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Cancer incidence in Canada: trends and projections (1983–2032)

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Health Promotion and Chronic Disease Prevention in Canada: Research, Policy and Practice is the monthly, online scientific journal of the Health Promotion and Chronic Disease Prevention Branch of the Public Health Agency of Canada. The journal publishes articles on disease prevention, health promotion and health equity in the areas of chronic diseases, injuries and life course health. Content includes research from fields such as public/community health, epidemiology, biostatistics, the behavioural and social sciences, and health services or economics.

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Preface

This report provides estimates of the projected cancer burden in Canada as well as in the provinces and territories, to the year 2032. These estimates are based on current trends and, given the latency period of most cancers, are not unreasonable.

The information provides a timely benchmark to measure progress and should be a valuable resource for future cancer control and care.

The overall cancer incidence rate is projected to remain relatively constant over the next 28 years, with a 5% decline for males and a 4% increase for females. The decline in smoking-related cancers, particularly in males, will be balanced by increases in thyroid, uterus and liver cancers. Furthermore, the growth and aging of the population will mean that the numbers of new cases per year are projected to increase by 84% for men and 74% for women. Our population trends will overwhelm even those areas where we expect to see moderate improvements in rates and will result in much higher numbers of new cases. Clearly, more effort is needed if we are to succeed in significantly reducing the rates, the numbers and the overall burden of cancer.

The importance of cancer prevention is heightened by the lack of large improvements in survival for most cancers. Cancer prevention is hampered by the relative complexity of cancer biology; cancer is many different diseases often with diverse and poorly understood etiologies. Although much is known, control efforts have been mixed. The large declines in smoking-related cancers reflect the success of tobacco control efforts over almost 50 years. However, current attempts to control the obesity epidemic and decrease sedentary lifestyles have not yet been successful and clearly need to be a major focus of future efforts in cancer prevention.

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Cancer incidence in Canada: trends and projections (1983–2032)

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Purpose and intended audience

Each year, the Canadian Cancer Statistics publication provides an estimate of expected case counts and rates for common cancer sites for the current year in Canada as a whole and in the provinces and territories. This monograph expands on the Canadian Cancer Statistics publication by providing historical and projected cancer incidence frequencies and rates at national and regional levels from 1983 to 2032. The aim is that this monograph will be an important resource for health researchers and planners. Most importantly, it is hoped the monograph will:

- provide evidence-based input for the development of public health policy priorities at the regional and national levels; and
- guide public health officials in planning strategy including designing and evaluating preventive interventions and planning resources (treatment requirements) and infrastructure for future cancer control and care intended to reduce the burden of cancer in Canada.

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Executive Summary

In this monograph, we present historical and projected cancer incidence frequencies and rates for Canada, excluding non-melanoma skin cancers (i.e. basal and squamous carcinomas), in 1983 to 2032. The information is intended to help in planning strategy and allocating resources and infrastructure for future cancer control and health care.

Projected changes in cancer incidence rates

From 2003–2007 to 2028–2032, the age-standardized incidence rates (ASIRs) for all cancers combined are predicted to decrease in Canadian males by 5%, from 464.8 to 443.2 per 100 000 population, and increase in Canadian females by 4%, from 358.3 to 371.0 per 100 000. The overall decrease in cancer rates in males will be driven by the decrease in lung cancer rates in men aged 65[*] or older and in prostate cancer rates in men aged 75 or older. The overall increase in cancer rates in females reflects the predicted rise in lung cancer rates in women aged 65 or older. The increase also represents the expected increase in cancers of the uterus, thyroid, breast (in females under 45), leukemia, pancreas, kidney and melanoma.

The largest changes in ASIRs projected over the 25-year forecasting horizon are increases in thyroid cancer (55% in males and 65% in females) and liver cancer in males (43%) and decreases in larynx cancer (47% in males and 59% in females), lung cancer in males (34%) and stomach cancer (30% in males and 24% in females). The incidence rate of lung cancer in females is projected to continue to rise by 2% from 2003–2007 to 2008–2012 and then start to decrease in the last 20 projection years, by 18%. Breast cancer incidence is expected to change the least (an increase of less than 1%) of all cancers in females. The predicted changes in the rates for colorectal cancer are below the medians in all cancers, with a decrease of 6% for both males and females during the entire projection period. The rates for prostate cancer are projected to be stable, based on an assumption of future stabilization in the prevalence of screening.

New cancer cases to rise

The annual number of new cancer cases is predicted to increase by 84% in Canadian males, from 80 800 in 2003–2007 to 148 400 in 2028–2032, and by 74% in Canadian females, from 74 200 to 128 800.

Drivers of the changes in cancer cases

The primary reason for the increase in the number of all newly diagnosed cancer cases will be the aging of the Canadian population and, to a lesser extent, the increase in population size. Changes in the risk of cancer will constitute a relatively small component of the projected increase in new cases. Preventive interventions can have a strong influence on future incidence rates for individual cancer types.

Most common cancers

The most common new cancers in males—prostate, colorectal, lung and bladder cancers, and non-Hodgkin lymphoma—are projected to remain the same from 2003–2007 to 2028–2032, but colorectal cancer is predicted to outrank lung cancer as the second most frequently diagnosed cancer by 2028–2032. For females, breast, lung, colorectal and uterine cancers figure as the top 4 most common incident cancers in both periods. However, thyroid cancer will overtake non-Hodgkin lymphoma as the fifth most common cancer by 2028–2032.

Incidence by geographical region

There is an east–west gradient in incidence across Canada. The highest incidence rates for most cancers are projected to be in eastern Canada (Atlantic region [New Brunswick, Prince Edward Island, Nova Scotia, and Newfoundland and Labrador], Quebec or Ontario) for both males and females. While British Columbia is projected to continue to have the lowest incidence rates for the majority of cancers in both sexes, this province will also continue to experience the highest rates for esophageal cancer in females, liver cancer in both sexes and testis cancer. The Atlantic region is projected to have the lowest incidence rates for cancers of the breast, uterus and ovary in females, and for liver cancer and leukemia in both sexes. In contrast, this region is projected to experience elevated incidence rates in males for about half the cancers studied.

The incidence rates for all cancers combined are projected to continue to be highest for males in the Atlantic region and for females in Quebec in 15 years but in Ontario thereafter, and lowest in British Columbia. The inter-regional differences are larger in males than in females, possibly due to variations in prostate-specific antigen (PSA) testing (for prostate cancer) and risk factors. In both males and females, colorectal cancer incidence rates will remain highest in the Atlantic region and lowest in British Columbia. Lung cancer incidence rates are projected to be highest in Quebec and lowest in Ontario and British Columbia for both sexes. The similar regional rates of breast cancer in females are expected to persist. The significantly lowest rates of prostate cancer in Quebec are projected to continue, as are the elevated rates in the Atlantic region.

Incidence by sex and age

Cancer is more common in males than in females except in those aged under 55. The overall cancer incidence rate in men aged 65 or older has been falling and will continue to do so. The decrease in lung cancer rates in men aged 65 or older from decreased tobacco use and the decrease in prostate cancer rates in men aged 75 or older have contributed to the overall decrease in this age range. In women aged 65 or older, the relatively stable rate is primarily the result of an increase in lung cancer incidence offset by decreases in incidence for the other cancer sites. This stable trend is projected to continue. Targeted cancer prevention efforts and specific needs for health care services can be expected to vary at different points in the age continuum for males and females.

Smoking-related cancers

Between 2003–2007 and 2028–2032, substantial risk reductions are projected for major common tobacco-related cancers in

[*] All ages are in years unless otherwise specified.

Canada, even with relatively lower reductions or delayed downturn trends in females. The differences between males and females in the predicted incidence trends of these cancers mirror the historical pattern of reductions in smoking prevalence that took place in males 20 years earlier than in females. Given the lag of 20 years or more between the reduction in smoking and subsequent decrease in cancer incidence, the incidence rates in females will likely begin to drop more noticeably over the longer term. By comparison, the risk of cancer incidence is forecast to increase for non-tobacco-related cancers.

Cancers associated with excess weight and physical inactivity

Over the 25-year projection period, the incidence rates for cancers associated with excess weight and physical inactivity are estimated to increase by 0.6% to 16% for cancers of the uterus, kidney, pancreas, female breast and male esophagus, in descending order. Incidence rates are expected to decrease by 2% to 6% for colorectal and female esophageal cancer. Increased obesity prevalence in Canada may contribute to the increased incidence trends.

Most common infection-associated cancers

From 2003–2007 to 2028–2032, the incidence rates of liver cancer are expected to escalate almost 3 times faster in males than in females (43% vs. 15%), while the rate of stomach and cervical cancer will continue to decrease by 20% to 30%. The ongoing increasing trend of liver cancer incidence is possibly linked to the historical increase and continued high incidence in hepatitis C virus (HCV) infection, the aging of the previously infected population, and increasing immigration from areas where risk factors such as hepatitis B virus (HBV) are prevalent. The persisting decrease in incidence of stomach cancer may be explained by improved healthy behaviours, such as decreased smoking and changes in diet, and increased recognition and treatment of *Helicobacter pylori* infection. The continuing downward trend in the rates of cervical cancer is mainly attributable to general population screening with the Papanicolaou (Pap) test and successful treatment of screening-detected premalignant lesions. The immunization of school-aged children with the vaccine for human papilloma virus (HPV) is anticipated to further reduce the incidence of cervical cancer.

Implications for cancer control strategies

The projected aging and growth of the population are expected to lead to a progressive and significant increase in the total number of new cancer cases in Canada over the next 25 years. Consequently, this report indicates the need to continue to strengthen cancer control strategies and leverage resources to meet future health care requirements and reduce the burden of cancer in Canada. Although incidence rates are projected to decrease for many cancers, the rates for some cancers, for example, thyroid, liver, uterus, pancreas, kidney and leukemia, are estimated to increase. Additional etiological research is needed to better understand risk factors and guide prevention efforts.

This monograph underscores the importance of cancer prevention by curbing smoking; promoting healthy eating, physical activity and weight management; enhancing uptake of cancer screening; and increasing coverage of HPV vaccination. The implication of future changes in our demographic profiles and cancer trends should be addressed from the full spectrum of cancer control, including research and surveillance, prevention and early detection, treatment, and psychosocial, palliative and medical care.

Chapter 1: Introduction

A prominent characteristic of current sociodemographic changes in Canada is the accelerated growth in the number and proportion of seniors. Figure 1.1 shows that the percentage of men aged 65* or older is projected to increase from 12% in 2003–2007 to 21% in 2028–2032 and of women the same age from 15% to 24% in the same period. The increase in the number of older adults is a consequence of reduced mortality rates in all age groups and the aging of the baby boomer generation. This demographic trend is expected to result in a significantly higher number of cancer diagnoses and therefore demand for health care services. Defining the expected societal burden of cancer can provide evidence-based input into planning cancer control programs, leveraging resources to meet future health care needs and reducing the expected burden of cancer in Canada.

We quantify the future burden of cancer from two perspectives: age-standardized rate and the number of new cancer cases. Changes in incidence rates communicate changes in risk of developing cancer over time. The future number of new cases is a consequence of changes both in the cancer rates and in the population size and composition.

The main source of estimates of expected case counts and rates for common cancer sites in the current year for Canada and the provinces and territories is the annual Canadian Cancer Statistics report.[1] These estimates provide important information for cancer control planners, public policy analysts, and provincial and territorial health care professionals who need to know the relative burden of different types of cancer and for different geographical regions.

Currently, there are no widely available long-term national projections for Canada, whereas several other developed countries have documented their profiles.[2-5] To map out such a possible future cancer scenario, this monograph presents estimates of cancer incidence frequencies and rates in Canada for 25 cancer sites by geographical area, sex and age group through 2028–2032.

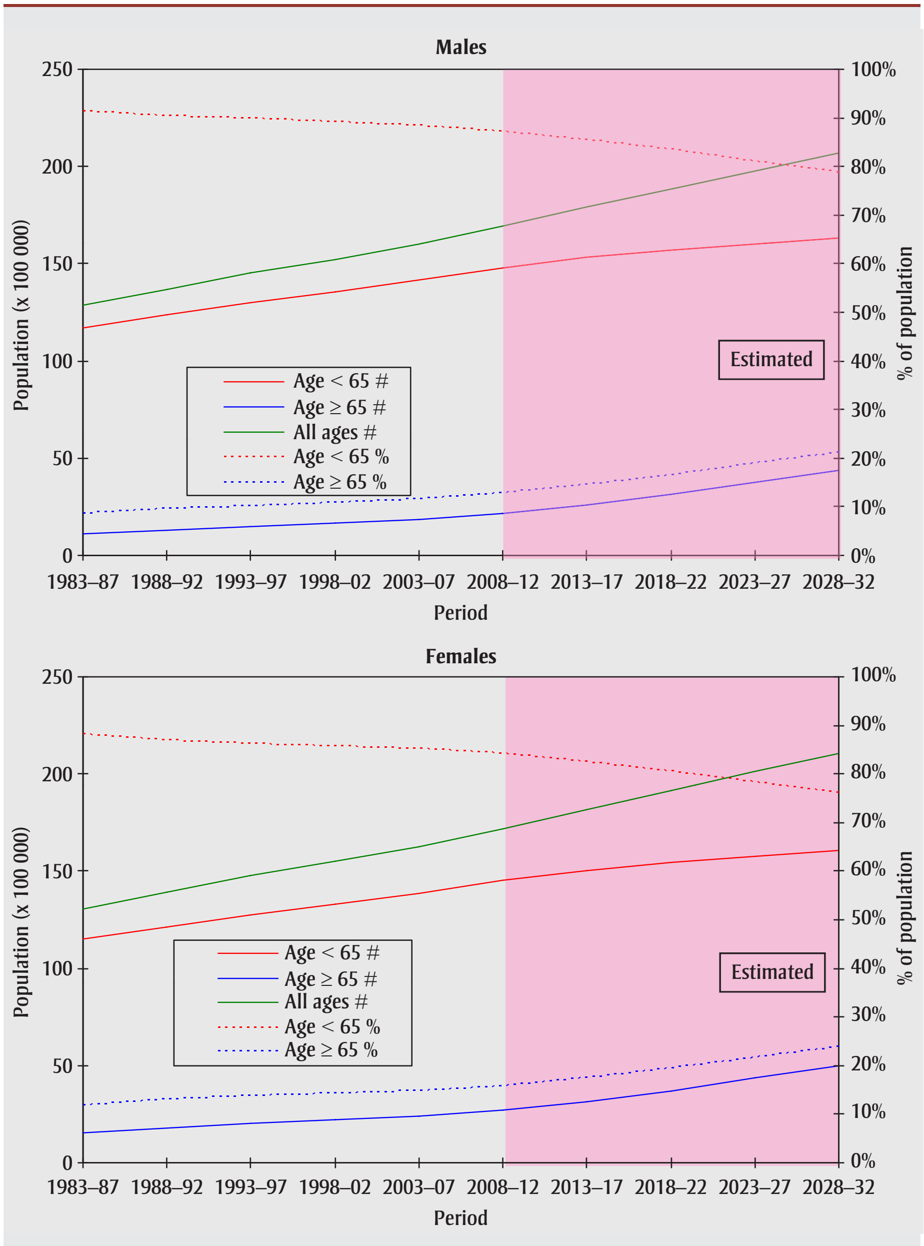
Chapter 2: Data and Methods

2.1 Data

The observed cancer incidence data used for the projections cover 1983 to 2007, which represents the most recent period for which data are available for all parts of Canada. We extracted data from the Canadian Cancer Registry (CCR) for 1992 to 2007 and from the National Cancer Incidence Reporting System (NCIRS) for

* All ages are in years unless otherwise specified.

FIGURE 1.1
Historic and projected growth in average annual population in Canada by age, 1983–2032



the earlier years. While the CCR is a person-oriented database, the NCIRS is an event-oriented database with cases diagnosed from 1969 to 1991. The cases in the NCIRS were coded in or converted to the International Classification of Diseases, Ninth Revision (ICD-9).[6] Projections were prepared for the most frequent invasive primary cancers (including in situ bladder cancers but excluding non-melanoma skin cancer (i.e. basal and squamous carcinoma). We generally defined cancer cases based on the International Classification of Diseases for Oncology, Third Edition (ICD-O-3) and classified them using Surveillance, Epidemiology, and End Results (SEER) Program Incidence Site Recode shown in Table 2.1.[7,8] Cases retrieved from the NCIRS used equivalent ICD-9 codes. Changes in cancer definition over time were derived following the methods outlined in the Canadian Cancer Statistics.[1]

Population estimates for Canada and the provinces/territories are based on quinquennial censuses conducted from 1981 to 2006. We used intercensal estimates prepared by Statistics Canada for the years between these censuses and postcensal estimates for 2007 to 2010.[9] Projected population estimates were used for 2011 to 2032, as prepared by Statistics Canada under assumptions of medium growth (scenario M1).[10] The scenario M1 incorporates medium growth and historical trends (1981–2008) of interprovincial migration. For the total population, the low and high growth scenarios are about 6% below and above the M1 scenario, but this range is reduced to 3% for ages 65 or older.

Data on cancer incidence counts and population estimates were summarized into 5-year age groups (0–4, 5–9, …, 80–84, 85+) and 5-year periods of diagnosis (1983–1987, 1988–1992, 1993–1997, 1998–2002, 2003–2007) by sex and geographical region (British Columbia, the Prairie provinces [Alberta, Saskatchewan and Manitoba] individually and together, Ontario, Quebec, the Atlantic provinces [New Brunswick, Prince Edward Island, Nova Scotia and Newfoundland and Labrador] individually and together, and the North [Yukon, Northwest Territories and Nunavut]). The projected population figures were similarly aggregated for 5 projection quinquennia (2008–2012, 2013–2017, 2018–2022, 2023–2027, 2028–2032). The single-year data from 1994 to 2007 were used for projecting prostate cancer incidence. Rates for each category were calculated by dividing the number of cases in each category (a combination of cancer site, sex, region, period, and age group) by the corresponding population figure. These age-specific rates were standardized to the 1991 Canadian population (Table 2.2), using the direct method,[11] to obtain the age-standardized incidence rates (ASIRs).

2.2 Methods

2.2.1 Projection methods

Future trends in cancer incidence rates are generally estimated by extending past trends using statistical models. A statistical model formulates the relationship between the risk factors and the cancer rates, and projections can be obtained by applying the future times in the equation.

There are several methods for projecting cancer burden, differing in terms of the type of model, selection of the data used for model fitting, and the method of extrapolating the model components into future periods. The model type diverges from simple linear or log-linear regression of age-specific rates or counts against time[2,12,13] to age–period–cohort (APC) modelling.[11,14,15] Within the framework of APC models, effects of age, period and cohort are addressed in heterogeneous ways such as generalized linear models[16,17] including their derivative, Nordpred method, based on a step function on 5-year intervals,[3,15] generalized additive models[18,19] with polynomial[15,20] or spline smoothing methods,[21] and Bayesian models[22] with Markov chain Monte Carlo (MCMC) simulation.[23] The link function is either common exponential[11,14,22] or non-canonical power.[3,15] A model is fitted to all available data or their subset for an adequate fit through a goodness-of-fit test.[3,15] The assumptions used for extrapolating the observed trends include keeping current rates unchanged in future,[24] continuing overall historical trend,[2,22] extending only the most recent trend,[3,15] and adjusting the extent to which the observed trend are likely to influence the future.[3,15] To develop the most accurate profile of future cancer burden, we used the major projection models to produce projections of current rates as would have been forecast 15 or 20 years ago based on the long-term data series in Canada, compared the projected rates with those observed, and concluded with a cancer-dependent modelling approach. This multiple modelling approach consists of the following models and integrates the strengths of these models.

The common projection models relate incidence to the 3 intrinsically interdependent time dimensions: age at diagnosis (age), year of diagnosis (period), and year of birth (cohort). The Nordpred APC model[3,15] uses the power-5 link function instead of the traditional logarithmic link to reduce the exponential changes; summarizes the linear trends in period and cohort over the observed data into a drift component and then arithmetically attenuates the drift into the future to damp the impact of past trends in the future; chooses data for model fitting; and chooses the drift for extrapolations. Nordpred with its standard and various modified parameter settings was the primary method used in the

TABLE 2.1
Cancer definitions for incidence

Cancer	ICD-O-3 site/histology type[a] (Incidence)
Oral	C00–C14
Esophagus	C15
Stomach	C16
Colorectal	C18–C20, C26.0
Liver	C22.0
Pancreas	C25
Larynx	C32
Lung	C34
Melanoma	C44 (Type 8720–8790)
Breast	C50
Cervix	C53
Body of uterus	C54–C55
Ovary	C56.9
Prostate	C61.9
Testis	C62
Kidney	C64.9, C65.9
Bladder (including in situ)	C67
Central nervous system	C70–C72
Thyroid	C73.9
Hodgkin lymphoma[b]	Type 9650–9667
Non-Hodgkin lymphoma[b]	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
Multiple myeloma[b]	Type 9731, 9732, 9734
Leukemia[b]	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
All other cancers	All sites C00–C80, C97 not listed above
Mesothelioma[b]	9050-9055
Kaposi's sarcoma[b,c]	9140
Small intestine	C17
Anus	C21
Gallbladder	C23
Other digestive system	C22.1, C24, C26.8–9, C48
Other respiratory system	C30–31, C33, C38.1–9, C39
Bone and joints	C40–41
Soft tissue (including heart)	C38.0, C47, C49
Other skin	C44 excl. 8050:8084, 8090:8110, 8720:8790
Other female genital system	C51–52, C57–58
Penis	C60
Other male genital system	C63
Ureter	C66
Other urinary system	C68
Eye	C69

Continued on the following page

TABLE 2.1 (continued)
Cancer definitions for incidence

Cancer	ICD-O-3 site/histology type[a] (Incidence)
Other endocrine	C37.9, C74, C75
Other, ill-defined, and unknown	Type 9740, 9741, 9750–9758, 9760–9769, 9950–9962, 9970–9989; C76.0–76.8 (type 8000–9589); C80.9 (type 8000–9589); C42.0–42.4 (type 8000–9589); C77.0–C77.9 (type 8000–9589)
All cancers	All invasive sites

[a] ICD-O-3 refers to the International Classification of Diseases for Oncology,Third Edition.[7] Cancers are classified by SEER Incidence Site Record.[8]

[b] Histology types 9590–9989 (leukemia, lymphoma and multiple myeloma), 9050–9055 (mesothelioma) and 9140 (Kaposi's sarcoma) are excluded from other specific organ sites.

[c] Data are not available for Ontario and Canada.

projections in this monograph. When cohort effects were not present, we considered a Nordpred model without cohort component as an alternative. When there were too few observed cases to properly estimate model parameters via the Nordpred method or projections from

TABLE 2.2
1991 Canadian standard population

Age Group	Population (per 100 000)
0–4	6946.40
5–9	6945.40
10–14	6803.40
15–19	6849.50
20–24	7501.60
25–29	8994.40
30–34	9240.00
35–39	8338.80
40–44	7606.30
45–49	5953.60
50–54	4764.90
55–59	4404.10
60–64	4232.60
65–69	3857.00
70–74	2965.90
75–79	2212.70
80–84	1359.50
85+	1023.70
Total	100 000.00

Data source: Census and Demographics Branch, Statistics Canada

Note: The Canadian population distribution is based on the final postcensal estimates of the July 1, 1991, Canadian population, adjusted for census undercoverage. The age distribution of the population has been weighted and normalized.

Nordpred seemed unlikely based on biological and clinical grounds, we pursued Bayesian APC models[22] or submodels with various prior settings, 5-year average method or applying a relative percentage adjustment to national estimates to obtain the estimates for a jurisdiction. Bayesian models estimate the age-specific rates from their posterior distribution through repeated iterative sampling. The 5-year average model assumes the current age-specific rates will remain in future. In addition, we used an age-specific trend power-5 model fitted to most recent data for the projections of prostate cancer to reduce the impact of prostate-specific antigen (PSA) screening on the long-term historical trend.

All the long-term projection models depend on an assumption of the continuity of past trends in age-specific rates, but with different extent. The details of these models, model section methods, and ''best'' models are described below.

2.2.1.1 Projection models

2.2.1.1.1 Nordpred power-5 models—modified generalized linear models (NP_ADPC and NP_ADP)

The Nordpred approach was developed as part of a comprehensive analysis of cancer trends in the Nordic countries.[3,25] The approach is based on a standard APC Poisson regression model[14,16,26] but has been shown to give more realistic predictions, especially for long-term projections.[15,27] It is now one of the most frequently used methods for cancer projections worldwide.[28-31] The log-linear relationship between the rate and the covariates in the standard model produces predictions in which the rates grow exponentially with time. Nordpred uses a power-link function instead of the log-link function to lower this growth. The power-link function is an approximation of the log-link function based on Box-Cox power transformation theory, in which $\lim_{\lambda \to 0} x^{\lambda} = \log(x)$. The Nordpred model is defined as

$$\text{case}_{ap} \sim \text{Poisson}(\mu_{ap}),$$

$$R_{ap}\left(or, \left(\frac{\mu_{ap}}{n_{ap}}\right)\right) = (A_a + D \cdot p + P_p + C_c)^5, \quad (\text{NP\_ADPC})$$

where R_{ap} is the incidence rate for age group a in calendar period p, which is the mean count μ_{ap} of case_{ap} divided by the corresponding population size n_{ap}; A_a, P_p and C_c are the non-linear components of age group a, period p and cohort c, respectively; and D is the common linear drift parameter of period and cohort.[26] A cohort is calculated by subtracting age from period: $c = A + p - a$, with A = number of age groups (i.e. 18).

To achieve an adequate fit of each data to the model, the number of 5-year periods on which the projections should be based is chosen in the Nordpred software by using a goodness-of-fit test to successively remove the earlier periods. To extrapolate the model for future periods, two approaches are considered instead of simple continuation of the overall historical trend. Firstly, the software determines whether the average trend across all observed values, or the slope for the last 10 years of observed values, is used as the drift component D to be projected. The software does this by testing for departure from a linear trend. If the trend across the entire observation period departs significantly from linearity, only the trend in the most recent 10 years is used for projection. The ''recent'' option in the software allows choosing between using the average trend (recent = F) or the trend for the last 10 years (recent = T). Secondly, to attenuate the impact of current trends in future periods, a ''cut trend'' (or ''drift'') option is used, which is a vector of proportions indicating how much to cut the trend estimate for each 5-year projection period. A gradual reduction in the drift parameter of 25%, 50%, 75% and 75% in the second, third, fourth and fifth 5-year period, respectively, is used as a default ''cut'' in Nordpred.[3,25]

To explore accurate projection methods for this study, we compared the power-5 models and Poisson models (using log link instead of the power link in equation NP_ADPC), with the Nordpred option recommendations and their modifications. The default ''cut trend'' vector was modified to reduce or increase the impact of current trend in future periods.

For each age group, a minimum of 5 cases in each 5-year period was required; for age groups below this limit, the average number of cases in the last 2 periods was used to calculate future rates. If a limit of 10 had been used, as in the report for Nordic countries in most of the situations,[3] a larger number of age groups would have been based on the average rates. This would reduce the effect of current trends, so a low limit of 5 was chosen as a trade-off between unbiased estimation of the underlying trend and a large estimation error.

In addition to the full ADPC model, we also considered using an age-drift-period model (ADP) with power-5 link functions for cancers with average annual counts of fewer than 50 over the last observed 5 years when cohort effects were not present based on a significance test:

$$R_{ap} = \left(A_a + D \cdot p + P_p\right)^5. \qquad \text{(NP\_ADP)}$$

This ADP model was used for rare cancers in Iceland in an analysis of cancer trends in the Nordic countries.[3]

2.2.1.1.2 Bayesian Markov chain Monte Carlo method

Instead of a maximum likelihood approach, we applied a Bayesian framework to the APC model or submodel. The Bayesian method incorporates prior knowledge into the model to derive a posterior distribution and uses MCMC approximations[22,23] for inference (parameter estimates). We considered this approach for situations in which average annual count over the last observed 5 years was less than or equal to 10 (when there were too few observed cases to properly estimate model parameters via the Nordpred method) or if projections from Nordpred seemed unlikely. We considered 2 Bayesian approaches.

2.2.1.1.2.1 Bayesian APC model with autoregressive prior – Bray approach (B_APC)

For the classical APC Poisson model,[26] Bray specified a second-order autoregressive prior model to smooth age, period and cohort effects and to extrapolate period and cohort effects.[22,23] The model can be written as,

$$\text{case}_{ap} \sim \text{Poisson}(\mu_{ap}),$$

$$\log\left(\frac{\mu_{ap}}{n_{ap}}\right) = A_a + P_p + C_c$$

Supposing that we compute N-period projections based on P-period observed data, there are total $C = A+P-1$ cohorts. With the Nordpred model, an individual cohort c can be calculated as $c = A + p - a$. The prior distributions are defined as follows. For the A age effects:

$$A_1 \sim normal\left(0{,}1000000\frac{1}{\tau_A}\right);$$

$$A_2|A_1 \sim normal\left(0{,}1000000\frac{1}{\tau_A}\right);$$

$$A_a\left|A_{1,\ldots,a-1} \sim normal\left(2A_{a-1} - A_{a-2}, \frac{1}{\tau_A}\right),\right.$$

$$3 \le a \le A.$$

For the $P + N$ period effects:

$$P_1 \sim normal\left(0{,}1000000\frac{1}{\tau_P}\right);$$

$$P_2|P_1 \sim normal\left(0{,}1000000\frac{1}{\tau_P}\right);$$

$$P_p\left|P_{1,\ldots,p-1} \sim normal\left(2P_{p-1} - P_{p-2}, \frac{1}{\tau_P}\right),\right.$$

$$3 \le p \le P + N.$$

For the $C + N$ cohort effects:

$$C_1 \sim normal\left(0{,}1000000\frac{1}{\tau_C}\right);$$

$$C_2|C_1 \sim normal\left(0{,}1000000\frac{1}{\tau_C}\right);$$

$$C_c\left|C_{1,\ldots,c-1} \sim normal\left(2C_{c-1} - C_{c-2}, \frac{1}{\tau_C}\right),\right.$$

$$3 \le c \le C + N.$$

The variance parameters τ_A, τ_P and τ_C (determining the smoothness of age, period and cohort effects, respectively) are given the same gamma prior,

$$\tau \sim \text{gamma}(0.001,\ 0.001).$$

Fitted and projected rates are derived by combining the simulated age, period and cohort effects based on

$$R_{ap} = \exp(A_a + P_p + C_c).$$

Three MCMC chains were run for a ''burn-in'' of 50 000 iterations. Parameter estimates (posterior medians) were based on an additional 50 000 iterations for each chain, thinned to every thirtieth sample (N = 150 000 samples). Chain convergence was assessed via the Gelman-Rubin statistic, examination of sample autocorrelation, and visual inspection. All Bayesian modelling was implemented in WinBUGS (Windows Version of Bayesian inference Using Gibbs Sampling);[32] additional details can be found elsewhere.[33]

2.2.1.1.2.2 Bayesian age–period model using national coefficients as priors' means for regional projections (B_AP)

To stabilize regional estimates, initial or ''prior'' distributions based on national data were assumed for regional parameters and then updated using the actual regional data. The model can be written as

$$\text{case}_{ap} \sim \text{Poisson}(\mu_{ap}),$$

$$\log\left(\frac{\mu_{ap}}{n_{ap}}\right) = A_a + P_p$$

We first used the model to estimate national-level age and period coefficients, denoted as $\hat{A}_a$ and $\hat{P}_p$, respectively. Regional age A_a and period P_p effects were then given normally distributed priors with means equal to the corresponding national estimates,

$$A_a \sim \text{normal}(\hat{A}_a, \frac{1}{\tau_A}),$$

$$P_p \sim \text{normal}(\hat{P}_p, \frac{1}{\tau_P}),$$

where variance parameters τ_A, τ_P were given the same gamma prior,

$$\tau \sim \text{gamma}(0.001, 0.001).$$

Following Spiegelhalter *et al.*,[34] corner constraints were imposed on the first age effect (A_1 = 0) to facilitate computations.

2.2.1.1.3 Five-year average model (AVG)

The 5-year average model assumes that the age-specific average rates of cancer incidence in the most recent 5 years of observed data will remain constant in future years, so that future numbers of cancer would be affected only because of demographic changes in the population. The projected rates are calculated as

$$R_a = \sum_{t=2003}^{2007} C_{at} \Big/ \sum_{t=2003}^{2007} P_{at},$$

where R_a represents the rate for age group a, C_{at} the number of cases for age group a in year t, and P_{at} the population size for age group a in year t.

2.2.1.1.4 Relative percent adjustment method – regional projections derived from scaling down national-level projections (SD)

For a cancer site in a region with average annual counts over the last observed 5 years of fewer than 10, the age-specific counts were also calculated by adjusting the national estimates (based on a modified method used in the Cancer Registry of Norway).[35] Let w denote the relative difference of the averages of the ASIRs in the last 5 observation years between the region and the whole country, that is,

$$w = \sum_{t=2003}^{2007} ASIR_{Rt} \Big/ \sum_{t=2003}^{2007} ASIR_{Nt},$$

then the cancer incidence rate in a region R, age group a and period p,

$$R_{Rap} = R_{Nap} * w = (C_{Nap}/P_{Nap}) * w,$$

where R_{Nap}, C_{Nap} and P_{Nap} are the national cancer incidence rate, count and population size at age group a and period p, respectively. For example, if the region had 5% lower rates than the national average in the last 5 observation years, the age-specific rates in each future period were adjusted down by 5% for that region. We therefore have the corresponding number of new cancer cases,

$$C_{Rap} = R_{Rap} * P_{Rap}.$$

2.2.1.1.5 Age-specific trend power-5 model fitting single-year data for short-term projections of prostate cancer (ADa)

Trends in prostate cancer incidence since the early 1990s have been subject to overdiagnosis (the detection of latent cancer that would never have been diagnosed in the absence of screening) because of the rapid dissemination of the PSA test.[36] The projections of period analysis from Nordpred seem unlikely. Therefore, an age-specific trend power-5 model based on yearly data was fitted to a minimum of 8 years of observations from 1994 to 2007 for projections of prostate cancer incidence in the first 5 (2008–2012) or 10 (2008–2017) future years: R_{ap} = $(A_a + D_a \cdot p)^5$, where D_a is the slope parameter in age group a, which takes the differentiation in trend from different age groups into consideration. This model also allowed for the ''spike'' value in the year 2001. Another peak year was in 1993, which was excluded from the modelling.

2.2.1.2 Comparison of models

We fitted the projection models described above to observed incidence counts in 1972–1991 and used them to estimate average annual number of cancer cases for the 5-year periods in 1992–2011. Projections were made for males and females, by age group, for the Canadian provinces and at the national level, for the cancer types shown in Table 2.1. Quebec was excluded from this analysis because of data quality issues prior to 1983.[37,38]

Given that prostate cancer accounts for nearly one-third of all new cancer cases in males in Canada, the effect of PSA screening is also clearly seen in the incidence of ''all cancers combined'' in males. The model comparisons were therefore considered with and without prostate cancer and ''all cancers combined'' for males when appropriate.

We compared projected average annual numbers of cancer cases with observed values. Median absolute relative difference between projected and observed values, |projected−observed|/observed, was calculated to examine each model's overall tendency to over- or underestimate the actual number of cancer cases. The absolute difference was used when comparing for rare cancers. We compared median prediction errors for each model for combinations of cancer type, geographical area and sex by length of projection. The comparisons considered only combinations for which the models produced projections. We used Friedman's test[39] to test for statistical difference in medians between different projection models. In addition to considering prediction error across all cancers, we separately compared model performance for each cancer type, across the geographical areas and sexes.

2.2.1.3 Projection validation and adjustment

The model selection was performed by assessing the models and integrating these model comparison results with those from other published studies. However, a model created on cohorts in early periods may give inaccurate predictions when applied to contemporary cohorts. Owing to limitations in the availability of different long-term datasets used for validating the selected models, we examined the projections from the selected models using our knowledge of data quality, trends in cancer rates in different regions, risk factors or interventions to ensure the estimates are appropriate. When the estimated trends seemed unlikely, we used such knowledge to adjust the extrapolation methods of the fitted models, or used Bayesian simulations instead of the generalized linear models. Such modifications were applied in the following situations: all cancers combined in males in Prince Edward Island, Saskatchewan and Alberta, and in females in Ontario, Manitoba and Alberta; female non-Hodgkin lymphoma in New Brunswick; multiple myeloma in males in the Atlantic region and New Brunswick, and in females in Ontario and British Columbia; and thyroid cancer in the provinces except Manitoba, Saskatchewan and British Columbia.

2.2.1.4 Selected models by cancer category

We used the following projection methods in this monograph.

- Common cancers (average annual count over the latest 5 observation years for a national or regional series, N > 50): NP_ADPC model with varied ''recent'' and ''drift'' values. One exception is that B_APC was applied to multiple myeloma in males in the Atlantic region as the projections from NP_ADPC seem questionable.
- Less common cancers (10 < N ≤ 50): NP_ADPC or NP_ADP model (based on the significance of the cohort effect and comparison with AVG results) with varied ''recent'' and ''drift'' values. The simple age-effect only AVG model has been proven to be the best approach for rare cancers in our model evaluation and other studies[27] and has been used in recent reports.[35] With this, we adopted either NP_ADPC or NP_ADP, from which the projections were closer to the AVG results, instead of basing them solely on linear extrapolation of the 5-year average rate into the future. One exception is that B_APC was applied to multiple myeloma in males in New Brunswick.
- Rare cancers (N ≤ 10): NP_ADPC, NP_ADP, B_APC, B_AP or SD model, whichever projections were closer to the AVG results.
- Prostate cancer: ADa + AVG, defined as
  - using ADa to project for the first 5 future years, and then
  - using the age-specific average rates of the predicted 5-year data to estimate counts for the second to fifth 5-year periods.
- ''All cancers'' for males: The estimates of incidence counts were computed as the sum of the estimates for prostate cancer and for all cancers excluding prostate, as estimated by NP_ADPC modelling.

Tables 2.3 shows the selected projection models for rare cancers or in small areas by cancer type, sex and geographical area.

2.2.2 Other analysis methods

2.2.2.1 Joinpoint regression analysis

We assessed observed trends (1986–2007) using joinpoint regression,[40,41] which involves fitting a series of joined straight lines on a logarithmic scale to the trends in ASIRs. The trends in incidence are reflected by the annual percent change. The models incorporated estimated standard errors of the ASIRs. The tests of significance used a Monte Carlo Permutation method. The estimated slope from this model was then transformed back to represent an annual percentage increase or decrease in the rate.

A minimum of 5 years of data before and after a changepoint in years in which the annual percent change changed significantly was required for a new trend to be identified. Thus, the most recent possible changepoint is 2003. In Figures 3.1 and 3.2, if no changepoint was detected from 1998 to 2007, then the annual percent change was estimated by fitting a model within this time period. If a changepoint was detected within this decade, then the annual percent change was estimated from the trend in the last segment. Both the changepoint year and the annual percent change for the years beyond the changepoint are indicated in these two figures.

2.2.2.2 Contribution of change in cancer risk, population growth and population age structure to incidence trend

Figure 3.4 shows the relative contributions of changes in the total numbers of new cases that can be attributed to changes in cancer risk, population growth, and aging of the population. The series were defined as follows (the annual ASIR was calculated by using the average annual population distribution in 1983–1987 for males or females as the standard weights):[1]

- The baseline (red reference line) represents the observed average annual number of new cancer cases during 1983–1987 for males or females.
- The lowest black line represents the average annual number of new cancer cases that would have occurred in each period if the average annual population size and composition had remained the same as they were in 1983–1987. Thus, it measures the impact of changes in cancer risk. This series was computed by multiplying the average annual population in 1983–1987 by the ASIR.
- The middle black line represents the average annual number of new cases that would have occurred if the age distribution of the average annual population had remained the same as it was in 1983–1987, measuring the impact of changes in risk and population growth. This series was computed by multiplying the average annual population by the ASIR.
- The top line represents the total average annual number of new cases that actually occurred (projected estimates as of 2008) in each period for males or females, reflecting the combined impact of changes in cancer risk, and population growing and aging.

2.3 Presentation of results

In this monograph, while the figures display longer-term time trends in ASIRs of each cancer for broader areas, the tables show cancer incidence frequencies and rates in all provinces and territories from the last observation period (2003–2007) onward. The numbers of cases shown in the tables and figures are average annual numbers. All the ASIRs were calculated per 100 000 person-years.

For each type of cancer, the historical and projected ASIRs are shown in figures to illustrate their time trends and differences between (1) sexes and age groups (< 45, 45–54, 55–64, 65–74, 75–84, 85+), and (2) regions (British Columbia, the Prairies, Ontario, Quebec, the Atlantic region and Canada as a whole). The trends for the North are not shown in the figures because of small numbers. Number of cases in Figure 3.8–3.10 was rounded to the nearest 100.

Tables for males and females give the observed (2003–2007) and projected average annual number of cases and ASIRs by the 10-year age group and province/territories combined. Number of cases was rounded to the nearest 5. The numbers were rounded separately, so it is possible that the totals in the tables do not add up.

Chapter 3 presents the overview of historical and projected trends for all cancers combined, whereas Chapter 4 breaks down such information by cancer sites.

TABLE 2.3
Projection models for rare cancers or in small areas by cancer type, sex and geographical area

Cause	Model			
	B_AP[a]	B_APC[a]	SD[a]	NP_ADP[a]
Oral			PE/F, TC/M+F	MB/F
Esophagus	TC/M, NL/F		PE+TC/F	NS/F
Stomach	PE/M	TC/F	PE/F, TC/M	NB/F
Colorectal			PE/F	TC/M+F
Liver		NS/F, TC/M	PE+NL/M+F, NB+SK+TC/F	MB+SK/M, AT/M+F
Pancreas		TC/M+F	PE/M+F	NL/F
Larynx	PE/F, TC/M	PE/M, NS+NB+MB+SK/F	NL+TC/F	AT/F
Melanoma			TC/M+F	
Breast			TC/F	
Cervix			PE/F, TC/F	MB/F
Body of uterus			TC/F	
Ovary		TC/F	PE/F	
Testis			PE+NL+TC/M	NS+NB+MB/M
Kidney	PE/F	TC/F	TC/M	PE/M, NL/M+F
Bladder			PE+TC/F, TC/M	NL/F
Central nervous system			PE+TC/M+F	NS/M, NB+NL+SK/F, MB/M+F
Thyroid	PE/M	PE/F	TC/M+F	NS/M, SK/F
Hodgkin lymphoma	NB/F		PE+NL+TC/M+F	NB+AB+AT/M, BC/F, NS+MB+SK/M+F
Non-Hodgkin lymphoma	PE/F, TC/M+F		PE/M	NL/M+F, AT+NS+NB/F
Multiple myeloma		AT+NB/M, PE/F	PE/M, NL/F, TC/M+F	NS+MB+SK/M+F, NL/M
Leukemia	PE/M, TC/F	PE/F	TC/M	NL/M+F
All other cancers	PE/F	TC/F		

Abbreviations: AB, Alberta; AT, All Atlantic provinces together (PE, NS, NB and NL); BC, British Columbia; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; PE, Prince Edward Island; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: The abbreviation before '/' refers to the province or region; 'M' or 'F' after '/' refers to males or females. For example, PE+TC/M+F in the 'SD' model was used for both males and females in PE and TC for central nervous system cancers.

[a] See Methods for the definitions.

The cancers are ordered by the ICD-O-3 codes.

Chapter 3: Overview of Observed and Projected Status of All Cancers

Recent changes in observed cancer incidence rates

The annual percent change in cancer-specific ASIRs in males and females in the last observed decade (1998–2007) shows varying trends by cancer site (Figures 3.1 and 3.2). Between 1998 and 2007, the overall incidence rate increased significantly in females by 0.3% per year. Statistically significant increases of 2% or more per year occurred for liver cancer in both males (3.6%) and females (2.4%), kidney cancer in males (2.6% since 2003) and thyroid in both males (6.8%) and females (6.9% since 2002). Significant annual decreases of 2% or more occurred in larynx cancer for both males (3.8%) and females (3.4%) and in stomach cancer in males (2.0%). The possible explanations for the observed trends can be found in the corresponding section of Chapter 4.

Overall (historic and projected) trends

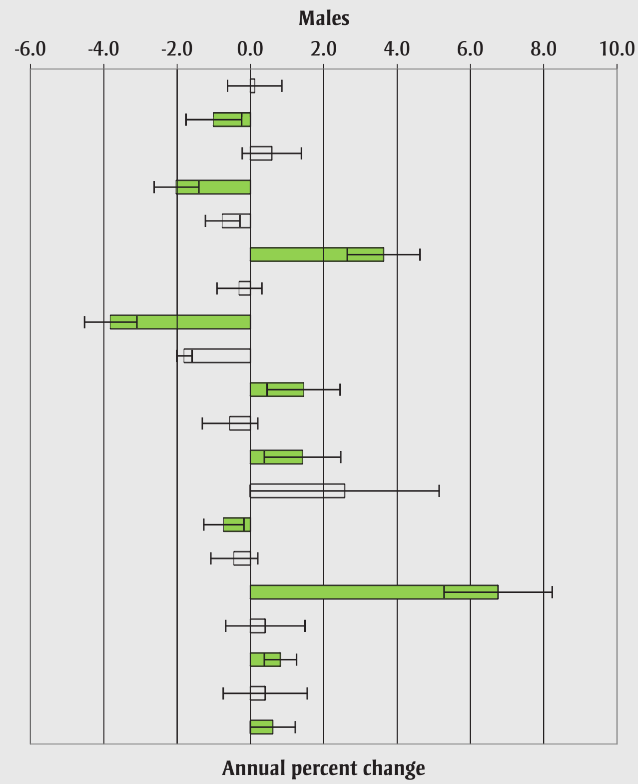
Figure 3.3 illustrates the average annual number of new cases and ASIRs for all cancers combined for 1983–2032, with projections as of the year 2008. Even though the observed ASIRs for all cancers combined stabilized, the number of new cancer cases continues to increase as the Canadian population grows and ages. The ASIRs in males decreased after increasing until 1993–1997. This pattern mirrors a similar trend in the incidence of prostate cancer, the leading cancer in males. The decrease also represents the decrease in lung cancer rates in men aged 65 or older. In females, the cancer incidence rate increased slightly over the observation horizon. The increase reflects the rise in rates in cancers of lung (in women aged 65 or older), uterus, thyroid, breast (in females aged under 45), leukemia, kidney, and melanoma.

