2,900	1,250	1,700	2,200	1,550
Ages 20+	**19,000**	**10,700**	**8,300**	**8,400**	**4,500**	**3,900**	**4,300**	**5,300**

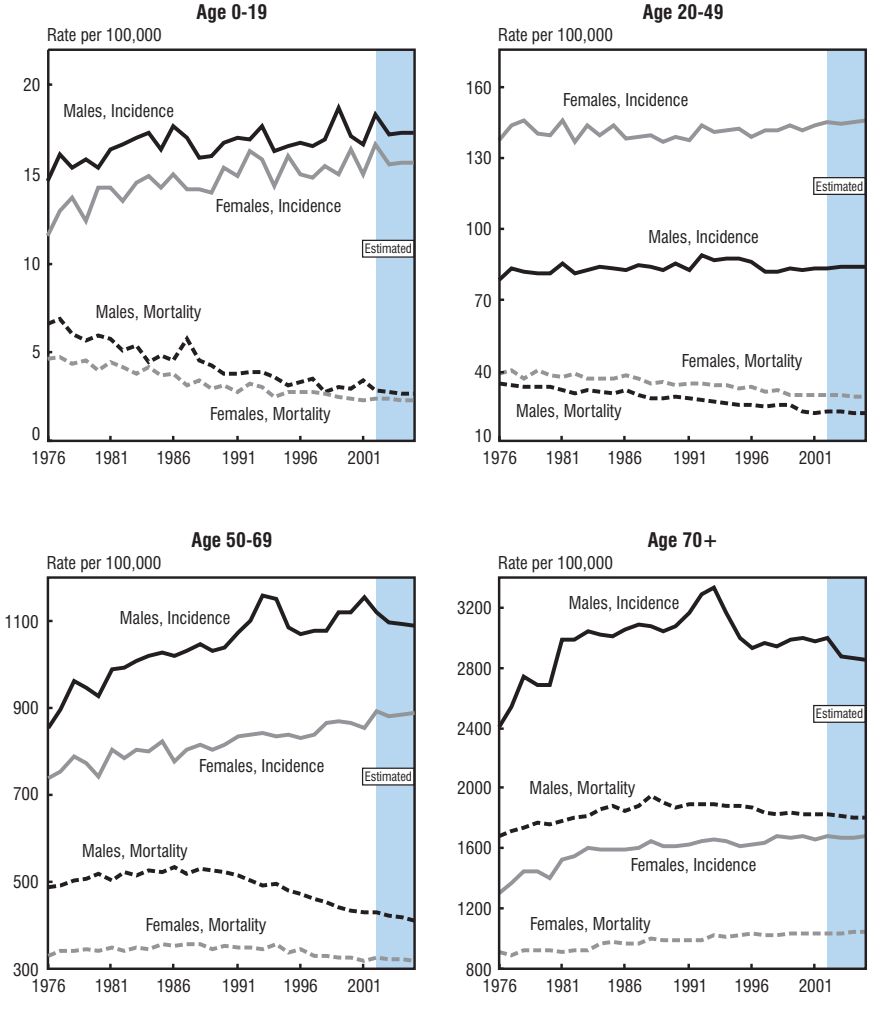
– Fewer than 3 cases or deaths.

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 and Risk Assessment Division, CCDPC, Public Health Agency of Canada

Figure 8

Age-Standardized Incidence and Mortality Rates by Broad Age Group, All Cancers, Canada, 1976-2005

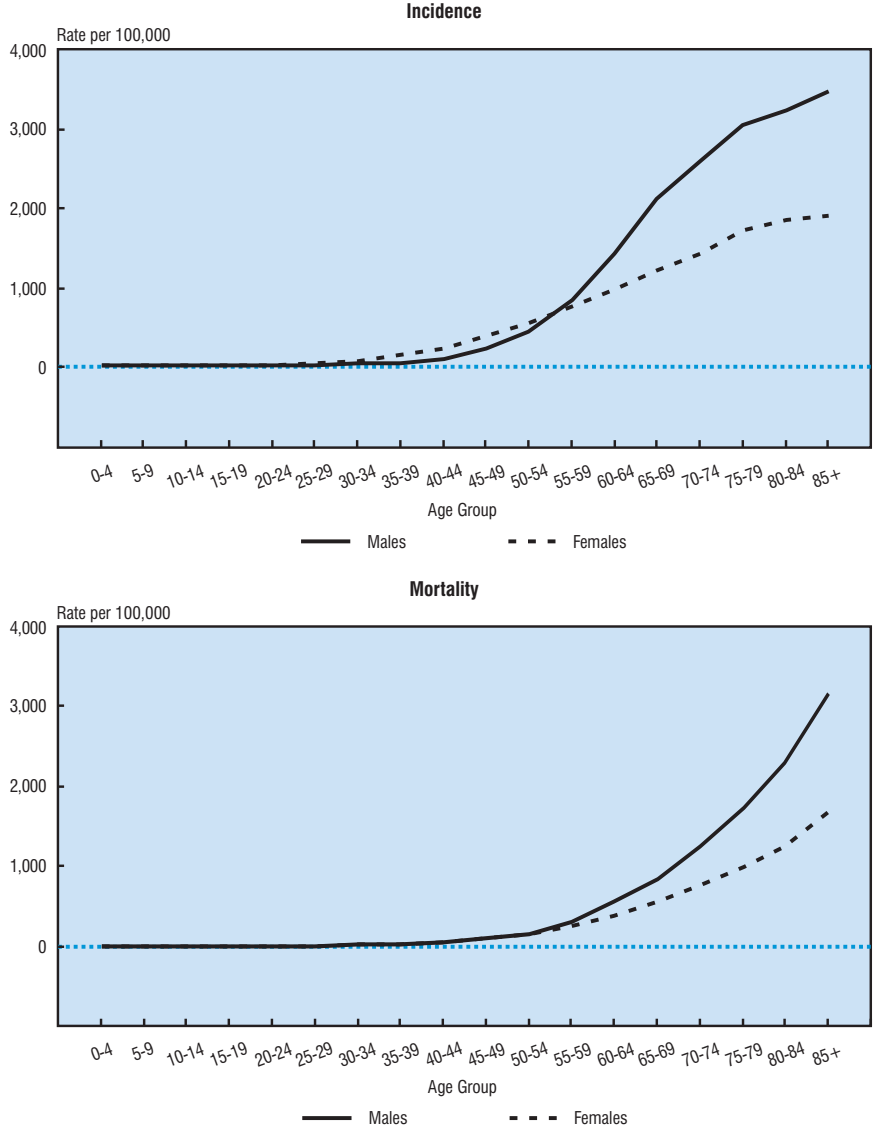


Note: Scales differ widely among the four age groups. Incidence figures exclude non-melanoma (basal and squamous) skin cancer. For 2002 Quebec incidence is estimated.

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

Figure 9

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 and Risk Assessment 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 15.6), will develop some type of cancer within this 10-year period; this percentage therefore describes, for a 50-year-old woman, the risk of developing some type of cancer before age 60. Similarly, a 60-year-old man has a 15.5% (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 7.1 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

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

	Probability (%) of Developing Cancer in Next 10 Years by Age Group						Lifetime Probability of Developing Cancer		Lifetime Probability of Dying from Cancer	
	30-39	40-49	50-59	60-69	70-79	80-89	%	One in:	%	One in:
Male										
All Cancers	**0.6**	**1.7**	**6.1**	**15.5**	**21.9**	**20.3**	**44.0**	**2.3**	**28.7**	**3.5**
Prostate	–	0.1	1.7	5.6	6.9	5.3	14.1	7.1	3.9	25.8
Lung	–	0.2	0.9	2.7	4.3	3.7	8.8	11.4	8.1	12.3
Colorectal	–	0.2	0.9	2.1	3.3	3.4	7.3	13.7	3.5	28.4
Lymphoma	0.1	0.2	0.4	0.7	1.1	1.1	2.9	34.3	1.7	59.2
Bladder	–	0.1	0.3	0.7	1.3	1.5	2.7	37.1	1.0	100.0
Kidney	–	0.1	0.3	0.5	0.7	0.6	1.7	57.8	0.7	140.8
Leukemia	–	0.1	0.1	0.4	0.6	0.7	1.5	65.0	1.0	98.0
Oral	–	0.1	0.3	0.4	0.5	0.4	1.4	70.8	0.6	181.8
Stomach	–	–	0.1	0.4	0.6	0.7	1.4	72.4	1.0	103.1
Melanoma	0.1	0.1	0.2	0.3	0.4	0.4	1.3	77.1	0.3	303.0
Pancreas	–	–	0.1	0.3	0.5	0.6	1.2	81.6	1.3	76.9
Female										
All Cancers	**1.2**	**3.0**	**6.3**	**10.1**	**13.6**	**13.5**	**38.4**	**2.6**	**23.5**	**4.3**
Breast	0.4	1.3	2.4	3.1	3.2	2.5	11.2	8.9	3.7	26.8
Colorectal	–	0.2	0.6	1.3	2.3	2.9	6.4	15.7	3.3	30.6
Lung	–	0.2	0.8	1.7	2.3	1.8	5.9	16.8	5.0	20.0
Lymphoma	0.1	0.1	0.3	0.5	0.8	0.9	2.5	40.1	1.4	69.9
Body of Uterus	–	0.1	0.5	0.7	0.7	0.5	2.3	43.4	0.5	185.2
Ovary	–	0.1	0.3	0.4	0.5	0.4	1.5	66.7	1.1	90.9
Pancreas	–	–	0.1	0.2	0.5	0.6	1.3	78.5	1.3	75.2
Leukemia	–	–	0.1	0.2	0.4	0.5	1.1	89.0	0.7	135.1
Kidney	–	0.1	0.2	0.3	0.4	0.4	1.1	89.9	0.4	227.3
Melanoma	0.1	0.1	0.2	0.2	0.3	0.2	1.1	92.8	0.2	526.3
Bladder	–	–	0.1	0.2	0.3	0.4	0.9	106.6	0.4	256.4
Stomach	–	–	–	0.1	0.3	0.4	0.8	127.7	0.6	175.4
Cervix	0.1	0.1	0.1	0.1	0.1	0.1	0.7	138.2	0.3	384.6
Oral	–	–	0.1	0.2	0.2	0.2	0.7	148.2	0.3	400.0

– 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 and Risk Assessment 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 2001 as represented by potential years of life lost (PYLL). This illustrates that cancer was the leading cause of PYLL for men and women: 967,000 potential years were lost as a result of cancer (Table 13), representing 31% of the PYLL resulting from all causes of death. Diseases of the heart were the second leading cause. Among children and youth aged 0 to 19, cancer ranked as the sixth leading cause of PYLL after perinatal causes, congenital anomalies, motor vehicle accidents, other accidents and suicide. The total PYLL due to cancer deaths among Canadian children and youth (ages 0-19) in 2001 was 15,760 years.