All cancers combined excludes non-melanoma skin cancer. In Canada, non-melanoma skin cancer accounts for about 30% of all new cancer cases.

Tables 3.1 to 3.4 show historic and projected numbers of new cancer cases and ASIRs by sex, period, age group and

FIGURE 3.1
Annual percent changes in age-standardized incidence rates (1998–2007) for selected cancers, males, Canada

Cause	Annual percent change	Change-point
All cancers	0.1	2003
Oral	-0.1	
Esophagus	0.6	
Stomach	-2.0	
Colorectum	-0.8	2000
Liver	3.6	
Pancreas	-0.3	
Larynx	-3.8	
Lung	-1.8	
Melanoma	1.4	
Prostate	-0.6	2001
Testis	1.4	
Kidney	2.6	2003
Bladder	-0.7	
Central nervous system	-0.4	
Thyroid	6.8	
Hodgkin lymphoma	0.4	
Non-Hodgkin lymphoma	0.8	
Multiple myeloma	0.4	
Leukemia	0.6	



Note: The error bars refer to 95% confidence intervals.

geographical region. From 2003–2007 to 2028–2032, the ASIRs for all cancers in Canada are projected to decrease in males by 5%, from 464.8 to 443.2 per 100 000, and to increase in females by 4%, from 358.3 to 371.0 per 100 000. The annual number of cases is projected to increase by 84% (from 80 810 to 148 370) in males and by 74% (from 74 165 to 128 830) in females.

Figure 3.4, presenting the determinants of increases in the total average annual numbers of cancer incidence cases (see Chapter 2 for definitions of the series), shows that the observed and projected increase in the number of cancer cases mainly results from the aging of the population and, to a lesser extent, population growth. Changes in the risk of cancer have been contributing marginally to the increase in new cases, especially in males. In 2028–2032, the percentages of the total changes due to aging, population increase and cancer risk are predicted to be 70.9%, 29.1% and 0.1% respectively in males, and 58.4%, 35.5% and 6.1% in females. In addition, the percentages of the total changes due to change of age distribution increase with time, from 41.5% in 1988–1992 to 70.9% in 2028–2032 in males and from 42.0% to 58.4% in females. The percentages due to change of population size generally decrease over the same period, from 39.8% to 29.1% in males and from 46.8% to 35.5% in females. The percentages due to change of cancer risk decrease in males from 18.7% to 0.1% over the study period, whereas the percentages in females increased from 11.2% in 1988–1992 to 14.1% in 1998–2002 (in part because of increased mammography screening) and decrease thereafter to 6.1% in 2028–2032.

Trends by age

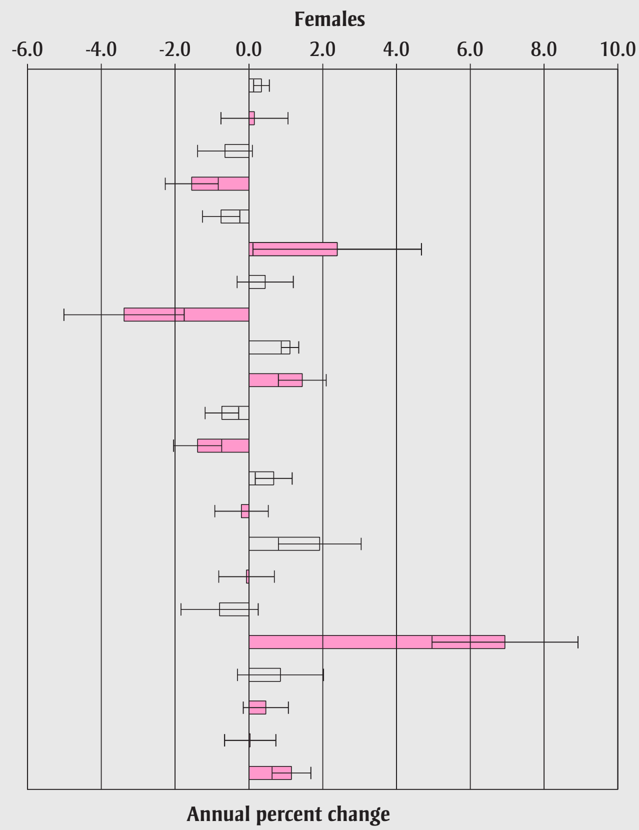
Figure 3.5 shows similar patterns of cancer occurrence and population distribution in males and females. The figure shows the increase in percentage of the population at older ages along with the corresponding increase in the number of expected cancer cases. Cancer cases increase with age until the peak in the 70–74 age group in both sexes, and illustrate approximately bell-shaped symmetric distributions about the peak in the 50-or-older age groups.

Trends by sex

Figure 3.6 compares the ASIRs for all cancers between sexes by 10-year age group from 1983 to 2032. Cancer is more common in males than in females except in those aged under 55. Breast cancer is the most common cancer in females under 55, accounting for 30% to 40% of cases in this age range in 2003–2007 (see Figure 3.9). Thyroid and cervical cancer also account for the higher cancer incidence in younger females. The overall cancer incidence rate in men aged 65 or older has been falling. The decrease in lung cancer incidence rates in males aged 65 or older as a result of decrease in tobacco use[36,42,43]

FIGURE 3.2
Annual percent changes in age-standardized incidence rates (1998–2007) for selected cancers, females, Canada

Cause	Annual percent change	Change-point
All cancers	0.3	
Oral	0.1	
Esophagus	-0.7	
Stomach	-1.6	
Colorectum	-0.8	2000
Liver	2.4	
Pancreas	0.4	
Larynx	-3.4	
Lung	1.1	
Melanoma	1.4	
Breast	-0.7	
Cervix	-1.4	
Body of uterus	0.7	
Ovary	-0.2	
Kidney	1.9	
Bladder	-0.1	
Central nervous system	-0.8	
Thyroid	6.9	2002
Hodgkin lymphoma	0.9	
Non-Hodgkin lymphoma	0.5	
Multiple myeloma	0.0	
Leukemia	1.2	



Note: The error bars refer to 95% confidence intervals.

and the decrease in prostate cancer rates in people aged 75 or older have together contributed to the overall decrease in this age range, as these two cancers account for 42% of all new cancer cases in Canadian men in 2003–2007. In women aged 65 or older, the relatively stable rate is the result of an increase primarily of lung cancer incidence offset by decreases in incidence for the other cancer sites.

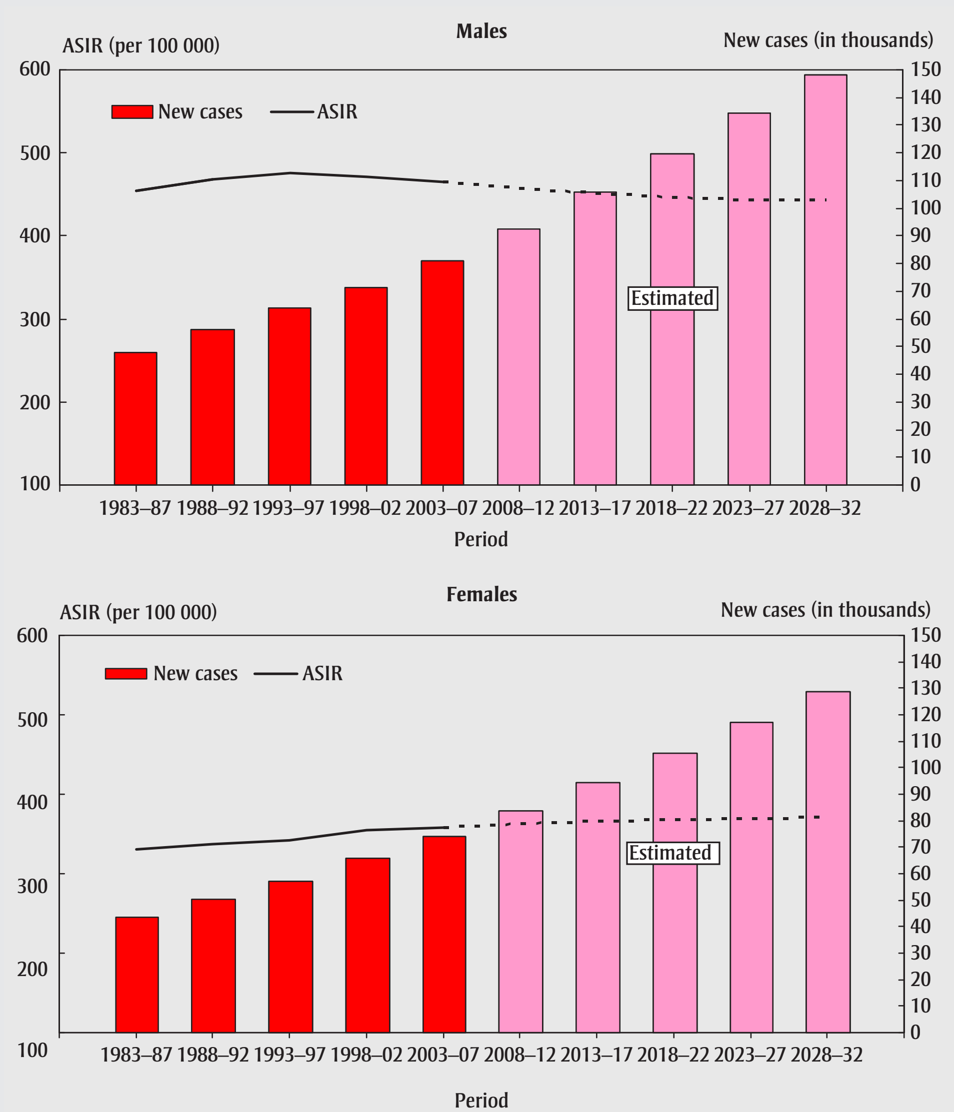
Trends by geographical region

Figure 3.7 shows historic and estimated ASIRs for all cancers combined by sex and region from 1983 to 2032. In males, the ASIRs for all cancers combined are projected to continue to be highest in the Atlantic region and lowest in British Columbia. Male incidence rates in Quebec, Ontario, the Prairies and British Columbia are projected to decrease and then stabilize, while rates in the Atlantic region will be relatively stable. In females, Ontario is predicted to surpass Quebec and experience the highest rates in 15 years (i.e. after 2018–2022), while British Columbia will continue to have the lowest incidence. Female incidence rates are predicted to increase 10%, 3% and 1% in Ontario, Quebec and the Atlantic region, respectively, and decrease 9% and 7% in British Columbia and the Prairies by 2028–2032. This follows an increasing trend in the former regions prior to 2008 and a decreasing trend in the latter regions starting in 1998–2002. The overall differences in cancer incidence across the country are smaller in females, ranging from 7.1 to 101.8 per 100 000 versus 45.9 to 134.6 per 100 000 in males over the observation and projection periods.

Observed most common cancers by sex and age

Figures 3.8 and 3.9 show the most common newly diagnosed cancers by sex and age group for 1983–1987 and 2003–2007. Overall, 52% of new cases in the last observation period (2003–2007) were in males and 48% in females. For males in each period, prostate, lung and colorectum were among the most frequently diagnosed cancer sites, together accounting for just over half the cases. In the last period the incidence of prostate cancer had replaced lung cancer in first place, followed by cancers of the colorectum and bladder. These cancers were similarly distributed for males within the various age groups, with some variation in proportions and ranking. The only exception was the youngest age group (<45 years), in which testis cancer was the most common newly diagnosed cancer. The incidence of testis cancer increased over the 2 periods of study. Other common cancers in the youngest males included non-Hodgkin lymphoma (NHL), leukemia and cancer of the central nervous system (CNS). Prostate cancer cases in men

FIGURE 3.3
Average annual new cases and age-standardized incidence rates (ASIRs) for all cancers, Canada, 1983–2032



aged 45 to 74 increased markedly and occurred with the highest frequency in the most recent period, as a prevalent pool of undiagnosed cancers were detected by prostate-specific antigen (PSA) screening.[36]

Breast cancer dominated cancer incidence in females, representing the same proportion of 27% of all diagnoses in the 2 periods studied, followed by lung and colorectal cancers (which had switched places between 1983–1987 and 2003–2007). The top 3 cancer diagnoses for females within each age group of 45 or older were these same 3, but with slight variations in rank. For the youngest females (<45 years), the most common newly diagnosed cancer was breast cancer, with 30% of new cases. The other common cancers in this age group included thyroid, cervical cancers and melanoma.

The most noticeable difference between males and females under 45 was the much higher proportion of thyroid cancer incidence in females. The most dramatic changes in the incidence proportions of different types of cancer as a function of age (<45 and 45+) occurred with melanoma, leukemia, CNS tumours, NHL, thyroid and genital tract malignancies.

The incidence proportions (by 10-year age group) of lung cancer in males aged 45 to 74 decreased by 7% to 12% between 1983–1987 and 2003–2007, whereas the incidence proportions of prostate cancer increased more pronouncedly (10%–20%) over the 2 periods for the same age groups. The incidence share attributed to NHL also registered some increase in the 2 youngest age groups, while the proportion of stomach cancer incidence decreased in each age group.

The increase of 6% to 8% between the study periods in the incidence proportion of lung cancer in women 65 or older is notable. A similar trend was observed in European countries.[4] The proportional increase in lung cancer incidence in females of all ages was 4% from 1983–1987 to 2003–2007. The incidence percen-

TABLE 3.1
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), all cancers, males, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	4720	560	495	125	155	1950	1080	100	155	20	65	15
	45–54	8265	970	850	230	280	3230	2000	225	285	40	140	20
	55–64	18 860	2280	1655	540	600	7145	4870	545	715	110	360	40
	65–74	24 570	3090	2090	840	825	9375	6135	710	905	140	420	40
	75–84	19 040	2600	1555	705	725	6985	4925	500	670	95	260	20
	85+	5350	785	440	235	240	1750	1470	155	195	30	55	5
	Total	80 810	10 280	7090	2675	2825	30 430	20 480	2235	2925	440	1295	140
2008–12	<45	4810	555	555	125	135	1940	1060	100	140	20	65	10
	45–54	9490	1015	1015	255	280	3865	2180	235	320	50	140	25
	55–64	23 235	2665	2120	695	680	9090	5640	710	875	135	455	55
	65–74	27 390	3435	2160	870	830	10 455	6875	850	1060	160	495	50
	75–84	20 520	2775	1680	675	660	7435	5520	545	705	110	275	25
	85+	7065	1050	560	245	265	2385	2055	180	220	30	55	5
	Total	92 515	11 495	8085	2860	2850	35 170	23 330	2620	3320	510	1490	170
2013–17	<45	5085	590	590	120	130	2030	1110	100	140	20	65	10
	45–54	9505	1000	1035	245	260	3965	2085	230	315	50	145	25
	55–64	26 330	2985	2610	795	750	10 455	6140	760	910	150	470	60
	65–74	33 695	4245	2810	1005	990	12 860	8175	1070	1320	200	630	75
	75–84	22 080	2955	1855	680	660	7910	5935	620	780	125	310	35
	85+	8940	1265	750	265	295	3080	2670	205	250	35	65	5
	Total	105 630	13 040	9645	3115	3085	40 300	26 115	2985	3715	580	1685	210
2018–22	<45	5420	650	605	125	130	2170	1155	105	145	20	70	10
	45–54	8895	925	1015	220	235	3735	1890	215	280	45	130	20
	55–64	28 975	3235	2945	845	800	11 885	6500	780	970	170	465	65
	65–74	40 245	5110	3665	1220	1165	15 510	9295	1250	1505	235	735	95
	75–84	25 830	3445	2220	740	750	9150	6925	760	950	145	385	50
	85+	10 370	1450	915	285	305	3530	3155	240	280	45	80	10
	Total	119 730	14 810	11 360	3440	3385	45 985	28 915	3355	4130	655	1870	250
2023–27	<45	5765	710	620	130	130	2340	1190	110	150	20	70	10
	45–54	9065	950	1065	215	240	3785	1940	215	275	40	125	20
	55–64	28 925	3245	2970	815	775	12 195	6210	750	950	170	460	60
	65–74	46 165	5815	4515	1415	1325	18 160	10 280	1350	1615	260	770	110
	75–84	32 640	4395	2960	895	945	11 625	8475	975	1220	180	505	70
	85+	11 725	1615	1055	305	335	3995	3570	280	330	50	95	10
	Total	134 285	16 725	13 185	3780	3750	52 105	31 670	3685	4545	725	2025	280
2028–32	<45	5990	745	620	135	125	2475	1220	115	150	15	70	10
	45–54	9780	1070	1135	235	260	4065	2060	215	295	45	135	15
	55–64	27 300	3075	2930	750	715	11 615	5685	700	860	150	420	55
	65–74	51 070	6370	5090	1510	1440	20 765	10 950	1405	1745	295	780	115
	75–84	39 720	5365	3930	1115	1140	14 280	9880	1155	1415	215	600	90
	85+	14 510	2010	1335	350	400	4855	4475	365	425	65	130	15
	Total	148 370	18 635	15 040	4090	4085	58 055	34 275	3955	4890	785	2140	305

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

TABLE 3.2
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), all cancers, females, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	7940	895	820	190	240	3505	1725	175	230	30	110	20
	45–54	11 490	1370	1095	310	395	4490	2950	280	345	45	185	30
	55–64	15 485	1870	1305	440	550	5810	4195	400	530	75	275	35
	65–74	16 325	2025	1350	515	570	6245	4280	405	570	85	250	25
	75–84	15 975	2035	1225	550	655	5960	4280	420	565	75	200	15
	85+	6945	900	540	280	310	2380	1990	190	265	35	55	5
	Total	74 165	9100	6335	2280	2715	28 385	19 425	1870	2505	345	1075	130
2008–12	<45	7900	850	875	185	235	3605	1630	165	195	25	105	20
	45–54	12 670	1430	1245	325	400	5195	3125	290	370	50	205	30
	55–64	18 805	2235	1690	520	645	7140	5030	480	595	85	335	45
	65–74	18 915	2315	1600	565	655	7135	5075	485	640	95	330	35
	75–84	16 755	2025	1390	545	630	6310	4635	420	575	80	215	20
	85+	8885	1185	730	315	375	3170	2530	225	305	40	65	5
	Total	83 930	10 040	7525	2460	2945	32 560	22 020	2070	2675	375	1255	160
2013–17	<45	8280	860	935	200	255	3865	1670	170	190	30	100	20
	45–54	12 770	1425	1290	290	385	5595	2910	275	340	45	195	30
	55–64	21 300	2425	2045	600	720	8270	5560	515	635	90	370	55
	65–74	23 685	2870	2075	660	795	8915	6405	625	785	115	445	50
	75–84	17 955	2150	1575	560	650	6745	4965	460	610	90	255	30
	85+	10 500	1310	915	355	420	3770	3125	260	345	50	85	5
	Total	94 495	11 035	8830	2660	3220	37 160	24 635	2305	2900	420	1450	195
2018–22	<45	8685	905	995	210	280	4130	1715	165	180	30	100	15
	45–54	12 365	1370	1275	260	360	5685	2610	260	300	40	175	30
	55–64	23 405	2590	2300	635	760	9510	5820	550	675	95	380	60
	65–74	28 330	3400	2640	790	940	10 780	7505	735	900	130	535	70
	75–84	21 170	2545	1915	620	735	7820	5945	550	720	110	340	45
	85+	11 635	1415	1075	365	450	4190	3530	280	360	55	100	10
	Total	105 590	12 230	10 200	2875	3525	42 110	27 125	2545	3140	465	1630	235
2023–27	<45	9035	975	1025	220	295	4425	1695	165	175	30	100	15
	45–54	12 750	1380	1340	280	375	5890	2665	265	305	45	160	30
	55–64	23 410	2625	2350	570	735	10 080	5360	525	635	90	360	60
	65–74	32 100	3775	3165	915	1050	12 430	8270	800	985	145	585	90
	75–84	26 800	3245	2495	740	905	9860	7535	715	910	135	455	65
	85+	13 085	1600	1270	400	480	4675	3975	320	405	70	120	15
	Total	117 185	13 600	11 645	3125	3845	47 365	29 500	2790	3415	515	1780	280
2028–32	<45	9110	995	1020	215	295	4580	1655	175	175	30	105	15
	45–54	13 610	1505	1475	310	435	6340	2785	250	295	45	150	25
	55–64	22 685	2560	2310	520	695	10 190	4825	500	570	80	325	60
	65–74	35 275	4085	3550	970	1115	14 235	8655	855	1065	155	605	100
	75–84	32 250	3900	3180	900	1080	11 955	8875	845	1065	160	550	95
	85+	15 895	1950	1570	445	555	5590	4925	390	500	85	170	25
	Total	128 830	14 995	13 105	3360	4170	52 890	31 720	3015	3670	555	1900	320

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

TABLE 3.3
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and povince/territories combined (TC), all cancers, males, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	46.0	43.1	43.4	42.8	42.4	48.3	45.6	44.4	54.1	53.3	40.8	35.0
	45–54	331.4	291.0	330.1	307.3	316.8	346.2	327.3	368.3	381.3	393.1	319.7	259.3
	55–64	1109.9	975.6	1099.4	1132.0	1019.7	1133.7	1120.4	1239.1	1295.8	1369.8	1124.0	932.9
	65–74	2287.3	2035.9	2305.9	2453.0	2218.9	2302.8	2297.5	2672.0	2642.8	2782.8	2238.1	2446.9
	75–84	3068.1	2876.7	3046.6	3012.9	2999.1	2907.7	3404.9	3358.1	3583.7	3517.4	2724.6	3229.8
	85+	3506.6	3246.0	3394.8	3122.3	3355.0	3093.5	4643.9	3735.2	3631.1	3692.9	2367.1	2467.3
	Total	464.8	420.2	461.3	467.3	444.3	461.1	489.3	517.7	535.7	550.6	433.8	440.2
2008–12	<45	47.7	42.4	45.1	42.4	37.9	49.3	46.6	47.6	54.9	49.3	47.5	31.2
	45–54	342.9	279.5	340.0	321.4	295.3	362.0	331.4	380.8	405.2	434.7	330.5	281.2
	55–64	1129.3	929.0	1062.6	1165.2	959.9	1190.9	1113.7	1341.0	1347.4	1419.7	1191.9	928.6
	65–74	2208.8	1946.8	2055.6	2394.1	2001.2	2254.4	2185.5	2666.1	2652.8	2729.1	2216.4	2327.6
	75–84	2942.7	2714.5	2860.4	2867.5	2672.3	2767.8	3280.2	3371.6	3424.2	3519.0	2613.7	3340.0
	85+	3368.6	3176.5	3220.2	2878.2	2999.6	2950.5	4469.9	3416.4	3477.7	3603.6	2139.2	3120.6
	Total	457.6	401.9	434.8	459.7	403.5	458.7	476.0	526.9	536.7	552.1	437.7	442.0
2013–17	<45	49.3	43.1	45.7	41.0	35.0	50.4	48.0	50.8	56.9	48.0	51.4	30.3
	45–54	341.9	268.5	344.9	330.3	282.8	357.2	328.3	386.7	413.8	441.6	348.7	292.8
	55–64	1120.4	919.8	1076.3	1150.2	915.9	1183.3	1085.6	1340.3	1296.4	1458.8	1186.2	893.9
	65–74	2157.2	1898.1	2018.9	2309.2	1895.1	2203.5	2104.0	2607.6	2617.2	2651.4	2200.5	2186.3
	75–84	2867.6	2608.8	2824.4	2879.8	2587.1	2684.2	3159.4	3320.8	3332.2	3382.3	2515.8	3452.5
	85+	3345.1	3061.9	3272.9	2824.4	2935.6	2902.9	4447.3	3397.1	3467.1	3615.1	2135.7	3071.7
	Total	451.4	392.1	433.7	452.5	385.4	451.3	464.1	523.7	528.8	545.3	437.3	433.5
2018–22	<45	50.5	44.6	45.4	40.6	33.3	51.5	48.5	52.0	59.0	46.4	56.1	27.4
	45–54	346.3	260.4	350.8	330.7	273.4	361.9	334.4	409.4	422.5	421.0	361.5	301.1
	55–64	1114.2	907.9	1083.8	1145.1	900.8	1176.9	1068.0	1332.7	1297.5	1502.9	1168.9	884.7
	65–74	2130.2	1870.0	2026.7	2258.2	1822.8	2190.7	2046.5	2573.5	2538.7	2609.4	2173.6	2126.1
	75–84	2782.1	2532.5	2759.1	2829.2	2486.9	2600.1	3020.4	3228.1	3286.9	3286.9	2500.3	3213.3
	85+	3277.6	2968.9	3268.1	2849.4	2826.1	2810.4	4351.1	3422.5	3345.9	3625.9	2135.2	3445.8
	Total	446.6	385.6	432.9	446.8	372.3	447.2	453.7	520.9	523.1	539.6	438.0	422.8
2023–27	<45	51.8	46.0	45.7	41.4	31.7	52.7	49.7	54.2	59.3	43.5	58.9	27.8
	45–54	354.3	264.7	354.7	315.8	273.9	373.8	340.6	423.8	445.9	424.3	380.5	275.7
	55–64	1112.2	889.6	1094.3	1169.0	893.6	1173.6	1061.8	1338.3	1322.3	1510.5	1204.6	902.2
	65–74	2115.6	1862.3	2045.3	2238.9	1788.2	2190.6	2000.2	2559.6	2468.9	2653.8	2143.9	2033.8
	75–84	2715.7	2477.3	2707.2	2724.7	2401.9	2556.1	2910.6	3132.1	3252.1	3133.1	2448.2	3025.3
	85+	3183.1	2848.0	3199.1	2872.0	2823.0	2745.5	4177.2	3286.2	3284.9	3337.1	1982.1	3329.5
	Total	443.8	381.8	433.2	443.0	365.2	446.8	445.9	518.7	521.3	533.2	439.6	407.6
2028–32	<45	52.8	46.8	45.8	42.0	29.9	53.8	51.0	55.6	57.2	36.2	59.7	28.1
	45–54	361.1	276.1	352.9	313.4	278.1	381.6	339.2	427.6	476.5	443.8	427.6	242.0
	55–64	1121.5	873.7	1106.0	1173.9	882.6	1186.9	1074.8	1383.0	1343.2	1459.9	1230.4	909.2
	65–74	2106.3	1845.6	2060.8	2239.0	1779.0	2184.7	1973.7	2541.9	2485.4	2730.1	2122.2	2018.7
	75–84	2682.2	2449.9	2725.4	2670.3	2326.4	2548.3	2832.4	3087.4	3143.8	3089.7	2426.8	2927.3
	85+	3086.7	2794.6	3120.2	2776.5	2689.4	2651.1	4018.4	3189.2	3258.1	3340.9	2043.7	2983.8
	Total	443.2	379.5	434.9	440.6	358.8	447.9	441.4	520.1	521.9	529.5	445.8	396.8

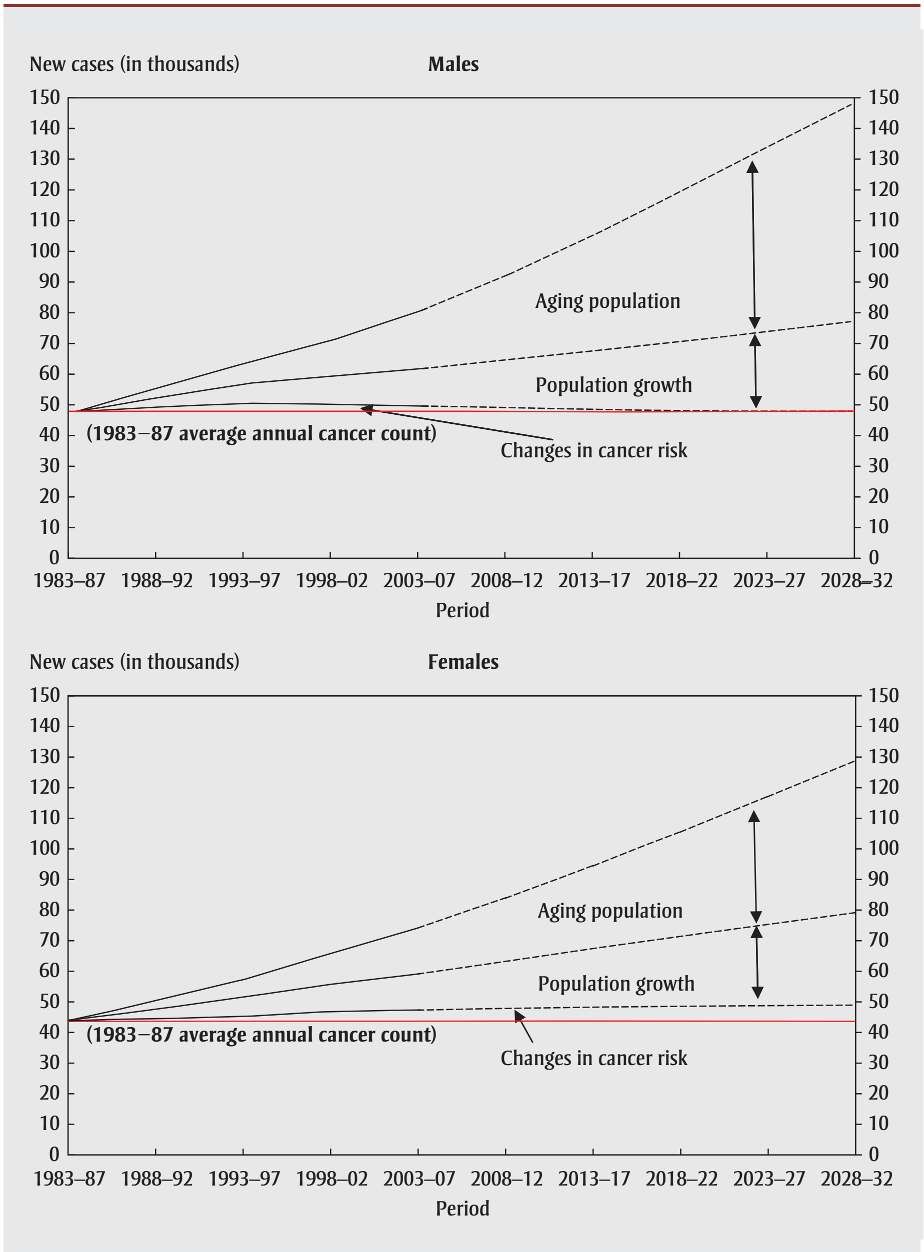
Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

TABLE 3.4
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), all cancers, females, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	77.6	67.3	76.0	65.9	68.9	86.2	73.4	74.7	77.5	68.5	67.6	60.3
	45–54	459.8	405.1	442.7	424.9	456.7	477.2	479.8	454.7	454.1	423.5	416.5	435.8
	55–64	875.8	779.9	865.6	901.5	908.0	876.9	914.4	886.4	923.9	902.5	848.4	1003.9
	65–74	1372.1	1283.4	1396.0	1386.5	1363.1	1362.6	1405.8	1391.2	1515.1	1583.5	1277.7	1680.4
	75–84	1828.8	1737.8	1805.9	1757.9	1867.6	1758.8	1971.2	1907.9	2085.6	1956.8	1569.3	2078.9
	85+	2023.8	1869.5	1978.6	1772.8	1919.8	1894.5	2453.6	1982.7	2097.8	1973.2	1081.8	1834.0
	Total	358.3	326.1	354.8	344.6	354.4	361.7	372.7	360.4	381.4	368.9	319.0	382.9
2008–12	<45	79.4	64.2	77.6	67.1	69.6	90.6	74.0	79.3	72.9	71.3	71.2	57.1
	45–54	465.1	389.1	445.4	415.8	432.8	493.0	484.2	454.3	459.2	407.4	459.5	414.1
	55–64	880.0	747.8	864.4	869.6	888.1	889.5	947.0	877.0	878.7	830.8	848.1	886.4
	65–74	1397.4	1250.5	1437.2	1447.9	1444.3	1384.0	1458.9	1445.6	1470.6	1530.6	1408.4	1718.1
	75–84	1838.1	1668.4	1892.9	1812.9	1899.0	1781.7	2000.7	1920.2	2079.2	1980.7	1605.8	2509.1
	85+	2042.4	1937.0	2094.1	1856.0	1992.9	1924.8	2419.9	1990.6	2126.3	1846.7	1145.8	1890.5
	Total	362.7	315.5	363.2	348.7	358.0	370.2	380.7	367.0	372.0	358.9	337.0	386.7
2013–17	<45	81.1	62.3	78.4	69.9	71.6	94.5	74.9	83.0	72.4	75.3	74.9	54.4
	45–54	476.5	387.4	464.0	397.7	428.8	521.5	482.0	461.4	447.9	392.3	458.6	404.5
	55–64	875.1	711.8	860.9	857.5	879.2	896.0	947.3	863.2	848.7	819.6	880.9	892.3
	65–74	1402.8	1217.3	1431.1	1435.6	1423.2	1395.4	1500.4	1446.6	1431.8	1396.2	1450.0	1556.5
	75–84	1862.5	1650.6	1965.0	1903.5	1963.8	1800.5	2045.9	1963.9	2042.2	2056.7	1712.4	2623.6
	85+	2059.0	1845.4	2165.1	1944.2	2011.0	1933.9	2480.6	2062.5	2253.8	1990.6	1264.3	2115.6
	Total	366.1	307.0	368.4	351.0	359.3	378.0	386.2	371.4	365.2	354.0	350.2	379.7
2018–22	<45	80.9	61.2	79.4	70.7	74.3	95.9	73.0	81.5	69.4	73.9	76.7	50.4
	45–54	494.7	386.2	473.2	401.4	431.9	557.2	489.0	496.7	451.8	411.0	462.2	412.6
	55–64	883.4	701.1	866.3	850.7	865.4	919.4	947.2	888.2	850.5	791.0	899.4	875.5
	65–74	1387.1	1168.3	1409.8	1396.5	1386.3	1390.1	1512.8	1401.1	1388.5	1340.6	1447.6	1564.1
	75–84	1881.5	1640.5	2005.3	1960.3	1982.8	1810.6	2087.7	1984.7	2025.1	2089.3	1827.0	2560.5
	85+	2061.9	1821.2	2209.9	1961.0	2090.4	1938.0	2500.3	2084.3	2196.0	1982.0	1337.4	2302.1
	Total	368.3	301.3	370.9	350.8	359.3	384.9	388.2	374.2	359.4	349.9	358.0	376.5
2023–27	<45	80.5	61.5	78.7	71.2	74.5	96.9	71.1	82.8	64.9	73.3	80.4	49.2
	45–54	503.5	379.6	478.4	419.1	442.0	573.2	491.3	514.4	478.8	448.5	459.7	411.6
	55–64	897.5	708.1	889.7	817.0	854.4	957.5	934.6	896.3	846.0	780.0	880.7	890.9
	65–74	1376.2	1134.0	1394.3	1381.2	1371.9	1392.5	1501.1	1383.3	1365.3	1332.4	1472.4	1618.6
	75–84	1878.9	1616.7	1979.2	1938.3	1946.1	1812.1	2126.5	1977.2	1997.4	1923.5	1831.2	2407.2
	85+	2092.4	1833.8	2294.3	2104.9	2144.1	1950.6	2550.1	2135.5	2204.3	2148.6	1405.5	2445.5
	Total	369.7	298.3	371.9	349.8	357.8	391.0	387.1	376.8	356.4	347.8	361.2	376.6
2028–32	<45	79.3	60.6	78.3	69.7	71.4	96.4	69.3	86.6	64.9	72.6	84.4	48.0
	45–54	504.3	382.7	485.0	429.0	478.0	582.6	477.6	485.1	451.0	444.3	452.0	390.9
	55–64	924.9	712.0	903.0	820.6	859.0	1011.6	940.4	950.5	855.6	814.0	876.3	921.1
	65–74	1385.3	1127.1	1399.5	1365.6	1345.9	1421.1	1493.7	1415.0	1380.4	1308.4	1483.6	1620.8
	75–84	1852.7	1562.0	1946.5	1884.9	1896.6	1797.0	2129.0	1906.7	1951.7	1895.8	1819.4	2483.2
	85+	2099.2	1825.4	2300.0	2107.2	2136.8	1948.8	2582.1	2131.0	2190.7	2121.5	1498.1	2307.0
	Total	371.0	295.8	372.7	347.2	356.3	397.6	384.8	380.5	353.5	346.9	364.1	377.6

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

FIGURE 3.4
Trends in average annual new cases for all cancers and ages, attributed to changes in cancer risk, population growth, and aging population, Canada, 1983–2032



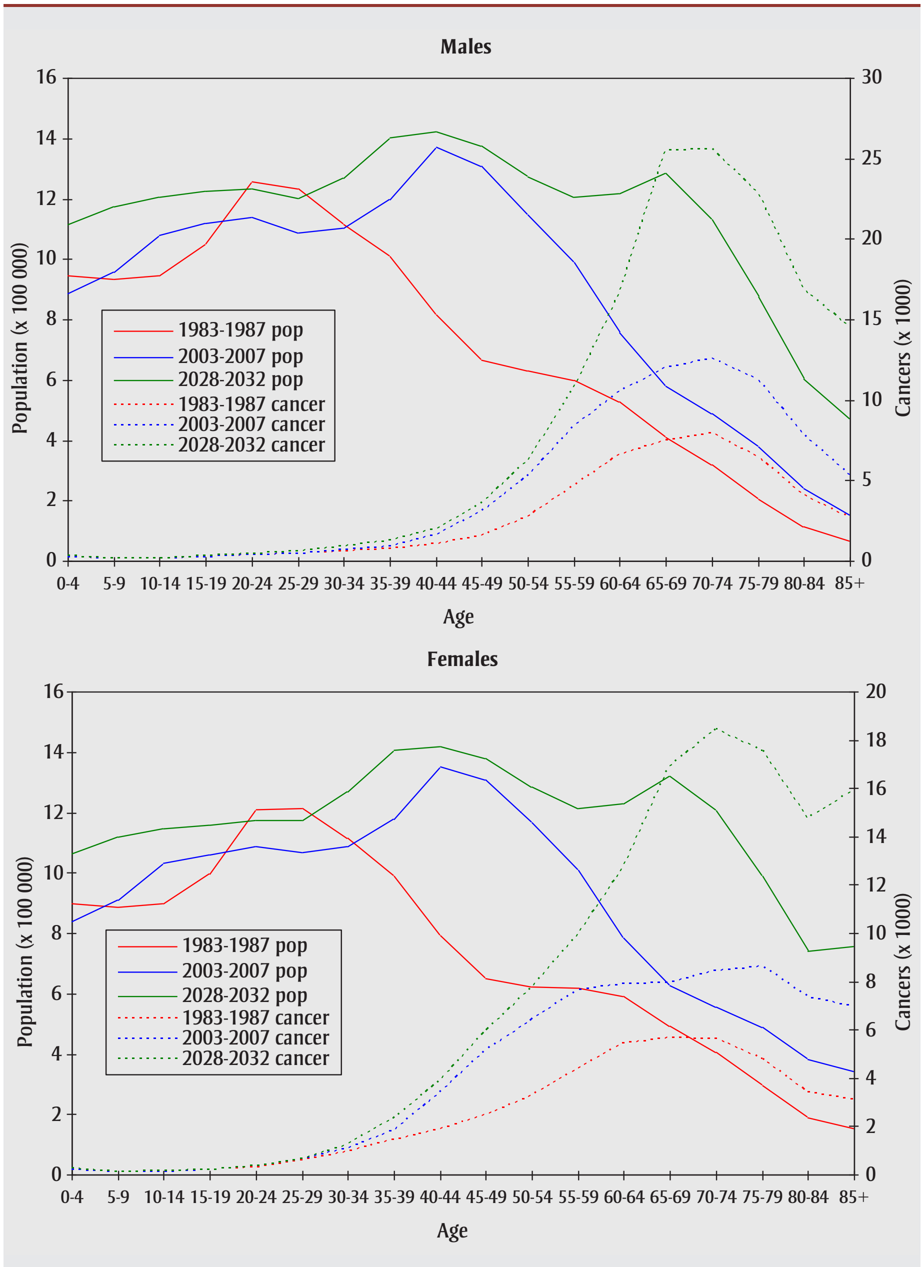
tage also increased notably for NHL in women aged 65 to 84 and for thyroid cancer in those under 55. The proportion of breast cancer incidence increased by 2% to 3% in women aged between 45 and 64. This increased share for breast cancer may be partly attributable to the impact of early detection with the increased uptake of mammography screening. There was a marked reduction in the incidence proportion for cervical cancer in females aged under 45 as well as noteworthy reductions in the incidence proportions for stomach cancer and colorectal cancer in all female age groups. Many more cervical cancers are prevented by screening each year.

Projected most common cancers by sex and age

As the projected change in cancer incidence is attributable primarily to demographic factors, the relative frequencies of major cancers are not expected to change significantly. Figure 3.10 shows the cancer types that are projected to be newly diagnosed with the greatest frequency in 2028–2032 by sex and age group. By 2028–2032, colorectal cancer is projected to have overtaken lung cancer as the second most frequently diagnosed cancer in males, even though colorectal cancer will maintain a similar percentage of the total cancer cases in males as during 2003–2007. This change in ranking is the result of a decrease of 27% in the incidence of lung cancer as a proportion of all cancers, reflecting the historical reduction in smoking prevalence after accounting for a lag period.[42-44] In males, the most common cancers in 2028–2032 are projected to be prostate cancer (28%), colorectal (13%), lung (11%), bladder (6%) and NHL (4%). The age-specific analysis indicates that, between 2003–2007 and 2028–2032, the incidence of lung cancer in males (as a proportion of total cancer cases) will decrease by 19%, 34%, 32%, 30% and 21% for each of the 10-year age groups from 45 to 85 and over, respectively. Another notable change in the incidence frequency will be the 32% decrease in the melanoma incidence proportion in the youngest males (< 45 years). Cancers of the prostate, colorectum and lung are projected to be the top 3 most common types, in that order, within each age group from 45 years and older.

For females, the top 4 most common incident cancers are expected to remain the same as in the last observation period (2003–2007). However, thyroid cancer will outrank NHL as the fifth most common cancer. Specifically, the most commonly diagnosed cancers in females in 2028–2032 are projected to be breast cancer (24%), lung cancer (12%), colorectal cancer (12%), uterine cancer (6%), thyroid cancer (5%) and NHL (4%). The overall increase in thyroid cancer will be mainly from the proportional increases of 67% in women aged 45 to 54, 140% in those aged 55 to 64, and 105% in those aged 65 to 74. The 26% predicted reduction in the incidence proportion for cervical cancer in females under 45 will underscore the further success of prevention and screening programs.[45,46] Compared with the 2003–2007 age-specific results, the projected most common incident cancers in females will be the same within each 10-year age group, but with changes in ranking order for the under-65 and 75–84 age groups. The cancers in the 'Other' category, together representing just

FIGURE 3.5
Historic and projected[a] growth in average annual population (pop) and in average annual incidence cases of all cancers in Canada by age, 1983–2032



[a] Cases and populations in the 2028–2032 period are projected.

over one-third of all new cancer cases, will be examined in Chapter 4.

Chapter 4: Projections by Cancer Site

1. Oral cancer

Oral cancers are also referred to as cancers of the buccal cavity and pharynx. In 2003–2007, the average annual number of new oral cancer cases was 2285 in males and 1085 in females (Tables 4.1.1 and 4.1.2), accounting for 2.8% and 1.5% of all male and female cancer cases, respectively. Oral cancer was the ninth most common cancer for males and the fourteenth most common in females in that period. The lifetime risk of developing oral cancer is about 1 in 67 for males and 1 in 137 for females.[1] Within oral cancers the percentages of cases in 2007 by subsite were lip (9%), tongue (25%), salivary gland (11%), mouth (19%), nasopharynx (7%), oropharynx (4%), and other and unspecified (23%).[1] The male-to-female ratio of ASIRs in Canada has decreased rapidly, from 3.3:1 in 1983–1987 to 2.4:1 in 2003–2007 for all ages combined (Figure 4.1.1). In 2003–2007, the incidence rates of oral cancer were low for both males and females aged under 45 (Tables 4.1.3 and 4.1.4). Rates increased steeply up to ages 70 to 74 and then rose slowly. The majority of cases (72% in men and 73% in women) occurred in people aged 55 or over (Tables 4.1.1 and 4.1.2). The 5-year relative survival rates for oral cancer diagnosed between 2006 and 2008 were 61% for males and 68% for females.[1]

In males, incidence rates of oral cancers have decreased over the observation period, falling from 18.8 per 100 000 in 1983–1987 to 12.6 in 2003–2007 (Figure 4.1.1). The decreased trends accelerated with age in males (Figure 4.1.2). Across the country, the largest decrease was observed in the Prairies. Rates of oral cancers have decreased marginally in females.