The PYLL due to specific types of cancer (Table 13) show that lung cancer was responsible for 253,000 PYLL, representing 26% of the premature mortality caused by cancer. For men in 2001, the three leading cancers were lung, colorectal and prostate, accounting for 48% of the PYLL due to cancer. The three leading cancers for women were lung, breast and colorectal, accounting for 53% of PYLL due to cancer. The ranking by relative importance of these cancers for men and women with respect to PYLL has been consistent in recent years. For women, however, the potential years of life lost due to lung cancer, which are greater than for breast cancer, reflect the high rates of lung cancer mortality among women aged 50 to 79. Among men, although prostate cancer is more common than lung cancer, the PYLL due to lung cancer are four times higher than for prostate cancer, reflecting higher mortality rates for lung cancer and the younger age at which men develop and die from this disease.

Premature mortality is higher for cancers that are more common, have an earlier age of onset, and more quickly lead to death. With regard to the most common cancers in women and men, the PYLL from breast cancer (95,000) far exceed the PYLL from prostate cancer (34,000), reflecting the relatively young age at which women die from breast cancer. In contrast, the PYLL for Hodgkin's disease, at 3,000 for men and women, reflect a cancer that is less common and relatively curable.

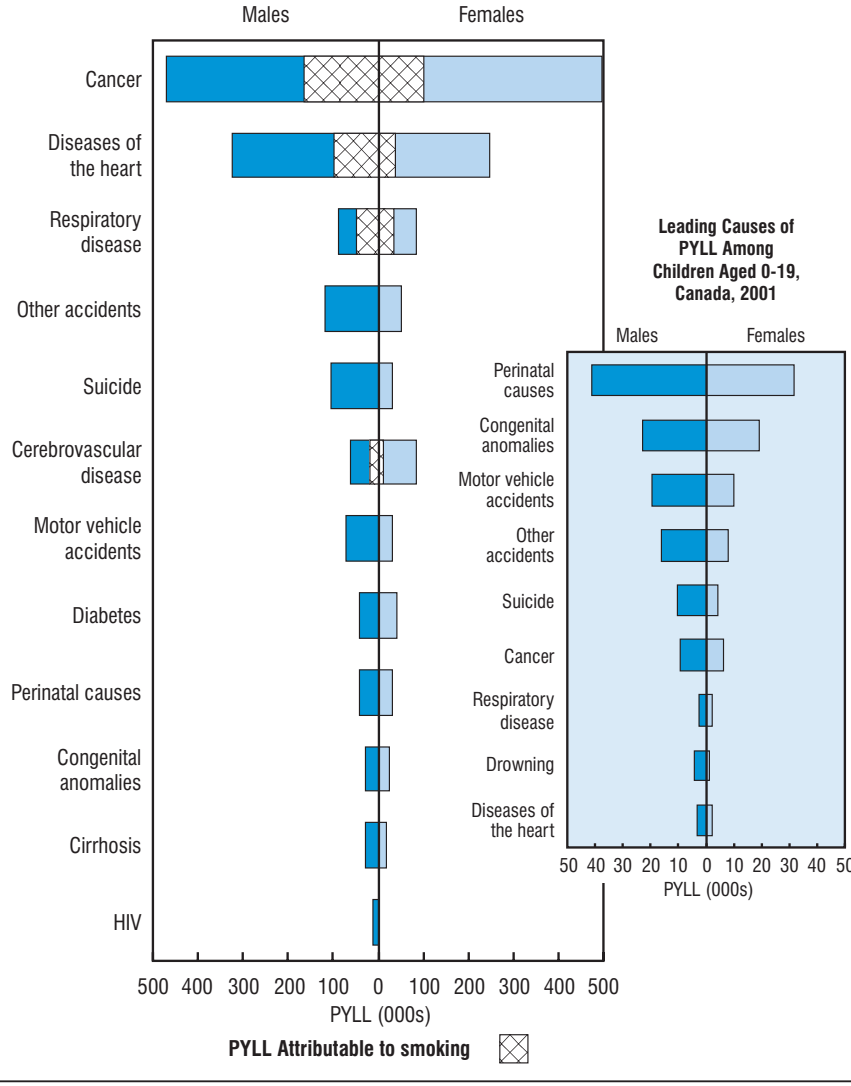
Although the number of men who die from cancer each year exceeds the number of women, the PYLL for women (498,000) are slightly higher than the PYLL for men (469,000). This is because women generally live longer than men, and some of the deaths due to female cancers occur at younger ages.

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, 2001



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

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

Table 13
Potential Years of Life Lost Due to Cancer, Canada, 2001

	Potential Years of Life Lost (PYLL)					
	Total		Males		Females	
	Years	%	Years	%	Years	%
ALL CAUSES	3,073,000	–	1,647,000	–	1,425,000	–
All Cancers	967,000	100	469,000	100	498,000	100
Childhood Cancer (Ages 0-19)	15,760	1.6	9,320	2.0	6,440	1.3
Cancer Site						
Lung	253,000	26.2	137,000	29.3	116,000	23.3
Colorectal	107,000	11.0	54,000	11.6	52,000	10.5
Breast	95,000	9.8	–	–	95,000	19.0
Pancreas	45,000	4.7	22,000	4.7	23,000	4.6
Non-Hodgkin's Lymphoma	41,000	4.2	22,000	4.7	19,000	3.7
Brain	36,000	3.8	20,000	4.2	17,000	3.4
Prostate	34,000	3.6	34,000	7.3	–	–
Leukemia	34,000	3.5	19,000	4.0	15,000	3.0
Stomach	27,000	2.8	16,000	3.5	11,000	2.2
Ovary	26,000	2.7	–	–	26,000	5.2
Kidney	21,000	2.2	13,000	2.7	8,000	1.7
Esophagus	20,000	2.1	16,000	3.3	5,000	1.0
Oral	17,000	1.8	12,000	2.6	5,000	1.0
Bladder	17,000	1.7	11,000	2.4	5,000	1.0
Multiple Myeloma	15,000	1.5	8,000	1.6	7,000	1.5
Melanoma	14,000	1.4	8,000	1.7	6,000	1.2
Cervix	10,000	1.0	–	–	10,000	2.0
Body of Uterus	11,000	1.1	–	–	11,000	2.1
Larynx	7,000	0.8	6,000	1.3	1,000	0.2
Hodgkin's Disease	3,000	0.3	2,000	0.4	2,000	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. Childhood cancers are also included within the relevant sites.

Source: Surveillance and Risk Assessment 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 (or about 2.5% 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 (2.5%), 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.

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		Ratio of Cases per Population	
	Males	Females	Males	Females	Males	Females
Colorectal	51,000	51,500	0.3	0.3	1:303	1:306
Lung	18,000	18,200	0.1	0.1	1:854	1:860
Prostate	113,600	–	0.7	–	1:135	–
Breast	–	155,100	–	1.0	–	1:101
Other Cancers	187,200	196,800	1.2	1.3	1:82	1:79
All Cancers	**369,800**	**421,600**	**2.4**	**2.7**	**1:42**	**1:37**

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

Table 15 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.

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,[16] currently, approximately 80% of Canadian children and teenagers with acute lymphoblastic leukemia are alive five years after diagnosis.[17] 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.

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

Table 15

New Cases and Age-Standardized Incidence Rates and Deaths and Age-Standardized Mortality Rates by Histologic Cell Type for Children and Youth Aged 0-19 Years, Canada, 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**	**42.50**	**337**	**29.6**	**8.49**	**0.20**
Acute lymphocytic	1,255	19.5	32.29	138	12.1	3.45	0.11
Acute non-lymphocytic	264	4.1	6.77	97	8.5	2.44	0.37
Brain and Spinal	**1,086**	**16.9**	**27.40**	**285**	**25.1**	**7.17**	**0.26**
Astrocytoma	498	7.7	12.46	75	6.6	1.85	0.15
Primitive neuroectodermal	246	3.8	6.29	74	6.5	1.88	0.30
Ependymoma	87	1.4	2.26	29	2.6	0.74	0.33
Lymphoma	**1,082**	**16.8**	**26.37**	**91**	**8.0**	**2.22**	**0.08**
Hodgkin's disease	587	9.1	14.15	14	1.2	0.34	0.02
Non-Hodgkin's lymphoma	486	7.6	11.97	77	6.8	1.88	0.16
Carcinoma	**554**	**8.6**	**13.42**	**31**	**2.7**	**0.77**	**0.06**
Thyroid	221	3.4	5.33	1	0.1	0.02	0.00
Melanoma	151	2.3	3.66	2	0.2	0.05	0.01
Germ Cell and Other Gonadal	**440**	**6.8**	**10.86**	**26**	**2.3**	**0.64**	**0.06**
Gonadal germ cell tumours	274	4.3	6.66	5	0.4	0.12	0.02
Soft Tissue	**386**	**6.0**	**9.71**	**77**	**6.8**	**1.95**	**0.20**
Rhabdomyosarcoma	150	2.3	3.83	38	3.3	0.96	0.25
Fibrosarcoma	68	1.1	1.68	5	0.4	0.12	0.07
Sympathetic Nervous System	**325**	**5.1**	**8.92**	**90**	**7.9**	**2.29**	**0.28**
Neuroblastoma	307	4.8	8.47	90	7.9	2.29	0.29
Bone	**346**	**5.4**	**8.44**	**103**	**9.1**	**2.50**	**0.30**
Osteosarcoma	170	2.6	4.12	57	5.0	1.38	0.34
Ewing's sarcoma	130	2.0	3.19	40	3.5	0.97	0.31
Renal Tumours	**286**	**4.4**	**7.57**	**42**	**3.7**	**1.05**	**0.15**
Wilms' tumour	263	4.1	6.99	35	3.1	0.87	0.13
Retinoblastoma	**105**	**1.6**	**2.94**	**2**	**0.2**	**0.05**	**0.02**
Hepatic Tumours	**72**	**1.1**	**1.93**	**26**	**2.3**	**0.67**	**0.36**
Other Cancers	**92**	**1.4**	**2.38**	**27**	**2.4**	**0.70**	**0.29**
Total (5 years)	**6,427**	**100.0**	**162.44**	**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's lymphomas include 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 and Risk Assessment Division and Chronic Disease Control and Management Division, CCDPC, Public Health Agency of Canada and Health Statistics Division, Statistics Canada

Progress in Cancer Prevention: Modifiable Risk Factors

There are many risk factors for cancer that we cannot change, such as age, sex and genetic inheritance. The focus of this special topic is the prevalence of important risk factors that we *can* change (and for which Canadian population data exist), as an indicator of progress toward cancer risk reduction. Data are taken primarily from the *Progress Report on Cancer Control in Canada*, published by the Public Health Agency of Canada in 2004. The report contains a more complete description of the policy and program interventions employed to achieve changes in the prevalence of these risk factors.[1] The *Progress Report on Cancer Control in Canada* can be found at http://www.phac-aspc.gc.ca/publicat/prccc-relccc/index.html

A considerable body of evidence has accumulated over the past few decades regarding the causes of cancer. Many of these, such as tobacco use, unhealthy diet and exposure to environmental and workplace carcinogens, are modifiable. This has led to a firm belief that it should be possible to prevent many cancers by either reducing the number of people exposed to substances that increase cancer risk (for example, through environmental and occupational protection measures) or improving cancer-protective behaviours. Furthermore, some such changes (e.g., reduction in the prevalence of obesity) would also improve other aspects of health, such as cardiovascular disease and diabetes.