From 1998 to 2007, the ASIRs for oral cancers have significantly decreased by 1.0% per year in males and have remained relatively static in females (Figures 3.1 and 3.2). The trend pattern by sex is similar for all age groups except in the group younger than 45 (Figure 4.1.2).

The ASIRs for oral cancer in Canadian males are projected to continue to fall in all age groups above 45, but beginning to increase after 15 years for the group aged between 45 and 54 (Figure 4.1.2). However, the projections in the young age groups may be affected by random error from the small number of cases in these age ranges. The rates in females will remain stable in each age group (Figure 4.1.2). Oral cancer rates will continue to be significantly higher for males than for females, but the male-to-female ratio will decrease to 2.2:1 in 2028–2032.

Figure 4.1.1 illustrates the inter-regional variation of ASIRs for oral cancer. The predictions indicate that the rates of oral cancer in males will continue to gradually decrease and then stabilize in all regions. The rates in the Prairies will have dropped from being the highest in the country in 1983–1987 to the lowest as of 2008–2012. In females, the rates are projected to decrease

FIGURE 3.6
Age-standardized incidence rates (ASIRs) for all cancers by age group (– males, – females), Canada, 1983–2032

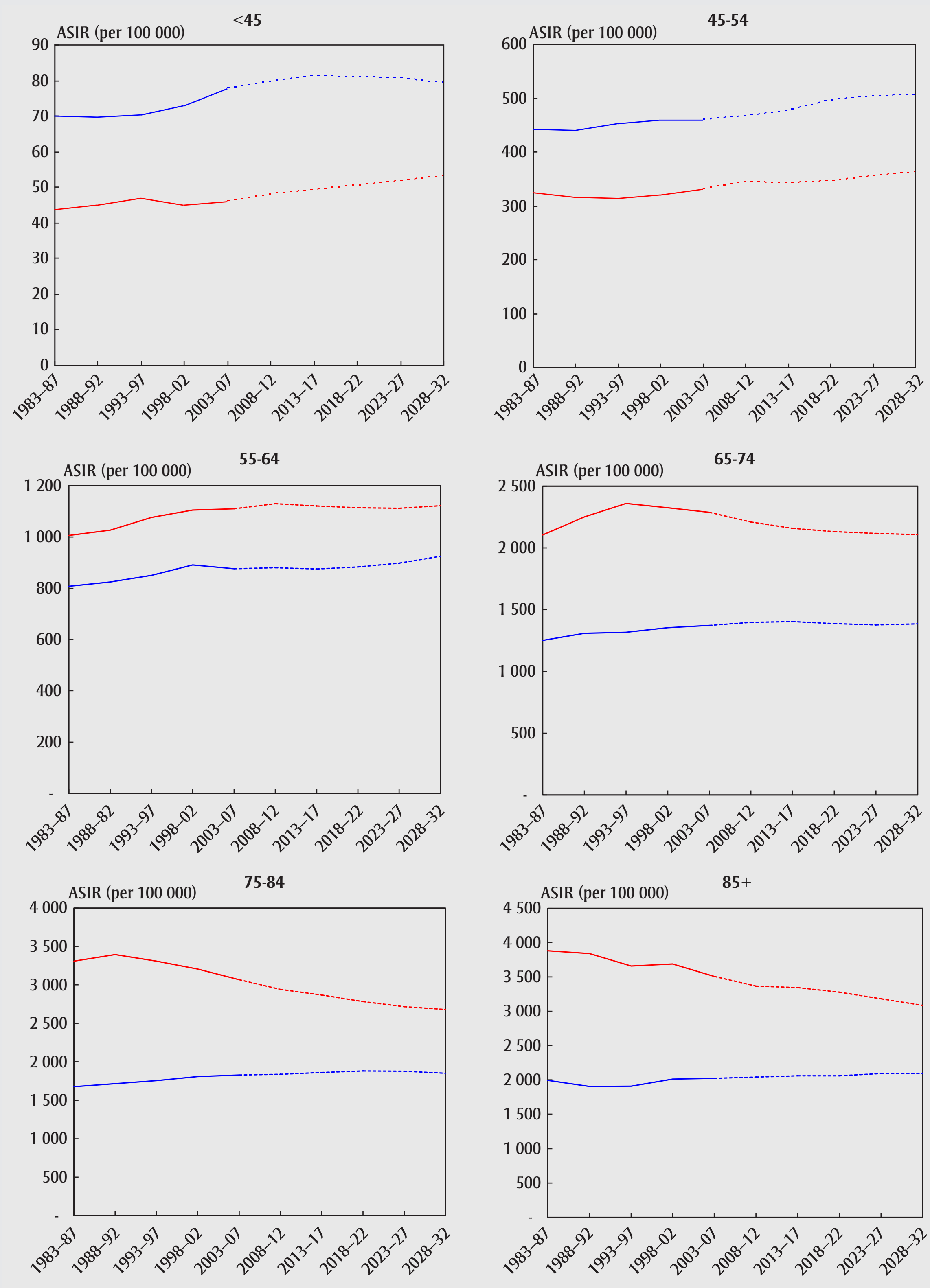
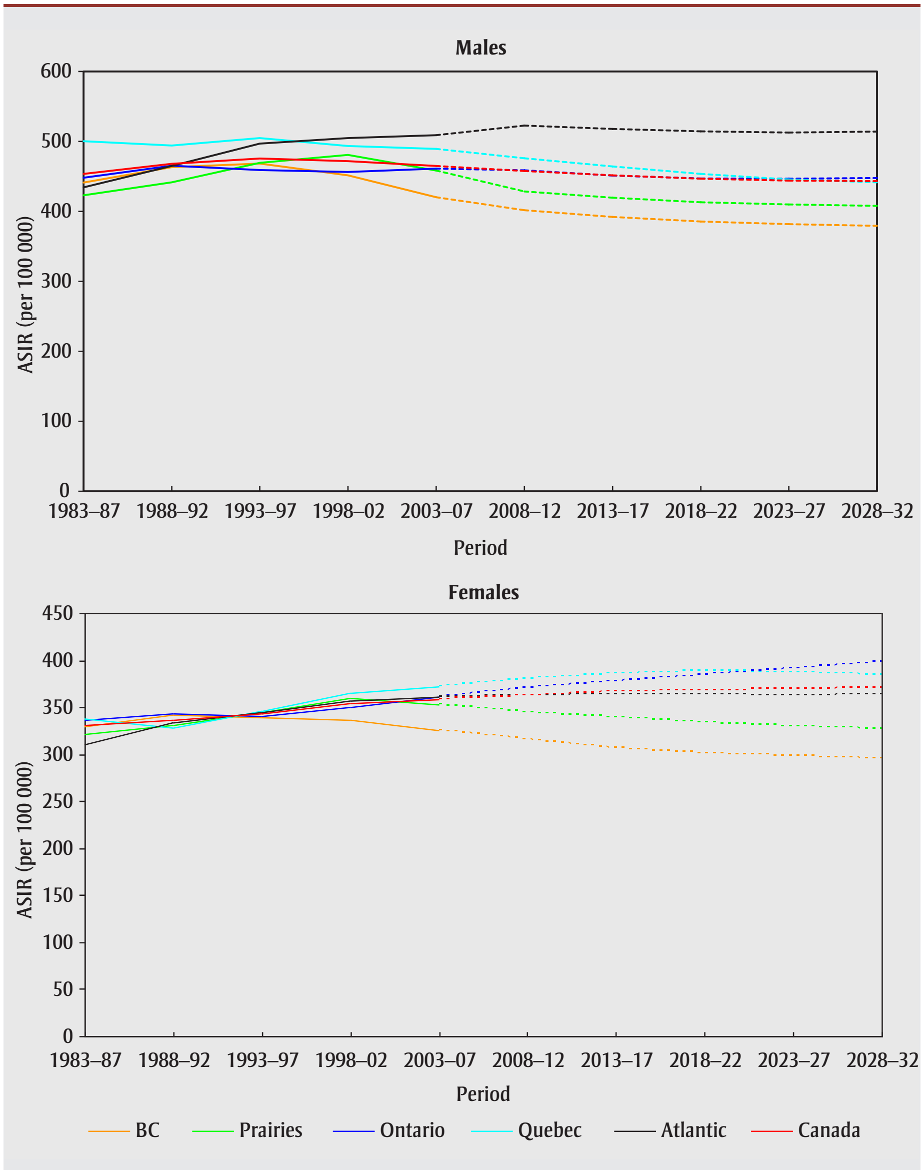


FIGURE 3.7
Age-Standardized Incidence Rates (ASIRs) by region, all cancers, 1983–2032



in British Columbia and, to a lesser extent, in the Prairies, but are likely to increase in the Atlantic region and Quebec, and remain stable in Ontario. The ASIRs for females will be 4.4 per 100 000 in British Columbia and 4.9–5.8 per 100 000 in the other regions by 2028–2032. In general, the incidence rates are projected to be higher in eastern Canada than in western Canada.

From 2003–2007 to 2028–2032, ASIRs for Canada are predicted to decrease by 6% in males, from 12.6 to 11.8 per 100 000, and to remain stable in females, changing only from 5.2 to 5.3 per 100 000 (Tables 4.1.3 and 4.1.4). Due to the projected Canada population growth and aging, the annual number of cases is estimated to increase by 57% in males, from 2285 to 3595, and by 62% in females, from 1085 to 1760 (Tables 4.1.1 and 4.1.2).

Comments

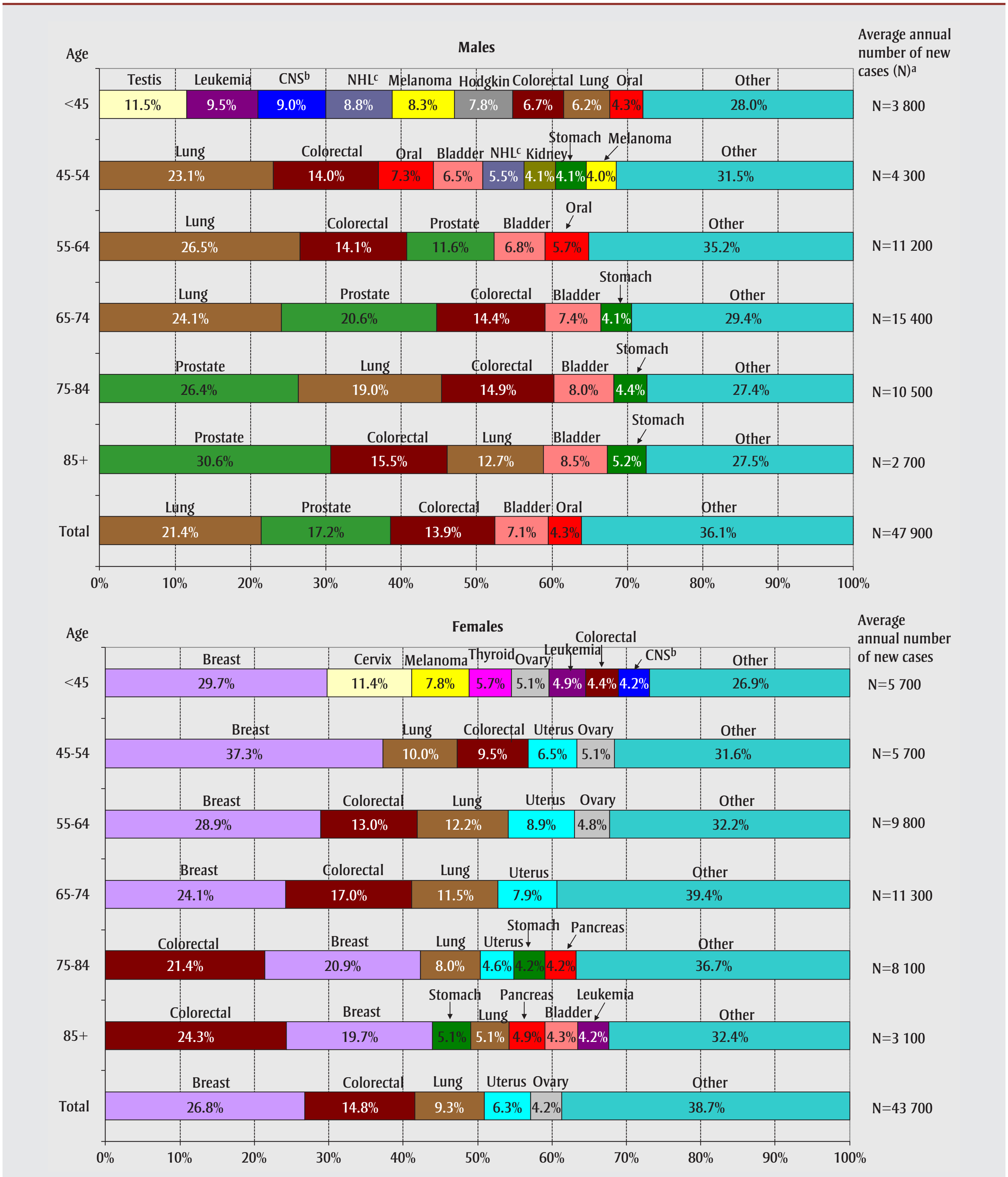
The major risk factors for oral cancer (except salivary gland, nasopharyngeal and lip cancers) are tobacco and alcohol use.[47-50] In 2011, the age-standardized prevalence of current smoking in Canadians aged 12 or older was 23.0% for males and 17.9% for females, with crude rates of 22.3% and 17.5%, respectively.[51] A decrease in smoking prevalence began in the mid-1960s in males and in the mid-1980s in females.[42,43] The decrease in smoking likely accounts for the downward trends in male oral cancer incidence. For females, the impact of decrease in smoking is largely not yet reflected in the incidence data used for the projections, given the lag of at least 20 years between the fall in smoking rates and the decrease in oral cancer incidence rates. It is likely that incidence rates in females will begin to drop as well over the longer term.

Human papilloma virus (HPV), particularly HPV type 16, is a risk factor for oropharyngeal cancer, and Epstein-Barr virus (EBV) is a risk factor for nasopharyngeal cancer.[52,53] Oropharynx cancer is increasing in incidence in Canada,[54,55] with a decreasing age at diagnosis.[55] This increase has also been reported in the United States (US),[56] Denmark[57] and Korea,[58] where HPV-unrelated oral cancers have decreased. A change in sexual behaviour that increases oral exposure to HPV may be one reason for the rise in HPV-associated oral cancers.[54] Since the fall of 2008, all provinces and territories have introduced HPV immunization programs for girls into their routine immunization schedules (see more in Section 11).[59] The vaccination coverage has increased significantly in Ontario since the program was initiated in the 2007.[60] HPV vaccination and the upward trend in coverage may cause a decrease in rates of HPV-associated oral cancers in the future. The contributions of other risk factors for oral cancers, including diet and sun exposure (linked to lip cancer), are unclear.

2. Esophagus cancer

Esophageal cancer is infrequent but very malignant. The average annual number of new esophageal cancer cases in 2003–2007 was 1095 in males and 385 in females (Tables 4.2.1 and 4.2.2), constituting 1.4% and 0.5% of all male and female cancer cases, respectively. From 1983–1987 to 2003–2007, the ASIRs of esophageal cancer in Canada increased by 6.9% in males, from 5.8 to 6.2 per 100 000, and decreased by 10.5% in females, from 1.9 to 1.7 per 100 000 (Figure 4.2.1). In recent years, the ASIRs have remained relatively stable (Figures 3.1 and 3.2). The distribution of morphology in Canada in 2002–2006 for adenocarcinoma, squamous cell carci-

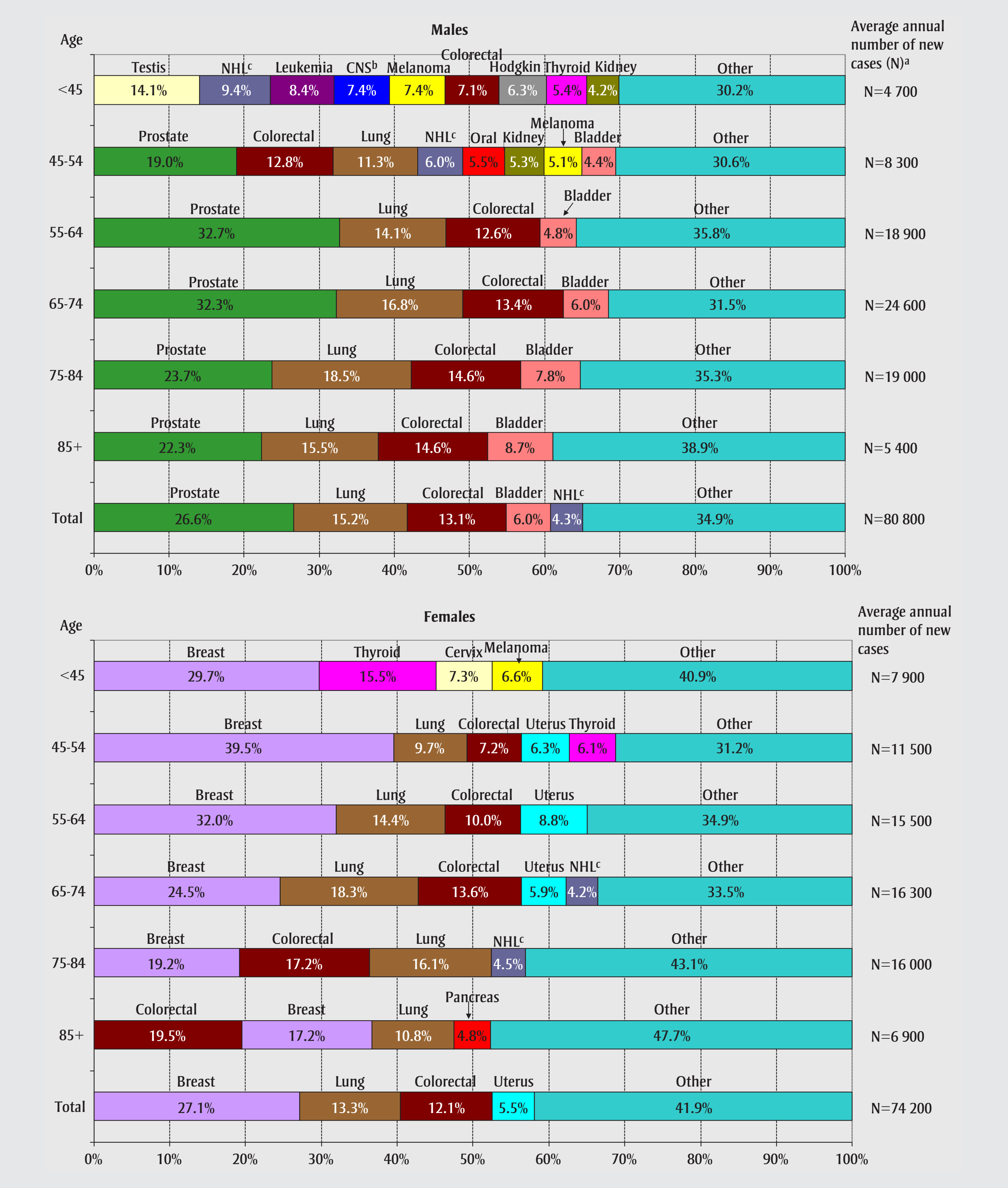
FIGURE 3.8
Most common newly diagnosed cancers in Canada, 1983–1987



[a] Total of rounded numbers may not equal rounded total number;

[b] CNS refers to central nervous system cancer; [c] NHL refers to non-Hodgkin lymphoma.

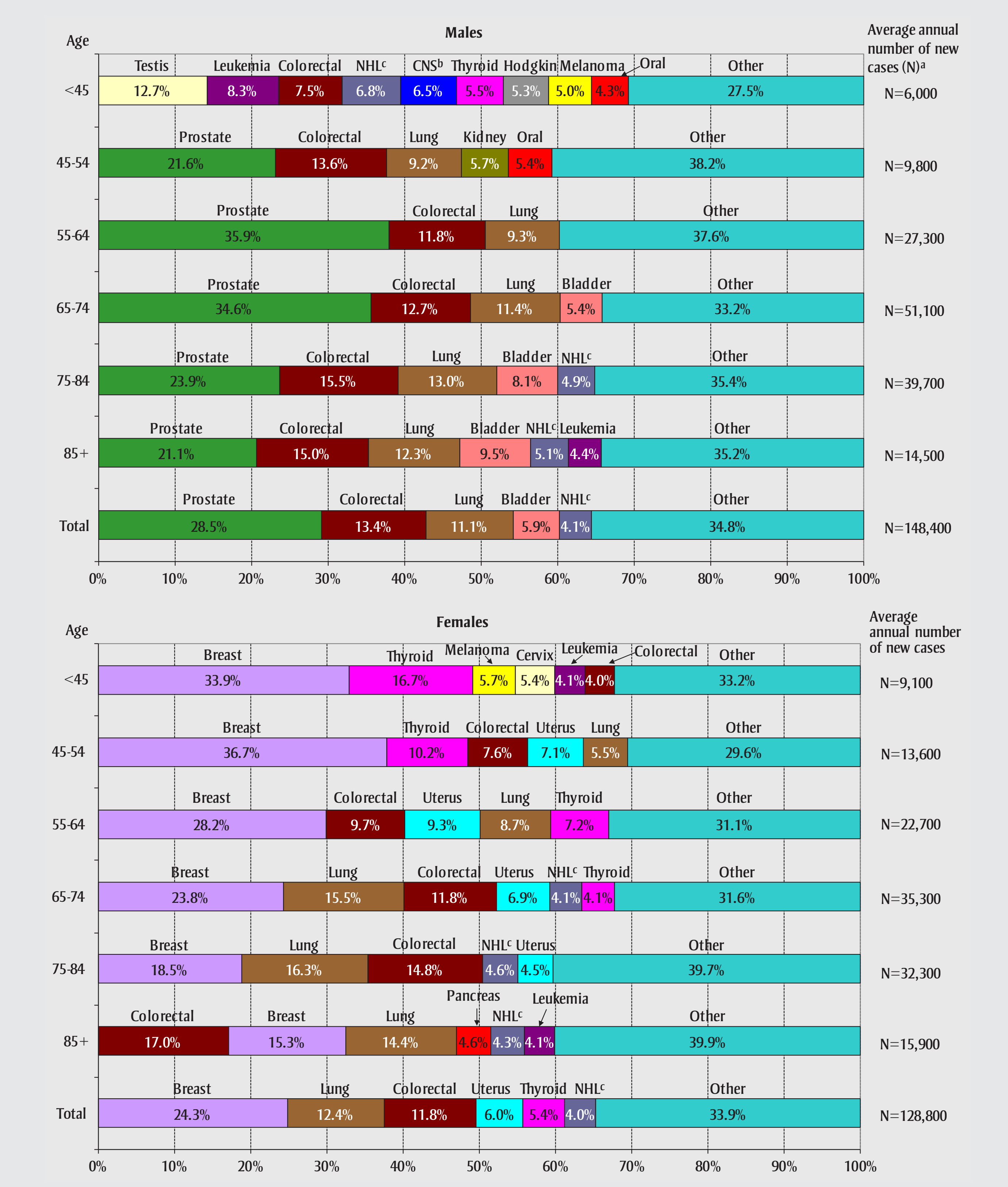
FIGURE 3.9
Most common newly diagnosed cancers in Canada, 2003–2007



[a] Total of rounded numbers may not equal rounded total number;

[b] CNS refers to central nervous system cancer; [c] NHL refers to non-Hodgkin lymphoma.

FIGURE 3.10
Projected most common newly diagnosed cancers in Canada, 2028–2032



[a] Total of rounded numbers may not equal rounded total number;

[b] CNS refers to central nervous system cancer; [c] NHL refers to non-Hodgkin lymphoma.

TABLE 4.1.1
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), oral cancer, males, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	185	25	15	5	5	80	35	5	5	0	5	0
	45–54	455	65	45	10	20	180	95	10	15	0	5	0
	55–64	660	85	45	15	25	250	175	15	25	5	15	0
	65–74	545	65	45	15	20	200	150	15	20	0	10	0
	75–84	340	35	20	10	15	145	90	10	10	0	5	0
	85+	100	10	5	5	5	40	25	5	5	0	0	0
	Total	2285	285	180	65	95	895	570	60	80	10	40	5
2008–12	<45	180	20	15	5	5	80	30	5	5	0	5	0
	45–54	505	70	55	10	15	205	105	10	20	0	5	0
	55–64	770	100	60	15	30	300	190	20	25	5	10	5
	65–74	585	65	40	15	20	205	160	15	20	0	10	0
	75–84	365	40	25	10	15	145	95	10	15	0	5	0
	85+	125	15	5	5	10	45	30	5	5	0	0	0
	Total	2525	310	200	60	95	975	605	60	90	10	40	10
2013–17	<45	190	20	15	5	5	80	30	5	5	0	5	0
	45–54	485	70	50	5	15	200	100	10	20	0	10	0
	55–64	890	115	80	15	30	350	205	20	30	5	15	5
	65–74	715	85	50	15	30	260	185	20	25	5	15	0
	75–84	355	40	25	10	15	135	95	10	15	0	5	0
	85+	155	15	10	5	5	60	35	5	5	0	0	0
	Total	2795	345	230	55	100	1085	655	65	100	10	45	10
2018–22	<45	215	20	15	5	5	90	30	5	5	0	5	0
	45–54	445	60	45	5	10	185	100	10	20	0	5	0
	55–64	965	130	95	15	30	395	220	20	35	5	15	5
	65–74	870	105	70	20	35	325	215	25	30	5	15	5
	75–84	405	45	25	10	15	155	115	10	15	0	5	0
	85+	160	20	10	5	5	65	40	5	5	0	0	0
	Total	3060	380	260	55	105	1210	720	70	110	10	45	10
2023–27	<45	245	25	15	5	5	100	30	5	5	0	5	0
	45–54	460	60	45	5	10	195	110	5	15	0	5	0
	55–64	930	130	95	10	30	395	225	20	40	5	15	5
	65–74	1015	125	105	20	35	395	250	30	35	5	15	5
	75–84	510	60	40	10	20	205	145	15	20	0	10	0
	85+	165	20	10	5	5	65	45	5	5	0	0	0
	Total	3325	415	305	55	110	1360	800	75	120	10	50	10
2028–32	<45	255	25	10	5	5	100	25	5	5	0	5	0
	45–54	525	65	45	5	10	235	105	5	15	0	5	0
	55–64	870	125	90	10	25	375	230	15	35	5	15	5
	65–74	1105	145	125	20	40	455	280	30	40	5	20	5
	75–84	635	75	55	15	25	270	180	20	25	5	10	0
	85+	210	20	15	5	10	85	60	10	5	0	5	0
	Total	3595	450	340	60	115	1515	880	80	130	10	55	10

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

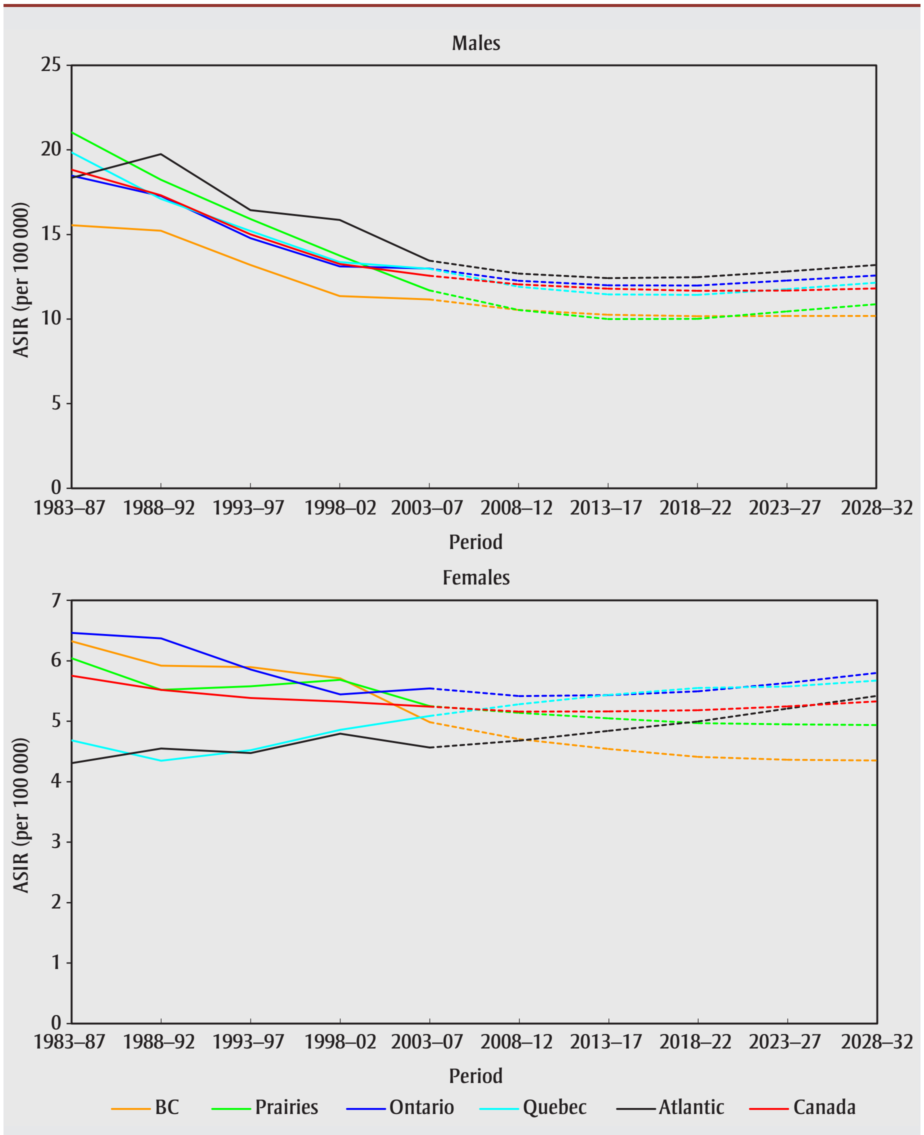
TABLE 4.1.2
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), oral cancer, females, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	120	15	10	5	5	55	25	5	0	0	0	0
	45–54	170	20	15	5	5	70	40	5	5	0	5	0
	55–64	230	30	20	5	5	95	60	5	10	0	0	0
	65–74	240	30	20	5	10	95	65	5	5	0	0	0
	75–84	220	30	20	10	10	85	50	5	5	0	5	0
	85+	105	15	10	5	5	40	25	0	5	0	0	0
	Total	1085	140	90	30	45	435	260	20	30	5	15	5
2008–12	<45	120	15	10	5	5	55	25	0	0	0	0	0
	45–54	190	25	15	5	5	80	45	5	5	0	5	0
	55–64	285	35	25	5	10	115	75	5	10	0	5	0
	65–74	245	30	20	10	10	95	65	5	10	0	0	0
	75–84	230	25	20	5	10	90	60	5	5	0	5	0
	85+	125	15	10	5	10	50	35	0	5	0	0	0
	Total	1195	150	100	30	50	480	300	25	35	5	15	5
2013–17	<45	125	15	10	5	5	60	30	0	0	0	0	0
	45–54	195	30	10	5	5	85	45	5	5	0	5	0
	55–64	335	40	30	5	10	140	85	5	10	0	5	0
	65–74	295	35	30	10	15	110	80	5	10	0	5	0
	75–84	225	25	15	5	10	85	60	5	5	0	5	0
	85+	155	20	15	5	10	55	45	5	5	0	0	0
	Total	1330	160	110	35	55	535	340	25	40	5	15	5
2018–22	<45	140	15	10	5	5	65	25	0	0	0	0	0
	45–54	180	30	10	5	5	80	45	5	5	0	5	0
	55–64	375	45	30	5	15	160	90	5	10	0	5	0
	65–74	365	40	35	10	15	140	100	10	10	0	5	0
	75–84	240	25	20	10	10	90	65	5	10	0	0	0
	85+	160	20	15	5	10	60	50	5	5	0	0	0
	Total	1465	175	120	35	60	595	375	30	40	5	15	5
2023–27	<45	150	15	10	5	5	75	30	0	0	0	0	0
	45–54	185	25	10	5	5	80	45	5	5	0	0	0
	55–64	380	55	25	5	15	165	85	5	10	0	5	0
	65–74	430	45	40	10	20	175	110	10	15	0	5	0
	75–84	295	30	30	10	15	110	85	5	10	0	5	0
	85+	165	20	15	5	10	60	50	5	5	0	0	0
	Total	1605	190	130	35	65	660	405	30	45	10	15	10
2028–32	<45	155	15	10	5	5	85	30	0	0	0	0	0
	45–54	210	25	10	5	5	85	45	5	5	0	0	0
	55–64	355	50	20	5	10	155	85	5	10	0	5	0
	65–74	480	55	40	10	20	200	120	10	15	0	5	0
	75–84	370	40	35	10	20	145	100	10	15	0	5	0
	85+	185	20	20	5	10	65	55	5	10	0	0	0
	Total	1760	205	140	40	70	735	435	35	50	10	15	10

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

FIGURE 4.1.1
Age-standardized incidence rates (ASIRs) by region, oral cancer, 1983–2032



noma, and other and unknown types was 56%, 30% and 14% in males and 28%, 53% and 19% in females, respectively.[61] Survival is poor, with a 5-year relative survival rate of 14% in 2006–2008.[1]

From 2003–2007 to 2028–2032, the ASIRs of esophageal cancer for the country are projected to remain stable, at 6.2 per 100 000 in males and at 1.7 per 100 000 in females (Tables 4.2.3 and 4.2.4). Because of the aging and growth of the Canadian population, the annual number of new male cases is projected to increase by 93%, from 1095 to 2110, and of new female cases by 79%, from 385 to 690 (Tables 4.2.1 and 4.2.2). The overall stable ASIRs are expected to continue in both sexes for all age groups, the only exception being an increase in males younger than 55 (Figure 4.2.2). Random error from the few cases in this age group could potentially influence the accuracy of this finding.

In 2003–2007, incidence rates for esophageal cancer increased steeply with age: most of the cases occurred in people aged 55 or older (85% in males and 92% in females). In the same period, the overall ASIRs for esophageal cancer were 3.6 times greater for males than for females. By age group, the male-to-female rate ratio of esophageal cancer at the national level decreased with age from 5.3:1 in the 45–54 age group to 2.2:1 in those 85 and older. This pattern is projected to continue over the projection period.

Across all regions of Canada and all periods shown in Tables 4.2.3 and 4.2.4, the average ASIRs of esophageal cancer range from 5.0 (Saskatchewan) to 8.4 (Nova Scotia) per 100 000 in males and from 0.8 (Newfoundland and Labrador) to 2.3 (British Columbia) per 100 000 in females. These differences are likely related to the combined effects of variation in risk factor prevalence and cancer registry practices. Figure 4.2.1 shows the differences in ASIRs by broader areas. In males, the Atlantic region is projected to have about 18% higher rates than the Prairies and between 25% and 28% higher rates than other regions, where the rates are trending to the same level after 2023–2027. The predictions indicate that rates will slightly increase in the Atlantic and Prairie regions, and remain stable in other regions.

In females, the rates in British Columbia are predicted to be between 42% and 75% higher than those in the other regions. This is notable given that British Columbia generally has lower than national average rates for most cancers. Quebec is projected to continue to have the lowest rates of esophageal cancer. Incidence rates for females have and will continue to decrease steadily from 1993–1997 rates in the Prairies, in Quebec, and most markedly in Ontario. In contrast, the rates in British Columbia are projected to increase marginally. The increase in rates of esophageal cancer is less evident for females than for males in Atlantic Canada.

Comments

While overall incidence rate has stabilized over the past 2 decades, the 2 main types of esophageal cancer demonstrate opposite trends. Adenocarcinoma incidence rose by 4% per year, whereas squamous cell carcinoma incidence decreased by 3% per year from 1986 to 2006.[61] Similar incidence trends have been observed in Australia, the US, and parts of Europe.[62,63] Furthermore, the observation that the increase is also seen in more recent birth cohorts would suggest that adenocarcinoma incidence will continue to increase in the years to come.[64] The observed trends may be linked

TABLE 4.1.3
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), oral cancer, males, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	1.7	1.7	1.4	1.5	1.5	1.9	1.5	1.6	2.3	1.2	2.8	3.7
	45–54	18.3	19.1	18.3	15.8	20.8	19.6	15.7	16.9	22.9	11.8	16.4	22.9
	55–64	38.3	35.8	29.5	33.4	44.9	39.3	40.4	33.0	43.1	39.9	40.2	53.2
	65–74	50.8	43.0	48.2	49.9	53.7	49.0	56.0	63.5	58.5	35.7	56.4	68.8
	75–84	54.6	38.7	41.5	41.9	70.8	59.5	61.6	59.2	52.8	43.8	33.4	93.9
	85+	66.4	48.0	54.1	66.5	80.7	68.0	74.1	106.9	59.6	79.7	80.4	0.0
	Total	12.6	11.2	10.8	11.2	14.2	13.0	13.0	13.3	14.3	10.4	13.0	17.6
2008–12	<45	1.8	1.6	1.2	1.0	1.1	1.9	1.3	1.4	2.1	1.5	2.9	2.5
	45–54	18.3	19.3	17.9	11.5	17.4	19.2	15.9	16.5	24.7	18.5	17.7	26.1
	55–64	37.2	33.7	30.2	25.0	41.7	38.8	37.0	34.1	41.2	30.2	31.1	53.0
	65–74	47.0	37.5	38.4	42.2	51.5	44.4	50.2	50.4	50.7	37.2	48.2	66.9
	75–84	52.0	40.5	40.9	43.6	61.6	53.1	56.7	58.4	65.3	47.1	47.5	74.2
	85+	58.5	41.7	42.0	58.4	88.1	57.9	60.3	86.0	61.7	54.0	80.8	83.3
	Total	12.1	10.5	9.9	9.2	12.9	12.3	11.9	12.1	14.1	10.4	12.4	17.2
2013–17	<45	1.9	1.5	1.1	1.0	1.0	2.0	1.3	1.3	2.0	1.5	2.8	2.6
	45–54	17.7	18.4	16.2	8.8	15.4	18.3	16.1	15.5	27.7	18.5	18.9	25.2
	55–64	37.6	35.3	33.4	23.5	38.1	39.1	36.2	35.2	43.7	27.9	31.7	53.6
	65–74	45.9	36.9	36.4	37.2	53.8	44.6	47.3	45.6	48.6	35.9	47.2	65.3
	75–84	46.2	34.8	36.3	35.8	51.3	46.4	51.9	53.0	59.2	36.9	36.7	65.9
	85+	57.1	40.8	37.2	52.3	72.7	58.3	58.2	82.2	67.1	65.9	68.2	81.4
	Total	11.8	10.3	9.5	8.0	11.9	12.0	11.5	11.5	14.3	9.9	11.9	16.8
2018–22	<45	2.0	1.4	1.0	0.9	1.0	2.1	1.1	1.3	2.0	1.5	2.7	2.9
	45–54	17.5	17.4	15.3	7.9	14.1	18.0	17.8	14.4	28.1	18.5	18.1	25.0
	55–64	37.0	37.1	35.3	20.4	35.9	38.8	36.2	32.2	49.6	26.5	36.8	52.7
	65–74	46.1	37.7	39.4	34.6	52.2	46.2	47.6	49.6	49.8	32.6	43.1	65.6
	75–84	43.5	32.1	33.7	33.7	49.9	43.8	50.2	50.5	55.4	39.9	37.2	61.9
	85+	50.9	37.1	33.5	47.0	68.2	50.0	56.2	77.8	59.5	48.1	59.4	72.5
	Total	11.7	10.2	9.6	7.3	11.3	12.0	11.4	11.2	14.7	9.4	11.9	16.6
2023–27	<45	2.1	1.4	0.9	0.9	1.0	2.1	1.1	1.3	2.0	1.5	2.7	3.0
	45–54	18.1	16.9	14.7	7.5	13.7	19.7	19.1	13.9	27.9	18.5	17.7	25.8
	55–64	36.0	36.4	34.9	17.8	33.8	38.4	38.5	32.2	55.4	25.8	40.3	51.3
	65–74	46.6	40.7	46.6	35.3	50.2	47.9	48.6	52.3	53.5	31.0	45.8	66.3
	75–84	42.5	32.5	34.7	31.7	54.2	45.5	49.8	48.0	53.9	42.9	36.6	60.6
	85+	45.3	31.6	32.2	40.6	55.5	46.1	53.2	74.4	55.6	46.6	45.3	64.5
	Total	11.7	10.2	10.0	6.9	11.0	12.3	11.8	11.2	15.3	9.4	12.1	16.7
2028–32	<45	2.2	1.4	0.9	0.9	0.9	2.0	1.0	1.2	2.0	1.5	2.7	3.1
	45–54	19.6	16.4	14.1	7.1	13.3	22.4	17.2	13.4	27.7	18.5	17.3	28.0
	55–64	35.7	35.1	34.3	17.0	32.2	38.4	43.2	31.3	56.4	25.2	39.5	50.9
	65–74	45.7	42.7	50.1	31.8	48.4	47.9	50.4	50.1	61.5	29.5	53.8	65.1
	75–84	42.9	33.6	39.3	31.1	53.4	47.8	51.7	55.2	55.5	40.9	34.3	61.1
	85+	44.2	31.2	31.0	43.4	63.4	45.3	54.5	74.2	52.5	58.4	55.8	62.9
	Total	11.8	10.2	10.2	6.6	10.7	12.6	12.2	11.1	15.9	9.3	12.6	16.8

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

TABLE 4.1.4
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), oral cancer, females, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	1.2	1.2	0.9	1.2	1.1	1.3	1.0	1.1	0.6	0.4	1.4	2.2
	45–54	6.8	6.3	6.7	6.1	6.9	7.3	6.5	6.8	6.8	7.5	6.7	14.0
	55–64	13.1	12.4	13.0	9.8	11.3	14.2	13.0	8.4	14.2	16.1	6.0	34.7
	65–74	20.0	17.5	18.9	19.5	26.6	20.5	20.7	18.2	16.9	29.8	12.2	68.2
	75–84	25.2	24.5	27.0	26.2	35.9	25.5	23.4	18.2	26.1	30.7	23.6	0.0
	85+	30.8	30.4	35.7	24.2	41.2	31.5	29.5	25.2	25.5	32.2	23.5	0.0
	Total	5.2	5.0	5.1	4.8	6.0	5.5	5.1	4.4	4.7	5.9	4.1	10.7
2008–12	<45	1.2	1.2	0.8	1.1	1.1	1.4	1.2	0.9	0.7	1.4	1.2	2.4
	45–54	7.0	7.1	5.2	6.1	6.6	7.6	7.0	6.2	6.1	7.8	6.8	14.1
	55–64	13.3	12.0	12.9	9.8	15.0	14.2	13.6	9.3	11.9	14.9	8.2	26.9
	65–74	18.1	15.5	19.7	20.8	24.0	18.1	18.5	14.9	20.4	20.3	9.3	36.7
	75–84	25.0	21.5	23.9	21.4	32.5	25.3	26.3	23.6	24.3	28.1	21.1	50.7
	85+	29.1	25.5	34.8	20.1	41.7	28.8	31.3	19.0	27.5	32.7	20.9	58.9
	Total	5.2	4.7	4.8	4.6	6.0	5.4	5.3	4.1	4.7	5.8	3.9	10.4
2013–17	<45	1.3	1.0	0.8	1.1	1.1	1.4	1.3	0.9	0.7	1.4	1.2	2.5
	45–54	7.2	8.6	4.2	6.1	6.6	7.6	7.3	6.1	6.1	8.1	6.8	14.6
	55–64	13.8	11.3	12.5	9.3	15.0	15.1	14.3	9.1	12.1	15.5	8.6	27.9
	65–74	17.5	14.6	19.1	17.6	24.0	17.4	18.8	14.7	21.0	19.6	8.2	35.3
	75–84	23.1	18.8	22.1	23.8	32.6	23.1	25.1	22.7	23.9	26.0	17.1	46.8
	85+	30.7	26.8	35.8	20.3	41.8	29.5	34.2	28.2	26.9	34.4	28.5	62.1
	Total	5.2	4.5	4.5	4.5	6.0	5.4	5.4	4.1	4.8	5.8	3.8	10.4
2018–22	<45	1.3	1.0	0.8	1.1	1.1	1.5	1.2	0.9	0.7	1.5	1.2	2.7
	45–54	7.2	7.8	3.6	6.1	6.7	7.6	8.5	6.1	6.1	8.1	6.8	14.6
	55–64	14.1	12.4	10.8	9.1	15.0	15.5	14.8	9.0	12.3	15.8	8.9	28.5
	65–74	17.9	14.0	18.9	16.2	24.1	18.3	19.8	16.1	18.0	20.1	10.1	36.3
	75–84	21.5	16.4	22.8	24.2	32.7	21.1	23.7	19.6	27.4	24.1	12.5	43.5
	85+	28.7	25.2	28.9	19.3	41.9	26.7	34.8	26.4	30.6	32.2	19.1	58.0
	Total	5.2	4.4	4.3	4.3	6.0	5.5	5.5	4.1	4.7	5.8	3.7	10.5
2023–27	<45	1.3	1.0	0.8	1.1	1.1	1.6	1.2	0.9	0.7	1.5	1.2	2.7
	45–54	7.4	6.5	3.6	6.1	6.7	7.8	8.7	6.1	6.1	8.3	6.8	15.0
	55–64	14.5	14.9	9.1	8.9	15.1	15.6	14.9	9.0	12.3	16.3	9.0	29.3
	65–74	18.5	13.3	18.2	16.0	24.1	19.4	20.1	15.9	18.1	20.7	10.3	37.4
	75–84	20.8	15.6	21.9	21.1	32.7	20.5	23.8	20.7	26.2	23.4	11.8	42.1
	85+	26.4	21.0	29.6	24.9	41.9	24.7	31.3	26.0	27.1	29.6	17.7	53.3
	Total	5.2	4.4	4.0	4.3	6.0	5.6	5.6	4.1	4.7	5.9	3.6	10.6
2028–32	<45	1.3	1.0	0.8	1.1	1.1	1.8	1.2	0.9	0.7	1.5	1.2	2.7
	45–54	7.8	6.4	3.5	6.1	6.7	7.8	7.4	6.1	6.1	8.8	6.8	15.8
	55–64	14.5	13.9	7.9	8.8	15.1	15.6	16.8	9.0	12.4	16.2	9.2	29.3
	65–74	18.9	15.0	15.9	15.8	24.2	19.8	20.7	15.9	18.2	21.3	10.4	38.3
	75–84	21.5	15.0	22.2	19.8	32.8	21.6	24.6	21.9	23.3	24.1	13.7	43.5
	85+	24.8	19.3	30.9	21.7	42.0	22.6	30.0	20.9	36.0	27.8	9.9	50.1
	Total	5.3	4.4	3.8	4.1	6.1	5.8	5.7	4.1	4.7	6.0	3.7	10.8

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

FIGURE 4.1.2
Age-standardized incidence rates (ASIRs) for oral cancer by age group (– males, – females), Canada, 1983–2032

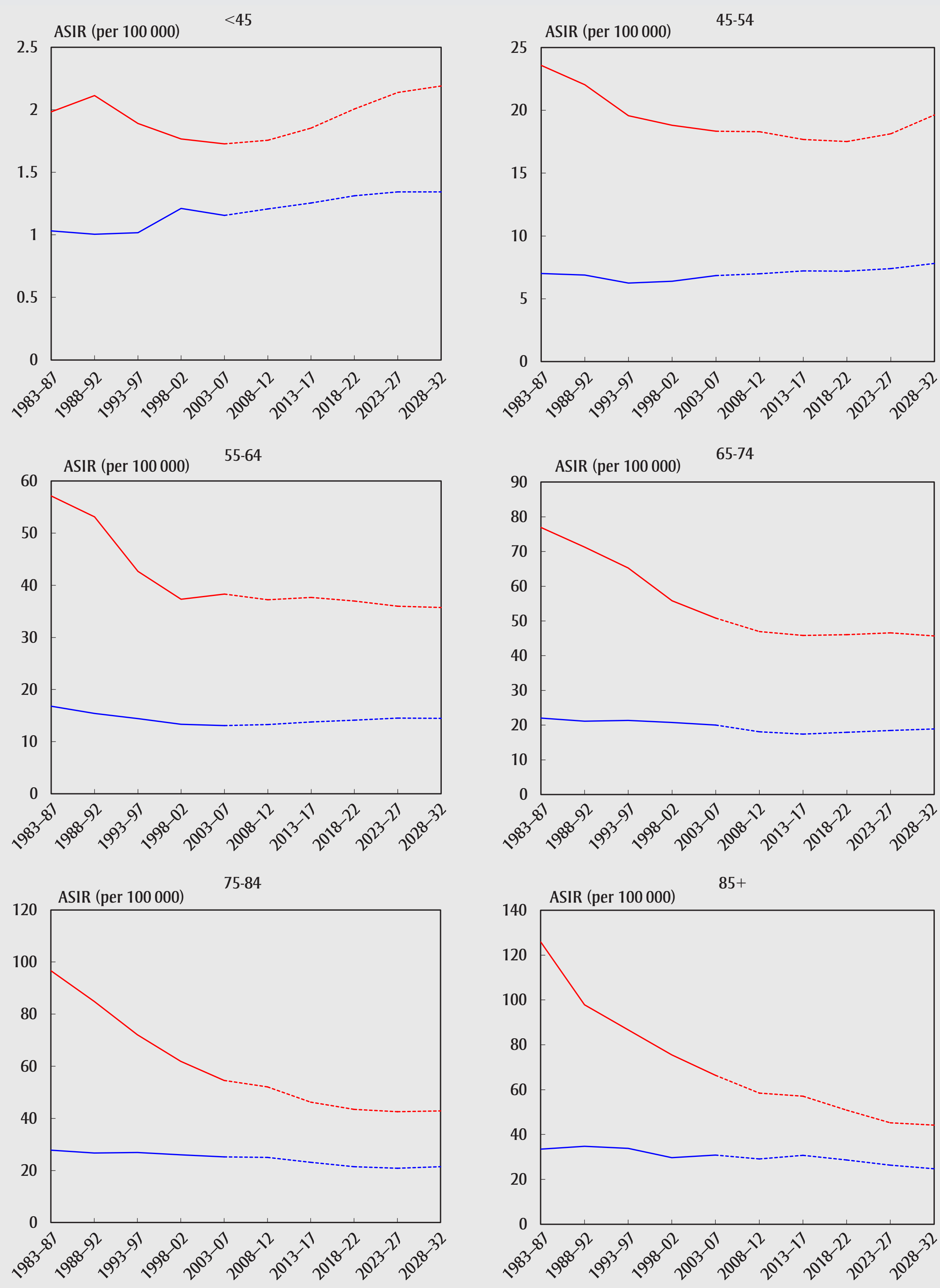


TABLE 4.2.1
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), esophagus cancer, males, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	30	5	0	0	0	15	5	0	0	0	0	0
	45–54	130	15	20	5	5	50	30	5	5	0	5	0
	55–64	280	40	25	5	10	105	70	5	15	0	5	0
	65–74	320	45	25	5	10	120	80	10	15	0	5	0
	75–84	265	40	20	10	10	100	55	10	10	0	5	0
	85+	65	10	5	0	5	25	15	0	5	0	0	0
	Total	1095	155	100	30	35	415	255	30	45	5	20	0
2008–12	<45	35	5	0	0	0	15	5	0	0	0	0	0
	45–54	155	20	20	5	5	65	30	5	5	0	0	0
	55–64	345	45	40	10	10	125	80	10	15	0	5	0
	65–74	370	50	35	5	10	130	95	10	15	5	5	0
	75–84	290	45	25	10	10	110	60	10	10	0	5	0
	85+	100	15	10	5	5	40	20	0	5	0	0	0
	Total	1290	180	135	35	40	485	295	40	55	5	20	5
2013–17	<45	35	5	0	0	0	15	5	0	0	0	0	0
	45–54	155	20	25	5	5	70	30	5	5	0	0	0
	55–64	405	55	60	10	15	150	95	15	15	0	5	0
	65–74	460	70	45	10	15	160	120	15	25	0	10	0
	75–84	305	45	30	10	10	115	65	10	15	0	5	0
	85+	125	20	15	5	5	50	25	5	5	0	0	0
	Total	1490	210	170	35	45	560	345	45	60	10	20	5
2018–22	<45	40	5	0	0	0	15	5	0	0	0	0	0
	45–54	155	20	25	5	5	70	25	5	5	0	0	0
	55–64	440	55	65	10	15	175	105	15	15	5	5	0
	65–74	560	85	65	10	15	195	145	20	25	0	10	0
	75–84	355	55	30	10	10	125	85	15	15	0	5	0
	85+	140	25	15	5	5	55	30	5	5	0	0	0
	Total	1690	240	200	40	55	640	395	50	65	10	25	5
2023–27	<45	40	5	0	0	0	20	5	0	0	0	0	0
	45–54	160	20	25	5	5	70	25	5	5	0	0	0
	55–64	435	60	65	10	15	185	100	15	15	5	5	0
	65–74	655	95	85	15	20	240	170	20	25	0	10	0
	75–84	450	70	40	10	15	160	110	15	20	0	10	0
	85+	155	25	15	5	5	60	35	5	5	0	0	0
	Total	1900	275	235	45	60	730	445	55	75	10	30	5
2028–32	<45	40	5	0	0	0	20	5	0	0	0	0	0
	45–54	170	20	25	5	5	70	30	5	5	0	0	0
	55–64	440	60	65	10	15	185	90	10	15	5	5	0
	65–74	710	105	95	15	20	280	185	20	25	5	10	0
	75–84	555	90	60	15	15	200	130	20	25	0	10	0
	85+	195	35	15	5	5	70	50	5	10	0	5	0
	Total	2110	315	265	50	65	825	495	60	75	10	35	5

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

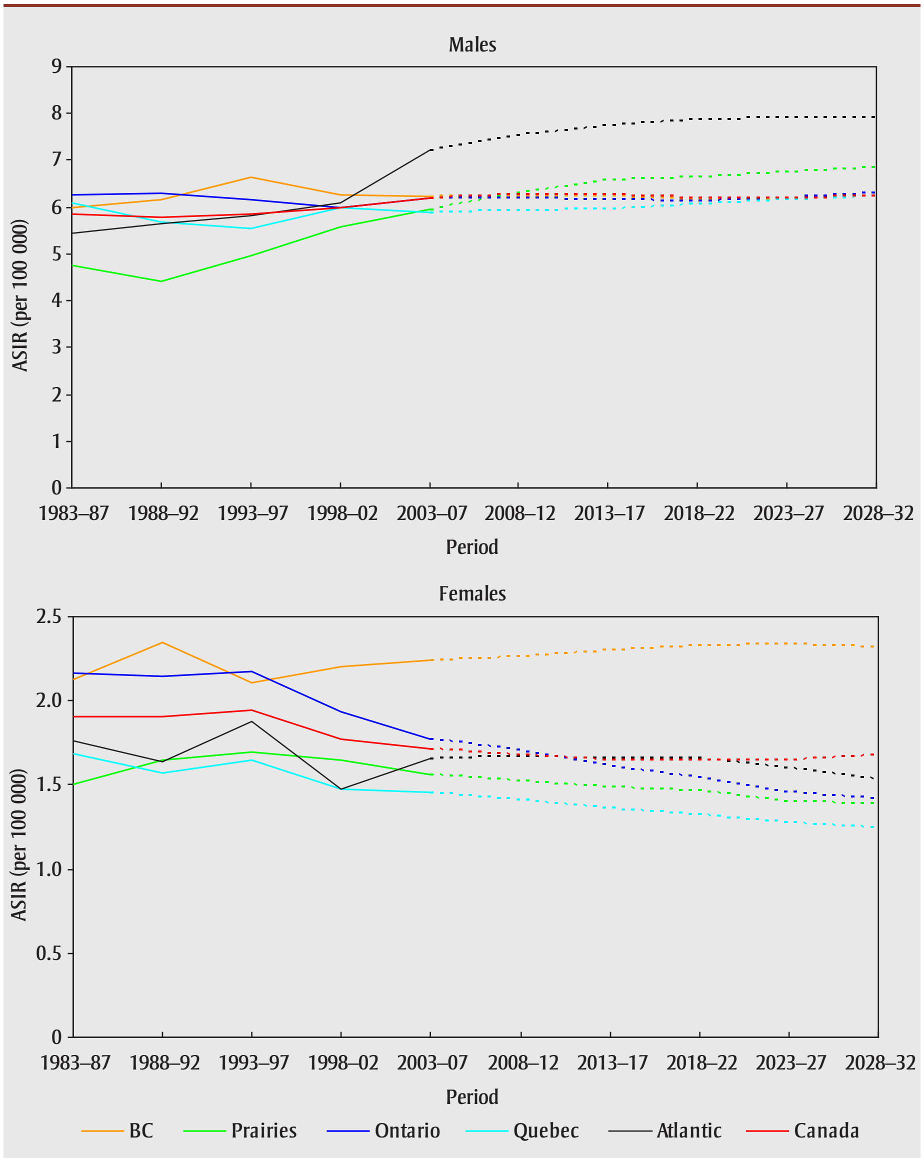
TABLE 4.2.2
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), esophagus cancer, females, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	10	0	0	0	0	5	0	0	0	0	0	0
	45–54	25	5	0	0	0	10	5	0	0	0	0	0
	55–64	65	10	5	0	0	25	15	0	0	0	0	0
	65–74	100	20	10	5	5	40	20	5	5	0	0	0
	75–84	120	20	5	5	5	50	25	5	5	0	0	0
	85+	70	10	5	5	5	25	10	0	5	0	0	0
	Total	385	70	30	10	10	150	80	10	15	0	5	0
2008–12	<45	5	0	0	0	0	5	0	0	0	0	0	0
	45–54	30	5	0	0	0	10	5	0	0	0	0	0
	55–64	75	15	5	5	0	25	20	0	5	0	0	0
	65–74	100	20	10	5	5	40	20	5	5	0	0	0
	75–84	125	20	10	5	5	50	25	5	5	0	0	0
	85+	90	15	10	5	5	35	20	5	5	0	0	0
	Total	430	80	35	15	15	165	90	10	15	0	5	0
2013–17	<45	5	0	0	0	0	5	0	0	0	0	0	0
	45–54	35	5	0	0	0	10	5	0	0	0	0	0
	55–64	85	20	10	5	0	30	20	0	5	0	0	0
	65–74	125	20	10	5	5	50	25	5	5	0	0	0
	75–84	130	30	10	5	5	50	25	5	5	0	0	0
	85+	100	15	10	5	5	40	20	5	5	0	0	0
	Total	480	90	45	15	15	180	95	15	15	0	5	0
2018–22	<45	10	0	0	0	0	5	0	0	0	0	0	0
	45–54	30	5	0	0	0	10	5	0	0	0	0	0
	55–64	100	20	10	5	0	30	15	0	5	0	0	0
	65–74	150	25	20	5	5	55	35	5	5	0	0	0
	75–84	140	35	10	5	5	55	25	5	5	0	0	0
	85+	115	20	15	5	5	45	20	5	5	0	0	0
	Total	540	105	60	15	15	195	105	15	20	5	10	0
2023–27	<45	10	0	0	0	0	5	0	0	0	0	0	0
	45–54	30	5	0	0	0	10	5	0	0	0	0	0
	55–64	105	20	15	5	0	30	15	0	5	0	0	0
	65–74	170	35	25	5	5	60	35	0	5	0	5	0
	75–84	175	35	15	5	5	65	35	10	5	0	5	0
	85+	115	25	15	5	5	40	20	5	5	0	0	0
	Total	605	125	75	20	10	210	110	15	20	5	10	0
2028–32	<45	10	0	0	0	0	5	0	0	0	0	0	0
	45–54	35	5	5	0	0	10	5	0	0	0	0	0
	55–64	100	20	15	5	0	30	15	0	5	0	0	0
	65–74	195	40	30	5	5	65	30	0	5	0	5	0
	75–84	210	45	25	5	5	75	45	10	5	0	5	0
	85+	140	25	20	5	5	55	30	5	5	0	0	0
	Total	690	140	90	20	15	235	120	15	20	5	10	0

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

FIGURE 4.2.1
Age-standardized incidence rates (ASIRs) by region, esophagus cancer, 1983–2032



to changes in risk factors, which include smoking, alcohol use, overweight (body mass index [BMI]: 25–29 kg/m^2) and obesity (BMI $\geq$ 30 kg/m^2), and insufficient intake of fruit and vegetables.

Tobacco smoking and alcohol drinking are the main risk factors for this cancer, with a stronger association with squamous cell carcinoma than with adenocarcinoma.[65,66] In a US case-control study, ever smoking, alcohol use, and low fruit and vegetable consumption were linked to 56.9% (95% confidence interval [CI]: 36.6%–75.1%), 72.4% (CI: 53.3%–85.8%) and 28.7% (CI: 11.1%–56.5%) of squamous cell carcinoma cases, respectively.[67] Reduced smoking in Canada may contribute to the decreasing incidence of squamous cell carcinoma.[43,61] About 55% of male esophageal cancers and 44% of female esophageal cancers could be avoided if smoking were eliminated, as could 40% and 30% of such cancers in males and females, respectively, if drinking were eliminated.[3]

The increasing prevalence of gastroesophageal reflux disease (GERD) and obesity is thought to add to the changes in incidence of esophageal cancer. An important risk factor for adenocarcinoma is GERD and the associated development of Barrett's esophagus.[68] In Western countries, the prevalence of GERD ranges from 10% to 20% of the population.[69] Obesity causally increases risk of adenocarcinoma,[70,71] and the link is greater than that of any other obesity-associated cancer.[68] A proposed mechanism is that obesity increases intra-abdominal pressure and gastroesophageal reflux.[68] In contrast to adenocarcinoma, increased BMI may reduce the risk of squamous cell carcinoma.[70,71] Recent Canadian data suggest that the prevalence rates of obesity have nearly doubled in adults from 1978/79 to 2012.[51,72,73] The prevalence of GERD has increased significantly in Western populations in recent decades[74] and likely continues to increase because of the aging of the population[69] and the increased prevalence of obesity. The observed slight increase in esophagus cancer incidence in males may reflect these changes in the prevalence of GERD and obesity in Canada, as adenocarcinoma accounts for a majority of all male esophageal cancer cases.[61] The increased prevalence of obesity might play a part in the decrease of squamous cell carcinoma incidence, and therefore the slight decrease of overall esophagus cancer rates in females.

The high incidence rates of esophagus cancer in females in British Columbia could partially be explained by high number of immigrants from South Asia and China where hepatitis B virus (HBV) is endemic (see the detailed explanations in Chapter 5).[75-78]

3. Stomach cancer

Stomach cancer (sometimes referred to as gastric cancer) was responsible for approximately 1.9% of all incident cases of cancer in Canada in 2003–2007 (Tables 4.3.1 and 4.3.2). It is the tenth most common cancer in males and the fifteenth most common in females. One in 73 males and 1 in 127 females can expect to be diagnosed with stomach cancer in their lifetime, and 1 in 111 males and 1 in 195 females can expect to die from it.[1] On average, 1925 and 1080 new cases of stomach cancer were diagnosed each year in males and females, respectively, during 2003–2007.

The overall incidence rate of stomach cancer in Canada has decreased for a long time (Figure 4.3.1). In 1998–2007, the incidence rate of stomach cancer was the second most rapidly decreasing of all cancers after larynx (2% per year in males

TABLE 4.2.3
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), esophagus cancer, males, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	0.3	0.3	0.1	0.1	0.6	0.3	0.3	0.1	0.3	0.8	0.2	0.6
	45–54	5.3	4.8	6.9	5.4	3.6	5.4	4.6	7.2	5.9	3.6	6.1	2.6
	55–64	16.5	16.2	18.2	12.4	14.4	16.7	15.7	15.8	23.1	23.6	15.4	23.8
	65–74	29.9	29.9	30.1	19.1	27.9	29.7	29.6	39.3	42.1	31.5	24.4	25.1
	75–84	42.5	44.0	43.1	47.0	36.7	42.5	39.5	52.9	51.4	36.8	43.7	61.3
	85+	42.9	50.4	43.3	29.3	41.7	40.0	43.3	43.7	52.2	26.6	62.5	0.0
	Total	6.2	6.2	6.4	5.0	5.7	6.2	5.9	7.2	8.0	6.7	6.0	6.6
2008–12	<45	0.3	0.3	0.1	0.1	0.5	0.4	0.2	0.2	0.2	0.6	0.1	0.3
	45–54	5.5	5.0	7.4	5.6	4.1	6.0	4.7	7.1	7.7	6.0	4.5	5.0
	55–64	16.7	15.9	20.9	13.2	15.6	16.3	16.1	21.8	22.5	12.5	16.8	19.5
	65–74	29.8	29.7	32.5	20.5	27.0	28.0	30.6	38.3	43.5	46.7	24.6	36.3
	75–84	41.4	43.8	45.1	41.0	37.1	41.3	36.2	53.3	52.7	52.7	37.9	42.0
	85+	48.1	52.8	49.7	36.4	40.9	46.6	48.1	40.5	57.8	50.4	62.1	38.2
	Total	6.3	6.2	7.0	5.1	5.7	6.2	5.9	7.7	8.4	7.7	5.7	6.8
2013–17	<45	0.4	0.3	0.1	0.1	0.5	0.4	0.2	0.2	0.2	0.6	0.1	0.3
	45–54	5.6	5.4	7.8	5.7	4.1	6.3	4.7	7.4	7.9	6.0	4.5	5.0
	55–64	17.3	16.5	24.2	16.2	15.7	17.1	16.4	22.8	21.4	19.4	16.6	19.3
	65–74	29.6	30.4	32.1	17.5	27.7	27.6	31.4	35.9	45.2	32.2	26.7	36.3
	75–84	39.6	39.7	45.6	41.3	35.3	38.5	36.0	59.4	53.9	44.3	41.5	41.9
	85+	47.2	52.3	55.0	32.8	49.4	47.3	43.9	48.1	51.6	58.3	36.2	38.1
	Total	6.3	6.2	7.4	5.1	5.8	6.2	6.0	8.0	8.4	7.1	5.7	6.8
2018–22	<45	0.4	0.3	0.1	0.1	0.5	0.4	0.2	0.2	0.2	0.6	0.1	0.3
	45–54	6.1	5.4	7.8	5.7	4.1	6.7	4.7	7.4	7.9	6.0	4.5	5.0
	55–64	16.9	16.1	24.2	16.2	15.7	17.4	17.0	22.8	21.4	25.5	16.6	19.3
	65–74	29.6	30.9	35.4	18.9	27.1	27.9	31.9	37.3	39.9	21.0	26.7	36.1
	75–84	38.1	39.5	40.1	37.1	36.4	36.1	36.6	53.5	57.7	48.7	42.9	41.6
	85+	44.8	47.9	49.4	39.0	47.0	44.2	42.2	47.4	60.0	35.0	56.8	38.1
	Total	6.2	6.2	7.4	5.1	5.7	6.1	6.0	7.8	8.3	6.8	5.9	6.7
2023–27	<45	0.4	0.3	0.1	0.1	0.5	0.4	0.2	0.2	0.2	0.6	0.1	0.3
	45–54	6.3	5.4	7.8	5.7	4.1	6.7	4.7	7.4	7.9	6.0	4.5	5.0
	55–64	16.9	16.7	24.2	16.2	15.7	17.9	17.1	22.8	21.4	29.0	16.6	19.2
	65–74	30.0	31.1	37.7	21.8	27.1	28.9	32.6	37.0	37.7	24.0	26.7	35.8
	75–84	37.2	39.5	38.5	31.5	36.4	35.4	37.7	50.7	56.6	29.8	46.4	41.4
	85+	42.2	42.5	49.0	34.7	44.6	40.6	43.2	53.3	54.3	28.7	49.1	37.5
	Total	6.2	6.2	7.5	5.1	5.7	6.2	6.2	7.8	8.0	6.6	6.0	6.7
2028–32	<45	0.4	0.3	0.1	0.1	0.5	0.4	0.2	0.2	0.2	0.6	0.1	0.3
	45–54	6.3	5.4	7.8	5.7	4.1	6.7	4.7	7.4	7.9	6.0	4.5	5.0
	55–64	18.0	16.7	24.2	16.2	15.7	18.8	17.1	22.8	21.4	33.0	16.6	19.2
	65–74	29.1	30.9	37.7	21.8	27.1	29.3	33.5	37.0	37.7	27.4	26.7	35.9
	75–84	37.5	40.6	42.7	35.0	35.8	35.9	38.1	51.8	50.3	14.3	46.4	41.3
	85+	41.1	45.7	40.1	31.2	48.1	38.7	43.8	41.3	64.0	32.2	58.5	37.4
	Total	6.2	6.2	7.5	5.2	5.7	6.3	6.2	7.7	7.9	6.6	6.1	6.7

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

TABLE 4.2.4
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), esophagus cancer, females, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	0.1	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
	45–54	1.0	1.4	0.7	0.3	0.7	1.3	0.9	0.7	1.3	2.0	0.4	0.0
	55–64	3.6	4.8	3.3	4.0	1.8	3.7	3.4	2.5	3.8	2.7	2.1	0.0
	65–74	8.2	11.3	9.3	8.7	6.6	8.2	6.4	10.0	9.8	7.3	2.9	27.5
	75–84	13.3	17.9	9.9	10.5	13.0	13.9	11.3	16.3	15.4	20.4	7.6	0.0
	85+	19.7	24.1	21.9	16.6	18.7	21.2	15.3	21.0	20.8	10.7	11.8	0.0
	Total	1.7	2.2	1.7	1.5	1.4	1.8	1.5	1.8	1.9	1.8	0.8	1.9
2008–12	<45	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.1	0.1	0.1	0.1
	45–54	1.1	1.6	0.8	0.8	0.7	1.0	0.8	0.8	1.6	1.2	1.1	1.3
	55–64	3.5	4.7	3.5	4.1	2.2	3.4	3.4	3.4	4.6	3.7	3.2	4.0
	65–74	7.5	11.0	8.3	9.2	6.0	7.8	6.0	7.7	7.2	7.9	6.5	8.4
	75–84	13.5	18.4	12.1	9.9	13.7	14.4	10.5	20.6	14.1	14.2	12.6	15.1
	85+	20.5	23.8	25.6	18.0	14.8	21.2	18.4	26.1	24.7	21.6	19.2	23.0
	Total	1.7	2.3	1.7	1.6	1.3	1.7	1.4	1.9	1.9	1.8	1.5	1.9
2013–17	<45	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.1	0.1	0.1	0.1
	45–54	1.3	1.6	0.8	0.8	0.7	1.0	0.7	0.8	1.6	1.3	1.1	1.4
	55–64	3.6	5.5	3.9	4.1	2.1	3.2	3.2	1.1	4.5	3.8	3.1	4.0
	65–74	7.3	9.0	8.3	9.6	5.5	7.7	6.4	8.4	7.0	7.7	6.4	8.2
	75–84	13.0	21.9	13.9	10.7	11.7	12.6	9.4	24.3	13.7	13.6	12.4	14.5
	85+	19.3	21.2	22.3	17.7	15.2	20.5	17.0	20.1	24.1	20.2	18.9	21.6
	Total	1.7	2.3	1.8	1.7	1.2	1.6	1.4	1.9	1.9	1.7	1.5	1.8
2018–22	<45	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.1	0.1	0.1	0.1
	45–54	1.3	1.6	0.8	0.8	0.7	0.9	0.7	0.8	1.6	1.3	1.1	1.4
	55–64	3.7	5.5	4.3	4.1	2.0	3.0	2.7	1.0	4.4	3.9	3.1	4.2
	65–74	7.3	9.1	9.5	9.9	5.1	7.1	6.8	8.6	6.8	7.6	6.4	8.1
	75–84	12.4	21.4	12.8	11.3	8.9	12.5	9.1	19.2	13.4	13.1	12.4	13.9
	85+	20.1	25.3	30.1	18.5	17.6	20.1	15.5	38.4	23.5	21.1	18.7	22.5
	Total	1.7	2.3	1.9	1.7	1.1	1.5	1.3	1.9	1.8	1.7	1.5	1.9
2023–27	<45	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.1	0.1	0.1	0.1
	45–54	1.2	1.6	0.8	0.8	0.7	0.9	0.6	0.8	1.6	1.3	1.0	1.4
	55–64	4.1	5.5	4.7	4.1	1.9	2.9	2.6	0.9	4.3	4.3	3.1	4.6
	65–74	7.3	10.3	10.7	10.0	4.8	6.8	6.2	3.6	6.6	7.6	6.4	8.1
	75–84	12.0	18.0	12.9	11.6	8.3	12.2	9.7	23.7	13.0	12.6	12.3	13.5
	85+	18.1	29.7	29.6	18.9	11.3	16.4	13.7	33.6	22.9	19.0	18.7	20.3
	Total	1.6	2.3	2.0	1.7	1.0	1.5	1.3	1.6	1.8	1.7	1.5	1.8
2028–32	<45	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.1	0.1	0.1	0.1
	45–54	1.2	1.6	0.8	0.8	0.7	0.9	0.6	0.7	1.6	1.3	1.1	1.4
	55–64	4.1	5.6	5.1	4.1	1.8	2.8	2.5	0.8	4.3	4.3	3.1	4.6
	65–74	7.7	10.3	12.0	10.1	4.4	6.4	5.6	3.4	6.4	8.1	6.4	8.6
	75–84	12.1	18.7	14.4	11.9	7.8	11.4	10.3	19.0	12.7	12.7	12.4	13.5
	85+	18.5	25.2	26.4	19.4	10.6	18.8	14.5	24.8	22.4	19.4	18.8	20.7
	Total	1.7	2.3	2.2	1.8	0.9	1.4	1.2	1.3	1.7	1.8	1.5	1.9

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

FIGURE 4.2.2
Age-standardized incidence rates (ASIRs) for esophagus cancer by age group (– males, – females), Canada, 1983–2032

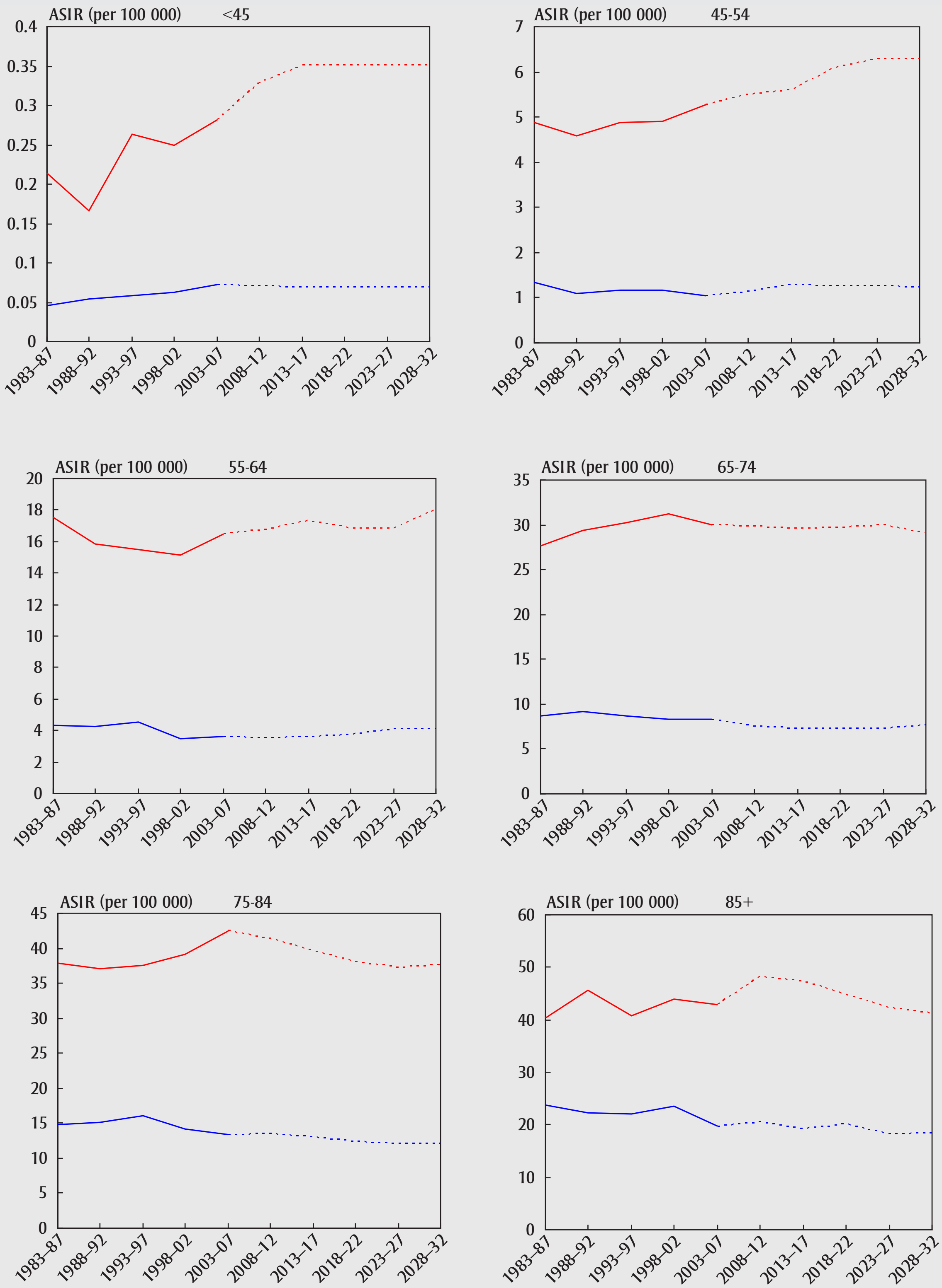


TABLE 4.3.1
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), stomach cancer, males, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	75	10	10	0	5	30	15	0	0	0	0	0
	45–54	200	25	20	5	10	70	50	5	10	0	5	0
	55–64	400	50	30	10	15	145	105	10	15	0	15	0
	65–74	545	70	45	15	20	205	145	15	15	0	15	0
	75–84	535	65	40	15	25	190	150	15	15	0	15	0
	85+	175	25	15	5	10	55	45	5	5	0	5	0
	Total	1925	245	160	55	80	700	510	55	65	5	50	5
2008–12	<45	70	10	10	0	0	30	15	0	0	0	0	0
	45–54	205	25	20	5	10	85	45	5	10	0	5	0
	55–64	440	55	35	10	20	160	110	15	15	0	15	0
	65–74	560	70	45	15	20	205	150	15	20	5	15	0
	75–84	550	75	45	15	20	195	155	15	15	0	10	0
	85+	200	30	20	5	10	70	50	5	5	0	5	0
	Total	2020	260	170	55	80	745	525	55	65	10	50	5
2013–17	<45	70	10	10	0	0	30	15	0	0	0	0	0
	45–54	200	30	15	5	5	80	40	5	5	0	0	0
	55–64	460	55	40	15	25	175	105	10	15	0	10	0
	65–74	650	80	55	15	25	245	165	20	20	5	20	0
	75–84	545	75	45	15	20	200	155	15	15	0	10	0
	85+	225	35	20	5	10	80	60	5	5	0	5	0
	Total	2150	280	185	55	85	805	540	60	70	10	50	5
2018–22	<45	65	10	10	0	0	30	15	0	0	0	0	0
	45–54	195	30	15	0	5	80	40	5	5	0	0	0
	55–64	480	60	40	15	20	195	105	10	15	0	10	0
	65–74	735	100	65	20	35	270	175	20	25	5	20	0
	75–84	585	75	50	15	20	215	160	15	20	5	15	0
	85+	250	35	20	5	10	95	65	5	10	0	5	0
	Total	2315	310	200	55	95	880	560	60	70	10	50	5
2023–27	<45	65	10	5	0	0	25	10	0	0	0	0	0
	45–54	195	30	10	0	5	85	45	5	5	0	0	0
	55–64	480	70	35	10	20	190	95	10	15	0	5	0
	65–74	790	105	75	25	35	300	180	20	25	5	20	0
	75–84	705	95	60	15	30	260	190	25	20	5	15	0
	85+	255	35	25	5	10	100	65	5	10	0	5	0
	Total	2490	340	215	60	100	960	585	60	75	10	50	5
2028–32	<45	55	10	5	0	0	25	10	0	0	0	0	0
	45–54	185	25	10	0	5	80	40	5	5	0	0	0
	55–64	475	70	30	10	15	185	95	5	10	0	5	0
	65–74	845	110	75	20	35	340	185	20	25	5	15	5
	75–84	820	120	75	20	40	295	210	25	25	5	20	0
	85+	300	40	30	5	10	115	75	10	10	0	5	0
	Total	2680	370	225	60	110	1040	610	60	80	10	45	10

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

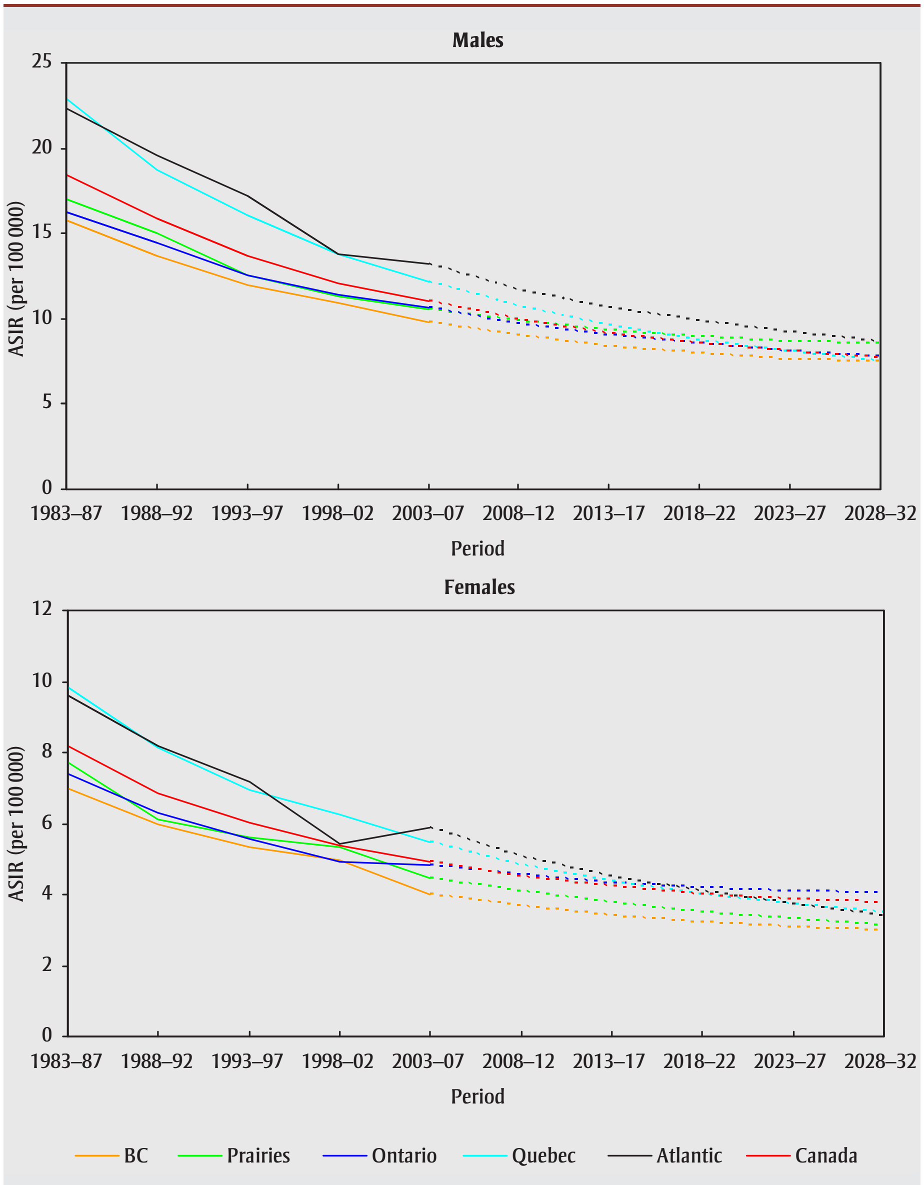
TABLE 4.3.2
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), stomach cancer, females, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	65	5	5	0	0	25	10	0	0	0	5	0
	45–54	105	10	10	0	5	45	25	5	0	0	0	0
	55–64	155	20	15	5	5	55	40	5	5	0	5	0
	65–74	240	25	15	5	10	90	70	10	10	0	10	0
	75–84	330	35	25	10	15	115	100	10	10	0	10	0
	85+	190	15	15	5	10	70	60	5	5	0	0	0
	Total	1080	115	85	30	40	405	305	30	30	5	30	5
2008–12	<45	65	10	5	0	0	30	15	0	0	0	0	0
	45–54	105	15	10	0	5	45	20	0	5	0	0	0
	55–64	175	20	15	5	5	70	40	5	5	0	5	0
	65–74	240	25	20	5	10	90	70	5	5	0	10	0
	75–84	315	35	20	10	10	115	95	10	10	0	10	0
	85+	210	20	15	5	10	75	65	5	5	0	5	0
	Total	1110	120	90	25	40	425	300	30	30	5	30	5
2013–17	<45	70	10	5	0	0	30	15	0	0	0	0	0
	45–54	105	10	10	0	5	50	20	0	5	0	0	0
	55–64	195	25	20	5	5	80	45	5	5	0	5	0
	65–74	265	30	20	5	10	105	70	5	10	0	10	0
	75–84	305	35	20	10	10	110	90	10	5	0	10	0
	85+	215	20	20	5	10	80	65	5	5	0	5	0
	Total	1155	130	100	25	40	455	305	30	30	5	30	5
2018–22	<45	70	5	5	0	0	30	15	0	0	0	0	0
	45–54	110	10	10	0	5	55	20	0	0	0	0	0
	55–64	205	25	25	5	5	85	40	5	5	0	5	0
	65–74	305	35	25	5	10	125	75	5	10	0	10	0
	75–84	315	35	25	5	10	115	95	10	5	0	10	0
	85+	215	20	20	5	5	80	70	5	5	0	5	0
	Total	1220	135	110	25	40	490	310	30	30	5	30	5
2023–27	<45	65	5	5	0	5	25	10	0	0	0	0	0
	45–54	125	10	10	0	5	65	20	0	0	0	0	0
	55–64	205	25	25	5	5	90	35	5	5	0	5	0
	65–74	350	40	30	5	10	145	80	5	10	0	10	0
	75–84	360	45	30	5	10	135	100	10	10	0	10	0
	85+	225	20	20	5	10	85	70	5	5	0	5	0
	Total	1320	150	120	25	45	540	315	30	30	5	30	10
2028–32	<45	55	5	5	0	5	25	10	0	0	0	0	0
	45–54	125	10	10	0	5	60	20	0	0	0	0	0
	55–64	215	25	25	0	5	105	35	5	5	0	0	0
	65–74	370	45	40	5	10	155	75	5	10	0	10	5
	75–84	425	50	35	10	15	165	110	10	10	5	10	5
	85+	235	20	25	5	10	90	70	5	5	0	5	0
	Total	1425	160	135	25	45	595	325	30	30	10	30	10

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

FIGURE 4.3.1
Age-standardized incidence rates (ASIRs) by region, stomach cancer, 1983–2032



and 1.6% per year in females) (Figures 3.1 and 3.2). Stomach cancer has a poor 5-year relative survival rate, at 23% in males and 28% in females in 2006–2008.[1]

The incidence rates increased with age from 0.7 per 100 000 in males aged under 45 to 113.5 in those aged 85 or older, and from 0.6 to 55.1 per 100 000 in females for the same age groups (Tables 4.3.3 and 4.3.4) in 2003–2007. Most people diagnosed with stomach cancer are 65 or older (65% in men and 70% in women). The male-to-female ratio of rates approximated 1:1 in those younger than 45 and increased to 1.9:1 to 2.7:1 in the over-45-year age groups in 2003–2007.

From 2003–2007 to 2028–2032, ASIRs of stomach cancer for Canada are expected to decrease by 30% in males, from 11.1 to 7.7 per 100 000, and by 24% in females, from 4.9 to 3.7 per 100 000 (Tables 4.3.3 and 4.3.4). With the projected Canada population growth and aging, however, the annual number of male cases is predicted to rise by 39%, from 1925 to 2680, and the number of female cases is predicted to rise by 32%, from 1080 to 1425 (Tables 4.3.1 and 4.3.2). The projected long-term trends in males and females show a tendency toward a convergence of rates in each age group (Figure 4.3.2). Elevated rates are reported for the Atlantic region, with the highest rates in Newfoundland and Labrador, but the long-term trends indicate a convergence of rates in regions as well (Figure 4.3.1).

Comments

The gram-negative bacterium *Helicobacter pylori* (*H. pylori*) is a major risk factor for stomach cancer. In addition, dietary habits, tobacco smoking, alcohol, genetic factors, occupational exposure to dusty and high temperature environments, X-radiation, gamma-radiation and socioeconomic factors contribute to stomach carcinogenesis.[47,79]

Elevated risk for stomach cancer has been linked to diets rich in starch, poor in protein quality, and poor in fruits and vegetables.[79] A meta-analysis of prospective studies found that stomach cancer risk increases with increasing salt intake.[80] High salt intake may cause damage to gastric mucosa and help *H. pylori* colonization.[79] Dietary nitrate can also increase stomach cancer risk, as it may result in endogenous *N*-nitrosation.