Monitoring the numbers of people having exposures or engaging in behaviours that affect their risk of cancer is a useful way to measure progress towards cancer prevention and control. For example, reduction in the percentage of young people starting to smoke should lead to a future reduction in the incidence of tobacco-related cancers. We have seen this happen to some extent: the incidence of lung cancer is falling in men as a result of lowered tobacco use beginning 30 or more years ago.[2]

Tobacco use, unhealthy diet, excess body weight, physical inactivity, alcohol consumption and over-exposure to sun are well-documented modifiable risk factors for several common forms of cancer and account for a substantial number of cancer diagnoses each year. Table 16 summarizes current knowledge about cancer sites for which there is potential for prevention through changes in these risk factors.[3]

Tobacco

Tobacco has long been recognized as a major cause of cancer, accounting for about 30% of cancer incidence (excluding non-melanoma skin cancer) and cancer deaths. Exposure to tobacco increases the risk of several types of cancer, including bladder, cervix, colorectal, esophagus, kidney, larynx, lung, oral and pancreas. Canada has been a world leader in tobacco control and we have made steady progress in reducing the prevalence of smoking in the past 35 years: half of Canadians 15 years of age or older smoked in 1965, but only 21% in 2002 (Figure 11.1). Reductions in smoking happened earlier in men than in women and have already brought about reductions in lung cancer incidence and mortality, but the lung cancer epidemic in women has not yet reached its peak.

According to the latest results from the Canadian Tobacco Use Monitoring Survey (CTUMS), over 5 million people were current smokers (23% of men and 18% of women) in 2003. Smoking among youth 15-19 years old had declined to 18% from 22% in 2002 and 28% in 1999[4]. In this age group, females smoked slightly more than males: 20% vs. 17%.

In addition to reductions in smoking prevalence, the amount smoked by smokers has declined, from 20 cigarettes per day in 1985 to 16 per day in 2002, a 20% decrease in the amount smoked. Encouragingly, over 20% of self-identified smokers in the 1994-1995 National Population Health Survey (NPHS) had quit smoking by the time of the 2000-2001 survey.

On a less positive note, smoking among Canada's Aboriginal peoples is more than twice as common as among Canadians overall. Rates among Aboriginal youth are particularly high: 54% of 11-19-year-olds and 65% of 20-25-year-olds. The use of smokeless tobacco (chewing tobacco and snuff) is also prevalent among Inuit.

Environmental tobacco smoke (ETS) is also recognized as carcinogenic to humans. Non-smokers who are exposed to second-hand smoke ("passive smoking") have about 20% greater risk of lung cancer than people who are unexposed, and there is increasing evidence of an effect on risk of other cancers. According to the 2000-2001 Canadian Community Health Survey (CCHS), more than one-quarter (28%) of Canadians are exposed to ETS, varying by age and sex. (Figures. 11.2 and 11.3) Rates of exposure ranged from 18% in British Columbia to 46% in the Northwest Territories (NWT). More and more municipalities and even some provinces are banning smoking in public places, so we expect exposure to be lower in the next survey round.

There has been considerable progress in measures to protect non-smokers from exposure to environmental tobacco smoke in the workplace. CTUMS found that two-thirds of workers (66%) had workplaces with complete restrictions on smoking in 2003, compared to only 40% in 1994, and only 9% had no restrictions (there was considerable variation by province, with 72% of Ontario workplaces fully protected, but only 47% of Saskatchewan workplaces).

These changes have been achieved by an array of strategies intended to prevent the onset of smoking, protect smokers and non-smokers alike from the harmful effects of smoking, support cessation, and shift social norms toward non-smoking. Specific interventions include taxation, regulation (e.g. bans on tobacco advertising, restricting smoking in workplaces and public spaces), public education and social marketing, and cessation programs.

Unhealthy diet, physical inactivity and excess body weight

The constellation of unhealthy diet, physical inactivity and excess body weight is a powerful determinant of cancer risk. The International Agency for Research on Cancer attributes about one-fourth to one-third of cancers of the breast, colon, esophagus, kidney and uterus to excess body weight and physical inactivity[5]. A number of other cancers are related to poor diet, including those in the bladder, lung, oral cavity, pancreas, prostate and stomach. The American Institute for Cancer Research estimates that about 30 to 40% of all cancer cases could be prevented over time by a combination of following recommended diets and maintaining physical activity and appropriate body weight.[6] Increasingly, governments, health professionals and voluntary organizations are applying the lessons learned from the tobacco control experience to

tackle the challenge of improving diets, promoting physical activity and reducing obesity on a population level.

Many aspects of diet have a role in cancer risk, including consumption of red meat and animal fat and fruit and vegetable intake. Consistent with *Canada's Food Guide to Healthy Eating*, the Canadian Cancer Society recommends that Canadians eat 5 to 10 servings of fruit and vegetables a day. Fruit and vegetable consumption has increased by about 40% since the 1960s, from 221 kg per person annually in 1963 (137 kg fruits, 84 kg vegetables) to 308 kg per person annually in 2001 (183 kg fruit, 125 kg vegetables) (Figure 11.4). These changes have probably contributed to reduced risk of some cancers, especially of the gastrointestinal tract. Despite this increase in intake, most Canadians still do not follow the recommendations. In 2001, more than 60% of Canadians consumed less than the recommended amount, varying from 55% in Quebec to 72% in NWT (Figure 11.5). Fruit and vegetable consumption also varies by age and sex, with men consistently eating fewer servings than women in all age groups and the highest fruit and vegetable consumption found in people over age 55. As might be expected, fruit and vegetable consumption was also higher among people in higher income and educational categories, and in those practicing other health promoting behaviours such as physical activity and non-smoking.

Physical inactivity rates have been gradually declining since 1994 (Figure 11.6), but in 2000-2001, more than half of Canadians over 12 years of age were still considered physically inactive, according to the CCHS. Women and older Canadians are more likely to be physically inactive, and there is a general east-west gradient, with higher levels of physical inactivity in the Atlantic provinces and Quebec, and among women and older Canadians (Figures 11.7, 11.8).

In contrast to trends in physical inactivity, the prevalence of unhealthy weights is increasing, particularly among children. In 1981, 18% of children were overweight and 5% obese; in 1998-1999, the National Longitudinal Study of Children and Youth (NLSCY) found 37% of children aged two to eleven overweight (BMI* 25-29.9) and 18% obese (BMI >30) (Figure 11.9). Younger children are more likely to have higher BMI than older children, which is of concern, because it may suggest continuing increases in prevalence of excess body weight and obesity as these children age. Already, according to the CCHS, almost 50% of all Canadians are at least overweight and 15% are considered obese. Unhealthy weights are more prevalent in men than in women and at older ages among adults (Figure 11.10). There is a gradient of increased cancer risk with increased excess body weight.

Alcohol

Alcohol consumption is implicated in many types of cancer. Drinking two standard drinks per day raises risk of cancers of the mouth, pharynx, esophagus (especially in those who smoke heavily), larynx and oral cavity. It is a factor in risk of breast cancer in women and in colorectal cancer, particularly in men. Risk increases with the amount of alcohol consumed. The 2000-2001 CCHS found that men consume more alcohol than women at all ages. The prevalence of heavy drinking (five or more drinks on one occasion 12 or more times per year) varied across Canada, with the highest rates in the three territories, Newfoundland and Nova Scotia; the lowest rates of heavy

* BMI is Body Mass Index, a measure of relative body weight calculated by dividing weight (in kilograms) by height (in meters) squared.

drinking were in Ontario, British Columbia and Quebec. In 2003, according to the CCHS, 18% of the population aged 12 and over were heavy drinkers.

Sun exposure and ultraviolet radiation

Radiation from the sun is accepted as a human carcinogen, causing all forms of skin cancer, including cancer of the lip (IARC 1992).[7] Tanning beds and lamps, like the sun, also emit ultraviolet radiation and are considered carcinogenic.[8] Skin cancer is the most commonly occurring cancer in Canada, accounting for about 1/3 of all newly diagnosed cancers. It ranks much lower as a cancer cause of death: the most common forms, basal cell carcinoma and squamous cell carcinoma, are non-lethal, and the most serious form, melanoma, is the least common. Since most skin cancers are related to over-exposure to the sun, reduction of sun exposure has the potential to substantially reduce the number of cancers. In fact, its impact on the number of new cancers prevented would be comparable to the effect of tobacco control, although it would have less impact on mortality and on cancer care costs, since the majority of skin cancers are treated outside of hospital and the cancer care system.

Over-exposure to ultraviolet rays from the sun during childhood and adolescence may be particularly harmful, and sunburn is one marker of over-exposure. According to the 1996 National Sun Exposure Survey, half of adults reported at least one sunburn during the previous summer and 45% of children under age 12 had been sunburned at least once. Women were more likely than men to report having adopted sun safety measures (Figure 11.11), and sun safety efforts increased with age. Notably, those aged 15 to 24 spent most time in the sun and rarely employed sun protection practices. (Figure 11.11). Parents responding to the survey reported younger children spending even more time in the sun, but parents took other sun safety precautions to protect them.

Other modifiable risk factors

Other potentially modifiable (some more readily than others) risk factors for cancer include some infections (e.g. some types of human papilloma virus), sexual behaviour and exposure to carcinogens in the workplace or environment. Despite evidence that some of these exposures are in fact causally related to cancer, we lack ongoing registry or other surveillance data needed to track population trends and assess their impact.

The Canadian Cancer Society's recommendations for reducing cancer risk are in the CCS web site (www.cancer.ca) Prevention section (click on Seven Steps to Health).

Implications

The population impact of current trends in exposure to modifiable risk factors is enormous; Table 17 provides estimates of the numbers of potentially preventable new cancer cases and deaths each year. While we have certainly made advances in recent decades in the area of tobacco control, it is clear that we need to apply what we have learned there to increase impact and to effectively control other known important cancer risk factors. Unfortunately, it is likely to be many years before the full benefit of improvements in cancer risk factors will be evident by reductions in cancer rates. For example, if we could reduce tobacco use by 60% tomorrow, we might be able to decrease tobacco-associated cancer mortality rates by 20% by the year 2020. To achieve successes similar to those already seen in the area of tobacco control in other areas of primary prevention, we will need to employ a similarly integrated approach and comprehensive set of interventions to those employed in tobacco, including education and social marketing, policies to create a social environment that supports

positive change, and programs to assist people in making healthy choices. The Canadian Strategy for Cancer Control (www.cancercontrol.org) is proposing an action plan for primary prevention of cancer (and other chronic diseases) that, if implemented, should bring about important reductions in cancer incidence related to these modifiable risk factors.

Because the importance of modifiable risk factors as indicators of cancer control success, *Canadian Cancer Statistics* will provide updates on this topic periodically in future issues.

Many risk factors for cancer are both common and preventable: tobacco use, unhealthy eating, excess body weight, physical inactivity and over-exposure to ultraviolet rays from the sun.

Progress in cancer prevention has been achieved through tobacco control. If the lessons from the tobacco control experience are applied in other areas, even greater gains can be made in cancer prevention.

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Table 16

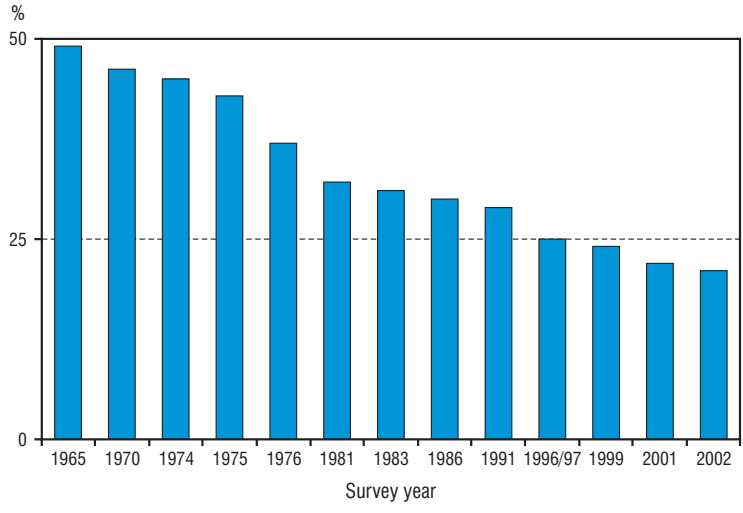
Modifiable Risk Factors: Potential Cancer Risk Reductions Associated with Key Cancer Prevention Messages

	Prevention strategy					
Cancer risk reduction benefit	Avoid tobacco	Be physically active	Maintain a healthy weight	Eat a healthy diet	Limit alcohol	Avoid excess sun exposure
Bladder	✔			✔		
Breast		✔	✔	✔	✔	
Cervix	✔					
Colorectal	✔	✔	✔	✔	✔	
Esophagus	✔		✔	✔	✔	
Kidney	✔		✔			
Larynx	✔			✔	✔	
Lung	✔			✔		
Oral	✔			✔	✔	✔
Pancreas	✔			✔		
Prostate				✔		
Skin						✔
Stomach	✔			✔		
Uterus (excluding cervix)			✔			

Source: Adapted from: 1) Stein CJ, Colditz GA. *Modifiable risk factors for cancer.* Br J Cancer 2004;90:299-303 and 2) Institute of Medicine (IOM). Curry SJ, Byers T, Hewitt M (eds). *Fulfilling the potential of cancer prevention and early detection.* Washington, DC: The National Academies Press, 2003

Figure 11.1

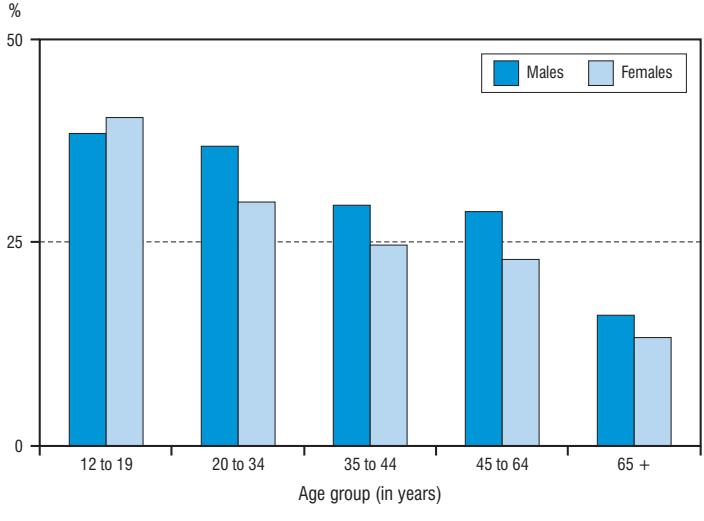
Percentage of Current Smokers in Canada, Aged 15 Years and Over



Reference: Progress Report on Cancer Control in Canada, CCDPC, Public Health Agency of Canada
Source: Labour Force Survey Supplement, 1965-1975, 1981-1986; Canada Health Survey, 1978; General Social Survey, 1991; Survey on Smoking in Canada,1994; National Population Health Survey 1996/97; Canadian Tobacco Use Monitoring Survey (Annual), 1999-2002

Figure 11.2

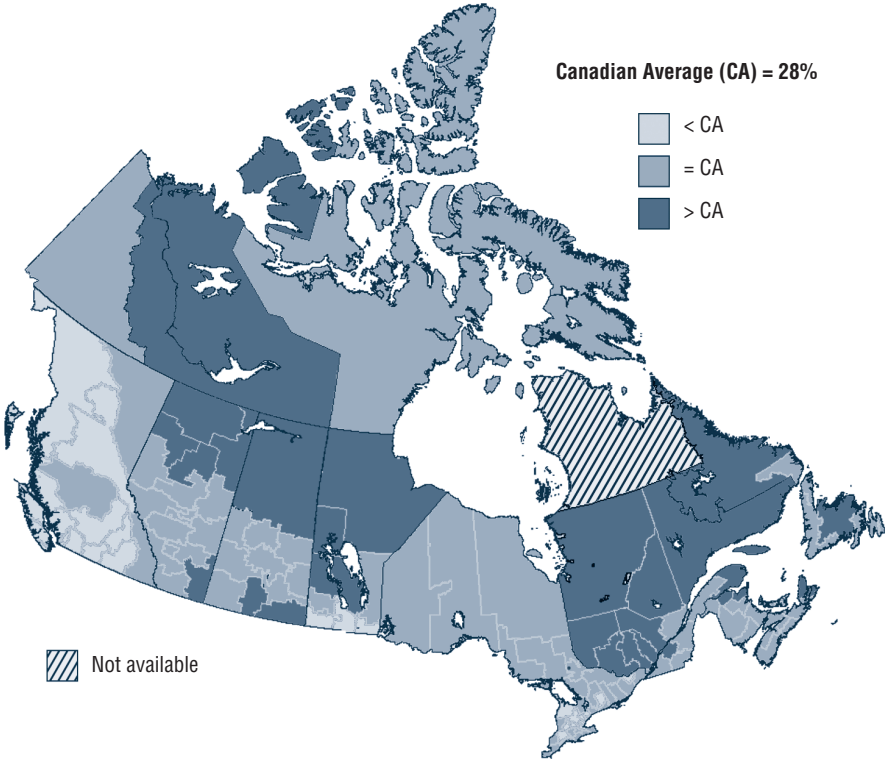
Percentage of Canadian Non-smokers Aged 12 Years and Over Exposed to Second-hand Smoke, by Age Group, 2000/01



Reference: Progress Report on Cancer Control in Canada, CCDPC, Public Health Agency of Canada
Source: Statistics Canada, Canadian Community Health Survey

Figure 11.3

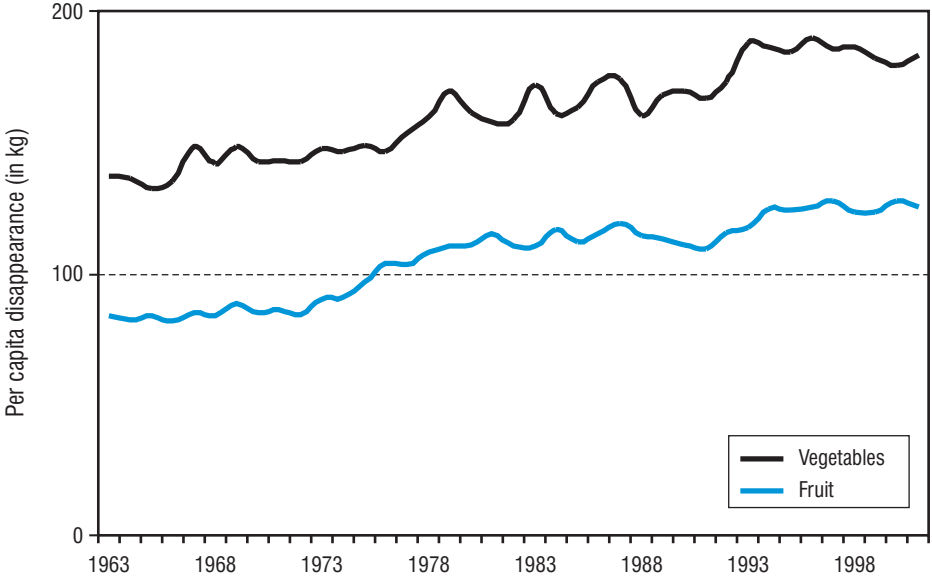
Proportion of Non-Smokers Aged 12 Years and Over Exposed to Second-hand Smoke, 2000/01



Reference: Progress Report on Cancer Control in Canada, CCDPC, Public Health Agency of Canada
Source: Canadian Community Health Survey, 2000–2001

Figure 11.4

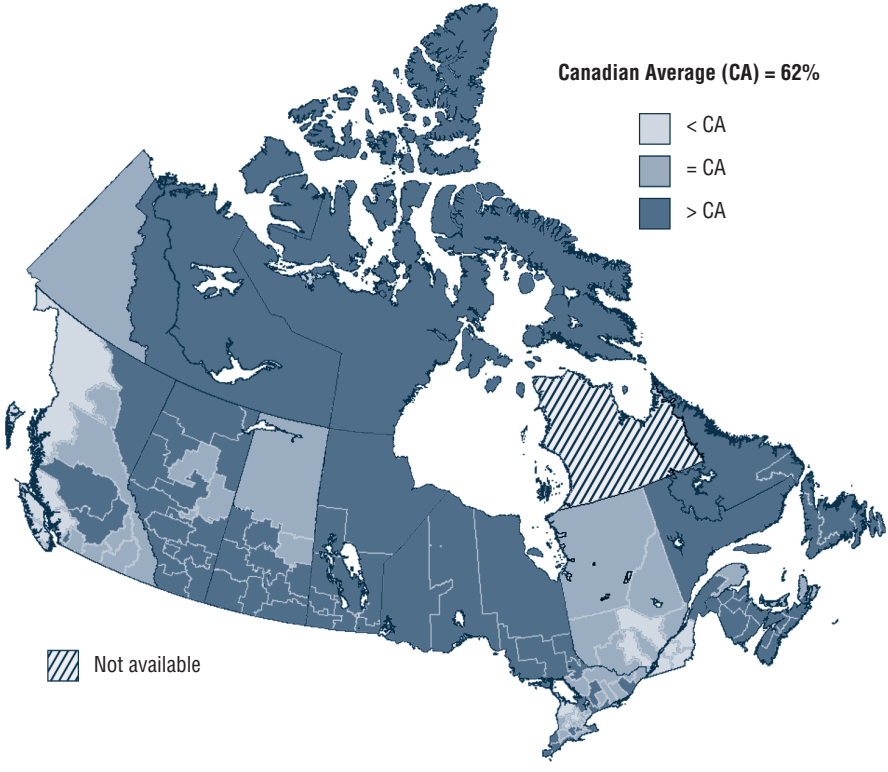
Estimated per Capita Consumption of Fruits and Vegetables in Canada, 1963-2001