Since the early 1960s, annual per capita fruit and vegetable consumption rates in Canada have increased by over 30%, from 84 kg of fruits and 139 kg of vegetables in 1963 to 132 kg of fruits and 179 kg of vegetables in 2009.[81] The decrease in stomach cancer incidence rates may be attributable to improved healthy lifestyles such as decreased smoking[42,43] and changes in diet,[82] and more recently to the increased recognition and treatment of *H. pylori* infection.[83]

4. Colorectal cancer

Colorectal cancer is the third most common cancer for both males and females in Canada. In 2003–2007, the average annual number of new cases of colorectal cancer in Canada was 10 620 in males and 9010 in females, 13.1% and 12.1% of all male and female cases, respectively (Tables 4.4.1 and 4.4.2, Figure 3.9). Slightly more than two-thirds of new cases of colorectal cancer were cancers of the colon. One in 13 males and 1 in 15 females can expect to be diagnosed with colorectal cancer in their lifetime, and 1 in 29 males and 1 in 31 females can expect to die from it.[1] The 5-year relative survival

TABLE 4.3.3
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), stomach cancer, males, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	0.7	0.6	0.8	0.4	0.8	0.7	0.7	0.6	0.7	0.4	0.9	0.6
	45–54	7.9	7.5	8.2	6.1	10.7	7.6	7.9	7.5	10.7	13.3	9.9	7.6
	55–64	23.6	20.9	21.2	19.3	27.7	23.4	24.2	26.3	26.9	12.6	42.2	25.6
	65–74	50.7	44.6	47.1	50.4	50.0	50.2	54.2	61.1	47.3	42.9	73.3	84.7
	75–84	86.1	74.1	80.2	64.7	93.7	79.5	103.1	107.1	91.4	50.4	148.1	61.3
	85+	113.5	103.4	103.6	82.5	116.8	101.6	138.8	126.3	137.9	106.3	223.3	290.3
	Total	11.1	9.8	10.4	9.2	12.1	10.6	12.2	12.8	11.9	8.6	17.9	14.4
2008–12	<45	0.7	0.8	0.6	0.6	0.6	0.7	0.7	0.6	0.6	0.6	0.8	0.9
	45–54	7.4	6.7	6.8	5.2	8.5	7.8	6.8	7.8	9.4	7.7	6.5	9.6
	55–64	21.4	19.7	18.3	19.4	28.4	21.3	21.2	25.6	23.3	21.4	36.0	27.8
	65–74	45.1	38.5	44.4	41.8	48.4	44.7	47.1	48.4	46.1	45.8	74.6	58.5
	75–84	78.4	73.0	72.9	62.3	84.5	72.1	92.1	93.8	81.3	73.5	116.0	101.6
	85+	95.6	85.4	103.0	67.2	104.1	88.2	113.1	120.7	112.1	89.0	139.3	123.9
	Total	10.0	9.0	9.4	8.4	11.2	9.7	10.7	11.3	10.7	9.7	15.1	12.9
2013–17	<45	0.7	0.7	0.6	0.6	0.6	0.7	0.7	0.6	0.6	0.5	0.8	0.9
	45–54	7.4	8.1	5.2	4.1	8.0	7.3	6.2	7.2	7.9	7.1	5.4	9.6
	55–64	19.6	17.6	17.4	19.3	28.0	19.6	19.0	19.4	23.6	19.9	28.6	25.4
	65–74	41.6	35.8	38.6	38.2	48.5	41.7	42.1	49.7	41.7	42.3	73.4	53.9
	75–84	70.6	64.5	68.5	57.8	76.5	66.8	81.2	81.5	71.3	68.0	88.7	91.5
	85+	84.1	78.9	87.9	55.4	90.8	77.8	98.5	103.1	98.5	82.3	138.7	109.0
	Total	9.2	8.4	8.5	7.7	10.6	9.0	9.6	10.2	9.7	9.0	13.2	11.9
2018–22	<45	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.8	0.7
	45–54	7.8	8.6	4.5	3.2	7.5	7.8	7.0	6.8	6.9	6.6	4.5	10.1
	55–64	18.5	16.2	15.5	17.3	22.9	19.3	17.4	17.1	22.4	18.4	19.3	24.0
	65–74	38.8	36.9	35.1	36.3	51.7	38.2	38.5	44.8	39.9	39.4	65.6	50.3
	75–84	63.0	54.6	63.3	54.0	73.8	60.6	70.7	69.8	63.3	63.2	86.3	81.7
	85+	79.8	72.0	78.1	56.4	90.3	77.3	91.0	101.4	93.0	76.6	110.0	103.4
	Total	8.5	7.9	7.7	7.2	10.3	8.5	8.7	9.2	9.0	8.4	11.4	11.1
2023–27	<45	0.6	0.5	0.5	0.6	0.6	0.6	0.4	0.6	0.5	0.5	0.8	0.7
	45–54	7.5	7.8	3.8	2.5	7.0	8.3	7.6	6.4	6.0	6.2	3.7	9.8
	55–64	18.5	19.3	12.6	14.5	21.8	18.4	16.3	15.2	19.5	17.3	16.8	24.0
	65–74	36.1	33.1	34.0	36.1	50.0	36.1	35.2	36.2	40.7	37.0	52.0	46.8
	75–84	58.8	52.4	55.9	49.6	73.3	57.2	64.5	72.5	57.9	59.3	82.3	76.3
	85+	69.8	62.6	77.3	49.4	76.8	68.7	78.4	80.5	78.6	72.0	82.9	90.4
	Total	8.1	7.6	7.0	6.7	9.8	8.1	8.0	8.3	8.3	7.9	9.8	10.5
2028–32	<45	0.5	0.5	0.5	0.6	0.6	0.5	0.4	0.6	0.5	0.5	0.8	0.6
	45–54	7.0	7.0	3.3	2.0	6.6	7.4	6.2	6.0	5.3	5.9	3.1	9.0
	55–64	19.4	20.5	11.1	12.1	20.7	19.2	17.9	13.4	17.4	16.5	14.6	25.2
	65–74	34.7	31.5	30.2	32.6	42.5	35.6	32.8	32.6	38.2	35.1	38.1	44.9
	75–84	55.3	53.7	51.6	48.0	79.7	52.6	59.6	65.1	56.3	56.4	75.1	71.6
	85+	63.6	52.3	68.4	48.7	81.2	63.6	69.4	74.4	73.1	68.6	94.9	82.5
	Total	7.7	7.5	6.3	6.1	9.5	7.8	7.5	7.5	7.8	7.5	8.4	10.0

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

TABLE 4.3.4
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), stomach cancer, females, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	0.6	0.5	0.7	0.6	0.6	0.7	0.5	0.8	0.5	1.5	1.6	2.8
	45–54	4.1	3.7	3.9	3.0	3.7	4.7	3.9	4.8	2.4	1.7	4.4	2.8
	55–64	8.7	8.0	10.0	6.4	9.4	8.6	8.7	7.5	8.6	4.8	15.2	23.1
	65–74	20.2	15.2	15.3	18.7	18.7	19.7	22.8	26.4	20.6	44.0	42.5	27.5
	75–84	37.5	31.3	35.1	30.4	35.6	34.2	45.8	42.8	32.0	32.4	76.1	92.7
	85+	55.1	35.8	54.7	35.7	47.4	54.3	74.4	62.9	47.9	21.4	47.0	96.5
	Total	4.9	4.0	4.6	4.0	4.6	4.8	5.5	5.7	4.4	6.0	9.0	10.4
2008–12	<45	0.7	0.6	0.6	0.4	0.7	0.7	0.6	0.6	0.4	0.8	1.2	1.9
	45–54	3.9	3.6	4.3	2.8	3.7	4.4	3.3	3.7	3.5	4.7	5.1	9.5
	55–64	8.2	6.6	8.4	7.1	8.8	8.9	7.9	7.2	9.8	10.0	12.3	17.6
	65–74	17.7	13.3	16.1	13.2	18.4	17.6	19.6	18.4	15.7	21.5	32.3	30.8
	75–84	34.1	29.9	30.0	28.5	29.0	31.4	40.5	38.6	27.3	41.4	69.7	53.0
	85+	48.0	32.4	50.0	34.6	52.0	46.4	59.9	58.4	45.0	58.3	54.8	83.2
	Total	4.5	3.7	4.3	3.5	4.4	4.5	4.8	4.7	4.0	5.5	7.7	8.7
2013–17	<45	0.7	0.6	0.4	0.4	0.7	0.8	0.6	0.6	0.4	0.8	1.2	2.0
	45–54	3.9	3.4	4.5	2.5	3.7	4.5	3.1	3.7	3.5	4.7	4.4	10.1
	55–64	8.1	7.0	8.4	6.2	7.6	8.6	7.4	6.4	7.8	9.9	12.3	19.2
	65–74	15.6	12.1	15.5	11.0	16.5	16.2	16.5	15.9	13.7	19.0	25.8	34.4
	75–84	31.2	26.4	27.1	25.8	29.9	28.8	37.0	34.0	25.1	37.9	60.1	59.6
	85+	42.6	29.2	42.7	29.7	39.9	42.3	52.5	51.9	37.4	51.8	54.5	92.9
	Total	4.2	3.4	4.0	3.1	4.1	4.3	4.4	4.2	3.5	5.1	6.8	9.6
2018–22	<45	0.6	0.5	0.4	0.4	0.7	0.7	0.5	0.6	0.4	0.8	1.2	2.1
	45–54	4.5	3.4	4.3	2.3	3.7	5.5	3.7	3.7	3.5	5.4	3.9	10.7
	55–64	7.8	7.1	8.9	5.1	6.5	8.4	6.7	5.8	6.3	9.5	9.7	20.7
	65–74	15.0	11.8	13.8	10.4	17.1	16.3	14.9	13.7	14.2	18.3	25.7	37.9
	75–84	27.7	22.8	26.6	21.7	27.2	25.9	32.6	29.9	19.6	33.7	47.6	66.8
	85+	38.1	26.4	37.5	25.6	34.4	36.7	47.8	46.2	32.2	46.4	52.5	104.0
	Total	4.0	3.2	3.8	2.7	3.9	4.2	4.0	3.8	3.2	4.9	6.1	10.4
2023–27	<45	0.5	0.5	0.4	0.4	0.7	0.6	0.5	0.6	0.4	0.7	1.2	2.2
	45–54	4.9	3.0	3.3	2.1	3.7	6.1	4.0	3.7	3.5	5.9	3.4	11.2
	55–64	7.8	6.8	9.2	4.2	5.6	8.6	6.2	5.2	5.0	9.5	7.6	22.1
	65–74	14.9	12.6	14.1	9.2	15.2	16.0	14.3	11.8	11.8	18.1	25.1	41.2
	75–84	25.0	21.4	25.5	19.1	26.1	24.4	28.1	26.4	19.1	30.4	39.2	74.4
	85+	35.9	23.1	35.0	24.4	40.7	35.4	44.5	41.2	31.7	43.7	41.0	116.6
	Total	3.9	3.1	3.6	2.4	3.7	4.1	3.7	3.5	2.9	4.7	5.4	11.3
2028–32	<45	0.5	0.4	0.3	0.4	0.7	0.5	0.4	0.6	0.4	0.6	1.2	2.3
	45–54	4.6	2.6	2.9	1.9	3.7	5.4	3.5	3.7	3.5	5.6	3.1	11.7
	55–64	8.8	6.9	9.0	3.4	4.8	10.2	7.3	4.8	4.0	10.7	5.9	23.3
	65–74	14.4	12.7	14.7	7.7	13.4	15.7	13.0	10.2	9.7	17.5	20.5	44.4
	75–84	24.4	20.9	22.8	18.2	26.3	24.7	25.9	23.2	18.8	29.6	39.6	81.9
	85+	30.8	19.7	35.8	18.6	30.4	30.6	38.0	36.7	21.3	37.5	32.4	130.8
	Total	3.7	3.0	3.5	2.2	3.4	4.1	3.5	3.1	2.5	4.6	4.8	12.1

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

FIGURE 4.3.2
Age-standardized incidence rates (ASIRs) for stomach cancer by age group (– males, – females), Canada, 1983–2032

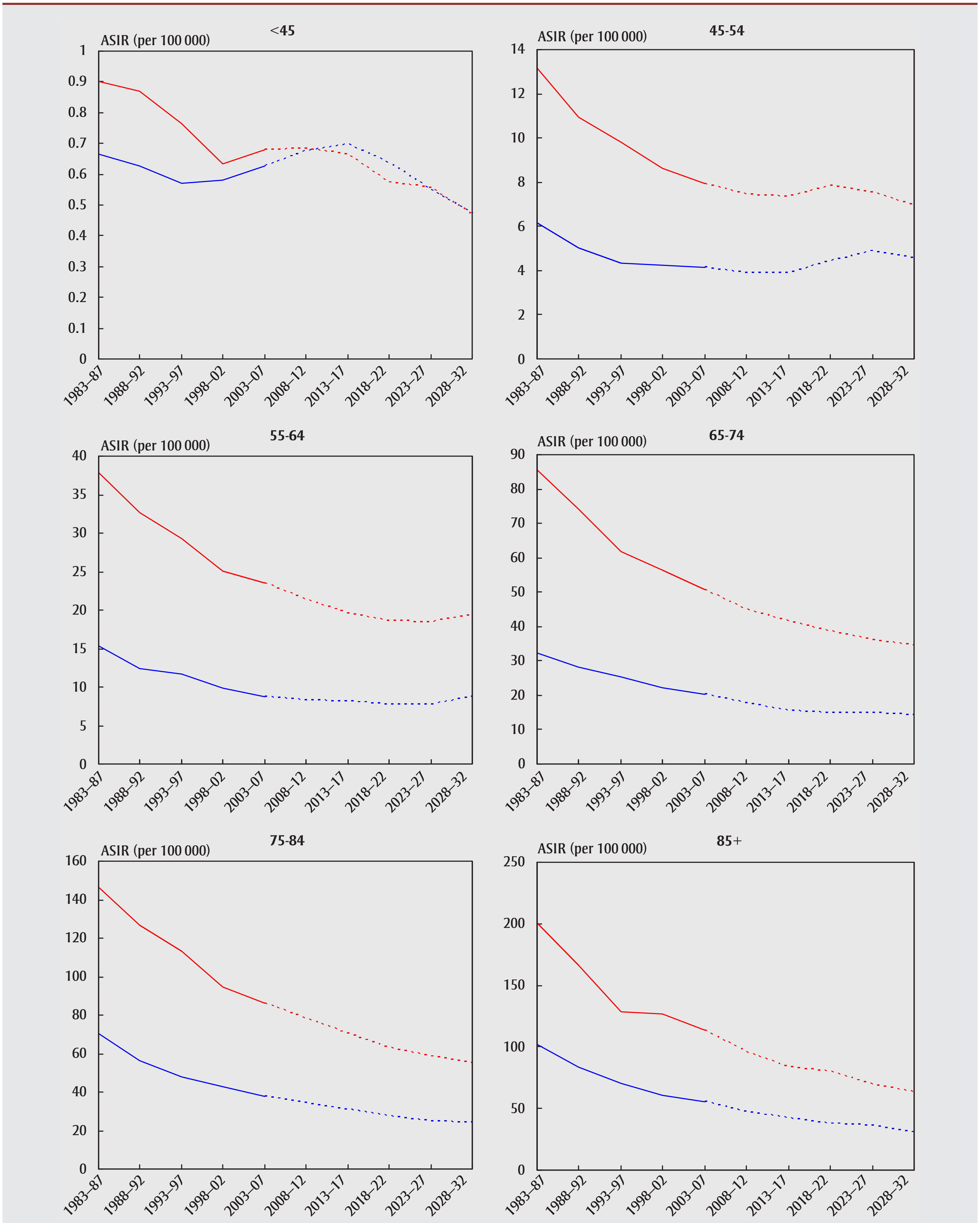


TABLE 4.4.1
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), cancers of colon and rectum, males, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	335	35	35	5	15	135	75	10	15	0	5	0
	45–54	1060	120	110	30	40	405	250	30	35	5	30	5
	55–64	2375	280	185	75	90	875	625	60	95	15	70	10
	65–74	3285	405	250	115	105	1220	885	75	120	15	75	10
	75–84	2785	365	230	100	110	995	740	70	100	15	60	5
	85+	780	115	60	35	40	260	195	20	40	5	15	0
	Total	10 620	1320	865	365	400	3890	2770	270	405	55	255	30
2008–12	<45	335	40	35	10	10	135	65	5	10	0	5	0
	45–54	1105	130	120	30	45	425	240	30	40	5	25	5
	55–64	2795	315	240	85	105	1065	690	75	100	15	85	15
	65–74	3650	465	285	130	125	1315	1000	90	135	20	95	15
	75–84	3160	405	270	110	115	1130	860	80	115	20	70	5
	85+	1045	155	85	40	45	355	270	25	45	5	15	0
	Total	12 090	1505	1035	405	440	4430	3130	310	450	60	295	40
2013–17	<45	365	45	40	10	10	160	65	5	15	0	5	0
	45–54	1125	135	120	30	45	445	230	35	40	5	25	5
	55–64	3070	350	295	95	115	1200	710	80	100	10	85	15
	65–74	4455	560	360	150	155	1605	1190	120	170	30	125	20
	75–84	3445	445	300	120	120	1225	960	90	125	20	85	10
	85+	1320	180	115	50	50	465	360	35	55	5	20	0
	Total	13 780	1715	1235	455	495	5095	3515	360	505	70	345	50
2018–22	<45	420	55	50	10	10	190	70	5	15	0	5	0
	45–54	1075	140	120	30	40	425	210	30	35	5	20	5
	55–64	3310	390	335	100	130	1320	725	85	110	10	80	15
	65–74	5290	655	465	180	185	1980	1340	145	190	30	155	30
	75–84	4035	530	355	145	140	1405	1150	110	155	30	110	10
	85+	1540	205	145	55	55	545	435	40	55	5	25	0
	Total	15 670	1980	1465	515	565	5870	3930	415	560	80	395	65
2023–27	<45	440	55	50	10	10	205	70	5	15	0	5	0
	45–54	1155	150	135	35	35	485	215	25	35	5	20	5
	55–64	3360	410	340	95	135	1370	710	95	110	10	75	15
	65–74	5915	760	575	215	215	2270	1435	155	195	25	160	35
	75–84	5090	670	465	175	180	1790	1430	150	195	40	150	15
	85+	1780	245	165	65	60	625	520	45	70	10	30	5
	Total	17 735	2290	1730	595	635	6750	4385	480	625	85	435	75
2028–32	<45	450	60	50	10	10	215	65	5	15	0	5	0
	45–54	1330	180	155	35	35	590	235	25	35	5	20	5
	55–64	3230	425	340	105	125	1335	660	85	105	10	65	15
	65–74	6465	850	655	220	240	2545	1515	175	210	30	150	35
	75–84	6155	800	605	215	220	2245	1660	185	225	35	185	25
	85+	2180	310	210	80	75	745	655	60	90	15	45	5
	Total	19 815	2625	2015	665	705	7675	4790	540	685	95	470	85

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

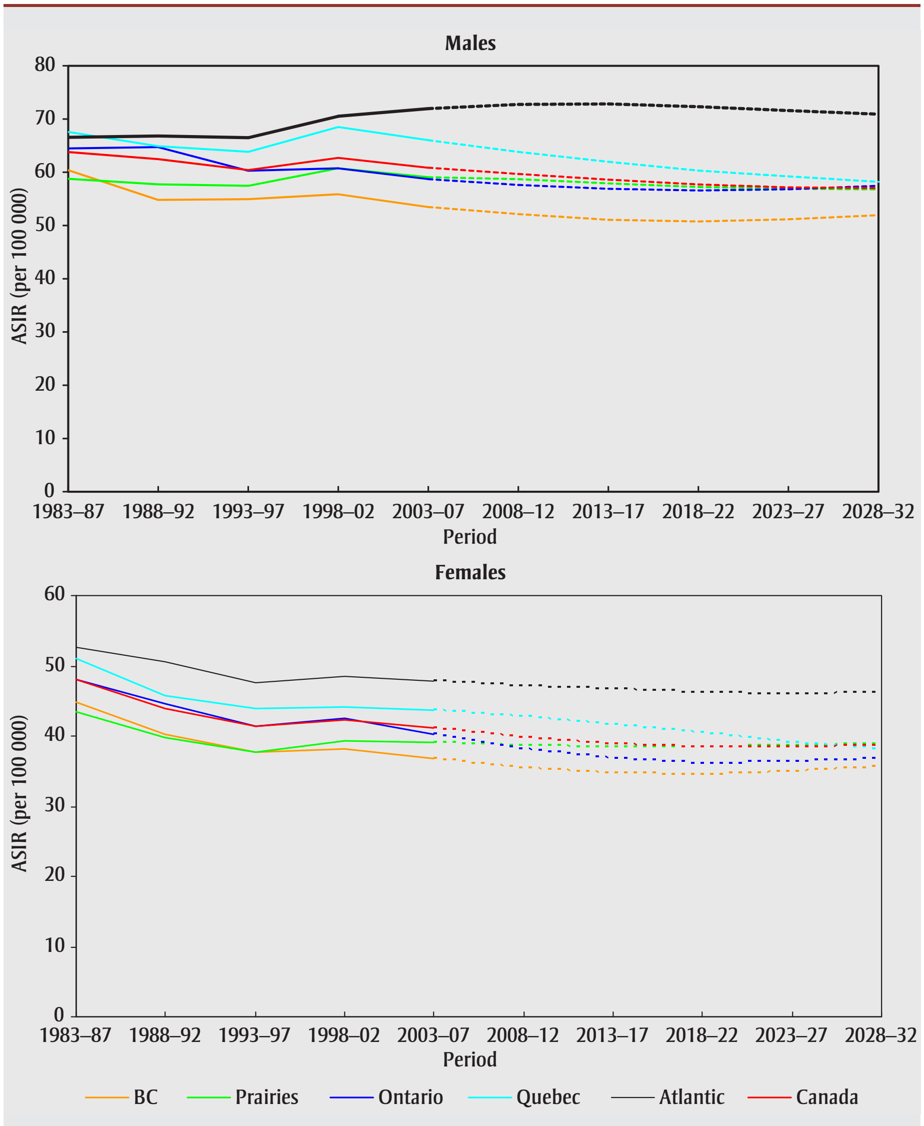
TABLE 4.4.2
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), cancers of colon and rectum, females, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	310	35	25	5	15	130	70	5	15	0	5	0
	45–54	830	105	80	25	30	310	205	20	30	5	20	5
	55–64	1545	180	115	45	55	575	425	40	55	10	45	5
	65–74	2225	265	175	70	70	845	590	50	85	10	50	5
	75–84	2740	335	195	95	115	1020	740	70	110	15	50	5
	85+	1355	165	100	60	60	460	385	40	60	10	20	0
	Total	9010	1090	690	300	345	3345	2410	225	350	50	195	20
2008–12	<45	310	35	30	5	15	120	65	5	10	0	10	0
	45–54	895	115	90	30	30	345	215	20	35	5	25	5
	55–64	1800	225	160	55	60	660	475	45	65	10	60	5
	65–74	2385	280	185	75	80	880	645	60	95	15	70	5
	75–84	2790	335	215	90	100	1025	785	65	105	15	55	5
	85+	1685	220	135	65	75	575	475	45	65	10	25	0
	Total	9870	1210	815	315	360	3605	2660	235	380	55	240	25
2013–17	<45	320	40	30	5	15	120	65	5	10	0	10	0
	45–54	925	115	95	25	35	365	205	15	35	5	30	5
	55–64	1985	255	210	65	70	740	490	45	70	10	60	5
	65–74	2855	340	235	85	90	1030	780	70	120	15	100	5
	75–84	2880	350	240	90	95	1040	805	70	110	15	65	5
	85+	1935	240	160	70	80	660	570	45	75	10	30	0
	Total	10 900	1340	970	345	385	3955	2915	250	420	60	290	30
2018–22	<45	345	50	30	5	15	135	45	5	10	0	10	0
	45–54	895	110	90	20	40	345	200	15	30	5	30	5
	55–64	2180	285	240	70	75	840	510	50	80	10	65	5
	65–74	3355	425	315	100	105	1220	870	75	140	20	115	10
	75–84	3250	400	280	100	105	1140	915	80	135	20	90	5
	85+	2110	265	195	70	75	715	630	50	75	15	30	5
	Total	12 135	1525	1150	375	415	4395	3170	275	465	65	340	35
2023–27	<45	395	50	35	5	15	165	45	5	10	0	10	0
	45–54	910	125	95	20	45	330	195	15	30	5	30	5
	55–64	2245	295	240	65	80	900	485	50	75	10	65	5
	65–74	3770	490	400	125	125	1405	910	85	150	20	120	10
	75–84	4010	495	360	115	125	1395	1115	100	170	25	120	10
	85+	2290	295	220	80	75	770	670	55	85	15	40	5
	Total	13 620	1750	1350	415	465	4970	3420	305	520	75	385	40
2028–32	<45	365	50	35	5	15	170	45	5	10	0	10	0
	45–54	1040	150	100	25	45	395	145	15	30	5	30	5
	55–64	2200	280	235	55	95	865	470	45	70	10	65	5
	65–74	4175	550	460	140	135	1615	945	90	165	25	125	15
	75–84	4780	630	480	145	145	1690	1260	115	200	25	140	15
	85+	2700	335	265	85	90	885	805	65	105	15	55	5
	Total	15 260	2000	1570	455	525	5620	3680	335	580	85	420	50

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

FIGURE 4.4.1
Age-standardized incidence rates (ASIRs) by region, colorectal cancer, 1983–2032



rate following a diagnosis of colorectal cancer was 65% in 2006–2008.[1]

In both males and females, the overall incidence rates of colorectal cancer have continued to decrease since 1983–1987, although the decrease was interrupted between 1993–1997 and 1998–2002 (Figure 4.4.1). This pattern appeared for all regions except in Atlantic Canada, where male rates in the last 2 observed periods increased slightly. From 2000 to 2007, colorectal cancer rates in Canada decreased significantly in both males and females by 0.8% per year (Figures 3.1 and 3.2).

Like most other cancers, the occurrence of colorectal cancer is strongly related to age, with 87% of cases in people 55 or older in 2003–2007. The ASIRs rose steeply with age, from 3.1 per 100 000 in males aged under 45 to 510.3 per 100 000 for those aged 85 and over and, correspondingly, from 2.9 to 394.9 per 100 000 in females (Tables 4.4.3 and 4.4.4). The incidence rates in males and females were almost the same in those under 45 (Figure 4.4.2). Above this age, the male-to-female incidence rate ratio increased with age to 1.6:1 in the 65–74 age group and then decreased to 1.3:1 in those aged 85 or older.

The predictions indicate that the incidence rates of colorectal cancer for both males and females will marginally decrease and then stabilize in most regions of Canada except Quebec, where rates will show a relatively striking decrease (Figure 4.4.1). Only male rates in the Atlantic region are predicted to increase until 2013–2017, followed by a levelling off. Internal ranking of the ASIRs in geographical areas is projected to be similar for both sexes, with elevated rates in the Atlantic region, where the highest rates will be in Newfoundland and Labrador, and the lowest rates in British Columbia. The long-term trends of the rates are projected to approach convergence everywhere except in the Atlantic region.

The rates are expected to rise in younger people (< 55), displaying a downward trend in the under 45 age group after 2018–2022 in males and 5 years later in females. The rates will decrease in the opposite ages (≥ 55), showing a reverse trend in 55–64 age range after 2018–2022 in men and 5 years sooner in women.

From 2003–2007 to 2028–2032, the ASIRs of colorectal cancer for Canada are expected to decrease by 6% in both sexes, from 60.8 to 57.0 per 100 000 for males and from 41.0 to 38.6 per 100 000 for females (Tables 4.4.3 and 4.4.4). Because of projected Canada population growth and aging, the annual number of new male cases is predicted to increase by 87%, from 10 620 to 19 815, and the number of new female cases, by 69%, from 9010 to 15 260 (Tables 4.4.1 and 4.4.2).

Comments

The decrease in colorectal cancer incidence likely reflects changes in prevalence of risk and protective factors and screening uptake. Lifestyle factors play a major role in colorectal cancer etiology. These risk factors include high consumption of red and processed meat, alcohol, smoking, obesity and physical inactivity.[47,84,85] High intake of fruit and vegetables may be protective.[86,87] Since the early 1960s, annual per capita red meat consumption rates in Canada increased by 25% from 65 kg (carcass weight) in 1963 to 81 kg in 1976, but has since dropped by 30% to 56 kg in 2009.[81] The proportion of Canadians who were at least moderately active increased from 39% in 1994/1995 to 52% in 2003, then stabilized in 2005.[88] A decrease in smoking prevalence began

TABLE 4.4.3
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), cancers of colon and rectum, males, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	3.1	2.7	3.0	2.3	3.5	3.2	3.0	3.4	4.7	2.6	3.8	4.3
	45–54	42.5	36.7	41.9	43.1	47.5	43.5	40.7	49.7	45.4	25.8	67.5	60.7
	55–64	139.5	118.9	121.4	156.1	153.6	138.7	143.7	138.9	169.7	177.6	213.3	206.6
	65–74	305.2	266.2	275.7	339.1	285.3	299.0	332.0	288.9	351.9	324.1	406.4	530.9
	75–84	449.0	401.2	454.3	424.0	445.9	413.3	511.3	473.1	547.0	535.9	629.0	605.7
	85+	510.3	480.5	454.5	471.1	528.6	456.2	611.7	539.1	715.8	504.8	607.4	580.6
	Total	60.8	53.5	56.8	62.8	61.6	58.7	66.0	61.8	73.7	66.4	84.7	91.1
2008–12	<45	3.3	3.0	3.0	3.7	3.5	3.4	2.8	3.1	4.8	2.8	4.1	4.1
	45–54	39.9	35.2	39.5	39.4	45.7	40.0	36.8	47.5	47.9	27.4	59.7	58.9
	55–64	136.1	108.8	120.8	141.9	145.8	139.7	136.4	144.5	157.7	132.9	222.5	223.2
	65–74	295.0	263.0	273.0	355.4	298.5	284.0	319.7	289.0	342.5	362.6	424.7	574.2
	75–84	452.3	397.1	460.2	462.1	460.6	420.4	512.2	488.4	550.6	556.4	655.2	673.5
	85+	497.4	464.6	494.3	480.7	512.2	440.3	589.4	521.5	727.2	592.3	633.8	903.9
	Total	59.7	52.1	56.9	64.7	61.9	57.6	63.8	62.2	72.6	67.0	87.3	100.9
2013–17	<45	3.5	3.2	3.2	3.6	2.7	3.9	2.7	3.1	5.2	2.8	4.2	4.1
	45–54	40.5	35.7	40.0	39.6	50.3	39.9	36.6	55.1	51.7	28.0	56.9	58.9
	55–64	130.9	108.0	122.6	140.0	141.5	136.4	125.4	139.6	145.7	101.0	218.8	230.6
	65–74	285.8	251.6	261.0	347.0	300.8	275.9	306.4	291.9	338.7	379.7	438.4	599.9
	75–84	446.9	392.5	455.9	509.5	460.0	415.1	512.3	479.6	531.5	580.5	680.9	702.7
	85+	494.6	438.8	512.7	509.8	502.3	436.4	598.5	539.0	742.2	580.7	645.7	940.8
	Total	58.6	51.1	56.4	65.9	61.6	56.9	62.0	62.7	71.4	66.2	88.7	104.7
2018–22	<45	3.8	3.5	3.5	3.5	2.7	4.4	2.7	3.0	5.3	2.8	4.2	4.1
	45–54	41.8	38.6	41.3	48.3	47.9	41.5	37.4	54.3	55.7	28.5	57.4	58.9
	55–64	127.4	109.7	123.7	134.7	147.6	131.0	119.3	149.1	146.1	105.2	198.6	235.7
	65–74	279.6	240.0	257.1	332.5	291.3	279.5	294.0	297.4	317.3	306.3	452.1	617.5
	75–84	434.3	391.0	440.7	544.1	457.3	399.2	501.7	469.7	536.1	643.4	702.5	722.7
	85+	487.0	425.0	519.7	524.5	509.8	432.1	597.5	550.2	688.7	579.1	670.8	966.0
	Total	57.7	50.8	56.1	66.7	61.2	56.6	60.3	63.5	70.1	63.9	89.0	107.4
2023–27	<45	3.8	3.5	3.5	3.4	2.7	4.5	2.7	3.0	5.3	2.8	4.2	4.1
	45–54	45.4	42.6	44.8	47.6	38.1	48.5	37.8	53.9	60.3	28.7	57.6	58.9
	55–64	129.2	112.5	125.2	137.6	159.2	131.7	121.4	171.1	154.6	105.8	189.9	238.3
	65–74	270.4	242.5	261.3	335.9	287.6	273.5	278.7	290.3	295.6	246.9	437.6	626.4
	75–84	423.4	377.6	424.2	535.9	461.6	393.5	491.7	480.2	526.2	653.4	719.3	732.9
	85+	483.4	431.7	508.6	611.8	504.2	429.3	611.0	532.3	683.8	615.1	692.8	978.9
	Total	57.2	51.2	56.2	67.7	61.0	56.8	59.2	65.1	69.5	60.6	88.1	108.7
2028–32	<45	3.8	3.5	3.5	3.4	2.7	4.5	2.6	3.0	5.3	2.8	4.2	4.1
	45–54	49.1	46.4	48.8	46.8	38.1	55.4	38.7	53.5	60.5	28.9	57.8	58.9
	55–64	132.7	120.5	128.7	162.3	153.5	136.5	124.7	170.1	163.4	106.5	190.5	240.9
	65–74	265.4	245.7	263.2	321.2	297.6	266.7	270.5	315.9	299.2	253.7	402.4	635.5
	75–84	414.9	364.4	420.8	518.3	445.0	399.6	475.4	489.1	493.5	518.1	738.5	743.2
	85+	464.0	427.9	489.1	621.8	503.3	406.0	588.6	530.5	694.7	694.5	711.4	991.9
	Total	57.0	51.9	56.8	68.2	60.5	57.5	58.2	67.0	69.4	57.1	86.7	110.0

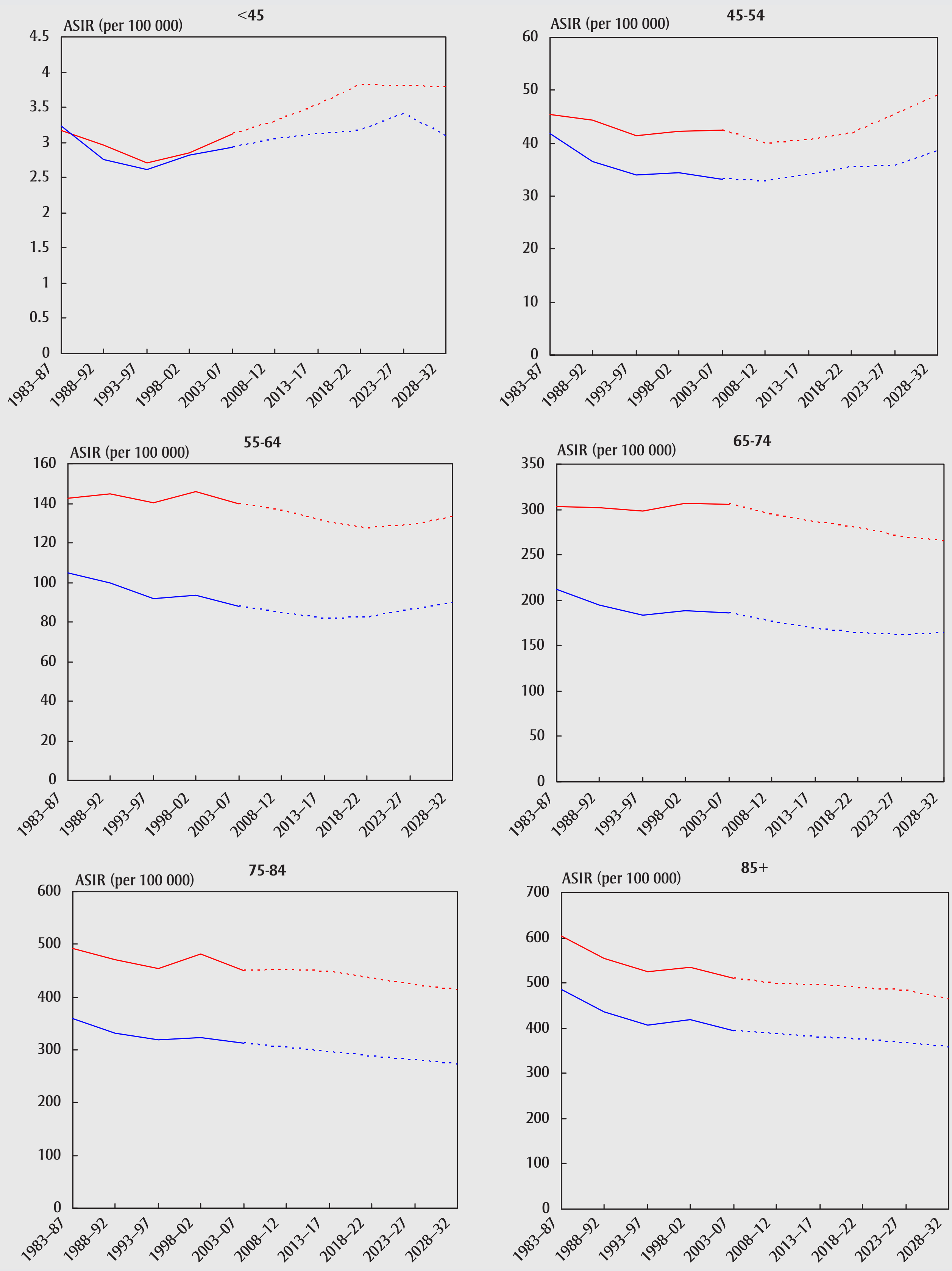
Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

TABLE 4.4.4
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), cancers of colon and rectum, females, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	2.9	2.7	2.4	2.5	4.0	3.1	2.8	2.6	4.2	4.2	3.9	4.6
	45–54	33.1	31.4	32.1	33.7	33.9	32.7	33.0	29.9	38.3	38.8	48.7	62.3
	55–64	88.0	74.8	77.2	94.3	89.0	87.4	92.8	90.5	99.0	101.4	137.8	128.0
	65–74	185.9	167.1	177.4	193.5	171.0	184.0	193.3	168.4	226.7	214.0	263.7	248.8
	75–84	311.9	283.0	284.7	296.5	320.0	299.8	339.7	314.4	393.7	348.3	390.4	394.0
	85+	394.9	346.2	364.1	368.6	380.5	368.4	472.1	396.1	463.0	493.3	360.6	482.6
	Total	41.0	36.7	37.8	41.1	41.1	40.2	43.6	39.6	49.8	47.9	55.5	56.9
2008–12	<45	3.0	2.7	2.5	2.4	4.2	2.9	2.9	2.9	3.9	3.6	5.1	6.1
	45–54	32.7	30.7	32.3	36.6	34.2	32.7	32.8	27.7	40.1	38.4	58.8	67.7
	55–64	84.4	75.1	82.3	88.6	81.5	82.7	89.6	79.2	97.7	99.1	148.6	111.4
	65–74	176.3	151.8	168.0	194.0	170.7	170.1	186.2	173.6	222.2	206.9	299.8	220.6
	75–84	304.1	273.0	290.5	296.0	299.8	287.6	337.3	296.6	380.6	357.0	406.3	422.1
	85+	387.2	360.2	388.1	367.4	391.3	347.5	456.1	383.2	460.1	454.6	388.8	614.2
	Total	39.8	35.4	38.1	40.8	40.0	38.1	42.7	38.2	48.9	46.7	61.6	57.5
2013–17	<45	3.1	2.9	2.5	2.4	4.2	2.9	2.8	2.8	3.8	3.7	5.7	6.0
	45–54	34.0	31.2	32.7	35.0	38.8	33.7	33.7	28.4	42.1	39.9	67.4	66.5
	55–64	81.7	74.7	87.6	92.7	85.7	80.3	84.0	76.3	95.4	95.9	147.0	109.6
	65–74	169.4	143.5	163.9	183.7	163.0	161.3	182.4	160.4	217.1	198.9	328.6	217.6
	75–84	296.4	268.6	295.9	313.8	281.8	275.3	329.0	293.5	374.5	347.9	436.6	417.2
	85+	379.5	338.3	384.6	381.1	383.2	339.5	451.2	359.9	492.0	445.5	426.0	607.4
	Total	38.9	34.7	38.5	41.1	39.6	36.8	41.6	36.6	48.6	45.7	66.3	56.7
2018–22	<45	3.2	3.2	2.5	2.4	4.1	3.1	1.9	2.7	3.8	3.7	6.2	6.0
	45–54	35.4	30.3	33.2	32.9	49.9	33.3	37.7	29.3	43.0	41.6	77.1	65.8
	55–64	82.3	76.7	89.6	96.0	85.1	81.2	82.9	79.4	97.6	96.6	157.6	108.5
	65–74	163.9	145.4	168.2	181.5	153.9	157.3	174.5	145.7	211.5	192.4	314.1	215.7
	75–84	287.9	255.1	291.4	319.4	277.8	262.7	320.9	287.3	375.2	338.0	473.0	413.9
	85+	373.6	338.3	398.7	375.5	352.8	329.9	447.2	360.1	456.7	438.6	428.1	602.9
	Total	38.4	34.6	39.0	41.1	39.6	36.2	40.5	35.7	48.2	45.1	68.9	56.2
2023–27	<45	3.4	3.1	2.5	2.4	4.1	3.6	1.9	2.6	3.8	4.0	6.4	6.0
	45–54	35.7	34.5	33.1	32.8	49.7	31.6	34.9	28.8	42.9	41.9	79.8	65.4
	55–64	85.9	79.4	90.3	92.9	95.5	85.3	84.3	83.2	102.2	100.9	166.0	107.9
	65–74	161.0	146.0	176.9	189.4	163.5	157.0	164.2	145.4	208.6	189.1	301.3	214.7
	75–84	280.3	247.2	285.0	304.1	266.4	255.9	313.4	271.9	369.1	329.0	488.8	412.3
	85+	366.4	335.3	399.8	416.4	341.1	321.2	429.5	363.3	472.5	430.1	450.6	600.7
	Total	38.3	35.0	39.4	41.2	40.6	36.4	39.1	35.4	48.3	45.0	70.0	56.0
2028–32	<45	3.1	3.1	2.5	2.4	4.1	3.5	1.9	2.6	3.8	3.6	6.7	6.0
	45–54	38.5	37.8	33.1	32.8	49.4	36.2	25.0	28.3	42.7	45.2	82.6	65.0
	55–64	89.5	78.0	91.2	88.0	118.6	85.8	92.2	86.2	104.2	105.1	180.9	107.4
	65–74	163.4	152.4	179.7	194.6	160.2	160.5	162.7	152.0	213.9	191.8	309.6	213.7
	75–84	273.3	252.5	293.5	303.0	254.9	252.7	299.8	252.2	360.8	320.8	452.1	410.6
	85+	356.9	313.2	388.8	399.9	343.1	308.0	423.3	354.6	463.8	419.0	477.6	598.5
	Total	38.6	35.5	39.9	41.0	41.9	36.9	38.1	35.3	48.4	45.3	71.3	55.8

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

FIGURE 4.4.2
Age-standardized incidence rates (ASIRs) for colorectal cancer by age group (– males, – females), Canada, 1983–2032



in the mid-1960s in males and in the mid-1980s in females in Canada.[42,43] These risk factor changes may partly account for the decrease in incidence.

The use of hormone replacement therapy (estrogen plus progesterone) by women appears to reduce colorectal cancer risk;[89] this may partially explain the lower incidence in females than in males, especially in those older than 55. In addition, compared with males, females in Canada have been engaging in healthier eating patterns.[90,91] This may also contribute to the gender difference in colorectal cancer risk. Known modifiable risk factors and genetic factors explain only a fraction of colorectal cancer cases.[36]

The decrease in colorectal cancer incidence rates may also result from the introduction or increased use of screening that allows the detection and removal of adenomatous polyps.[92,93] The screening rates increased from 2005 to 2008 in most provinces in Canada.[94] In 2008, 32% (range: 16%–46%) of Canadians aged 50 to 74 reported having either a fecal occult blood test (FOBT) in the past 2 years or a sigmoidoscopy/colonoscopy in the past 5 years.[36,94] Uptake of screening in Canada lags behind that in the US.[36,95] As of 2010, all provinces had announced or started implementing organized colorectal cancer screening programs. It should be noted that these estimates may change with the increased use of screening in the near future, which may result in more colorectal cancer cases being diagnosed in the early stages.

5. Liver cancer

In 2003–2007, liver cancer was responsible for 1.3% and 0.5% of all new cancer cases in Canadian males and females, respectively. During this period, the average annual number of new cases of liver cancer was 1025 in males and 350 in females (Tables 4.5.1 and 4.5.2). While incidence rates for all cancers combined and for most types of cancer are stable or decreasing, liver cancer incidence rates are rising significantly in both sexes. Though rare in Canada, liver cancer is the second fastest increasing cancer in both males and females (after thyroid cancer). Between 1998 and 2007, liver cancer rates rose an average of 3.6% per year in males and 2.4% per year in females (Figures 3.1 and 3.2). Approximately 95% of all liver cancer cases in the last observed period occurred in people aged 45 or older (Tables 4.5.1 and 4.5.2). The overall incidence rate of liver cancer in males was 3.5 times higher than in females (Tables 4.5.3 and 4.5.4). The male-to-female ratio of the rates ranged between 2.5:1 and 5.1:1 for all age groups. Survival is poor, with a 5-year relative survival rate of 20% in 2006–2008.[1]

Figure 4.5.1 shows that the ASIRs of liver cancer are predicted to increase and eventually plateau in both sexes in all regions except in the Atlantic region for females, where it will stay unchanged. Male incidence rates in Ontario and Quebec are expected to reach a peak after 20 years and then decrease marginally. Female rates are projected to peak in Quebec after 10 years and in the Prairies and for Canada as a whole 5 years later. The rates in Atlantic Canada are predicted to be between 1.5 and 2.3 times lower than in the other regions for both males and females from 2008–2012 to 2028–2032, a result of the increased divergence in the rates over the observed periods. British Columbia is projected to experience the highest incidence rates across the country.

Rates for Canadian men in the 45–54 age group are predicted to have reached a peak already and to decrease until 2028–2032 (Figure 4.5.2). The gap in rates between the sexes will widen over time for those aged 55 or older, peaking in 2013–2017 and 2023–2027 for the 55–64 and 65–74 age groups, respectively.