Reference: Progress Report on Cancer Control in Canada, CCDPC, Public Health Agency of Canada
Source: Statistics Canada, 2002

Figure 11.5

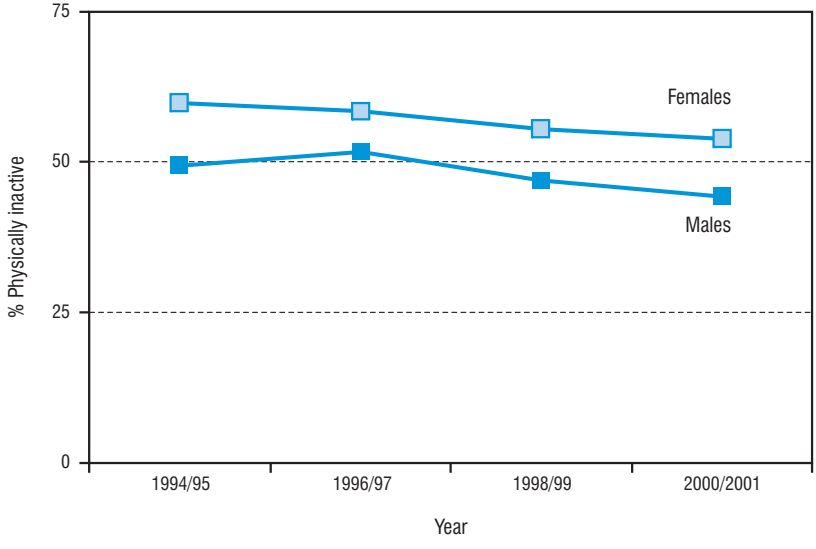
Proportion of the Population Aged 12 Years and Over Who Eat Fruits and Vegetables Less Than Five Times Daily, 2000/01



Reference: Progress Report on Cancer Control in Canada, CCDPC, Public Health Agency of Canada
Source: Canadian Community Health Survey, 2000–2001

Figure 11.6

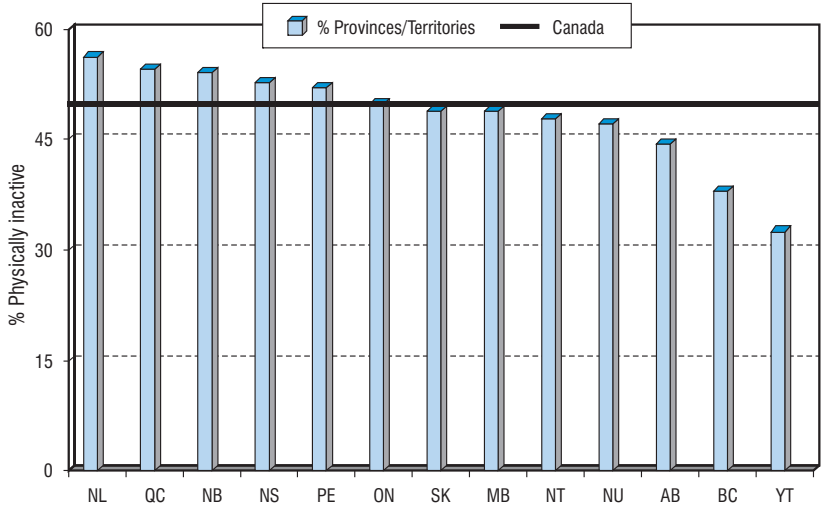
Percentage of Canadians Aged 12 Years and Over Who are Physically Inactive, by Sex, 1994/95-2000/01



Reference: Progress Report on Cancer Control in Canada, CCDPC, Public Health Agency of Canada
Source: National Population Health Survey, Canadian Community Health Survey, Statistics Canada

Figure 11.7

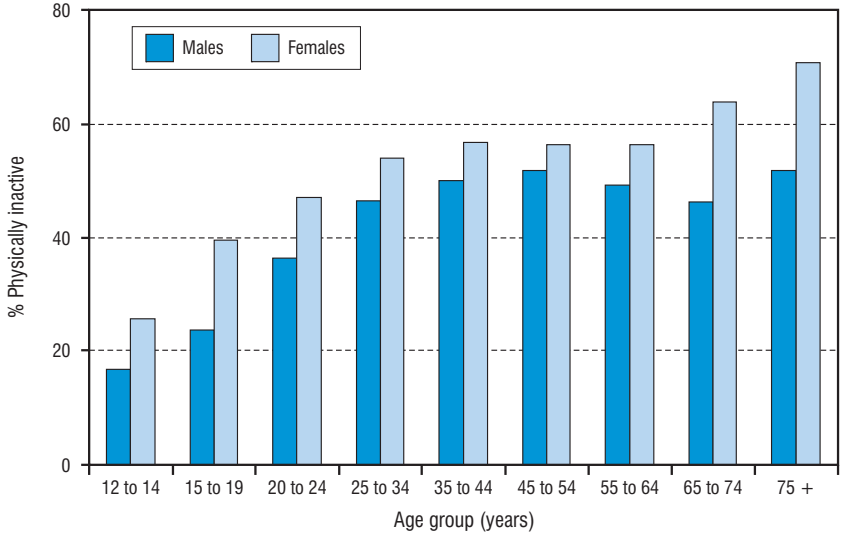
Percentage of Canadians Aged 12 and Over Who are Physically Inactive, by Province, 2000-01



Reference: Progress Report on Cancer Control in Canada, CCDPC, Public Health Agency of Canada
Source: Statistics Canada, Canadian Community Health Survey

Figure 11.8

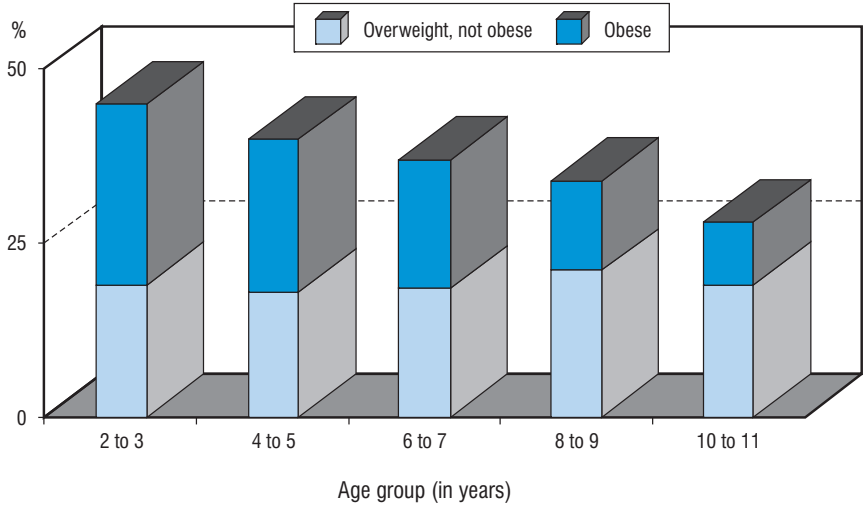
Percentage of Canadians Aged 12 Years and Over Who are Physically Inactive, by Sex and Age, 2000-01



Reference: Progress Report on Cancer Control in Canada, CCDPC, Public Health Agency of Canada
Source: Statistics Canada, Canadian Community Health Survey

Figure 11.9

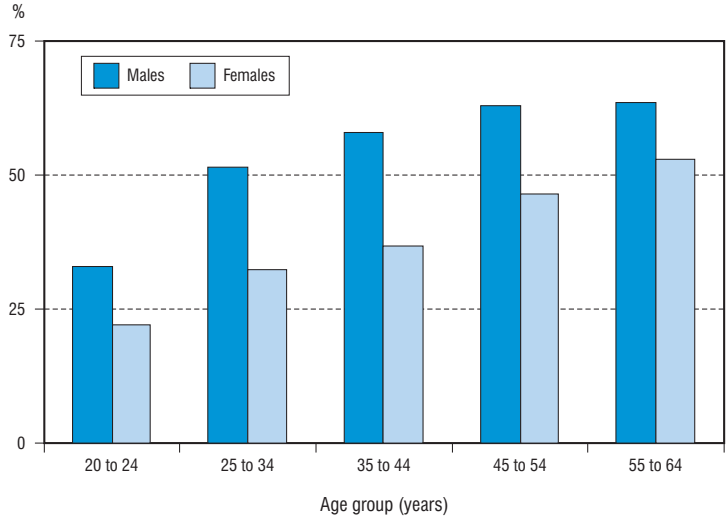
Percentage of Canadian Children Overweight or Obese, by Age Group, 1998/99



Reference: Progress Report on Cancer Control in Canada, CCDPC, Public Health Agency of Canada
Source: National Longitudinal Survey of Children and Youth

Figure 11.10

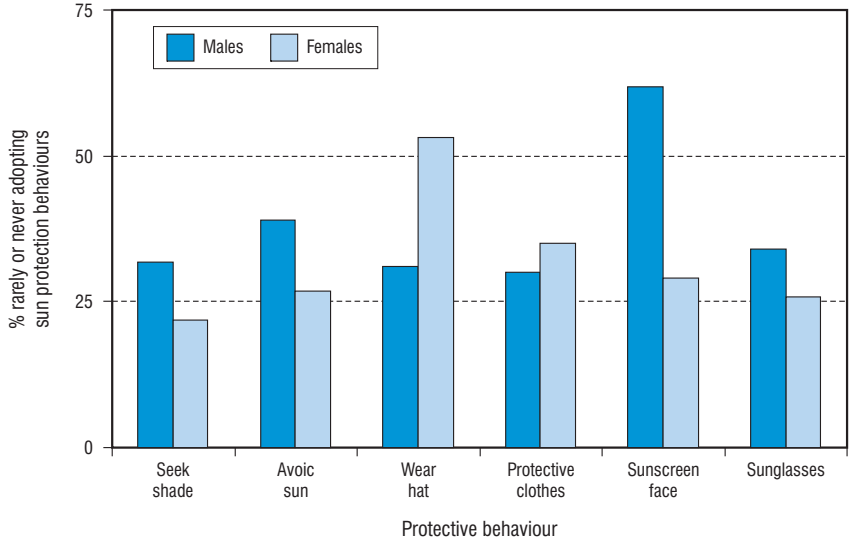
Percentage of Canadians Aged 20-64 Years Who are Overweight (BMI 25-29.9) or Obese (≥30), by Age Group and Sex, 2000-2001



Reference: Progress Report on Cancer Control in Canada, CCDPC, Public Health Agency of Canada
Source: Statistics Canada, Canadian Community Health Survey

Figure 11.11

Percentage of Canadians Aged 15 Years and Over Who Rarely or Never Adopt Sun Protection Behaviours, by Sex



Reference: Progress Report on Cancer Control in Canada, CCDPC, Public Health Agency of Canada
Source: The National Sun Exposure Survey, UBC, 1998

Table 17

Estimated Numbers of Cancer Cases and Deaths Potentially Preventable According to Selected Modifiable Risk Factors, Canada, 2005

Risk factor	# of cases	# of cancer deaths
Tobacco[1]	44,700	20,850
Unhealthy diet, physical inactivity, excess body weight[1]	44,700	20,850
Alcohol[2]	4,470	2,085
Sun[3]	65,840	725

[1] Assuming 30% of cancers/cancer deaths, excluding non-melanoma skin cancers, are related to risk factor

[2] Assuming 3% of cancers/cancer deaths, excluding non-melanoma skin cancers, are related to alcohol consumption[9]. May be greater percentage in smokers due to synergistic effects of tobacco and alcohol – that is, the effects of one risk factor enhance the effects of the other.

[3] Assuming 80% of new cases of skin cancer (non-melanoma and melanoma types) and 80% of melanoma deaths are related to sun exposure.

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

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

ICDO-3 International Classification of Diseases for Oncology, Third Edition.[18]

ICD-10 International Statistical Classification of Diseases and Related Health Problems, Tenth Revision.[19]

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

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

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

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

Incidence, Mortality and Prevalence Rates

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

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

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

Index of age-standardized rates The age-standardized rate of the base year, 1975, is set at 100. Index values for subsequent years are derived by multiplying the age-standardized rate for the year by 100 and then dividing by the 1975 rate.

Prevalence The definition of prevalence is the proportion of a population that is affected by disease at a given point in time and is referred to as complete prevalence. In this document our estimate is more accurately described as limited-duration prevalence, and the duration is 15 years. By this we mean the prevalence of cases diagnosed within 15 years before the point in time for which the estimate is calculated. This estimate should always be an underestimate of complete prevalence, and the magnitude of the underestimate is dependent on cancer site.[20]

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/Oesophagus	C15	C15
Stomach	C16	C16
Colorectal	C18-C21,C26.0	C18-C21,C26.0
Pancreas	C25	C25
Larynx	C32	C32
Lung	C33-C34	C33-C34
Melanoma	Type 8720-8790	C43
Breast	C50	C50
Cervix	C53	C53
Body of Uterus	C54-C55	C54-C55
Ovary	C56,C57.0-.4	C56,C57.0-.4
Prostate	C61	C61
Testis	C62	C62
Bladder	C67	C67
Kidney	C64-C66,C68	C64-C66,C68
Brain	C70-C72	C70-C72
Thyroid	C73	C73
Lymphoma	Type 9590-9596, 9650-9729 Type 9823, all sites except C42.0,.1,.4 Type 9827, all sites except C42.0,.1,.4	C81-C90,C96
Hodgkin's Disease	Type 9650-9667	C81
Non-Hodgkin's Lymphoma	Type 9590-9596,9670-9719,9727-9729 Type 9823, all sites except C42.0,.1,.4 Type 9827, all sites except C42.0,.1,.4	C82-C85,C96.3
Multiple Myeloma	Type 9731,9732,9734	C88,C90
Leukemia	Type 9733,9742,9800-9801,9805, 9820, 9826,9831-9837,9840,9860-9861,9863, 9866-9867,9870-9876, 9891,9895-9897, 9910,9920,9930-9931,9940,9945-9946, 9948,9963-9964 Type 9823 and 9827, sites C42.0,.1,.4	C91-C95
All Other Sites	All sites C00-C80, C97 not listed above	All sites C00-C80, C97 not listed above
All Cancers excluding Lung	C00-C97 excluding C33-C34	C00-C97 excluding C33-C34
All Other and Unspecified sites (grouping used only in Appendix Tables 1 and 2)	Type 9140,9740,9741,9750-9758, 9760-9769, 9950-9962, 9965-9989 C76.0-C76.8 (type 8000-9589) C80.9 (type 8000-9589) C42.0-C42.4 (type 8000-9589) C77.0-C77.9 (type 8000-9589)	C44,C46,C76-C80,C96.0-.2, C96.7-.9, C97
All Cancer Sites	All invasive sites	All invasive sites

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

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 (2001) 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 2004 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**	**138,151**	**72,779**	**65,372**
Oral (Buccal Cavity and Pharynx)	**C00-C14**	**3,135**	**2,157**	**978**
Lip	C00	403	308	95
Tongue	C01-C02	666	428	238
Salivary Gland	C07-C08	332	194	138
Mouth	C03-C06	658	398	260
Nasopharynx	C11	233	175	58
Oropharynx	C10	130	100	30
Other and Unspecified	C09,C12-C14	713	554	159
Digestive Organs	**C15-C26,C48**	**29,092**	**16,120**	**12,972**
Esophagus	C15	1,245	900	345
Stomach	C16	2,832	1,816	1,016
Small Intestine	C17	453	253	200
Large Intestine	C18,C26.0	12,169	6,083	6,086
Rectum and Anus	C19-C21	6,379	3,864	2,515
Liver	C22	1,348	965	383
Gallbladder	C23	375	129	246
Pancreas	C25	3,213	1,599	1,614
Other and Unspecified	C24,C26.1-.9,C48	1,078	511	567
Respiratory System	**C30-C36,C38.1-.9,C39**	**21,566**	**12,812**	**8,754**
Larynx	C32	1,142	943	199
Lung	C33-C34	20,153	11,694	8,459
Other and Unspecified	C30-31,C35-36,C38.1-.9,C39	271	175	96
Bone	**C40-C41**	**289**	**177**	**112**
Soft Tissue (including Heart)	**C38.0,C47,C49**	**780**	**416**	**364**
Skin (Melanoma)	**Type 8720-8790**	**3,849**	**2,024**	**1,825**
Breast	**C50**	**18,817**	**149**	**18,668**
Genital Organs	**C51-C63**	**29,033**	**21,329**	**7,704**
Cervix	C53	1,373	–	1,373
Body of Uterus	C54	3,425	–	3,425
Uterus, Part Unspecified	C55	101	–	101
Ovary	C56,C57.0-.4	2,271	–	2,271
Prostate	C61	20,347	20,347	–
Testis	C62	804	804	–
Other and Unspecified	C51-52,C57.5-.9,C58,C60,C63	712	178	534
Urinary Organs	**C64-C68**	**8,824**	**6,004**	**2,820**
Bladder	C67	4,695	3,481	1,214
Kidney and Other Urinary	C64-C66,C68	4,129	2,523	1,606
Eye	**C69**	**230**	**123**	**107**
Brain and Central Nervous System	**C70-C72**	**2,283**	**1,234**	**1,049**
Endocrine Glands	**C37,C73-C75**	**2,620**	**667**	**1,953**
Thyroid	C73	2,414	567	1,847
Other Endocrine	C37,C74-C75	206	100	106
Leukemia	**See Glossary**	**3,689**	**2,155**	**1,534**
Other Blood and Lymph Tissues	**See 3 components below**	**7,969**	**4,320**	**3,649**
Hodgkin's Disease	Type 9650-9667	775	436	339
Non-Hodgkin's Lymphoma	See Glossary	5,501	2,996	2,505
Multiple Myeloma	Type 9731,9732,9734	1,693	888	805
All Other and Unspecified sites	**See Glossary**	**5,576**	**2,772**	**2,804**
Mesothelioma	**Type 9050-9055**	**399**	**320**	**79**

– Not applicable

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

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

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

Table A2

Actual Data for Cancer Deaths by Site and Sex, Canada, 2001

Site	ICD-10	Total	Males	Females
All Cancer Sites	**C00-C97**	**63,775**	**34,024**	**29,751**
Oral (Buccal Cavity and Pharynx)	**C00-C14**	**1,029**	**723**	**306**
Lip	C00	20	15	5
Tongue	C01-C02	226	156	70
Salivary Gland	C07-C08	96	65	31
Mouth	C03-C06	180	108	72
Nasopharynx	C11	87	61	26
Oropharynx	C10	94	73	21
Other and Unspecified	C09,C12-C14	326	245	81
Digestive Organs	**C15-C26,C48**	**16,711**	**9,201**	**7,510**
Esophagus	C15	1,362	1,016	346
Stomach	C16	1,861	1,168	693
Small Intestine	C17	157	96	61
Large Intestine	C18,C26.0	6,443	3,275	3,168
Rectum and Anus	C19-C21	1,442	834	608
Liver	C22	1,406	899	507
Gallbladder	C23	251	76	175
Pancreas	C25	3,193	1,581	1,612
Other and Unspecified	C24,C26.1-.9,C48	596	256	340
Respiratory System	**C30-C36,C38.1-.9,C39**	**17,181**	**10,421**	**6,760**
Larynx	C32	498	424	74
Lung	C33-C34	16,572	9,931	6,641
Other and Unspecified	C30-31,C35-36,C38.1-.9,C39	111	66	45
Bone	**C40-C41**	**150**	**93**	**57**
Soft Tissue (including Heart)	**C38.0,C47,C49**	**334**	**157**	**177**
Skin (Melanoma)	**C43**	**709**	**435**	**274**
Breast	**C50**	**5,017**	**49**	**4,968**
Genital Organs	**C51-C63**	**6,565**	**3,884**	**2,681**
Cervix	C53	403	–	403
Body of Uterus	C54	316	–	316
Uterus, Part Unspecified	C55	347	–	347
Ovary	C56,C57.0-.4	1,457	–	1,457
Prostate	C61	3,825	3,825	–
Testis	C62	28	28	–
Other and Unspecified	C51-52,C57.5-.9,C58,C60,C63	189	31	158
Urinary Organs	**C64-C68**	**2,888**	**1,927**	**961**
Bladder	C67	1,491	1,061	430
Kidney and Other Urinary	C64-C66,C68	1,397	866	531
Eye	**C69**	**28**	**12**	**16**
Brain and Central Nervous System	**C70-C72**	**1,552**	**857**	**695**
Endocrine Glands	**C37,C73-C75**	**230**	**110**	**120**
Thyroid	C73	125	56	69
Other Endocrine	C37,C74-C75	105	54	51
Leukemia	**C91-C95**	**2,093**	**1,204**	**889**
Other Blood and Lymph Tissues	**C81-C90,C96.3**	**3,820**	**2,066**	**1,754**
Hodgkin's Disease	C81	131	72	59
Non-Hodgkin's Lymphoma	C82-C85,C96.3	2,553	1,402	1,151
Multiple Myeloma	C88,C90	1,136	592	544
All other and unspecified sites	**See Glossary**	**5,171**	**2,629**	**2,542**
Mesothelioma	**C45**	**297**	**256**	**41**