From 2003–2007 to 2028–2032, the Canadian ASIRs for liver cancer are projected to increase by 43% in males, from 5.7 to 8.2 per 100 000, and by 15% in females, from 1.6 to 1.9 per 100 000 (Tables 4.5.3 and 4.5.4). The annual number of new cases in males is projected to increase by 178%, from 1025 to 2845, and the number of new cases in females is projected to increase by 117%, from 350 to 760 (Tables 4.5.1 and 4.5.2).

Comments

Chronic infection with HBV or hepatitis C virus (HCV) is the primary risk factor for the development of most liver cancers worldwide.[47,86,96,97] A recent report from the Mayo Clinic based on a US cohort suggests the main cause of the increase in liver cancer has been the rise in chronic HCV infection.[97] HCV is much more common than HBV in Canada, with incidence rates in 2000 of 61.0 and 3.2 per 100 000 people, respectively.[98] The incidence rates of HCV for both Canadian males and females increased sharply beginning in 1992, the start of widespread testing for HCV, reached their peaks in 1995, and have since decreased but remained high.[98,99] Given a latency period of approximately 20 years between the time of infection with HCV and the onset of liver cancer,[100,101] HCV is likely responsible for a substantial proportion of the observed and projected increases in liver cancer incidence. The higher rates of liver cancer in British Columbia may be in part explained by the higher HCV rates in this province.[99]

Although HCV is the leading risk factor for liver cancer in Western countries—especially in Canada—HBV is implicated in over two-thirds of liver cancers in the developing countries.[86] HBV infection accounts for 23% of all hepatocellular carcinoma in developed countries.[1] HBV vaccination in early childhood greatly reduces the likelihood of hepatitis B.[76] Currently, all provinces and territories have a childhood hepatitis B immunization program.[102,103] The ongoing increasing trends of liver cancer incidence in Canada, especially in British Columbia, are possibly linked to the increasing immigration from endemic areas of HBV.[75-78,104] The number of immigrants in Canada reached 6.2 million, or 20% of the total population, in 2006, with Asia and the Middle East accounting for 41% of the immigrant population.[105,106] In British Columbia, the proportion of immigrants was 27% of the total provincial population in 2006, with 54% of the immigrant population coming from Asia and the Middle East, and 28% from Eastern Asia, mainly China. East Asia is one of the areas with high HBV prevalence.[76-78] Significantly higher incidence rates of liver cancer have been found in immigrants from South-East Asia and North-East Asia.[104]

TABLE 4.5.1
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), liver cancer, males, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	50	10	5	0	0	20	10	0	0	0	0	0
	45–54	175	30	25	0	5	75	30	0	5	0	0	0
	55–64	265	40	25	5	10	100	70	5	5	0	0	0
	65–74	285	45	25	5	10	105	85	5	5	0	5	0
	75–84	210	30	15	5	5	75	65	5	5	0	0	0
	85+	40	5	5	0	5	10	15	0	0	0	0	0
	Total	1025	160	95	20	30	390	280	15	20	5	10	0
2008–12	<45	50	10	5	0	0	25	10	0	0	0	0	0
	45–54	180	35	20	0	5	80	35	0	5	0	0	0
	55–64	425	65	50	5	10	165	105	5	5	0	5	0
	65–74	375	55	30	5	15	145	110	5	10	0	5	0
	75–84	265	40	25	5	10	90	85	5	5	0	0	0
	85+	70	10	10	0	5	20	25	0	0	0	0	0
	Total	1370	210	140	20	45	520	370	20	25	5	10	0
2013–17	<45	50	10	5	0	0	25	10	0	0	0	0	0
	45–54	180	35	25	0	5	80	35	0	5	0	0	0
	55–64	535	80	60	5	15	220	120	5	5	0	5	0
	65–74	575	85	50	10	20	215	160	5	15	0	5	0
	75–84	320	45	30	5	10	110	105	5	5	0	5	0
	85+	100	15	10	0	5	30	30	0	0	0	0	0
	Total	1760	270	185	25	55	680	460	20	30	5	15	0
2018–22	<45	50	10	5	0	0	30	10	0	0	0	0	0
	45–54	160	30	30	0	5	70	30	0	0	0	0	0
	55–64	555	85	55	5	20	235	130	5	10	0	5	0
	65–74	855	125	90	10	25	325	210	10	15	5	10	0
	75–84	410	60	35	5	15	145	125	10	10	0	5	0
	85+	130	20	15	0	5	40	45	0	0	0	0	0
	Total	2165	330	230	30	70	845	550	25	40	10	20	0
2023–27	<45	50	10	5	0	0	25	10	0	0	0	0	0
	45–54	150	30	30	0	5	65	25	0	0	0	0	0
	55–64	530	80	60	5	20	225	115	5	10	0	5	0
	65–74	1025	150	100	10	30	410	240	10	20	5	10	0
	75–84	620	95	55	5	15	210	180	10	15	0	5	0
	85+	155	20	20	5	5	50	50	0	0	0	0	0
	Total	2530	390	270	30	80	990	620	25	45	10	20	0
2028–32	<45	50	10	5	0	0	25	10	0	0	0	0	0
	45–54	140	35	35	0	5	65	25	0	0	0	0	0
	55–64	475	75	60	5	20	200	105	5	5	0	5	0
	65–74	1065	155	95	10	35	435	245	10	20	5	10	0
	75–84	905	140	95	10	20	315	230	10	20	5	10	0
	85+	210	30	20	5	10	65	65	5	5	0	0	0
	Total	2845	450	310	35	90	1110	675	30	50	10	25	0

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

TABLE 4.5.2
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), liver cancer, females, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	20	5	0	0	0	10	5	0	0	0	0	0
	45–54	35	5	5	0	0	15	5	0	0	0	0	0
	55–64	55	10	5	0	0	20	15	0	0	0	0	0
	65–74	90	15	5	0	5	30	30	0	0	0	0	0
	75–84	110	15	10	0	5	35	35	0	0	0	0	0
	85+	40	5	5	0	0	5	15	0	0	0	0	0
	Total	350	55	35	5	15	120	105	5	10	0	5	0
2008–12	<45	25	0	0	0	0	10	5	0	0	0	0	0
	45–54	40	5	5	0	0	20	10	0	0	0	0	0
	55–64	75	15	10	0	5	25	20	0	0	0	0	0
	65–74	105	15	10	0	5	40	30	0	0	0	0	0
	75–84	130	15	15	5	5	45	40	0	0	0	0	0
	85+	60	10	10	0	5	15	20	0	0	0	0	0
	Total	435	65	45	10	15	150	125	5	5	0	5	0
2013–17	<45	25	5	0	0	0	10	5	0	0	0	0	0
	45–54	30	5	5	0	0	20	10	0	0	0	0	0
	55–64	95	20	10	0	5	40	20	0	0	0	0	0
	65–74	135	20	10	0	5	50	40	0	0	0	0	0
	75–84	145	20	15	5	5	50	50	0	0	0	0	0
	85+	80	10	10	0	5	20	30	0	0	0	0	0
	Total	520	80	55	10	20	185	150	5	10	0	5	0
2018–22	<45	30	5	0	0	0	10	5	0	0	0	0	0
	45–54	25	5	5	0	0	15	10	0	0	0	0	0
	55–64	110	25	10	0	5	50	25	0	0	0	0	0
	65–74	175	30	15	5	5	65	45	0	0	0	0	0
	75–84	165	20	20	5	5	55	55	0	0	0	0	0
	85+	100	15	15	0	5	25	35	0	0	0	0	0
	Total	605	100	65	10	20	220	170	10	10	0	5	0
2023–27	<45	30	5	5	0	0	15	5	0	0	0	0	0
	45–54	25	5	5	0	0	10	10	0	0	0	0	0
	55–64	90	25	10	0	5	45	25	0	0	0	0	0
	65–74	215	35	20	5	5	90	45	5	0	0	0	0
	75–84	210	30	25	5	5	65	60	5	5	0	0	0
	85+	110	15	15	0	5	25	40	0	0	0	0	0
	Total	680	115	80	10	25	250	185	10	10	0	5	0
2028–32	<45	30	5	5	0	0	15	5	0	0	0	0	0
	45–54	30	10	5	0	0	15	10	0	0	0	0	0
	55–64	70	25	10	0	5	35	20	0	0	0	0	0
	65–74	235	40	25	5	5	105	50	5	0	0	0	0
	75–84	265	40	35	5	10	85	70	5	5	0	5	0
	85+	125	15	20	0	5	30	40	0	0	0	0	0
	Total	760	130	95	10	25	285	195	10	10	0	5	0

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

TABLE 4.5.3
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), liver cancer, males, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	0.5	0.6	0.3	0.5	0.3	0.5	0.5	0.2	0.1	1.0	0.2	0.0
	45–54	7.1	9.7	8.8	2.4	5.1	8.3	5.2	1.9	4.5	3.6	3.8	2.6
	55–64	15.3	16.1	16.6	10.9	13.8	15.8	16.2	10.3	12.5	4.3	6.5	10.9
	65–74	26.5	28.2	25.9	14.7	22.3	25.6	32.4	15.9	17.4	19.4	18.0	10.9
	75–84	33.7	35.9	32.1	16.9	31.3	30.4	44.9	25.0	22.6	36.8	16.7	0.0
	85+	27.3	21.5	38.6	16.0	38.9	20.9	43.1	14.6	18.6	26.6	8.9	0.0
	Total	5.7	6.3	5.9	3.3	5.0	5.7	6.5	3.3	3.8	4.3	3.0	2.0
2008–12	<45	0.5	0.6	0.4	0.5	0.4	0.6	0.5	0.2	0.2	0.4	0.3	0.4
	45–54	6.6	9.1	7.2	2.8	5.8	7.4	5.2	2.1	3.4	5.1	3.4	2.2
	55–64	20.5	22.3	24.4	9.1	15.4	21.4	20.6	8.4	10.6	15.8	10.7	5.2
	65–74	30.4	30.1	30.2	16.4	32.4	31.2	35.2	17.5	21.7	23.4	15.9	11.7
	75–84	37.9	40.7	42.3	20.4	33.9	32.7	50.1	28.5	29.1	29.2	19.9	25.8
	85+	34.0	32.4	49.3	22.6	41.0	27.0	50.8	22.4	10.9	26.2	17.8	48.3
	Total	6.6	7.2	7.2	3.5	6.1	6.6	7.4	3.5	4.0	5.1	3.5	3.2
2013–17	<45	0.5	0.7	0.4	0.5	0.4	0.7	0.5	0.2	0.2	0.4	0.3	0.4
	45–54	6.4	9.0	8.6	2.8	5.8	7.0	5.3	2.2	3.4	5.0	3.4	2.0
	55–64	22.7	24.6	24.9	9.5	17.9	25.1	21.6	7.3	10.5	17.5	11.9	4.7
	65–74	36.8	37.7	37.1	17.4	36.8	36.8	41.3	17.9	27.6	28.4	19.3	10.7
	75–84	41.6	41.5	47.2	21.5	38.6	37.1	54.9	31.2	29.3	32.1	21.8	23.6
	85+	36.8	35.9	48.3	23.8	46.3	28.7	52.1	22.3	16.3	28.3	19.3	44.0
	Total	7.4	8.0	8.0	3.6	6.8	7.5	8.1	3.6	4.5	5.7	3.9	2.9
2018–22	<45	0.5	0.7	0.4	0.5	0.4	0.7	0.5	0.2	0.2	0.4	0.2	0.3
	45–54	6.3	8.8	9.7	2.8	5.8	6.8	5.3	2.2	3.4	4.8	3.3	1.8
	55–64	21.4	23.2	21.0	9.7	19.8	23.5	21.0	7.4	10.4	16.5	11.2	4.3
	65–74	45.3	46.5	49.1	18.0	40.1	46.0	46.5	16.5	27.3	34.9	23.7	9.7
	75–84	44.1	43.9	45.1	22.3	41.9	40.6	54.6	32.7	37.6	34.0	23.1	21.5
	85+	41.7	40.7	58.7	24.7	50.2	31.2	60.6	22.9	20.5	32.2	21.9	40.3
	Total	7.9	8.6	8.7	3.7	7.4	8.1	8.5	3.5	4.8	6.1	4.2	2.7
2023–27	<45	0.4	0.7	0.4	0.5	0.4	0.6	0.5	0.2	0.2	0.3	0.2	0.3
	45–54	5.7	9.0	10.3	2.8	5.8	6.6	4.2	2.2	3.4	4.4	3.0	1.7
	55–64	20.3	22.1	22.1	9.9	20.7	21.5	20.0	7.4	10.4	15.6	10.6	4.0
	65–74	46.8	48.1	44.5	18.4	41.8	49.2	46.4	14.5	27.2	36.0	24.5	8.8
	75–84	51.8	53.0	52.2	22.7	43.7	46.3	61.3	33.0	44.2	39.9	27.1	19.6
	85+	42.7	37.1	55.8	25.1	52.3	34.4	59.8	26.5	18.2	32.9	22.4	36.8
	Total	8.2	8.9	8.7	3.8	7.6	8.3	8.5	3.5	5.0	6.3	4.3	2.4
2028–32	<45	0.4	0.7	0.4	0.5	0.4	0.6	0.5	0.2	0.2	0.3	0.2	0.3
	45–54	5.2	9.1	10.9	2.8	5.8	6.2	4.0	2.2	3.4	4.0	2.7	1.6
	55–64	19.5	21.3	23.2	10.0	21.7	20.4	19.6	7.5	10.4	15.0	10.2	3.6
	65–74	43.7	45.3	37.5	18.7	43.6	45.4	43.4	14.5	27.1	33.7	22.9	8.0
	75–84	61.4	63.2	64.6	23.1	45.5	56.5	66.0	30.6	44.0	47.3	32.2	17.8
	85+	44.9	42.3	50.0	25.6	54.4	36.5	57.5	25.1	30.0	34.6	23.6	33.5
	Total	8.2	9.1	8.8	3.9	7.9	8.3	8.3	3.4	5.1	6.3	4.3	2.2

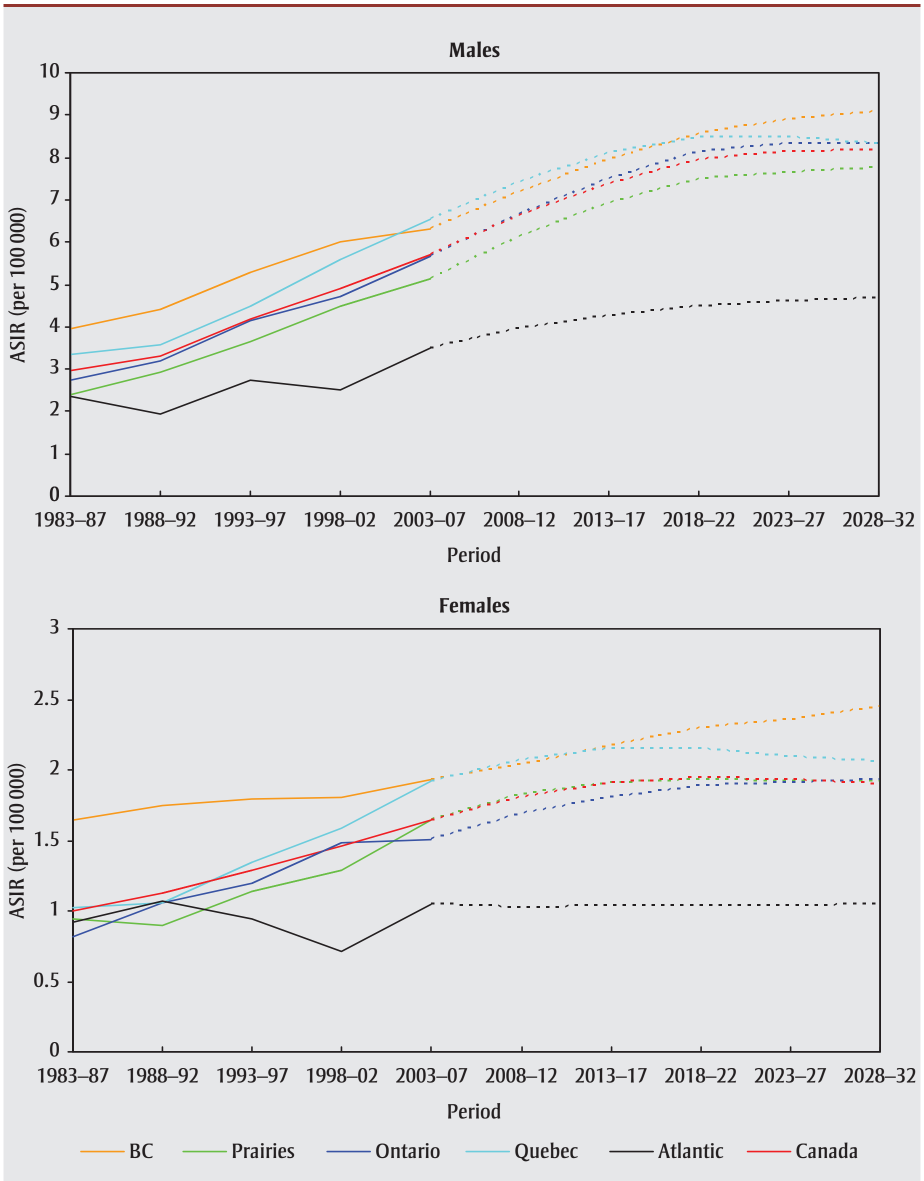
Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

TABLE 4.5.4
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), liver cancer, females, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	0.2	0.3	0.2	0.2	0.1	0.2	0.2	0.1	0.4	0.0	0.3	0.0
	45–54	1.4	2.0	1.3	0.3	1.7	1.6	1.0	0.3	0.5	2.0	0.9	0.0
	55–64	3.2	3.9	4.4	0.8	2.7	3.2	3.2	1.7	2.6	2.1	0.5	8.9
	65–74	7.7	9.1	7.6	6.1	7.4	7.0	9.1	6.2	5.2	3.4	5.0	0.0
	75–84	12.5	12.7	15.1	6.5	17.1	10.8	16.7	3.1	7.5	0.0	4.8	0.0
	85+	11.0	13.3	18.2	10.2	10.0	4.9	17.9	10.5	6.4	10.7	7.8	0.0
	Total	1.6	1.9	1.9	1.0	1.7	1.5	1.9	0.9	1.3	0.7	0.9	0.8
2008–12	<45	0.2	0.2	0.2	0.1	0.1	0.2	0.2	0.1	0.3	0.1	0.1	0.1
	45–54	1.4	1.8	1.2	0.8	1.1	1.8	1.2	0.8	0.6	0.6	0.8	0.6
	55–64	3.6	5.2	4.0	2.1	3.8	3.3	3.6	2.0	1.6	1.6	2.0	1.6
	65–74	7.8	8.5	7.8	4.6	9.4	7.4	9.4	4.3	3.5	3.5	4.4	3.5
	75–84	14.4	14.4	17.3	8.6	13.8	12.7	18.2	8.0	7.0	6.4	8.2	6.5
	85+	13.7	15.0	25.7	8.1	16.7	8.0	20.8	7.6	9.3	6.1	7.8	6.1
	Total	1.8	2.0	2.0	1.1	1.8	1.7	2.1	1.0	1.0	0.8	1.0	0.8
2013–17	<45	0.3	0.2	0.2	0.2	0.1	0.3	0.2	0.1	0.3	0.1	0.1	0.1
	45–54	1.2	1.9	1.2	0.7	1.1	1.6	1.3	0.6	0.6	0.5	0.7	0.5
	55–64	4.0	6.0	4.0	2.4	4.0	4.4	3.5	2.2	1.5	1.8	2.3	1.8
	65–74	8.1	9.1	8.3	4.8	7.6	7.5	9.3	4.5	3.4	3.6	4.6	3.6
	75–84	15.1	14.6	18.7	8.9	19.3	12.9	19.6	8.4	6.6	6.7	8.6	6.8
	85+	16.1	15.6	27.0	9.6	16.7	10.6	23.4	8.9	8.8	7.2	9.1	7.2
	Total	1.9	2.2	2.1	1.1	1.9	1.8	2.2	1.1	1.0	0.8	1.1	0.9
2018–22	<45	0.3	0.2	0.2	0.2	0.1	0.3	0.2	0.2	0.4	0.1	0.2	0.1
	45–54	1.0	2.0	1.2	0.6	1.1	1.3	1.4	0.5	0.6	0.4	0.5	0.4
	55–64	4.2	6.3	4.0	2.5	4.1	4.9	3.9	2.3	1.5	1.8	2.4	1.9
	65–74	8.6	10.4	8.6	5.1	7.9	8.1	9.2	4.7	3.2	3.8	4.9	3.8
	75–84	14.6	13.6	19.8	8.7	18.5	12.7	18.4	8.1	6.3	6.5	8.3	6.5
	85+	18.1	19.3	27.8	10.7	16.9	11.4	24.6	10.0	8.3	8.1	10.2	8.1
	Total	1.9	2.3	2.2	1.2	1.9	1.9	2.1	1.1	1.0	0.9	1.1	0.9
2023–27	<45	0.3	0.2	0.2	0.2	0.1	0.3	0.2	0.2	0.4	0.1	0.2	0.1
	45–54	1.0	2.0	1.2	0.6	1.1	1.2	1.5	0.6	0.6	0.4	0.6	0.4
	55–64	3.5	6.5	4.0	2.1	4.1	4.2	4.1	1.9	1.5	1.6	2.0	1.6
	65–74	9.2	11.2	8.8	5.5	8.1	9.9	8.5	5.1	3.1	4.1	5.2	4.1
	75–84	14.8	14.1	20.4	8.8	15.1	12.2	17.5	8.2	5.9	6.6	8.4	6.6
	85+	17.2	16.3	28.6	10.2	26.5	10.7	24.5	9.5	7.8	7.7	9.8	7.7
	Total	1.9	2.4	2.2	1.1	1.9	1.9	2.1	1.1	1.0	0.9	1.1	0.9
2028–32	<45	0.3	0.2	0.2	0.2	0.1	0.3	0.2	0.2	0.5	0.1	0.2	0.1
	45–54	1.0	2.1	1.2	0.6	1.1	1.3	1.5	0.6	0.6	0.4	0.6	0.5
	55–64	2.9	6.7	4.0	1.7	4.2	3.5	4.3	1.6	1.5	1.3	1.7	1.3
	65–74	9.2	11.5	9.0	5.4	8.3	10.3	8.9	5.1	3.0	4.1	5.2	4.1
	75–84	15.2	15.6	21.0	9.0	15.4	13.1	16.3	8.4	5.6	6.8	8.6	6.8
	85+	16.5	15.8	29.4	9.8	17.2	10.4	20.6	9.1	7.4	7.3	9.3	7.4
	Total	1.9	2.4	2.3	1.1	1.9	1.9	2.1	1.0	1.0	0.8	1.1	0.8

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

FIGURE 4.5.1
Age-standardized incidence rates (ASIRs) by region, liver cancer, 1983–2032



Other risk factors include increased rates of alcohol abuse, which increases the risk of liver cirrhosis and therefore the risk of liver cancer, tobacco smoking, diabetes, obesity and non-alcoholic fatty liver disease.[86,107-109] Recent Canadian data suggest that the prevalence rates of obesity have nearly doubled in adults from 1978/79 to 2012.[51,72,73] This increase may have contributed to the increased incidence trends of liver cancer.[51,72,73,110]

6. Pancreas cancer

Cancer of the pancreas is the second most common digestive system cancer after colorectal cancer. One in 71 males and 1 in 69 females can expect to be diagnosed with pancreas cancer in their lifetime, and 1 in 72 males and 1 in 71 females can expect to die from it.[1] The average annual number of new cases in 2003–2007 was 1810 in males and 1900 in females (Tables 4.6.1 and 4.6.2), approximately 2.2% and 2.6% of all male and female cancer cases, respectively. Pancreas cancer is the fourth leading cause of cancer death in Canada and has the lowest 5-year relative survival rate, at just 8% in 2006–2008.[1] This poor prognosis results from 80% of the cancers being diagnosed at a late stage.[111]

Between 2003 and 2007, the incidence rates of pancreas cancer increased steadily with age, to 97.1 per 100 000 in males aged 85 or older and 97.8 per 100 000 in females of the same age (Tables 4.6.3 and 4.6.4). Overall, males were 21% more likely to be diagnosed than were females (ASIR of 10.3 and 8.5, respectively). The disease was rarely seen before age 45, with only 3% and 2% of all male and female pancreas cancer cases diagnosed in that age group, respectively (Tables 4.6.1 and 4.6.2). Approximately 64% of the new pancreas cancers in males occurred in those aged 65 or older; the corresponding percentage for females was 75%. Figure 4.6.2 shows the ASIRs decreasing and then stabilizing over time for both sexes. The male-to-female ratio of ASIRs decreased over time also, becoming stable or uniform in the last observation period (2003–2007) in each age group.

Figure 4.6.1 shows that the downward trend in overall male ASIRs had levelled off in the last 2 observation periods, while the rates in females had changed little throughout the entire observation period. During 1998–2007, ASIRs remained relatively constant, although they decreased non-significantly in males by 0.3% per year and increased non-significantly by 0.4% per year in females (Figures 3.1 and 3.2).

The projections of male pancreas cancer incidence show stability in the predicted rates for Canada and its regions except in Quebec and the Atlantic region (Figure 4.6.1). The male rates in Quebec are expected to decrease by 10%, from 12.2 per 100 000 in 2003–2007 to 10.9 per 100 000 in 2028–2032, whereas incidence rates in the Atlantic region will rise by 16%, from 10.9 to 12.7 per 100 000 over the same period. For females, the analysis shows predicted stability in the Canadian and regional rates. The Atlantic region, which used to have relatively low incidence, is predicted to experience the highest rates, while Ontario will continue to have the lowest incidence in males. For females, Quebec and Ontario will remain in their respective highest and lowest ranking in the rates.

The overall age-specific incidence rates in Canada are expected to stabilize in each age group (Figure 4.6.2). The difference in

FIGURE 4.5.2
Age-standardized incidence rates (ASIRs) for liver cancer by age group (– males, – females), Canada, 1983–2032

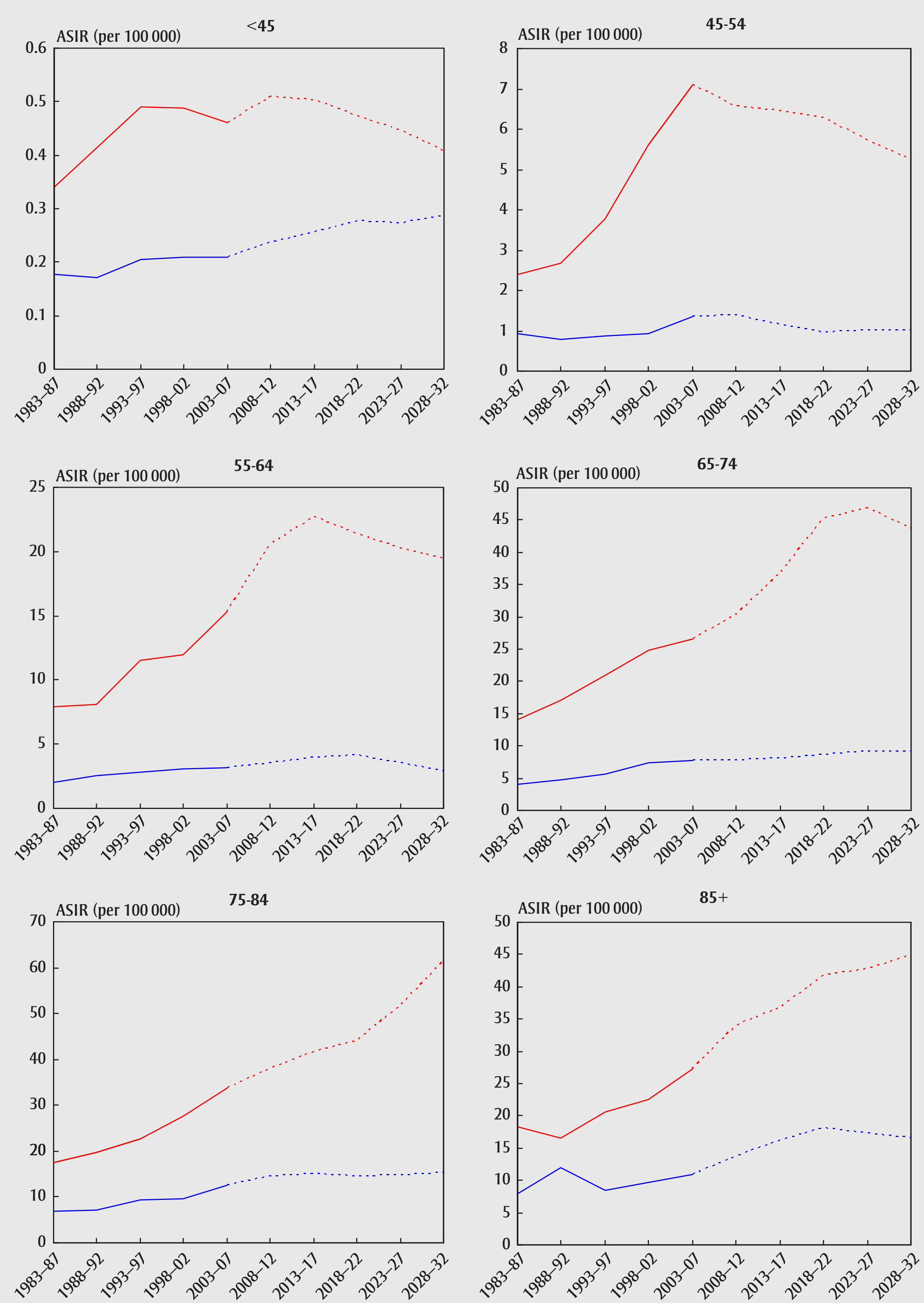


TABLE 4.6.1
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), pancreas cancer, males, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	50	5	5	5	5	20	10	0	0	0	0	0
	45–54	195	25	20	5	5	65	60	5	5	0	5	0
	55–64	415	55	35	10	15	145	120	15	15	0	5	0
	65–74	540	70	50	15	20	185	155	20	15	5	5	0
	75–84	465	65	40	15	20	155	135	15	15	0	5	0
	85+	150	25	20	5	5	40	35	5	5	0	0	0
	Total	1810	245	165	60	70	610	520	60	60	10	20	5
2008–12	<45	60	5	5	0	0	20	10	0	0	0	0	0
	45–54	210	25	20	5	5	70	60	5	10	0	0	0
	55–64	495	65	45	15	15	175	135	15	15	5	5	0
	65–74	615	75	50	20	25	205	175	25	20	5	10	0
	75–84	520	75	45	15	20	165	150	20	15	5	5	0
	85+	205	30	25	10	10	60	55	10	5	0	0	0
	Total	2100	280	190	65	75	700	590	70	70	10	25	5
2013–17	<45	60	5	5	0	0	20	10	0	0	0	0	0
	45–54	215	20	20	5	5	75	55	5	10	0	0	0
	55–64	575	80	50	15	15	200	160	15	15	5	10	0
	65–74	755	95	65	20	30	255	210	35	25	5	15	0
	75–84	570	80	50	15	20	185	160	25	20	5	5	0
	85+	255	40	30	10	10	75	70	10	10	0	0	0
	Total	2430	320	220	70	80	805	660	85	75	10	35	5
2018–22	<45	60	5	5	0	0	20	10	0	0	0	0	0
	45–54	235	20	20	5	5	75	50	5	5	0	0	0
	55–64	625	85	55	20	15	215	165	15	15	5	10	0
	65–74	915	125	85	25	30	310	245	35	25	5	20	0
	75–84	675	90	55	20	25	220	190	30	20	5	10	0
	85+	295	45	35	10	10	90	80	15	10	0	0	0
	Total	2805	370	255	80	90	935	735	100	80	15	40	5
2023–27	<45	65	5	5	0	0	20	10	0	0	0	0	0
	45–54	245	20	20	5	5	70	50	5	5	0	0	0
	55–64	640	80	55	20	15	230	150	15	15	5	10	0
	65–74	1065	150	100	30	35	360	285	35	25	5	20	0
	75–84	855	120	75	25	30	285	230	45	25	5	15	0
	85+	340	50	40	10	10	110	90	15	10	0	0	0
	Total	3210	425	295	90	100	1070	815	110	85	15	45	5
2028–32	<45	65	5	5	0	0	20	10	0	0	0	0	0
	45–54	245	20	20	5	5	70	50	5	5	0	0	0
	55–64	675	75	55	15	15	235	135	15	15	5	10	0
	65–74	1170	160	105	35	35	395	300	35	30	5	25	0
	75–84	1055	160	105	30	35	350	275	45	25	5	15	0
	85+	430	65	50	10	15	135	110	20	10	0	5	0
	Total	3635	485	340	105	110	1210	885	120	90	20	50	5

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

TABLE 4.6.2
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), pancreas cancer, females, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	45	5	5	0	0	20	15	0	0	0	0	0
	45–54	140	15	15	5	5	50	45	0	5	0	0	0
	55–64	290	45	25	10	10	95	80	10	10	0	5	0
	65–74	465	60	45	15	15	155	140	15	15	0	5	0
	75–84	625	85	50	25	20	215	180	20	25	5	0	0
	85+	335	45	30	15	15	105	100	15	15	0	0	0
	Total	1900	250	170	70	70	640	555	55	65	10	10	0
2008–12	<45	50	5	5	0	0	20	15	0	0	0	0	0
	45–54	150	15	15	5	5	55	50	5	5	0	0	0
	55–64	355	50	35	15	10	120	100	10	10	0	5	0
	65–74	530	75	50	15	15	175	155	15	20	0	5	0
	75–84	630	85	55	25	20	210	190	20	20	5	5	0
	85+	425	65	40	15	20	135	120	15	15	0	0	0
	Total	2140	290	200	75	70	715	635	65	70	10	15	5
2013–17	<45	60	5	5	0	0	30	15	0	0	0	0	0
	45–54	150	10	15	5	5	50	50	5	5	0	0	0
	55–64	410	55	50	20	10	135	110	10	15	0	5	0
	65–74	655	95	60	15	20	220	195	20	20	5	10	0
	75–84	660	90	60	20	20	220	200	20	20	5	5	0
	85+	490	75	50	20	15	155	145	15	15	0	0	0
	Total	2425	330	240	85	75	810	715	70	80	10	20	5
2018–22	<45	65	5	5	0	0	30	20	0	0	0	0	0
	45–54	160	10	15	5	5	60	50	5	5	0	0	0
	55–64	455	55	55	20	15	155	125	15	10	0	5	0
	65–74	800	115	85	25	25	270	220	25	25	5	10	0
	75–84	770	115	70	25	25	245	225	25	25	5	5	0
	85+	535	80	55	15	20	170	160	20	15	0	5	0
	Total	2785	380	285	90	90	930	800	80	85	10	25	5
2023–27	<45	65	5	5	0	0	30	20	0	0	0	0	0
	45–54	190	10	15	5	5	80	50	0	5	0	0	0
	55–64	455	45	55	20	10	150	125	10	10	0	5	0
	65–74	940	135	110	35	30	315	240	25	25	5	15	0
	75–84	985	155	90	25	30	315	280	30	30	5	10	0
	85+	600	95	65	20	20	185	170	20	20	5	5	0
	Total	3230	440	340	105	100	1075	880	90	90	15	35	5
2028–32	<45	70	5	5	0	0	35	20	0	0	0	0	0
	45–54	205	10	20	5	5	85	55	0	5	0	0	0
	55–64	475	40	50	20	10	175	120	10	10	0	5	0
	65–74	1045	130	120	40	30	355	265	30	25	5	15	0
	75–84	1215	190	125	40	40	390	315	40	40	5	15	0
	85+	725	120	75	20	25	215	205	25	25	5	5	0
	Total	3730	500	400	120	115	1250	975	105	100	15	40	5

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

TABLE 4.6.3
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), pancreas cancer, males, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	0.5	0.3	0.4	0.9	0.7	0.4	0.5	0.8	0.5	0.4	0.4	0.6
	45–54	7.7	7.4	7.0	6.0	5.7	7.2	9.6	6.4	8.7	11.2	8.4	7.6
	55–64	24.5	23.8	23.2	23.9	23.7	22.6	27.7	30.3	27.3	26.7	17.5	20.0
	65–74	50.1	44.3	53.4	48.1	54.1	45.1	58.4	76.3	49.0	73.7	28.8	34.4
	75–84	74.7	73.6	76.3	72.1	83.5	64.1	92.4	90.8	78.5	74.0	33.5	57.5
	85+	97.1	100.1	136.0	95.8	102.9	73.6	115.3	136.0	137.9	26.6	17.9	0.0
	Total	10.3	9.7	10.8	10.2	10.9	9.1	12.2	13.7	11.2	11.7	6.0	7.3
2008–12	<45	0.5	0.3	0.4	0.7	0.6	0.5	0.5	0.7	0.4	0.6	0.4	0.4
	45–54	7.6	6.9	6.2	7.4	6.0	6.4	9.2	6.7	9.9	8.6	5.4	6.5
	55–64	24.1	23.2	23.5	23.4	19.6	22.7	26.9	28.9	22.8	27.5	17.8	20.6
	65–74	49.5	43.5	46.7	48.3	57.6	44.5	56.4	79.2	49.0	56.5	50.6	37.9
	75–84	74.6	71.2	78.3	73.7	80.4	62.2	89.7	113.3	84.0	85.1	35.3	48.4
	85+	96.7	95.8	134.7	91.9	90.9	76.4	114.3	144.5	116.6	110.4	18.4	46.7
	Total	10.3	9.5	10.3	10.1	10.5	9.0	11.9	14.6	10.8	11.8	7.3	7.5
2013–17	<45	0.6	0.3	0.4	0.7	0.6	0.4	0.5	0.7	0.4	0.7	0.4	0.4
	45–54	7.8	5.9	6.4	7.5	5.9	6.8	8.4	7.0	10.1	8.9	5.4	6.4
	55–64	24.4	24.6	21.8	23.7	18.0	22.5	27.8	23.4	19.2	27.9	20.4	20.2
	65–74	48.6	43.1	46.8	51.2	53.3	43.7	53.8	83.6	49.9	55.5	58.7	37.1
	75–84	73.8	68.4	73.3	72.2	82.4	62.9	86.4	128.2	74.3	84.2	44.3	47.7
	85+	94.7	94.8	124.8	79.8	98.8	72.5	113.6	154.8	113.1	108.0	26.6	46.0
	Total	10.3	9.3	9.9	10.2	10.2	8.9	11.6	15.1	10.2	11.7	8.5	7.4
2018–22	<45	0.6	0.3	0.4	0.7	0.6	0.4	0.5	0.7	0.4	0.6	0.4	0.3
	45–54	9.1	5.8	6.3	7.5	5.7	7.3	8.4	7.2	10.2	10.4	5.4	6.3
	55–64	24.1	23.5	20.1	26.9	18.3	21.3	27.2	24.3	22.9	27.4	22.2	19.7
	65–74	48.4	45.0	47.6	47.8	46.5	43.8	53.4	75.2	41.6	55.2	57.6	36.3
	75–84	72.8	67.6	68.9	74.2	84.3	63.0	83.0	134.1	71.7	83.1	59.5	46.7
	85+	93.9	92.9	129.3	88.5	92.9	72.5	107.5	185.2	102.8	107.1	34.8	45.4
	Total	10.3	9.3	9.7	10.4	9.7	8.9	11.3	15.2	9.8	11.7	9.2	7.2
2023–27	<45	0.6	0.3	0.4	0.7	0.6	0.4	0.5	0.7	0.4	0.6	0.4	0.3
	45–54	9.5	5.7	6.2	7.5	5.7	6.8	8.4	7.3	10.2	10.8	5.4	6.2
	55–64	24.7	21.4	20.9	26.9	18.1	22.4	25.4	24.7	23.0	28.2	23.2	19.4
	65–74	48.8	47.9	44.5	49.4	44.1	43.4	55.3	63.7	39.1	55.7	59.7	35.5
	75–84	71.3	68.0	70.0	77.3	78.0	62.1	79.6	137.1	72.1	81.3	60.9	45.7
	85+	92.3	90.0	115.2	80.0	101.8	74.1	105.3	193.0	89.2	105.3	39.1	44.5
	Total	10.3	9.3	9.5	10.5	9.4	8.9	11.1	14.6	9.5	11.8	9.5	7.1
2028–32	<45	0.6	0.3	0.4	0.7	0.6	0.4	0.5	0.7	0.4	0.6	0.4	0.3
	45–54	8.9	5.6	6.1	7.5	5.6	6.8	8.4	7.4	10.3	10.2	5.4	6.1
	55–64	27.8	21.2	20.7	27.0	18.0	23.7	25.5	25.2	23.0	31.7	24.2	19.1
	65–74	47.8	45.8	42.5	54.4	44.9	41.5	53.6	64.7	43.8	54.6	61.8	34.8
	75–84	71.0	71.8	71.5	71.5	69.2	62.6	79.5	118.5	59.1	81.1	58.8	44.6
	85+	91.2	91.6	115.0	88.8	100.7	73.6	100.0	197.1	92.6	104.1	55.0	43.5
	Total	10.5	9.3	9.4	10.8	9.1	8.9	10.9	14.1	9.4	12.0	9.8	6.9

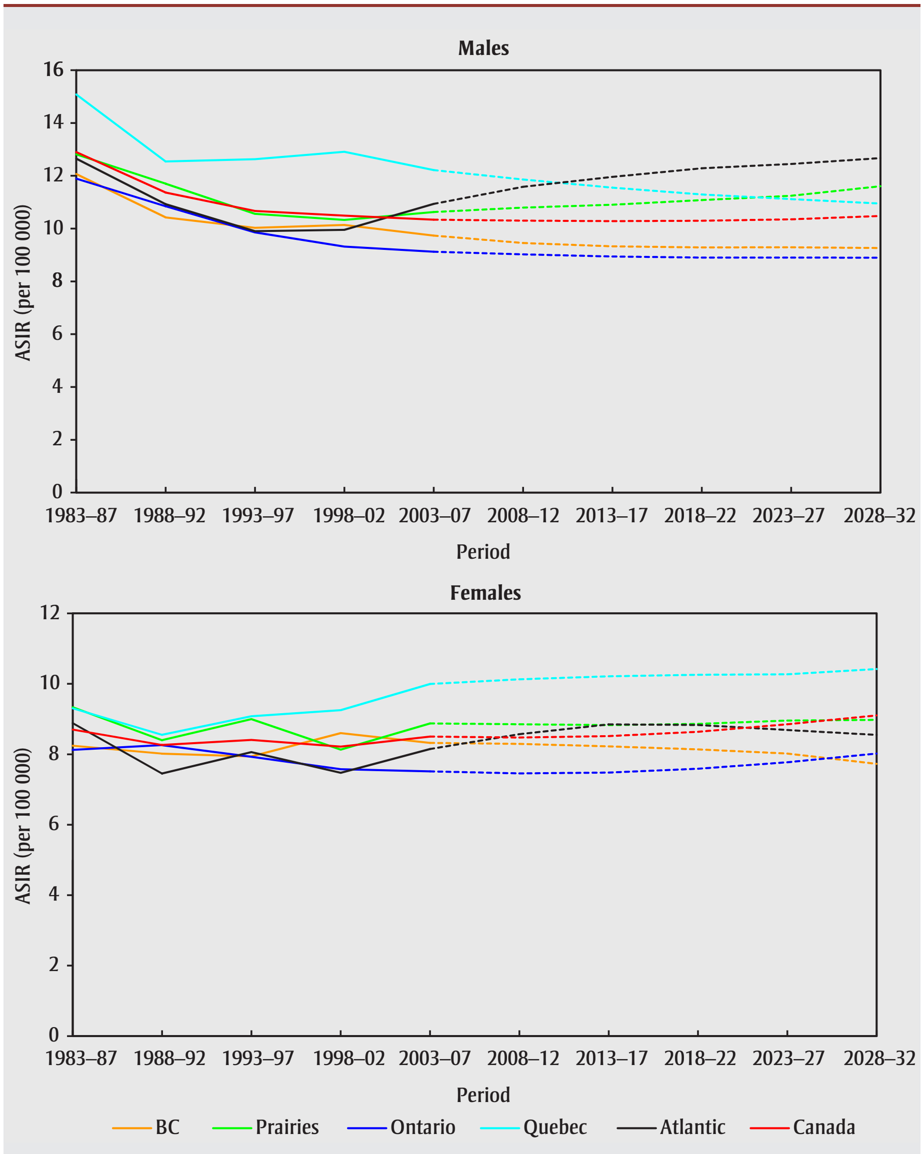
Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

TABLE 4.6.4
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), pancreas cancer, females, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	0.4	0.2	0.3	0.3	0.2	0.4	0.5	0.6	0.5	0.4	0.5	1.2
	45–54	5.6	4.7	6.5	4.9	5.7	5.3	6.9	3.9	5.4	3.5	3.5	5.8
	55–64	16.5	18.2	17.1	18.1	17.7	14.6	17.8	18.0	20.0	20.9	10.6	0.0
	65–74	38.8	37.5	45.0	41.3	40.1	33.9	45.8	44.0	37.0	22.0	15.3	40.7
	75–84	71.2	71.5	75.7	82.5	55.4	62.9	83.7	84.5	84.7	71.5	15.1	60.8
	85+	97.8	95.7	113.8	86.7	86.1	82.7	120.7	142.5	100.6	118.0	15.7	0.0
	Total	8.5	8.3	9.3	9.0	7.9	7.5	10.0	9.9	9.2	7.7	3.4	6.4
2008–12	<45	0.5	0.2	0.3	0.4	0.3	0.5	0.7	0.5	0.5	0.4	0.4	0.5
	45–54	5.5	4.0	6.1	7.0	4.6	5.0	7.3	4.7	5.1	5.0	2.9	5.4
	55–64	16.7	16.8	18.8	21.4	15.8	14.8	19.1	20.6	17.5	15.0	8.4	15.4
	65–74	39.0	39.6	44.5	42.9	37.9	34.0	45.2	44.3	41.0	35.1	20.3	37.4
	75–84	68.4	69.1	74.2	72.6	62.3	59.3	82.6	83.4	75.6	61.6	23.6	64.0
	85+	97.4	105.4	111.3	95.1	93.7	82.4	115.2	131.6	99.9	87.7	25.4	78.3
	Total	8.5	8.3	9.3	9.4	7.9	7.5	10.1	10.0	8.9	7.6	3.8	7.9
2013–17	<45	0.6	0.2	0.3	0.4	0.3	0.7	0.7	0.5	0.5	0.5	0.4	0.5
	45–54	5.5	2.8	6.0	7.1	4.1	4.7	8.3	4.7	5.1	4.9	2.9	5.0
	55–64	16.9	16.3	21.0	28.1	15.1	14.8	19.0	20.4	17.0	15.2	8.4	14.8
	65–74	38.9	40.9	41.7	38.1	38.5	34.1	45.5	44.0	38.7	35.0	25.6	35.5
	75–84	68.1	70.2	75.5	74.6	63.6	58.4	81.0	82.7	73.0	61.3	29.6	65.4
	85+	95.7	103.0	116.9	96.8	77.4	78.5	115.0	138.8	112.1	86.1	31.8	87.2
	Total	8.5	8.2	9.4	9.7	7.7	7.5	10.2	10.0	8.7	7.7	4.4	7.8
2018–22	<45	0.6	0.2	0.3	0.4	0.3	0.7	0.8	0.5	0.5	0.5	0.4	0.4
	45–54	6.3	2.8	6.0	7.1	3.8	6.0	9.2	4.7	5.1	5.7	2.9	4.6
	55–64	17.2	14.7	20.6	28.4	14.4	15.0	20.1	20.3	14.6	15.4	8.4	14.0
	65–74	39.1	40.1	44.6	42.7	38.7	34.5	44.1	46.4	37.8	35.2	31.0	34.1
	75–84	68.2	74.3	75.2	78.8	63.7	56.8	79.4	80.7	75.3	61.4	35.6	62.9
	85+	94.7	99.8	111.3	83.2	95.5	77.7	114.4	130.3	95.0	85.2	38.2	92.2
	Total	8.6	8.1	9.5	10.1	7.8	7.6	10.3	10.0	8.4	7.8	5.1	7.5
2023–27	<45	0.6	0.2	0.3	0.4	0.3	0.7	0.8	0.5	0.5	0.5	0.4	0.4
	45–54	7.3	2.8	6.0	7.2	3.6	7.6	9.3	4.7	5.1	6.6	2.9	4.2
	55–64	17.3	11.6	20.5	28.6	13.9	14.4	21.7	20.3	14.6	15.6	8.4	13.0
	65–74	40.0	40.0	48.5	53.6	39.0	35.1	43.3	46.3	35.6	36.0	36.2	32.8
	75–84	68.8	77.2	71.2	69.3	67.5	57.7	78.4	81.5	70.5	61.9	41.4	59.3
	85+	95.7	106.3	119.1	97.9	90.6	77.1	108.6	136.3	100.5	86.1	44.3	89.9
	Total	8.9	8.0	9.7	10.6	7.8	7.8	10.3	10.0	8.1	8.0	5.7	7.1
2028–32	<45	0.6	0.2	0.3	0.4	0.3	0.7	0.8	0.5	0.5	0.5	0.4	0.4
	45–54	7.5	2.7	5.9	7.2	3.5	7.6	9.4	4.7	5.1	6.8	2.9	3.8
	55–64	19.4	11.5	20.5	28.7	13.5	17.4	23.3	20.3	14.6	17.4	8.4	11.9
	65–74	40.6	35.6	47.7	53.9	38.5	35.2	45.0	46.2	32.0	36.5	42.0	30.9
	75–84	69.3	75.9	77.4	80.0	69.2	58.1	75.0	85.0	70.4	62.3	47.9	57.0
	85+	95.9	112.4	113.0	93.7	98.0	74.4	107.5	126.0	101.6	86.3	51.2	83.3
	Total	9.1	7.7	9.8	11.0	7.9	8.0	10.4	10.1	7.9	8.2	6.4	6.7

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

FIGURE 4.6.1
Age-standardized incidence rates (ASIRs) by region, pancreas cancer, 1983–2032



ASIRs between sexes appears to narrow with advancing age, starting from age 45.