– Not applicable

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

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

APPENDIX I: ACTUAL DATA FOR NEW CASES AND DEATHS

Table A3

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

	New Cases													
	Canada	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.	Nu.
Males														
All Cancers	**72,800**	**1,150**	**380**	**2,500**	**1,850**	**17,900**	**27,500**	**2,700**	**2,500**	**6,000**	**9,100**	**40**	**40**	**25**
Prostate	20,300	320	140	620	490	3,600	8,000	720	790	2,000	2,800	5	5	–
Lung	11,700	160	50	470	360	3,800	3,900	420	350	760	1,250	5	5	10
Colorectal	9,900	200	50	400	240	2,600	3,800	420	340	770	1,150	5	10	5
Bladder	3,500	40	10	100	130	1,300	1,200	110	100	180	320	–	–	–
Non-Hodgkin's Lymphoma	3,000	40	15	110	70	740	1,150	140	110	240	450	–	–	–
Kidney	2,500	30	15	120	75	670	1,050	100	90	200	270	–	–	–
Oral	2,200	45	10	80	55	540	780	110	65	180	240	–	–	–
Leukemia	2,200	25	10	50	40	560	910	80	95	210	250	–	–	–
Melanoma	2,000	30	15	95	55	280	890	60	50	170	330	–	–	–
Stomach	1,800	40	5	60	45	480	650	75	60	120	200	–	–	–
Pancreas	1,600	15	5	55	45	460	510	60	60	120	200	–	–	–
Brain	1,250	30	–	40	35	330	460	50	35	110	160	–	–	–
Larynx	940	20	5	30	30	330	300	25	25	70	95	–	–	–
Multiple Myeloma	890	15	5	20	15	210	390	30	25	70	110	–	–	–
Females														
All Cancers	**65,400**	**940**	**310**	**2,300**	**1,700**	**16,800**	**26,200**	**2,700**	**2,100**	**5,600**	**8,400**	**40**	**35**	**25**
Breast	18,700	290	80	660	460	4,900	7,400	730	600	1,750	2,500	15	15	–
Colorectal	8,600	160	60	350	230	2,200	3,300	380	300	590	1,050	5	5	5
Lung	8,500	85	35	290	230	2,400	3,000	410	270	620	1,150	5	5	10
Body of Uterus	3,500	50	15	110	80	820	1,550	170	120	350	440	–	–	–
Non-Hodgkin's Lymphoma	2,500	40	10	95	60	610	1,050	100	80	230	330	–	–	–
Ovary	2,300	40	5	50	70	560	1,000	95	75	190	270	–	–	–
Melanoma	1,850	30	10	85	60	270	800	40	60	170	290	–	–	–
Thyroid	1,850	30	5	40	45	380	1,200	55	40	210	150	–	–	–
Pancreas	1,600	10	5	55	50	460	610	70	45	120	240	–	–	–
Kidney	1,600	30	10	70	50	440	600	70	50	140	150	–	–	–
Leukemia	1,550	10	5	45	30	420	660	55	55	150	180	–	–	–
Cervix	1,350	25	10	50	35	340	520	40	30	180	170	–	–	–
Bladder	1,200	5	–	40	45	460	440	45	25	45	110	–	–	–
Brain	1,050	15	5	35	25	280	390	25	25	90	120	–	–	–
Stomach	1,000	20	5	35	25	270	370	40	30	80	130	–	–	–
Oral	980	15	5	35	15	200	430	60	35	80	130	–	–	–
Multiple Myeloma	810	10	5	15	20	220	300	30	25	55	95	–	–	–

– Fewer than 3 cases

[1] 2001 for Canada, Quebec; 2002 for Newfoundland, Prince Edward Island, Nova Scotia, New Brunswick, Ontario, Manitoba, Saskatchewan, Alberta, British Columbia; 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. Counts exclude cases of non-melanoma (basal and squamous) skin cancer.

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

Table A4

Actual Age-Standardized Incidence Rates for Major 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.	Y.T.	N.W.T.	Nu.
Males														
All Cancers	**468**	**415**	**512**	**494**	**459**	**482**	**453**	**453**	**453**	**439**	**405**	**372**	**359**	**477**
Prostate	132	116	183	122	124	97	132	121	143	148	125	66	63	–
Lung	76	59	70	93	90	103	64	69	61	56	56	76	66	239
Colorectal	64	72	69	76	60	69	62	68	60	57	52	78	98	103
Bladder	23	15	15	21	32	35	20	18	18	14	14	–	–	–
Non-Hodgkin's Lymphoma	19	14	18	21	17	19	18	22	20	17	20	–	–	–
Kidney	16	11	17	23	17	17	17	17	16	14	12	–	–	–
Leukemia	14	9	11	10	9	16	15	14	17	15	11	–	–	–
Oral	13	15	15	15	13	14	12	18	11	12	10	–	–	–
Melanoma	13	11	22	18	13	7	14	10	9	12	14	–	–	–
Stomach	12	15	6	12	12	13	11	12	10	8	9	–	–	–
Pancreas	10	5	9	11	11	12	8	10	10	9	9	–	–	–
Brain	8	12	–	8	9	9	8	8	7	7	7	–	–	–
Larynx	6	8	9	6	7	8	5	4	4	5	4	–	–	–
Multiple Myeloma	6	5	4	4	3	6	6	5	5	5	5	–	–	–
Females														
All Cancers	**345**	**298**	**344**	**375**	**348**	**350**	**359**	**368**	**333**	**349**	**325**	**341**	**324**	**629**
Breast	100	90	91	108	96	103	103	104	97	108	96	109	97	–
Lung	44	29	40	48	49	49	41	55	43	40	44	26	55	308
Colorectal	43	48	61	52	46	43	43	49	42	36	39	42	73	129
Body of Uterus	19	16	19	18	17	17	21	25	20	22	17	–	–	–
Non-Hodgkin's Lymphoma	13	12	13	16	12	13	14	13	13	14	12	–	–	–
Ovary	12	13	5	8	14	12	14	14	12	11	10	–	–	–
Thyroid	11	10	8	8	11	9	19	9	7	14	7	–	–	–
Melanoma	10	10	11	15	13	6	11	7	11	10	12	–	–	–
Pancreas	8	3	6	7	9	9	8	8	6	7	8	–	–	–
Cervix	8	10	10	10	8	8	8	6	6	11	7	–	–	–
Kidney	8	9	10	11	10	9	8	10	7	8	6	–	–	–
Leukemia	8	3	3	7	7	9	9	8	9	9	7	–	–	–
Bladder	6	1	–	6	8	9	6	6	4	3	4	–	–	–
Brain	6	5	7	6	6	7	6	4	5	6	5	–	–	–
Oral	5	4	7	6	3	4	6	8	5	5	5	–	–	–
Stomach	5	7	4	6	5	5	5	4	4	5	5	–	–	–
Multiple Myeloma	4	3	7	3	4	4	4	4	4	4	3	–	–	–

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

[1] 2001 for Canada, Quebec; 2002 for Newfoundland, Prince Edward Island, Nova Scotia, New Brunswick, Ontario, Manitoba, Saskatchewan, Alberta, British Columbia; 1998-2002 average for Yukon, Northwest Territories, Nunavut

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

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

APPENDIX I: ACTUAL DATA FOR NEW CASES AND DEATHS

Table A5

Actual Data for Deaths for Major Cancer Sites by Sex and Geographic Region, Canada, 2001[1]

	Deaths												
	Canada	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.	Nu.
Males														
All Cancers	**34,000**	**710**	**160**	**1,200**	**920**	**9,200**	**12,400**	**1,300**	**1,250**	**2,600**	**4,200**	**25**	**20**	**15**
Lung	9,900	200	55	370	310	3,100	3,400	340	340	630	1,100	10	5	5
Colorectal	4,100	110	20	150	110	1,050	1,550	170	140	320	480	–	5	–
Prostate	3,800	100	25	130	120	800	1,400	170	220	330	540	–	–	–
Pancreas	1,600	25	5	55	35	410	600	60	45	130	220	–	–	–
Non-Hodgkin's Lymphoma	1,400	20	5	40	45	340	540	60	45	110	190	–	–	–
Leukemia	1,200	10	5	35	25	290	480	45	50	110	160	–	–	–
Stomach	1,150	40	5	30	30	310	410	35	50	95	160	–	–	–
Bladder	1,050	25	–	40	20	240	440	40	40	80	130	–	–	–
Kidney	870	25	–	45	25	220	300	35	35	80	110	–	–	–
Brain	860	10	5	35	20	250	310	30	20	70	110	–	–	–
Oral	720	10	5	30	15	190	280	25	20	60	90	–	–	–
Multiple Myeloma	590	10	5	25	10	140	240	30	20	40	70	–	–	–
Melanoma	440	5	5	15	5	75	200	20	15	25	65	–	–	–
Larynx	420	15	5	10	10	150	160	10	10	15	50	–	–	–
Females														
All Cancers	**29,800**	**480**	**110**	**1,050**	**770**	**8,000**	**11,300**	**1,200**	**970**	**2,200**	**3,600**	**15**	**15**	**15**
Lung	6,600	75	30	270	180	1,850	2,500	260	180	460	880	5	5	10
Breast	5,000	85	25	170	110	1,350	1,850	180	160	420	600	5	–	–
Colorectal	3,800	90	10	150	110	1,050	1,400	140	130	280	420	–	5	–
Pancreas	1,600	25	5	55	40	420	580	65	50	120	250	–	–	–
Ovary	1,450	20	5	50	45	310	620	65	55	110	190	–	–	–
Non-Hodgkin's Lymphoma	1,150	15	5	30	40	290	460	55	40	85	130	–	–	–
Leukemia	890	10	5	30	25	250	340	35	40	55	110	–	–	–
Brain	700	10	–	25	15	190	250	25	30	50	100	–	–	–
Stomach	690	20	–	20	20	200	250	30	25	55	75	–	–	–
Body of Uterus	660	10	–	25	20	180	260	35	10	50	75	–	–	–
Multiple Myeloma	540	5	–	25	15	150	220	25	15	30	60	–	–	–
Kidney	530	10	5	25	15	150	180	25	15	45	65	–	–	–
Bladder	430	5	–	10	10	130	170	15	5	25	60	–	–	–
Cervix	400	15	–	20	15	65	170	25	15	35	45	–	–	–
Oral	310	–	–	10	5	90	120	5	15	20	40	–	–	–
Melanoma	270	5	–	5	5	70	120	10	10	20	35	–	–	–

– Fewer than 3 deaths

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

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

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

Table A6

Actual Age-Standardized Mortality Rates for Major Cancer Sites by Sex and Geographic Region, Canada, 2001[1]

	Rate per 100,000													
	Canada	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.	Nu.
Males														
All Cancers	**224**	**276**	**215**	**248**	**238**	**256**	**216**	**220**	**220**	**202**	**192**	**248**	**236**	**343**
Lung	65	75	79	76	80	85	59	58	61	50	51	106	88	164
Colorectal	27	43	26	31	28	30	27	29	24	25	22	–	35	–
Prostate	27	41	38	28	33	25	25	28	34	28	25	–	–	–
Pancreas	10	10	4	12	9	11	10	10	8	11	10	–	–	–
Non-Hodgkin's Lymphoma	9	8	7	8	12	9	9	9	8	8	9	–	–	–
Stomach	8	14	6	6	8	9	7	6	8	8	7	–	–	–
Leukemia	8	4	8	7	7	8	9	8	9	9	7	–	–	–
Bladder	7	10	–	8	6	7	8	7	7	7	6	–	–	–
Kidney	6	8	–	9	7	6	5	6	6	6	5	–	–	–
Oral	5	5	6	6	4	5	5	4	3	4	4	–	–	–
Brain	5	4	4	7	5	6	5	5	4	5	5	–	–	–
Multiple Myeloma	4	4	5	5	3	4	4	5	4	3	3	–	–	–
Larynx	3	5	4	2	3	4	3	1	2	1	2	–	–	–
Melanoma	3	2	4	2	1	2	3	3	3	2	3	–	–	–
Females														
All Cancers	**148**	**147**	**119**	**161**	**148**	**158**	**149**	**150**	**136**	**137**	**134**	**175**	**190**	**415**
Lung	34	24	32	43	37	38	33	35	27	30	34	28	41	236
Breast	25	25	29	26	21	27	25	23	23	26	23	37	–	–
Colorectal	18	26	10	20	21	20	18	17	17	17	15	–	34	–
Pancreas	8	7	7	8	8	8	7	7	6	7	9	–	–	–
Ovary	7	6	5	7	9	6	8	8	8	7	7	–	–	–
Non-Hodgkin's Lymphoma	6	4	5	4	8	6	6	7	5	5	5	–	–	–
Brain	4	3	–	4	3	4	4	4	5	3	4	–	–	–
Leukemia	4	3	3	4	5	5	4	4	5	3	4	–	–	–
Stomach	3	6	–	3	4	4	3	3	3	4	3	–	–	–
Body of Uterus	3	4	–	4	4	3	3	5	1	3	3	–	–	–
Multiple Myeloma	3	1	–	4	2	3	3	3	2	2	2	–	–	–
Kidney	3	4	3	3	3	3	2	3	2	3	2	–	–	–
Oral	2	1	–	1	1	2	2	1	1	1	1	–	–	–
Cervix	2	5	–	3	3	1	2	4	3	2	2	–	–	–
Bladder	2	1	–	1	2	2	2	2	1	1	2	–	–	–
Melanoma	1	2	–	1	1	1	2	1	1	1	1	–	–	–

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

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

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

Source: Surveillance and Risk Assessment Division, CCDPC, 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 (1950-2001),[21] the National Cancer Incidence Reporting System (NCIRS, 1969-1991) and the Canadian Cancer Registry (CCR, 1992-2002)[1] (the Health Statistics Division at Statistics Canada maintains all these databases).

Actual incidence and mortality data were available at the Public Health Agency of Canada for all the provinces and territories for the period 1969 to 2001. Incidence data were available for all the provinces and territories except Quebec for 2002.

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,[22] from postcensal estimates for the **period 2001 to 2003**[22] and from the Scenario 2 population projections for **2004 to 2005**.[23] The population estimates from **1971 to 2003** 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 2005 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 2001 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[24] was used in publications before 1995. It was replaced because it is much younger than the 1991 Canadian population. Consequently, estimates of age-standardized rates before 1995 are not comparable with later estimates.

Commencing with the 2000 edition of *Canadian Cancer Statistics*, the Northwest Territories represent a different geographic area than in the past. Its geographic boundaries were redrawn, reducing the land area representing the Northwest Territories, and a new territory named Nunavut was incorporated.[25]

APPENDIX II: METHODS

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 2005

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 2005 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 2005 were estimated (after consultation with the provinces/territories) by a five-year average of the most recent available data: Newfoundland and Labrador (male – prostate, melanoma; female – melanoma); Prince Edward Island (male – lung; female – lung, melanoma); Nova Scotia (male – prostate, colorectal, bladder; female – bladder, ovary); New Brunswick (male – prostate, colorectal, kidney, larynx, non-Hodgkin's lymphoma, leukemia, melanoma; female – breast, lung, colorectal, kidney, stomach, non-Hodgkin's lymphoma, melanoma); Ontario (male – prostate); Manitoba (male – colorectal, pancreas, prostate, kidney; female – breast, leukemia); Saskatchewan (female – lung); Alberta (male – prostate, bladder, stomach, pancreas); British Columbia (male – prostate); Northwest Territories (male – All Cancers, prostate; female – All Cancers); Yukon Territories (male – All Cancers, prostate; female – All Cancers) and Nunavut (male – All Cancers, prostate; female – All Cancers).

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

Prostate cancer incidence projection methodology was modified for the 2003 edition, as the anticipated decline in age-standardized rates from a peak in 1993 was observed until 1995, at which point a new and increasing trend was established. This observation

in the summary rates does not apply to the age-specific rates. Since 1981, the age-specific rates for Canada among men under 40 have revealed little change and shown no trend; among men aged 40-59 a steeply increasing trend started around 1991 and has yet to change course; among men aged 60-74 the rates follow the trends in the age-standardized rates from 1991 on; and among men over 75 years of age the brief spike in rates in the early to mid-1990s was followed by a steep decline to levels at or below the 1981 levels. Consequently, age-specific rate projections based on a Poisson regression model fit to data between 1981 and 1989 were abandoned in favour of Poisson regression models fit to data from 1991 to the most recent year of incidence data available (2001 Quebec, otherwise 2002). The provinces for which this method was applied include Prince Edward Island, Quebec and Saskatchewan.

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 2005

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 2005 were estimated (after consultation with the provinces/territories) by a five-year average of the most recent available data: Newfoundland and Labrador (male – prostate); Nova Scotia (male – prostate, non-Hodgkin's lymphoma, brain; female – lung, non-Hodgkin's lymphoma); New Brunswick (male – stomach, colorectal, multiple myeloma; female – lung, stomach, colorectal, bladder); Manitoba (male – non-Hodgkin's lymphoma, colorectal, kidney); Saskatchewan (male – oral, esophagus, stomach, kidney; female – lung, stomach, uterus, non-Hodgkin's lymphoma); Alberta (male – prostate); British Columbia (male – melanoma); 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 2005

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 2005 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 2005 were estimated by actual age-standardized mortality rates calculated over a five-year period for each of the areas and site combinations listed in the Mortality Estimates section.

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

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 Centre for Chronic Disease Prevention and Control, Public Health Agency of Canada. Together, these quality measures assess the precision (or imprecision) of a particular estimate but not the accuracy of the estimate. Note that any estimates are subject to error, and the

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

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

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

The AAPC values were calculated for each site by fitting a model that assumed a constant rate of change in the ASIRs or ASMRs, that is, a linear model applied to the ASIRs and ASMRs after logarithmic transformation. The estimated slope resulting from that fit was then transformed back to represent a percentage increase or decrease. Joinpoint analysis was applied to search for the most recent linear trend using ASIR or ASMR data points from 1986 to 2001. A minimum of five data points were required to identify a new trend, so the latest a new trend would be detected was 1997. Data from 1992 to 2001 were used for incidence and mortality unless the joinpoint 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 2005 in Canada

The pathology laboratories in British Columbia send all diagnostic reports of non-melanoma skin cancer (basal and squamous) to the provincial registry. It is assumed that non-melanoma skin cancer is under-reported to some extent. The age and sex-specific incidence rates in British Columbia for 1985-1994 (in 20-year age groups) have been projected to the current year and applied to the Canadian population estimates to generate a minimal estimate of the number of cases for Canada as a whole. A special study on non-melanoma skin cancer in British Columbia covered this period.

Probability of Developing/Dying from Cancer

Probabilities of developing cancer were calculated according to the age- and sex-specific cancer incidence and mortality rates for Canada in 2001 and life tables based on 1999-2001 all-cause mortality rates. The methodology used was that of Zdeb[26] and Seidman et al.[27] 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.

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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 1971 as the baseline. The uppermost series is a plot of the annual Canadian cancer cases/deaths observed or projected. The next to upper most series is an estimate of the cancer events expected if the age distribution of the 1971 population were held constant through time. The next to baseline series is an estimate of the expected number of cases/deaths assuming a population constant in both magnitude and distribution from 1971 to the current year.

In preparation of a more rigorous presentation of how these series were computed, let $P_{i,t}$ represent the sex-specific total population in Canada for year t, where i = M for males or i = F for females. That is, $P_{F,1971}$ represents the total 1971 Canadian female population. Next let $ASR_{i,t}$ denote the all-cancers, sex-specific, age-standardized incidence/mortality rate with the reference population being the 1971 Canadian population of the sex corresponding to i, which is either i = M for males or i = F for females. For example, $ASR_{F,2001}$ is the age-standardized rate for Canadian females in the year 2001.

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

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

Next to baseline: total 1971 population times the age-standardized rate for year t or, in symbols, $P_{i,1971}\ ASR_{i,t.}$

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

Potential Years of Life Lost (PYLL)

The indicator was calculated by obtaining deaths for ages < 1, 1-4, 5-9, . . . 90+ for Canada in 2001 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.[28]

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,[29] and relative risk estimates were obtained using

SAMMEC II.[30] Smoking-attributable mortality (SAM) was calculated[31] 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 (1992-2002), and survival data were obtained from the Information Management Division, Saskatchewan Cancer Agency. For each cancer site, data were stratified by month of diagnosis, age at diagnosis and sex. Expected prevalence was then calculated as the product of the age-specific crude survival rate and the number of incident cases. The stratum-specific estimates were aggregated by cancer site.

Survival rates were based on data from the Saskatchewan Cancer Registry. Data were first stratified by cancer site, sex and age groups 0-34, 35-64 and 65 or older, then monthly survival was calculated using the life table method as implemented in SAS version 8.1 (right censoring was adjusted for in the standard way). These estimates were based on cases diagnosed from the beginning of 1986 to the end of 2001, with follow-up to the end of 2002.

Annual national cancer incidence counts were stratified by year of diagnosis, cancer site, sex and age groups 0-1, 2-4, 5-9, 10-14 and so on by five-year age groups to age 85 and older. These data were then uniformly distributed to each month throughout the year by dividing the number of cases in each stratum by 12. Prevalence for 2001, allowing a maximum of 15 years of survival, was estimated within each stratum as the product of the crude survival rate and the corresponding case count. Estimates were limited to a maximum of 15 years' survival, which corresponds closely with lifetime prevalence, and used survival estimates up to the limit of their reliability.

APPENDIX III PREVIOUS SPECIAL TOPICS

In past years, other Special Topics included

- 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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