From 2003–2007 to 2028–2032, the pancreas cancer ASIRs in Canada are projected to remain stable in males, at 10.3 to 10.5 per 100 000, and to increase by 7% in females, from 8.5 to 9.1 per 100 000 (Tables 4.6.3 and 4.6.4). The annual number of male cases is projected to increase by 101%, from 1810 to 3635, and the number of female cases, by 96%, from 1900 to 3730 (Tables 4.6.1 and 4.6.2).

Comments

Lower incidence rates for cancer of the pancreas occurred in Newfoundland and Labrador, especially in females. These low rates are likely artefactual, given that death certificate information for Newfoundland and Labrador was not available for the data used in this study (see details in Chapter 5).

The International Agency for Research on Cancer (IARC) stated that tobacco smoking is the most important modifiable risk factor for pancreas cancer.[47,86] Smoking doubles the risk of developing pancreas cancer compared with not smoking,[86] and about 27% to 33% of pancreas cancers are caused by tobacco smoking.[52,112] The latency time between starting smoking and developing pancreas cancer is approximately 20 years.[113,114] The evidence also suggests that between 5% and 10% of all cases of pancreas cancer have a hereditary component,[115] and having a family history of pancreas cancer significantly increases the risk (odds ratio = 3.2, 95% CI: 1.8 – 5.6).[115] Certain hereditary conditions such as hereditary pancreatitis also increase the risk.[53,111,116]

The role of dietary factors in the etiology of pancreas cancer is inconclusive. The 2012 World Cancer Research Fund/American Institute for Cancer Research (WCRF/AICR) report stated that there is limited and inconclusive evidence that foods containing folate protect against pancreas cancer, but suggests that diets high in fruits decrease risk and diets high in red meats increase risk.[117] A recent large pooled analysis of 14 prospective cohort studies published during 1994–2010 concluded that dietary folate intake is not associated with the risk.[118] Moderate consumption of coffee and alcohol do not appear to increase risk, but heavy alcohol drinking and alcohol bingeing may increase risk.[86]

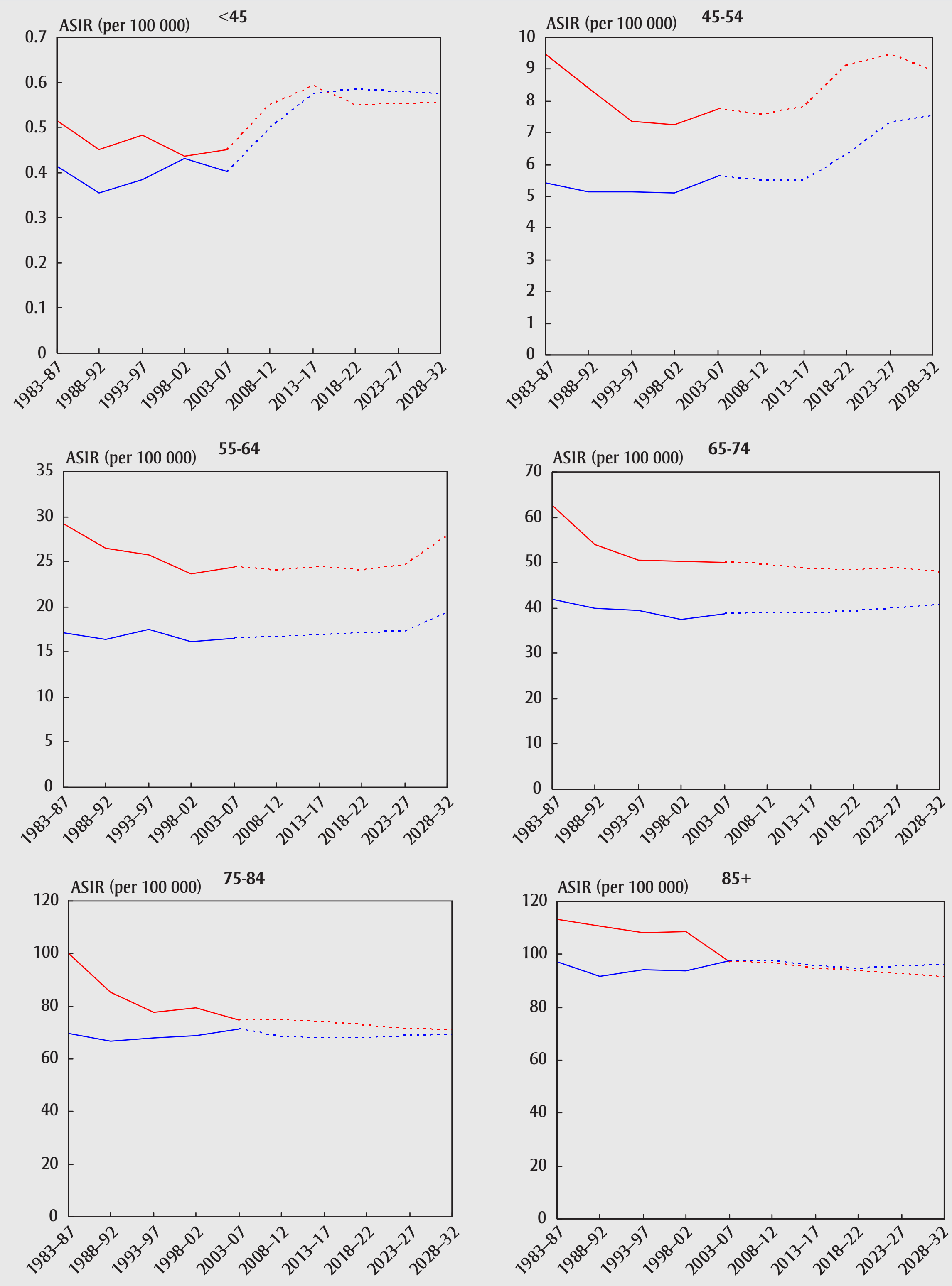
The 2012 summary of 23 prospective studies indicates an increase in pancreas cancer risk with increasing BMI.[119] The 2 systematic reviews report that occupational physical activity is protective, while recreational activity exposures are not significantly associated with the risk for pancreas cancer.[120,121] Recent meta- and pooled analyses show that diabetes is associated with 40% to 94% increased risk of pancreas cancer.[122,123] However it remains unclear whether diabetes is an early manifestation or an etiological factor of pancreas cancer.[122]

Similar trends in pancreas cancer incidence rates are observed in Great Britain.[124] The observed changes in the ASIRs of pancreas cancer for males and females partly reflects the change patterns of smoking in Canadian population,[42,43] given the latency period.

7. Larynx cancer

During 2003–2007, the average annual number of new cases of laryngeal cancer in Canada was 900 in males and 195 in females, approximately 1.1% and 0.3% of all new male and female cancer cases,

FIGURE 4.6.2
Age-standardized incidence rates (ASIRs) for pancreas cancer by age group (– males, – females), Canada, 1983–2032



respectively (Tables 4.7.1 and 4.7.2). Cancer of the larynx was much more common in males than in females. The male-to-female ratio of ASIRs was 5.1:1 (Tables 4.7.3 and 4.7.4). The lifetime risk of developing laryngeal cancer in Canada is 1 in 170 for males and 1 in 743 for females.[1] The lifetime probability of dying from the disease is 1 in 407 for males[1] and 1 in 1760 for females (estimate based on the same data used for the related reference). The 5-year relative survival rate for larynx cancer in Canada was 63% for both sexes combined between 2006 and 2008.[1]

Figure 4.7.1 shows the pattern by which ASIRs of laryngeal cancer changed with age between 2003 and 2007. In 2003–2007, laryngeal cancer was rare in males younger than 45 (0.2 per 100 000), but the incidence increased sharply with age, peaking at 29.5 per 100 000 in those aged 75 to 84. For females, the incidence increased gradually with age, from 0.0 in those under 45 to 5.5 per 100 000 in the 65–74 age range, and then decreased to 3.7 per 100 000 in those aged 85 or older. Approximately 86% of laryngeal cancer cases occurred in those aged 55 and over in both sexes.

The ASIRs of laryngeal cancer in Canada have decreased steadily from 1983–1987 to 2003–2007, by 43% (from 8.8 to 5.1 per 100 000) in males and by 33% (from 1.4 to 1.0 per 100 000) in females (Figure 4.7.2). During 1998–2007, the incidence rate of larynx cancer decreased the most rapidly of all cancers (3.8% per year in males and 3.4 per year in females) (Figures 3.1 and 3.2). When the rates are analyzed by age, significant decreases over time occurred in each age group in males. This finding compares with either very slowly decreasing or stable trends, in terms of absolute changes in rates, in females of each age group (Figure 4.7.3). Inter-regional comparison of incidence illustrates approximately parallel decreases for males. No geographical pattern was observed for females, except in Quebec, where the rates decreased consistently from the late 1980s and were higher in females as well as in males) than those in other regions over time (Figure 4.7.2). In 2003–2007, the ASIRs were higher in Quebec and lower in western Canada for both sexes.

The ASIRs of laryngeal cancer in males are expected to decrease by 43% to 49% in age groups above 45. Similarly, the rates in females of the same age will decrease by 47% to 65%, but as the ASIRs are much lower in females the absolute changes in ASIRs will be much smaller (Figure 4.7.3). The long-term trends of the rates in males and females are projected to converge in each age group. The predictions in Figure 4.7.2 show that the rates of laryngeal cancer will continue to decrease in males and females, most markedly in Quebec. In general, the incidence rates are projected to be higher in eastern Canada than in the western regions, but the long-term trends indicate a regional convergence of rates.

From 2003–2007 to 2028–2032, national larynx cancer ASIRs are expected to decrease by 47% in males, from 5.1 to 2.7 per 100 000, and by 59% in females, from 1.0 to 0.4 per 100 000 (Tables 4.7.3 and 4.7.4). The annual number of male cases is projected to be unchanged at around 900, and the number of female cases, to drop by 26%, from 195 to 145 (Tables 4.7.1 and 4.7.2).

Comments

Avoiding smoking and alcohol consumption could prevent over 90% of laryngeal cancers.[125-127] While most of the risk is linked to smoking, reducing drinking alone could still prevent one-quarter of the cancers. The strongly declining observed and projected rates in males likely reflect the role of decreased smoking since the 1960s.[42,43] The higher prevalence of smoking in males is also reflected in the much higher males ASIRs compared with female ASIRs. It is likely that incidence rates in females will drop more sharply than shown in these projections, given the declining pattern of smoking prevalence and the long latency period between the smoking reduction and the decrease in cancer incidence rate as discussed in Section 1, about oral cancers.

8. Lung cancer

Lung cancer is the second most common cancer and the leading cause of cancer death in both males and females in Canada. One in 11 males and 1 in 15 females can expect to be diagnosed with lung cancer in their lifetime, and 1 in 13 males and 1 in 18 females can expect to die from it.[1] The average annual number of new cases in 2003–2007 was 12 245 in males and 9865 in females (Tables 4.8.1 and 4.8.2), accounting for 15.2% and 13.3% of all male and female cancer cases, respectively (Figure 3.9). Lung cancer has a poor 5-year relative survival rate in Canada, at 14% in males and 20% in females for 2006–2008.[1]

In 2003–2007, the incidence rates increased with age to peak in the 75–84 age group, at 567.3 per 100 000 in males and 297.6 per 100 000 in females (Tables 4.8.3 and 4.8.4). The overall lung cancer rates were lower in males under age 55 than in females for 2003–2007, and the rates in males aged 55 or older were higher than the female rates in the whole observation period (Figure 4.8.2). The male-to-female ratio of incidence rates increased with age to 2.5:1 in people aged 85 or older in 2003–2007.

Lung cancer incidence rates for males have dropped over the entire observation period and showed a slowing increase for females (Figure 4.8.1). Between 1998 and 2007, the lung cancer incidence rates decreased significantly in males by 1.8% per year but increased significantly in females by 1.1% per year (Figures 3.1 and 3.2). All the regions have had a consistent decrease over the whole observed period for males. Rates for females have increased in each region although they have stabilized in British Columbia since 1993–1997 and in Ontario 5 years later (Figure 4.8.1).

The analysis predicts a steeper decrease in rates for males in the east (Ontario, Quebec and the Atlantic region) than in the west (Figure 4.8.1). For females, the rates will decrease in Ontario and British Columbia, and increase until 2013–2017 in Quebec and until 2008–2012 in other regions, followed by a gradual decrease. This projected future downturn of the rates is because of a decrease in rates in later birth cohorts. Quebec is predicted to continue to have the highest rates of lung cancer in both sexes. The differences in ASIRs in females between Quebec and the other regions will increase from between

TABLE 4.7.1
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), larynx cancer, males, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	20	0	0	0	0	5	5	0	0	0	0	0
	45–54	110	10	10	5	0	40	35	0	5	0	0	0
	55–64	260	25	20	5	5	90	90	5	10	0	5	0
	65–74	295	25	15	10	10	105	100	10	10	0	5	0
	75–84	185	20	10	5	5	65	60	5	5	0	5	0
	85+	35	5	0	0	0	15	10	0	0	0	0	0
	Total	900	90	55	25	25	320	305	25	30	5	20	0
2008–12	<45	15	0	0	0	0	5	5	0	0	0	0	0
	45–54	105	10	10	5	5	40	30	5	5	0	5	0
	55–64	255	25	20	10	5	95	80	5	10	0	5	0
	65–74	270	30	15	5	5	95	90	10	10	0	5	0
	75–84	185	20	10	5	5	65	65	5	5	0	5	0
	85+	45	5	5	0	0	15	15	0	0	0	0	0
	Total	870	90	60	25	20	315	285	25	30	5	20	0
2013–17	<45	10	0	0	0	0	5	5	0	0	0	0	0
	45–54	85	10	10	5	0	35	25	5	5	0	0	0
	55–64	260	25	25	10	5	105	75	5	10	0	5	0
	65–74	275	30	15	5	5	100	90	10	10	5	10	0
	75–84	175	20	10	5	5	60	60	5	5	0	5	0
	85+	50	5	5	0	0	20	15	0	0	0	0	0
	Total	860	95	65	25	20	325	270	25	30	10	20	0
2018–22	<45	10	0	0	0	0	5	5	0	0	0	0	0
	45–54	70	10	5	5	0	30	20	0	5	0	0	0
	55–64	260	30	30	15	5	105	70	5	10	0	5	0
	65–74	290	30	20	10	10	115	90	5	10	5	10	0
	75–84	180	20	10	5	5	65	60	10	5	0	5	0
	85+	55	5	5	0	0	20	20	0	0	0	0	0
	Total	865	100	75	30	20	340	260	25	30	10	25	0
2023–27	<45	10	5	0	0	0	5	5	0	0	0	0	0
	45–54	65	10	5	5	0	30	15	0	5	0	0	0
	55–64	235	30	25	10	5	100	65	5	10	0	5	0
	65–74	320	40	30	15	10	135	90	10	10	5	10	0
	75–84	200	25	15	5	5	70	65	10	5	0	5	0
	85+	55	5	5	0	0	20	20	0	0	0	0	0
	Total	890	115	80	35	25	360	260	25	35	10	25	0
2028–32	<45	10	5	0	0	0	5	5	0	0	0	0	0
	45–54	65	5	5	5	0	30	20	0	5	0	0	0
	55–64	205	25	25	10	5	95	55	5	10	0	5	0
	65–74	335	50	30	15	10	140	90	10	15	5	10	0
	75–84	225	30	20	5	5	85	70	10	5	0	10	0
	85+	60	10	5	0	0	25	20	0	0	0	0	0
	Total	900	125	90	35	25	380	260	25	35	10	25	0

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

TABLE 4.7.2
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), larynx cancer, females, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	5	0	0	0	0	0	0	0	0	0	0	0
	45–54	25	0	0	0	0	10	10	0	0	0	0	0
	55–64	50	5	5	0	0	20	15	0	0	0	0	0
	65–74	65	5	5	0	0	25	25	0	0	0	0	0
	75–84	40	5	5	0	0	15	15	0	0	0	0	0
	85+	15	0	0	0	0	5	5	0	0	0	0	0
	Total	195	15	15	5	5	70	70	5	5	0	5	0
2008–12	<45	5	0	0	0	0	0	0	0	0	0	0	0
	45–54	20	0	0	0	0	10	5	0	0	0	0	0
	55–64	50	5	5	0	0	20	15	0	0	0	0	0
	65–74	55	5	5	0	0	20	20	0	0	0	0	0
	75–84	45	5	5	0	0	15	15	0	0	0	0	0
	85+	15	0	0	0	0	5	5	0	0	0	0	0
	Total	185	20	15	5	5	70	65	5	5	0	5	0
2013–17	<45	5	0	0	0	0	0	0	0	0	0	0	0
	45–54	15	0	0	0	0	10	5	0	0	0	0	0
	55–64	45	5	5	0	0	20	15	0	0	0	0	0
	65–74	55	5	5	0	0	20	20	0	0	0	0	0
	75–84	45	5	5	0	0	15	15	0	0	0	0	0
	85+	15	0	0	0	0	5	5	0	0	0	0	0
	Total	175	20	15	5	5	70	60	5	5	0	0	0
2018–22	<45	5	0	0	0	0	5	0	0	0	0	0	0
	45–54	10	0	0	0	0	5	5	0	0	0	0	0
	55–64	40	5	5	0	0	20	10	0	0	0	0	0
	65–74	55	10	5	0	0	25	20	0	0	0	0	0
	75–84	40	5	5	0	0	15	15	0	0	0	0	0
	85+	20	0	0	0	0	5	10	0	0	0	0	0
	Total	170	20	15	5	5	75	55	5	5	0	0	0
2023–27	<45	5	0	0	0	0	5	0	0	0	0	0	0
	45–54	10	0	0	0	0	5	5	0	0	0	0	0
	55–64	30	5	5	0	0	20	10	0	0	0	0	0
	65–74	55	10	5	0	0	25	20	0	0	0	0	0
	75–84	40	5	5	0	0	15	15	0	0	0	0	0
	85+	20	0	0	0	0	5	10	0	0	0	0	0
	Total	155	25	15	5	5	80	55	5	5	0	0	0
2028–32	<45	5	0	0	0	0	5	0	0	0	0	0	0
	45–54	10	0	0	0	0	5	5	0	0	0	0	0
	55–64	25	5	5	0	0	20	10	0	0	0	0	0
	65–74	50	10	5	0	0	30	15	0	0	0	0	0
	75–84	40	5	5	0	0	20	15	0	0	0	0	0
	85+	15	0	0	0	0	5	5	0	0	0	0	0
	Total	145	25	15	5	5	80	50	5	5	0	0	0

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

TABLE 4.7.3
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), larynx cancer, males, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	0.2	0.1	0.1	0.4	0.2	0.2	0.2	0.1	0.1	0.0	0.1	1.0
	45–54	4.5	3.5	3.2	3.7	2.7	4.4	6.0	3.9	4.8	9.4	4.6	0.0
	55–64	15.3	11.7	12.7	9.7	9.6	14.4	20.7	14.7	15.5	20.3	19.0	3.6
	65–74	27.3	18.0	17.3	27.8	21.8	25.3	38.0	32.4	32.9	35.3	35.2	12.6
	75–84	29.5	23.1	16.4	14.0	23.4	27.6	42.8	43.1	30.9	21.7	43.9	0.0
	85+	23.0	17.4	15.5	18.6	19.5	23.0	30.4	43.7	14.9	26.6	17.9	145.1
	Total	5.1	3.7	3.4	4.1	3.8	4.8	7.0	5.9	5.4	6.2	6.3	3.3
2008–12	<45	0.1	0.2	0.1	0.3	0.1	0.2	0.2	0.3	0.2	0.2	0.1	0.2
	45–54	3.7	3.2	3.0	4.5	2.9	3.7	4.5	4.5	4.4	7.3	6.1	3.7
	55–64	12.3	8.3	9.9	13.1	8.0	12.4	16.0	11.2	14.0	25.2	16.5	13.4
	65–74	21.8	15.7	15.0	15.6	18.0	20.5	29.2	25.8	24.8	38.2	31.5	19.0
	75–84	26.6	20.7	16.6	19.9	17.3	23.9	38.2	44.3	28.1	37.0	43.3	22.5
	85+	21.2	15.2	16.8	12.1	19.2	20.7	31.2	25.0	21.4	23.7	11.5	19.5
	Total	4.2	3.1	3.1	3.7	3.1	4.0	5.6	5.2	4.7	7.3	6.0	4.0
2013–17	<45	0.1	0.2	0.1	0.3	0.1	0.1	0.1	0.3	0.2	0.2	0.1	0.1
	45–54	3.1	2.6	2.6	4.6	2.6	3.1	3.6	4.2	4.3	6.7	5.9	3.1
	55–64	11.0	8.2	10.1	17.6	7.4	11.6	13.1	10.6	15.0	23.4	14.6	11.4
	65–74	17.6	13.6	12.1	13.3	13.1	17.3	23.2	18.6	18.3	36.1	29.8	16.1
	75–84	23.0	16.6	16.0	13.7	17.2	21.0	32.6	39.6	25.3	36.2	38.8	19.1
	85+	19.0	15.7	11.7	13.3	15.0	17.9	28.6	25.4	16.8	24.0	14.6	16.7
	Total	3.6	2.8	2.8	3.8	2.7	3.5	4.7	4.5	4.2	6.9	5.5	3.4
2018–22	<45	0.1	0.2	0.1	0.3	0.1	0.1	0.1	0.3	0.2	0.2	0.1	0.1
	45–54	2.6	2.2	2.4	4.6	2.4	3.1	3.2	4.1	4.2	6.2	5.7	2.7
	55–64	10.0	8.4	10.2	17.8	6.6	10.4	11.5	10.0	14.6	21.6	14.0	10.0
	65–74	15.5	11.8	11.6	17.0	12.1	16.1	19.6	15.4	17.0	33.8	26.3	14.2
	75–84	19.4	16.5	13.8	9.8	15.7	17.9	26.5	32.1	20.9	34.7	37.3	16.8
	85+	17.7	12.8	13.5	11.9	12.4	16.5	27.9	26.7	15.1	23.8	13.6	14.5
	Total	3.1	2.6	2.7	3.9	2.4	3.2	4.0	4.0	3.9	6.4	5.2	3.0
2023–27	<45	0.1	0.2	0.1	0.3	0.1	0.1	0.1	0.3	0.2	0.2	0.1	0.1
	45–54	2.5	2.0	2.3	4.7	2.3	3.0	3.1	4.0	4.1	5.7	5.7	2.6
	55–64	9.1	7.9	9.8	18.0	6.2	9.5	10.7	9.8	14.5	19.8	13.7	9.4
	65–74	14.8	13.3	12.8	21.3	12.1	16.0	17.7	15.4	18.4	31.3	24.6	13.4
	75–84	16.6	15.4	12.0	7.9	12.6	15.9	22.9	24.2	15.5	32.8	36.4	15.8
	85+	15.4	11.5	13.1	6.0	16.2	14.9	23.9	22.9	13.8	23.0	11.9	13.5
	Total	2.9	2.6	2.6	4.1	2.3	3.0	3.6	3.6	3.7	6.0	5.0	2.8
2028–32	<45	0.1	0.2	0.1	0.3	0.1	0.1	0.1	0.3	0.2	0.2	0.1	0.1
	45–54	2.4	1.9	2.2	4.7	2.2	2.9	2.9	3.9	4.1	5.2	5.6	2.4
	55–64	8.4	7.4	9.5	18.1	5.8	9.7	10.2	9.5	14.3	18.2	13.5	8.7
	65–74	13.8	13.9	13.1	21.5	11.5	14.4	16.3	15.0	18.2	28.8	24.1	12.1
	75–84	15.1	14.6	12.3	11.3	12.2	15.4	20.2	21.9	15.4	30.7	32.8	14.5
	85+	13.2	13.2	11.1	5.2	12.2	12.6	19.8	18.0	10.5	22.0	12.6	12.4
	Total	2.7	2.6	2.6	4.2	2.2	2.9	3.3	3.4	3.7	5.5	4.8	2.5

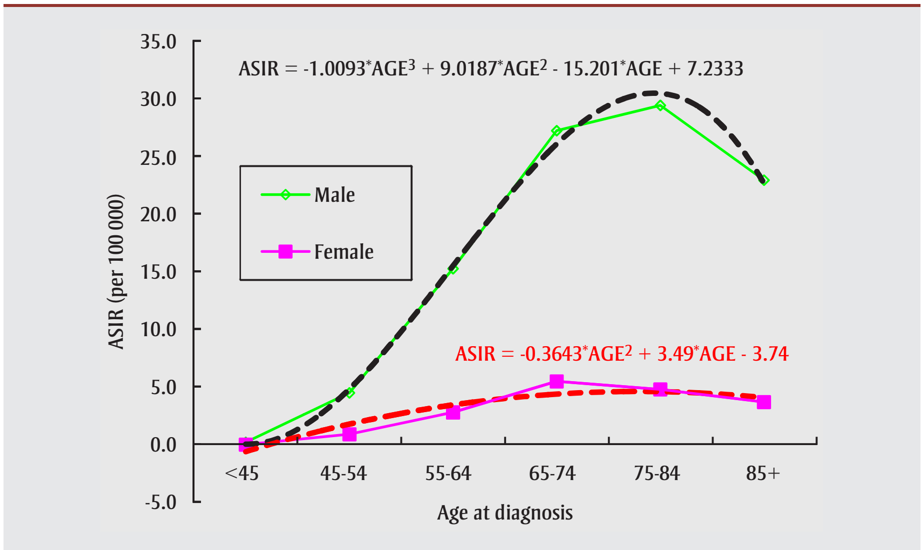
Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

TABLE 4.7.4
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), larynx cancer, females, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0
	45–54	0.9	0.1	0.6	0.6	0.9	0.9	1.5	1.3	1.6	0.0	0.5	2.9
	55–64	2.8	2.3	2.2	2.7	1.5	2.7	3.6	2.1	3.5	2.7	4.8	0.0
	65–74	5.5	3.8	4.1	3.7	4.4	5.2	8.2	2.7	3.7	7.3	3.1	14.3
	75–84	4.8	3.7	4.9	3.3	3.8	4.3	6.6	8.3	2.9	0.0	3.1	0.0
	85+	3.7	2.5	2.2	3.8	5.0	3.8	5.7	0.0	1.6	0.0	0.0	0.0
	Total	1.0	0.6	0.7	0.7	0.7	0.9	1.4	0.9	0.9	0.7	0.8	1.3
2008–12	<45	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.1
	45–54	0.7	0.3	0.7	0.6	0.7	0.8	1.1	1.3	1.3	0.9	0.6	0.9
	55–64	2.3	1.8	1.7	2.2	2.2	2.3	3.0	3.2	3.1	2.8	1.8	2.9
	65–74	4.2	3.5	3.0	3.9	3.3	3.8	6.0	5.0	4.0	3.5	3.4	5.3
	75–84	5.0	3.8	4.6	3.7	2.9	5.0	6.9	4.8	3.2	3.8	4.1	6.4
	85+	3.0	1.8	2.8	2.9	2.2	2.6	5.2	3.5	1.7	2.7	2.4	3.8
	Total	0.8	0.6	0.6	0.7	0.7	0.8	1.1	1.0	0.9	0.8	0.7	1.0
2013–17	<45	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.1
	45–54	0.5	0.3	0.7	0.5	0.6	0.7	0.8	1.1	1.1	0.8	0.4	0.7
	55–64	1.8	1.6	1.6	1.7	1.9	2.0	2.3	2.8	2.8	2.3	1.5	2.3
	65–74	3.3	3.2	2.1	3.3	2.9	3.2	4.7	4.4	3.6	3.0	2.7	4.2
	75–84	4.4	3.3	4.1	3.6	2.6	4.4	6.1	4.6	3.0	3.2	3.6	5.7
	85+	3.3	2.2	2.9	3.0	2.1	3.0	5.5	3.5	1.6	2.3	2.7	4.2
	Total	0.7	0.6	0.6	0.6	0.6	0.7	0.9	0.9	0.8	0.7	0.5	0.8
2018–22	<45	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0
	45–54	0.4	0.3	0.7	0.4	0.5	0.7	0.7	0.9	1.0	0.7	0.4	0.6
	55–64	1.5	1.5	1.6	1.4	1.7	2.0	1.9	2.4	2.4	2.0	1.3	2.0
	65–74	2.7	2.6	1.9	2.7	2.5	2.9	3.8	3.8	3.2	2.5	2.2	3.4
	75–84	3.4	3.3	2.8	3.2	2.3	3.4	4.7	4.2	2.8	2.7	2.8	4.4
	85+	3.3	2.2	3.0	3.0	1.9	3.3	5.7	3.5	1.5	1.9	2.7	4.2
	Total	0.5	0.5	0.5	0.5	0.5	0.6	0.8	0.8	0.7	0.6	0.4	0.7
2023–27	<45	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0
	45–54	0.4	0.3	0.7	0.3	0.5	0.7	0.7	0.8	0.9	0.6	0.4	0.6
	55–64	1.2	1.5	1.6	1.1	1.4	1.9	1.6	2.0	2.1	1.7	1.0	1.5
	65–74	2.3	2.5	1.9	2.2	2.1	2.7	3.2	3.3	2.9	2.1	1.9	2.9
	75–84	2.8	3.0	2.1	2.7	1.9	3.1	4.1	3.6	2.6	2.3	2.3	3.6
	85+	2.8	1.8	2.5	2.8	1.6	2.8	5.0	3.3	1.4	1.6	2.3	3.6
	Total	0.5	0.5	0.5	0.4	0.4	0.6	0.7	0.7	0.6	0.5	0.4	0.6
2028–32	<45	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	45–54	0.4	0.3	0.7	0.2	0.4	0.7	0.7	0.7	0.8	0.5	0.3	0.5
	55–64	1.1	1.4	1.5	0.9	1.2	1.9	1.5	1.7	1.9	1.4	0.9	1.3
	65–74	1.9	2.5	1.9	1.8	1.8	2.7	2.7	2.8	2.5	1.8	1.6	2.5
	75–84	2.2	2.6	1.9	2.2	1.7	2.9	3.2	3.2	2.3	2.0	1.8	2.9
	85+	2.0	2.2	1.4	2.5	1.4	2.0	3.7	2.9	1.3	1.4	1.6	2.5
	Total	0.4	0.5	0.4	0.3	0.4	0.6	0.6	0.6	0.5	0.4	0.3	0.5

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

FIGURE 4.7.1
Age-standardized incidence rates (ASIRs) for larynx cancer, Canada, 2003–2007



10% and 30% in 2003–2007 to between 33% and 65% in 2028–2032. These increased differences are not evident in males.

The male-to-female ratio of ASIRs for lung cancer in Canada has decreased from 3.1:1 to 1.5:1 over the observed period (1983–2007), and is projected to further decrease to 1.2:1 in 2028–2032 (Figures 4.8.1 and 4.8.2).

From 2003–2007 to 2028–2032, the ASIRs of lung cancer for Canada are projected to decrease in males by 34%, from 70.7 to 46.4 per 100 000, and to peak and then also decrease in females by 16%, from 47.1 to 39.6 per 100 000. Because of the aging and growth of the population, the annual number of new cases is projected to increase by 34% in males (from 12 245 to 16 420) and by 62% in females (from 9865 to 15 945).

Comments

Smoking causes about 90% of lung cancer deaths in males and between 75% and 80% in females in the US.[128,129] The trends in lung cancer incidence rates in Canada have closely mirrored historical patterns of smoking prevalence,[42,43] after accounting for a latency period of 20 years or more. Because smoking prevalence began to decrease in the mid-1960s in males and in the mid-1980s in females,[42,43] lung cancer incidence rates decreased for males over the whole observation period and showed the slowing of increase for females. The rates of lung cancer decreased from 1993–1997 to 2003–2007 in females aged less than 45, were relatively stable in women aged 45 to 54, showed a slowing increase in those aged between 55 and 64, and increased in those aged 65 or older. These trends are in agreement with the fact that the onset of cigarette smoking starts at younger ages and then follows the birth cohort as it ages, and lung cancer rates increase as the birth cohort ages.

Figure 4.8.3 shows the different results for projected lung cancer incidence in males and the similar results for females based on age–period–cohort models that include and exclude adjustment for available smoking prevalence data in Canada. In males, for the models with the same parameter settings (cut trend and using recent 10-year slope), the models incorporating smoking rates predict lower lung cancer incidence rates as compared with the models without adjustment for smoking, echoing the decreased pattern of tobacco consumption. In the absence of incorporating smoking information into the model, we projected the current trend in a larger extent (model M1T) than the default gradual damping of the impact of the current trend in future periods (model M0T), on the assumption that the current trend will continue into the future. The projected lung cancer pattern in males follows the forecast derived from the default Nordpred drift reduction model (M0T) with adjustment for smoking. The different reactions of the projection models to smoking factors for males and females are related to the different historical patterns of tobacco consumption[42,43] and the lag of at least 20 years between a drop in smoking rates and subsequent decrease in cancer incidence rates.

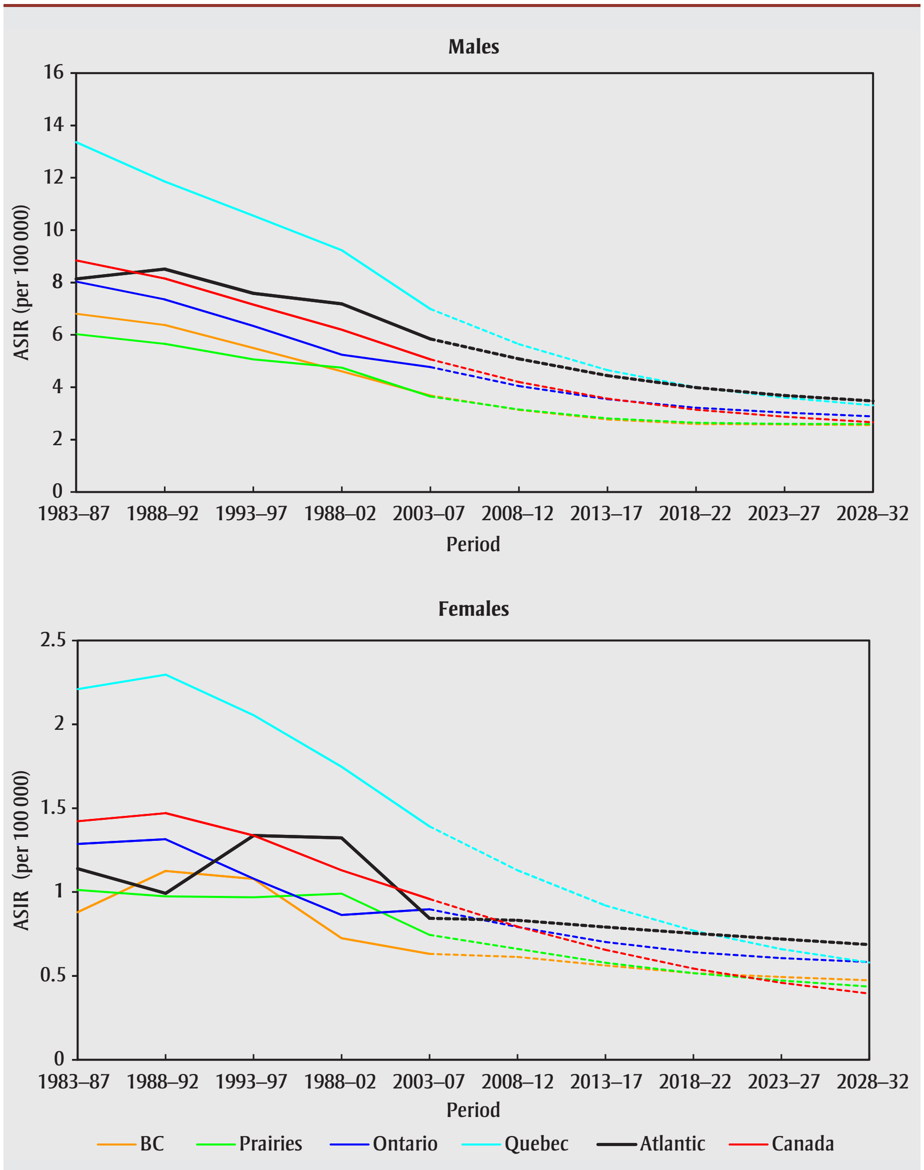
9. Melanoma

Cutaneous malignant melanoma (referred to as melanoma) is the eighth most common cancer in Canadian males and the seventh most common in Canadian females.[1] One in 63 males and 1 in 79 females can expect to be diagnosed with melanoma in their lifetime, and 1 in 287 males and 1 in 420 females can expect to die from it.[1] In 2003–2007, the average annual number of new cases of melanoma was 2320 for males and 2055 for females, or 2.9% and 2.8% of all male and female cases, respectively (Tables 4.9.1 and 4.9.2). During 1998–2007, melanoma ASIRs increased significantly in both sexes by 1.4% per year (Figures 3.1 and 3.2). The 5-year relative survival rates for melanoma diagnosed between 2006 and 2008 were 85% for males and 92% for females.[1]

Melanoma is one of the most frequently diagnosed cancers in young adults. The ASIRs in 2003–2007 increased with age to 79.8 per 100 000 in men aged 85 or older and to 37.1 per 100 000 in women of the same age, with the increase being steeper in men than in women for those aged 55 or older (Tables 4.9.3 and 4.9.4). The rates were up to 1.6 times higher in females than in males in those under age 45, approximately equal in the 45–54 age group, and up to 2.1 times higher in men than in women above 55. The observed differences between sexes increased with time in each age group except in the 45–54 age group (Figure 4.9.2).

From 1983–1987 to 2003–2007, melanoma ASIRs in males increased steadily in all regions, with the most pronounced increase in Atlantic Canada (Figure 4.9.1). The increase was not evident in the Prairies

FIGURE 4.7.2
Age-standardized incidence rates (ASIRs) by region, larynx cancer, 1983–2032



and less steep in Quebec in the last observation period (2003–2007). For females, the ASIRs in the Atlantic region, the Prairies and Quebec increased to their peaks in 1998–2002 and then displayed a downward trend at different levels, while the observed rates in Ontario continued to increase. In contrast, British Columbia rates decreased steadily until 1998–2002 and then turned into an upward trend.

The ASIRs of melanoma in males are projected to peak after 5 years in the Prairies and Quebec, and after 10 years in the Atlantic region, Ontario, British Columbia and Canada as a whole (Figure 4.9.1). The rates for females are predicted to peak after 15 years in Ontario, British Columbia and Canada as a whole, and after 20 years in the Atlantic provinces; whereas the rates in the Prairies and Quebec will continue their most recently observed downward trends. There are regional differences in ASIR levels, but the internal ranking of the regions is similar for males and females. When Quebec is excluded from assessing regional variation because of underreporting in the numbers of cases,[42,43] the lowest incidence rates of melanoma are forecast to be in the Prairies and the most elevated rates, in the Atlantic region and in males only in Ontario.

From 2003–2007 to 2028–2032, melanoma ASIRs in Canada are projected to peak and then decrease by 6% in males, from 13.1 to 12.4 per 100 000, and to increase by 5% in females from 10.7 to 11.2 per 100 000 (Tables 4.9.3 and 4.9.4). The annual number of male cases is projected to rise by 75%, from 2320 to 4065, and the number of female cases is projected to rise by 69%, from 2055 to 3465 (Tables 4.9.1 and 4.9.2).

In Quebec, because of the registry's dependence on hospital data before 2008, the numbers of melanoma cases are believed to be underreported.[130] Allowing for the expected number of Quebec cases after adjustment for underreporting, the annual increase in melanoma incidence for Canada from 2003–2007 to 2028–2032 would be approximately from 2480 to 4295 cases in males and from 2195 to 3640 cases in females. The adjusted annual number of cases in Quebec would increase over this period from approximately 460 to 660 in males and 405 to 490 in females. The corresponding prediction for the adjusted age-standardized rates in Quebec would be a decrease from 10.7 to 9.1 per 100 000 in males and a decrease from 8.8 to 7.6 per 100 000 in females.

Comments

According to IARC, about 80% of melanoma is caused by exposure to ultraviolet (UV) radiation[86] (from the sun and sunbeds). The risks associated with intense and intermittent exposure tend to be greater than those associated with chronic exposure, especially for younger people.[131] A history of sunburn doubles the risk.[132,133] People with fair complexions, light eyes, red hair colour, or multiple benign or dysplastic nevi are at higher risk.[52,134-137] The presence of a family history of melanoma doubles the risk of developing the disease.[138,139] Around 10% of melanoma cases are attributable to inherited risk.[111,140]

Based on an assumption that risk of melanoma will continue to decrease in the more recent birth cohorts (data not shown),[141] our analysis shows that the increase in melanoma incidence rates is projected to slow down appreciably in both sexes, and that rates are expected to decrease after 10 or 15 years. The statis-

FIGURE 4.7.3
Age-standardized incidence rates (ASIRs) for larynx cancer by age group (– males, – females), Canada, 1983–2032

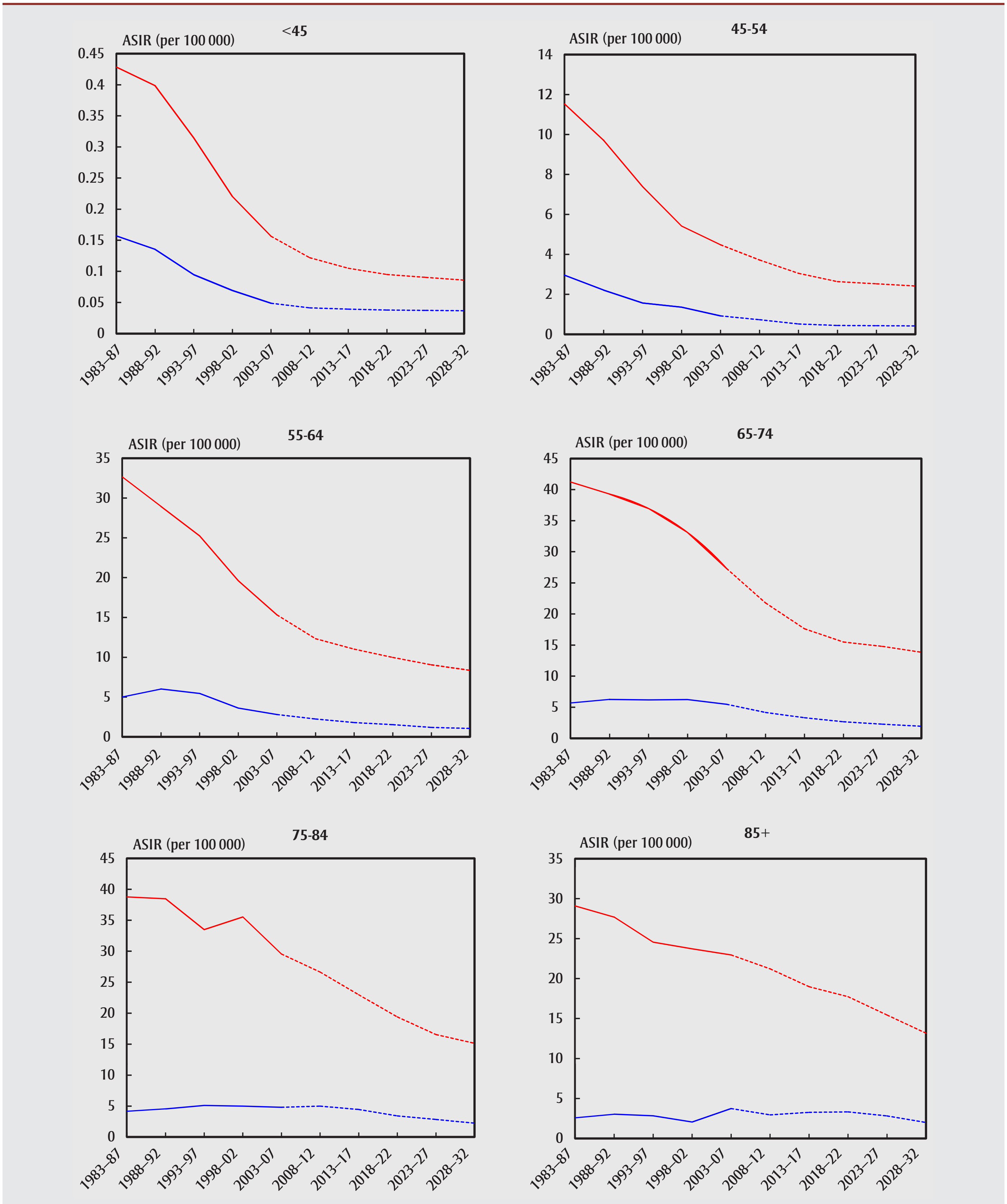


TABLE 4.8.1
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), lung cancer, males, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	165	15	10	0	5	70	50	5	5	0	0	0
	45–54	935	95	70	20	30	300	340	25	30	5	15	0
	55–64	2660	280	190	65	80	865	915	90	105	15	50	5
	65–74	4135	455	300	120	145	1380	1340	130	160	20	70	10
	75–84	3520	435	260	120	125	1145	1125	105	135	20	45	5
	85+	830	115	60	35	35	245	270	30	30	5	5	0
	Total	12 245	1395	895	360	425	4000	4040	385	470	60	185	25
2008–12	<45	150	10	15	0	5	55	45	5	5	0	0	0
	45–54	935	105	75	15	30	325	315	25	30	5	15	5
	55–64	2775	305	220	65	90	905	940	85	105	10	60	5
	65–74	4125	465	305	115	140	1330	1370	140	165	20	80	10
	75–84	3620	445	290	115	120	1140	1205	110	130	20	50	5
	85+	1095	150	75	40	40	345	350	35	35	5	5	0
	Total	12 695	1485	980	350	425	4100	4225	400	470	60	205	25
2013–17	<45	150	10	15	0	5	50	50	0	5	0	0	0
	45–54	835	90	75	15	25	315	255	15	25	5	10	5
	55–64	2885	335	245	65	95	955	960	85	100	10	60	5
	65–74	4550	535	365	115	150	1475	1485	160	185	20	95	10
	75–84	3600	445	300	110	120	1120	1200	115	130	20	55	5
	85+	1330	180	100	40	45	420	435	45	40	5	5	0
	Total	13 350	1595	1100	350	445	4335	4385	425	480	65	230	25
2018–22	<45	180	10	15	0	5	50	60	0	5	0	0	0
	45–54	715	65	70	10	25	280	210	15	20	5	10	5
	55–64	2995	365	260	65	95	1065	935	80	95	10	55	5
	65–74	4980	610	450	125	170	1635	1575	170	195	20	105	5
	75–84	3895	490	335	110	130	1210	1300	135	145	25	65	5
	85+	1455	200	115	45	45	460	475	45	40	5	5	0
	Total	14 225	1740	1245	355	475	4700	4555	450	500	65	245	25
2023–27	<45	215	10	15	0	5	50	65	0	5	0	0	0
	45–54	730	65	70	10	25	275	235	15	20	5	10	5
	55–64	2820	335	270	55	95	1090	795	65	90	10	50	10
	65–74	5465	705	515	135	195	1865	1675	175	190	20	115	5
	75–84	4560	595	430	125	145	1445	1465	165	175	25	80	5
	85+	1540	210	130	45	50	490	505	50	40	5	10	0
	Total	15 335	1920	1425	375	515	5220	4740	475	520	65	260	30
2028–32	<45	215	10	15	0	5	50	60	0	5	0	0	0
	45–54	905	70	75	10	25	285	290	15	20	5	10	5
	55–64	2525	275	265	50	90	1025	680	60	75	10	45	10
	65–74	5820	780	560	135	200	2140	1665	175	195	25	110	10
	75–84	5170	700	540	140	175	1670	1615	175	190	25	90	5
	85+	1785	250	150	50	55	570	580	65	50	10	10	0
	Total	16 420	2090	1610	390	555	5740	4885	490	535	70	265	35

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

TABLE 4.8.2
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), lung cancer, females, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	230	20	15	5	5	80	85	5	5	0	5	0
	45–54	1110	120	80	25	35	345	415	25	40	5	15	5
	55–64	2220	255	185	70	80	720	715	65	80	10	35	5
	65–74	2980	395	240	95	115	1060	810	90	115	15	40	5
	75–84	2575	360	200	85	110	930	685	75	95	10	20	5
	85+	750	115	60	30	35	255	200	20	25	5	0	0
	Total	9865	1265	780	310	385	3390	2910	280	360	50	115	20
2008–12	<45	185	15	20	5	5	75	60	5	10	0	5	0
	45–54	1170	120	95	25	35	360	460	30	40	5	20	5
	55–64	2620	305	205	75	95	790	910	75	85	15	40	5
	65–74	3460	445	290	115	125	1155	990	100	125	20	50	10
	75–84	2920	385	250	95	120	1025	815	90	110	15	25	5
	85+	1130	170	85	45	50	395	310	35	40	5	5	0
	Total	11 485	1450	940	360	430	3800	3545	335	410	60	145	25
2013–17	<45	185	15	20	5	10	80	60	5	10	0	5	0
	45–54	960	100	85	20	35	315	355	25	40	5	25	5
	55–64	2990	335	245	80	95	885	1080	90	90	10	45	10
	65–74	4170	535	355	135	145	1295	1285	125	145	20	65	10
	75–84	3250	435	290	105	130	1100	920	100	115	15	35	5
	85+	1475	200	125	60	65	510	435	50	50	5	5	0
	Total	13 025	1620	1115	395	475	4190	4130	390	455	65	180	35
2018–22	<45	205	20	25	5	10	90	70	5	10	0	5	0
	45–54	725	85	80	15	35	280	225	25	35	5	25	5
	55–64	3060	330	270	75	100	920	1095	85	100	15	50	10
	65–74	4815	620	400	140	155	1445	1555	145	160	20	75	15
	75–84	3805	510	355	125	140	1220	1110	115	130	20	45	10
	85+	1725	230	150	60	70	580	530	55	60	10	10	0
	Total	14 335	1790	1275	425	510	4535	4585	430	495	70	205	40
2023–27	<45	205	20	25	5	10	85	70	5	10	0	5	0
	45–54	705	85	85	20	35	295	210	25	35	5	20	5
	55–64	2510	275	240	65	95	825	820	70	95	15	50	10
	65–74	5390	675	460	145	155	1610	1760	160	170	20	80	20
	75–84	4545	620	430	140	160	1375	1390	135	155	20	55	10
	85+	1940	270	180	70	75	635	585	60	60	10	10	5
	Total	15 300	1945	1420	445	535	4830	4840	455	525	70	220	45
2028–32	<45	220	20	25	5	10	90	75	5	10	0	5	0
	45–54	755	95	95	20	40	325	235	25	35	5	20	5
	55–64	1970	240	225	60	95	740	545	65	85	15	50	10
	65–74	5465	665	500	140	165	1670	1740	155	180	20	90	20
	75–84	5250	720	485	150	170	1550	1665	155	170	20	60	15
	85+	2285	310	215	85	80	705	720	70	70	10	10	5
	Total	15 945	2050	1550	460	555	5075	4985	475	550	70	230	55

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

TABLE 4.8.3
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), lung cancer, males, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	1.5	1.0	1.0	0.8	1.2	1.6	1.9	1.4	1.8	0.8	0.6	2.5
	45–54	37.3	29.1	26.4	27.5	36.6	31.9	55.8	40.2	40.4	30.2	33.7	22.9
	55–64	157.5	119.5	126.0	136.8	137.8	138.3	211.8	205.6	190.9	166.3	161.4	180.1
	65–74	384.1	299.3	332.1	353.8	393.1	337.6	500.5	487.7	471.4	409.3	385.1	583.9
	75–84	567.3	479.5	512.7	503.5	528.2	475.9	776.0	709.6	737.5	742.0	453.5	933.5
	85+	544.8	483.0	477.7	439.2	472.9	437.1	852.6	767.4	555.5	478.2	142.9	435.4
	Total	70.7	56.6	60.3	61.9	67.2	60.9	96.2	89.5	86.2	77.5	61.9	97.4
2008–12	<45	1.4	0.8	1.1	0.8	1.2	1.4	1.9	1.2	1.5	1.5	1.2	2.8
	45–54	33.6	28.5	24.3	21.3	29.2	30.4	47.4	38.0	37.9	30.6	32.5	36.6
	55–64	135.3	106.7	113.4	111.8	127.1	118.9	185.7	163.9	163.3	106.7	153.0	107.3
	65–74	333.2	265.0	290.6	314.3	344.4	287.1	437.7	443.4	409.6	373.0	359.1	409.0
	75–84	518.8	434.2	494.4	477.5	489.8	424.0	716.5	688.2	641.1	663.9	454.0	716.8
	85+	521.7	457.0	441.3	455.9	462.6	425.3	757.0	700.3	542.7	522.4	161.7	577.7
	Total	62.9	51.1	55.2	55.7	60.7	53.6	85.7	81.1	75.6	68.0	59.9	74.6
2013–17	<45	1.4	0.7	1.0	0.8	1.1	1.2	2.1	1.1	1.4	1.5	1.2	2.8
	45–54	29.7	23.7	24.2	18.1	28.6	28.0	39.6	28.4	34.4	28.4	27.4	45.5
	55–64	123.2	103.3	102.3	95.9	119.8	108.3	170.2	147.7	139.6	92.6	152.0	76.6
	65–74	292.3	239.6	264.8	267.8	288.1	253.5	382.0	397.2	364.9	303.2	333.0	287.5
	75–84	467.0	391.1	455.6	456.3	469.4	380.1	641.1	624.3	562.2	571.0	439.2	552.1
	85+	498.3	435.6	443.6	450.2	454.3	394.7	724.8	707.8	536.9	574.7	179.0	444.5
	Total	56.5	46.7	51.0	49.9	55.2	48.1	76.8	73.2	67.2	59.0	57.1	57.4
2018–22	<45	1.6	0.7	1.0	0.8	1.1	1.2	2.5	1.1	1.4	1.5	1.2	2.8
	45–54	27.6	18.6	24.1	16.9	27.1	27.0	36.6	27.3	32.9	27.1	27.4	56.5
	55–64	115.4	102.7	96.2	85.3	109.0	105.8	153.9	139.9	126.7	86.6	141.1	102.2
	65–74	263.2	223.5	248.4	233.4	269.3	230.6	346.3	342.5	323.9	232.7	315.9	164.4
	75–84	419.7	358.8	417.9	420.6	429.1	343.5	566.1	575.2	510.4	533.1	413.7	411.9
	85+	459.5	408.8	413.3	434.3	436.4	364.6	657.3	665.7	455.1	526.9	192.3	432.1
	Total	51.7	43.6	47.7	45.1	51.2	44.6	69.5	66.5	60.4	51.7	54.2	47.2
2023–27	<45	1.8	0.6	1.0	0.7	1.0	1.1	2.4	1.1	1.4	1.5	1.2	2.8
	45–54	28.6	18.1	23.6	16.4	26.4	27.0	41.5	26.7	32.1	26.5	27.4	69.8
	55–64	108.0	91.6	98.8	79.0	111.4	104.6	135.4	115.9	121.3	83.8	125.5	132.9
	65–74	250.0	225.2	232.4	213.6	260.0	224.5	324.9	329.7	292.5	219.8	313.9	134.4
	75–84	379.2	334.5	393.4	374.4	372.2	318.3	504.0	527.1	469.4	449.2	381.6	269.5
	85+	418.7	370.7	387.6	431.7	434.5	337.3	590.0	607.0	417.7	455.8	174.5	274.7
	Total	48.6	41.4	45.6	41.5	48.6	42.8	64.0	61.2	55.9	46.8	51.4	42.5
2028–32	<45	1.8	0.6	0.9	0.7	1.0	1.0	2.4	1.1	1.3	1.5	1.2	2.8
	45–54	33.4	17.7	23.2	15.9	25.7	26.6	47.3	26.2	31.4	25.8	27.4	86.2
	55–64	103.7	77.9	99.9	77.1	109.1	104.6	128.3	114.1	119.3	81.0	125.5	170.7
	65–74	238.5	226.0	226.0	196.7	248.0	224.4	297.3	307.5	274.0	213.7	288.5	172.6
	75–84	348.8	319.8	374.7	336.1	362.2	297.2	463.8	461.5	423.0	368.4	367.3	150.3
	85+	379.4	350.4	355.3	387.0	383.3	309.9	518.9	574.3	381.9	468.3	164.7	211.1
	Total	46.4	39.5	44.2	38.3	46.7	41.7	60.0	56.7	52.3	43.3	49.1	45.3

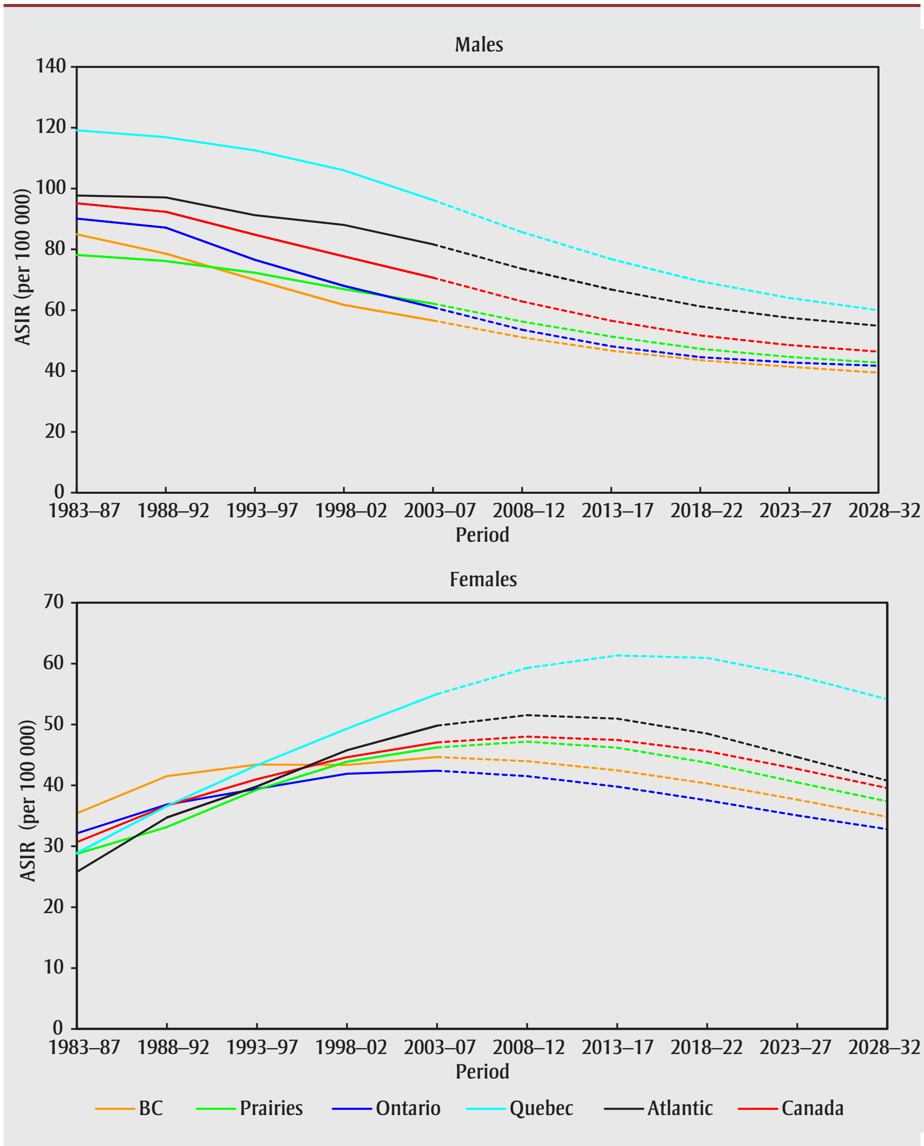
Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

TABLE 4.8.4
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), lung cancer, females, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	2.0	1.3	1.5	1.6	1.6	1.8	3.2	2.1	2.0	2.3	1.8	0.0
	45–54	44.1	35.0	32.9	32.0	39.6	36.6	67.3	42.7	49.9	44.5	34.3	47.5
	55–64	127.2	108.5	124.4	146.4	136.1	110.2	157.0	141.0	144.9	148.3	103.2	178.2
	65–74	250.2	251.5	246.1	251.0	270.9	231.0	266.5	300.4	304.6	311.5	194.3	508.3
	75–84	297.6	310.5	298.2	282.3	320.7	276.8	316.9	342.8	345.3	302.3	178.7	646.9
	85+	218.6	235.9	218.9	191.3	227.0	203.1	245.6	234.7	209.1	246.6	47.0	193.1
	Total	47.1	44.7	45.0	46.4	49.4	42.4	55.0	53.3	54.5	53.8	34.0	80.2
2008–12	<45	1.8	1.2	1.6	1.5	2.1	1.8	2.5	2.2	2.9	2.4	2.0	0.6
	45–54	42.1	32.3	33.1	28.3	36.9	33.4	70.0	45.2	48.6	50.3	47.4	46.9
	55–64	123.0	103.4	107.2	124.3	128.2	98.8	171.9	140.3	127.8	125.9	104.1	116.9
	65–74	255.7	240.5	258.2	297.3	277.4	223.6	285.1	300.4	288.4	301.1	215.2	502.7
	75–84	323.0	321.6	340.3	322.2	364.4	291.4	355.3	403.9	396.7	353.1	208.1	616.5
	85+	260.2	279.6	246.6	267.5	266.1	240.9	297.2	304.9	283.8	231.3	66.8	367.7
	Total	48.0	44.0	46.2	49.3	51.2	41.5	59.3	56.6	55.0	53.4	38.2	75.6
2013–17	<45	1.8	1.2	1.7	1.6	2.3	1.9	2.5	2.5	3.0	2.4	2.0	0.6
	45–54	34.3	25.7	30.0	25.3	38.2	28.7	55.8	41.3	50.7	54.6	54.3	47.0
	55–64	123.2	98.6	102.4	112.6	117.1	96.6	184.5	146.9	123.9	108.7	110.0	157.5
	65–74	247.0	226.4	244.7	289.3	258.4	202.9	300.7	289.7	268.8	262.5	218.8	346.8
	75–84	338.5	335.6	361.8	359.4	390.8	294.7	381.3	417.9	388.8	389.3	226.9	585.5
	85+	289.5	284.3	293.9	316.6	302.5	261.8	344.2	388.8	340.5	278.9	87.0	449.3
	Total	47.5	42.5	45.9	49.4	50.5	39.8	61.3	57.5	53.9	51.6	40.6	68.2
2018–22	<45	1.9	1.2	1.8	1.7	2.4	2.1	2.8	2.7	3.1	2.4	2.0	0.6
	45–54	28.4	23.2	29.8	26.6	40.2	26.9	41.3	44.4	51.8	57.7	59.4	47.1
	55–64	115.7	88.8	101.0	103.2	114.5	89.6	177.9	138.6	123.0	118.0	121.8	157.7
	65–74	235.6	212.7	213.5	245.4	227.0	185.9	314.3	276.3	247.7	210.9	205.7	282.3
	75–84	338.5	329.0	369.7	397.1	381.6	282.4	390.5	409.6	369.9	343.6	231.4	603.6
	85+	305.8	297.4	308.1	335.3	330.7	267.3	374.3	398.8	362.8	289.2	116.5	362.7
	Total	45.6	40.3	44.1	47.3	48.4	37.5	60.9	56.1	52.1	47.6	41.7	63.6
2023–27	<45	1.8	1.3	1.8	1.7	2.4	1.8	2.9	2.8	3.1	2.4	2.0	0.6
	45–54	27.7	23.3	30.4	27.3	41.2	28.8	38.7	46.1	52.4	59.3	62.1	47.1
	55–64	95.1	73.0	90.8	90.8	112.8	77.7	140.2	120.5	125.1	122.9	126.6	157.8
	65–74	230.8	202.8	203.1	221.6	204.4	180.2	319.6	274.8	237.2	183.4	205.2	344.1
	75–84	318.6	308.0	339.1	368.5	344.0	252.7	394.1	376.0	337.2	283.6	215.9	373.5
	85+	309.9	307.1	321.1	370.9	336.7	264.6	376.7	390.0	331.4	304.2	108.8	372.6
	Total	42.7	37.7	41.6	44.0	45.5	35.1	58.0	53.4	50.2	44.4	41.8	59.7
2028–32	<45	1.8	1.3	1.9	1.7	2.5	1.8	3.0	2.8	3.1	2.4	2.0	0.6
	45–54	27.6	23.5	30.9	28.0	42.3	29.2	40.0	47.8	53.0	61.0	64.9	47.2
	55–64	80.1	66.5	88.9	92.6	115.2	73.1	106.0	124.1	126.2	128.0	131.5	158.0
	65–74	212.7	181.4	195.3	198.0	196.7	165.4	298.7	248.8	234.9	190.3	216.2	344.3
	75–84	302.6	289.6	294.8	310.6	298.2	233.2	402.7	353.1	312.4	217.6	196.5	365.1
	85+	301.6	289.1	318.1	400.3	310.9	245.6	376.7	367.6	318.6	225.6	109.5	386.1
	Total	39.6	34.8	39.4	40.9	43.5	32.8	54.2	51.2	49.2	42.3	42.6	59.6

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

FIGURE 4.8.1
Age-standardized incidence rates (ASIRs) by region, lung cancer, 1983–2032



tical model demonstrates that in male melanoma in Canada, the last 3 estimated cohort coefficients are negative and the earlier cohort coefficients positive, so moving and applying these cohort values to older age groups could decrease the rates. In terms of risk factor, this is likely due to reduced exposure to carcinogenic ultraviolet rays through primary prevention programs aimed at reducing sun exposure and enhancing public awareness. Data to enable the monitoring of trends in sun exposure and sun behaviour of Canadians are lacking and are urgently needed. The projected downturn of melanoma incidence rates in Canada, especially in British Columbia and Ontario, is also possibly linked to the increasing immigration from rare areas of melanoma (such as Asia).[105,106,141]

10. Breast cancer (in females)

Breast cancer is the most frequently diagnosed cancer and the second leading cause of cancer death in females in Canada. The lifetime risk of developing breast cancer is estimated to be 1 in 9, and the lifetime probability of dying from the disease is 1 in 29.[1] The average annual number of new cases of breast cancer in females in 2003–2007 was 20 110 (Table 4.10.1), accounting for 13.0% of all new cancer cases in Canada and 27.1% of the cancer cases in females (Figure 3.9). Breast cancer risk is strongly connected to age, with 88% of cases occurring in women 45 or older in the same period and 67% of cases diagnosed in the age groups between 45 and 74. The incidence rate increased steeply with age up to age 65, followed by a less marked increase to a plateau at age 75–84 (Table 4.10.2). The 5-year relative survival rate was 88% in 2006–2008.[1]

Breast cancer incidence in Canada increased through the 1980s and 1990s and has decreased since then (Figure 4.10.1). Similar patterns occurred in women aged 45 to 74, despite fluctuation in the 65–74 age group (Figure 4.10.2). The rise in overall breast cancer incidence rates until 1998–2002 was seen primarily in women aged 55 to 74 and was more evident in women aged 55 to 64, who are in the targeted age group (50–69 years) of the provincial/territorial organized breast cancer screening programs. While incidence rates have remained steady over time in the youngest females, the rates have decreased in the oldest age group. During the last 10 observation years, breast cancer ASIRs decreased significantly by 0.7% per year (Figure 3.2). Inter-regional comparison illustrates that female breast cancer incidence rates appear to be fairly consistent across the country (Figure 4.10.1).

Extending the current 10 years trend into the future gives predicted relatively stable rates in Canada (Figure 4.10.1). The ASIRs are projected to increase slightly in British Columbia and Ontario but decrease slightly in other regions. The generally consistent regional rates of breast cancer in females are expected to continue.

The age-specific comparison indicates that the primary trend of cancer incidence in Canada in each age group is expected to be static (Figure 4.10.2). From 2003–2007 to 2028–2032, the ASIRs for breast cancer are projected to be stable and will be 98.7 per 100 000 by the end of that period (Table 4.10.2). Over the same period, the annual number of new cases is predicted to increase by 55%, from 20 110 to 31 255.

FIGURE 4.8.2
Age-standardized incidence rates (ASIRs) for lung cancer by age group (– males, – females), Canada, 1983–2032

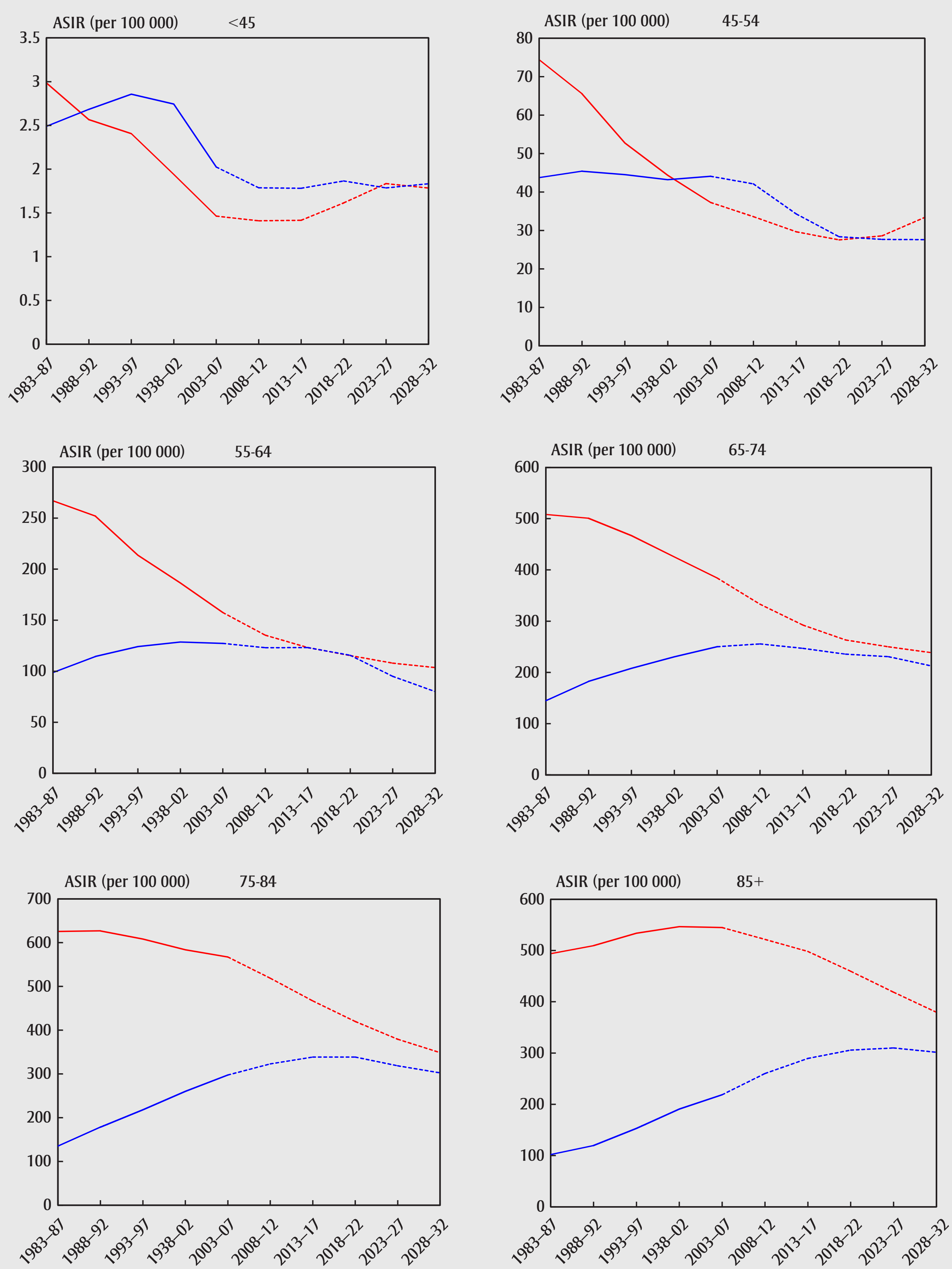
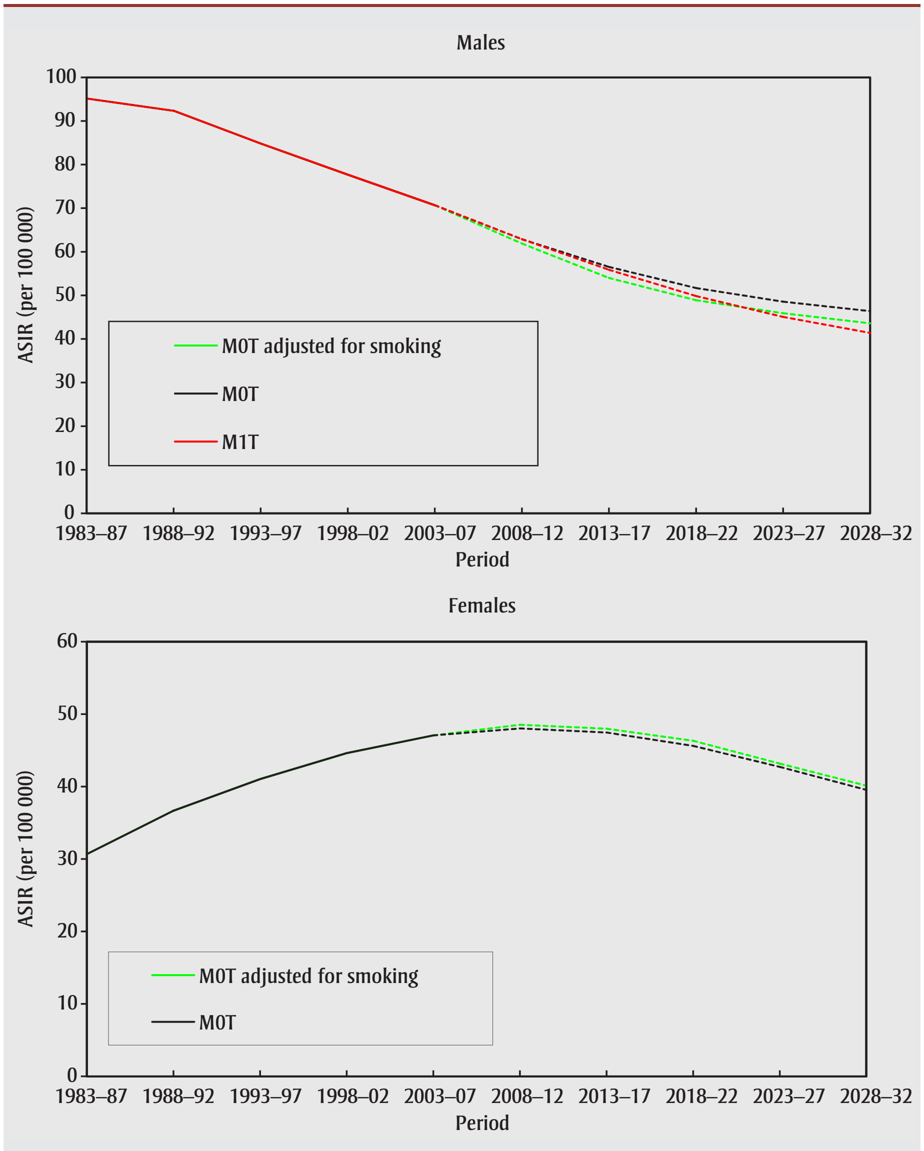


FIGURE 4.8.3
Age-standardized incidence rates (ASIRs) with and without adjustments for smoking prevalence rates, lung cancer, Canada, 1983–2032



Note: M0T is the Nordpred model with default drift reduction and using the recent trend for projection. M1T projects the current trend in a larger extent than M0T.

Comments

Breast cancer incidence in Canada rose steadily during the 1980s and 1990s and has since decreased. The most prominent increases until the early 1990s may reflect the introduction of organized provincial screening programs and increasing uptake of breast cancer screening, leading to a transient additional increase in incidence due to the detection of a prevalent pool of undiagnosed cancers.[1] Screening may have resulted in the more recent decrease because of the exhaustion of undiagnosed prevalent cases. In 2008, 72% of Canadian women aged between 50 and 69 reported having had a screening mammogram in the preceding 2 years, an increase from 40% in 1990.[142] The increase occurred from 1990 to 2000/2001, and mammography utilization rates have since stabilized.

In 2011, the Canadian Task Force on Preventive Health Care released its recommendations on breast cancer screening for women aged 40 to 74 at average risk of breast cancer.[143] The Task Force recommends that women aged 50 to 74 be routinely screened with mammography every 2 to 3 years (where previously it was 1 to 2 years), and that women aged 40 to 49 not be routinely screened with mammography. The Task Force notes a gap in knowledge exists about the benefits and harms of screening using mammography for females aged less than 40 and more than 74. In 2013, the Canadian Association of Radiologists (CAR) published new practice guidelines which differ from the Task Force's recommendations.[144] The CAR recommends annual screening of women aged 40 to 49 and annual or biennial screening of women aged 50 to 74.[144]

Some of screen-detected breast cancers are indolent and would never present clinically; this is referred to as over-diagnosis. In other research, in cohorts screened for breast cancer, there was an increase in the incidence of early-stage disease without a subsequent decrease in late-stage tumours, which is evidence of over-diagnosis in this disease.[145] Miller et al.[146] reported that 22% of screen-detected breast cancers were over-diagnosed in the most recent Canadian study with up to 25-year follow-up of women aged 40 to 59. The extent of over-diagnosis might be underestimated, as ductal carcinoma in situ was not included in the study. Miller et al.[146] also observed that mammography does not reduce breast cancer mortality. While the screening can detect small cancers, it is associated with exposure to x-rays, false positive results, complications of extra breast cancer diagnosis (such as biopsy), and treatment for breast cancer that would not have caused any problem in a woman's lifetime. Mammography screening for average-risk women should be considered based on a discussion between a woman and her physician weighing the benefits and risks.

The trend in breast cancer incidence rates is likely linked to changes in hormonal factors. Studies indicate that early menarche, late menopause, delayed first full-term pregnancy and no full-term pregnancy are associated with increased risks of breast cancer.[147] A larger number of births and breastfeeding have protective effects.[147] The long-term decrease in fertility rates in Canada would be expected to result in an increase in breast cancer rates,

TABLE 4.9.1
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), melanoma, males, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	350	55	35	10	10	155	50	10	15	0	5	0
	45–54	420	60	50	15	15	180	55	15	20	5	5	0
	55–64	510	90	50	15	15	230	65	15	25	5	10	0
	65–74	515	80	50	15	15	240	70	15	25	5	5	0
	75–84	400	65	30	10	10	200	45	10	15	5	5	0
	85+	120	25	10	5	5	55	15	0	5	0	0	0
	Total	2320	375	225	65	70	1070	300	65	105	15	35	5
2008–12	<45	335	55	35	10	5	160	45	10	10	0	5	0
	45–54	435	65	45	10	15	195	60	10	20	5	5	0
	55–64	640	110	65	20	20	295	70	20	30	5	10	0
	65–74	645	110	55	15	15	295	85	20	30	5	10	0
	75–84	525	85	45	15	10	265	60	15	20	5	10	0
	85+	200	35	15	5	5	95	20	5	10	0	5	0
	Total	2785	460	260	75	75	1305	335	80	120	20	45	5
2013–17	<45	330	50	35	5	5	170	40	10	10	5	5	0
	45–54	410	65	40	10	10	185	50	10	20	5	10	0
	55–64	710	120	75	20	20	330	75	20	30	5	10	0
	65–74	850	150	75	20	25	395	95	30	40	5	15	0
	75–84	630	105	50	15	15	315	70	15	25	5	15	0
	85+	290	50	25	5	10	145	35	5	10	5	5	0
	Total	3215	540	295	80	80	1540	365	90	135	25	55	5
2018–22	<45	325	50	30	10	5	170	40	10	10	5	5	0
	45–54	360	60	35	10	5	170	40	10	15	5	10	0
	55–64	725	115	75	15	20	350	80	20	30	5	10	0
	65–74	1010	185	90	25	25	475	100	30	45	10	15	0
	75–84	785	135	65	20	15	390	85	25	35	5	15	0
	85+	370	60	35	10	10	185	40	10	10	5	5	0
	Total	3570	605	330	85	85	1735	390	100	145	25	60	5
2023–27	<45	315	55	30	10	5	165	40	10	10	5	5	0
	45–54	325	50	30	5	5	160	40	10	15	5	15	0
	55–64	650	115	70	15	15	315	65	15	30	5	10	0
	65–74	1085	185	105	25	25	520	110	30	50	5	10	0
	75–84	1015	175	90	20	25	510	100	30	40	5	15	0
	85+	445	80	35	10	10	220	50	10	15	5	5	0
	Total	3835	660	365	90	90	1885	415	105	160	25	55	5
2028–32	<45	300	60	30	10	5	150	40	10	10	5	5	0
	45–54	320	45	30	10	5	170	40	10	10	5	15	0
	55–64	565	100	60	10	10	285	55	10	25	0	10	0
	65–74	1100	185	110	20	30	540	120	30	50	5	5	0
	75–84	1210	210	115	30	30	605	110	35	50	5	15	0
	85+	570	100	55	10	15	275	65	20	20	5	5	0
	Total	4065	700	400	90	90	2025	430	110	170	25	55	5

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

TABLE 4.9.2
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), melanoma, females, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	530	85	65	10	10	245	65	15	20	5	10	0
	45–54	430	65	55	15	10	195	50	15	20	0	10	0
	55–64	370	60	30	10	10	160	55	10	25	5	5	0
	65–74	315	45	25	5	10	150	45	10	15	0	5	0
	75–84	285	40	20	10	10	140	35	10	15	0	5	0
	85+	125	20	10	5	5	60	10	5	5	0	0	0
	Total	2055	320	210	55	55	950	260	60	100	15	30	5
2008–12	<45	530	85	55	10	10	255	60	15	20	0	10	0
	45–54	460	75	55	10	10	210	50	15	20	0	10	0
	55–64	490	85	40	10	10	220	60	15	25	0	10	0
	65–74	385	60	30	10	10	180	50	15	20	5	10	0
	75–84	335	50	25	10	10	165	40	10	15	0	5	0
	85+	185	30	15	5	5	90	15	5	5	0	0	0
	Total	2390	385	225	55	55	1115	270	70	110	15	40	0
2013–17	<45	550	90	50	10	15	270	60	15	20	5	10	0
	45–54	450	75	50	10	5	210	45	10	20	0	5	0
	55–64	550	95	45	15	15	240	60	20	30	0	10	0
	65–74	530	85	40	10	10	245	60	20	30	5	10	0
	75–84	380	60	30	10	10	190	40	10	20	5	5	0
	85+	235	40	20	5	10	115	20	5	10	0	5	0
	Total	2700	445	235	55	60	1270	285	80	125	15	45	5
2018–22	<45	555	95	40	10	15	285	60	15	20	5	10	0
	45–54	430	75	45	5	5	200	40	10	15	0	5	0
	55–64	585	95	50	10	10	260	55	20	30	0	10	0
	65–74	670	110	50	15	15	300	70	25	35	5	10	0
	75–84	465	75	35	10	10	225	50	15	25	5	10	0
	85+	280	45	25	5	10	135	20	5	10	0	0	0
	Total	2980	495	245	60	60	1405	295	85	135	15	50	5
2023–27	<45	550	100	35	10	15	295	60	10	20	5	15	0
	45–54	425	70	45	5	5	195	40	10	15	0	5	0
	55–64	560	95	45	10	10	255	50	15	25	0	5	0
	65–74	735	115	55	15	15	320	70	25	40	5	10	0
	75–84	635	100	50	10	10	295	60	20	35	5	10	0
	85+	320	50	30	5	10	155	25	10	10	5	5	0
	Total	3225	530	265	65	60	1515	305	95	150	15	45	5
2028–32	<45	520	100	25	10	15	285	60	10	20	5	15	0
	45–54	455	75	45	10	5	215	40	10	15	0	5	0
	55–64	530	90	45	5	10	240	45	15	25	0	5	0
	65–74	775	115	65	15	15	340	70	30	40	5	10	0
	75–84	790	125	65	15	10	360	70	20	45	5	10	0
	85+	400	65	35	10	10	185	30	10	15	5	5	0
	Total	3465	570	275	70	65	1625	315	100	165	15	45	5

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

TABLE 4.9.3
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), melanoma, males, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	3.4	4.3	3.2	3.2	2.5	3.9	2.0	3.9	5.6	4.5	3.4	0.6
	45–54	17.0	18.9	18.9	18.9	16.0	19.6	9.4	21.8	26.7	33.0	12.4	18.1
	55–64	29.7	37.2	32.0	26.2	27.4	36.0	15.2	30.0	42.0	35.0	26.3	14.7
	65–74	48.2	52.8	53.8	41.3	40.0	59.1	25.5	61.8	69.0	74.4	37.1	21.9
	75–84	64.1	72.9	59.6	40.2	33.7	84.2	30.6	79.6	82.9	102.3	72.6	28.8
	85+	79.8	93.5	77.3	53.2	80.7	99.8	44.1	58.3	78.3	159.4	53.6	0.0
	Total	13.1	15.4	13.6	11.3	10.6	16.0	7.0	15.3	18.9	20.0	11.6	6.1
2008–12	<45	3.4	4.1	2.9	2.8	1.9	4.2	1.9	4.2	4.6	6.1	2.9	1.6
	45–54	16.0	18.0	15.6	15.1	14.0	18.3	9.4	18.9	25.8	29.8	14.7	7.6
	55–64	31.1	38.8	32.4	30.4	25.8	38.4	13.4	35.9	43.6	52.5	32.2	14.8
	65–74	52.2	63.2	52.1	44.0	40.5	63.8	26.3	67.5	78.0	74.8	45.4	24.9
	75–84	74.9	81.6	73.5	59.0	48.8	98.1	35.4	82.2	95.8	118.8	86.4	35.6
	85+	94.3	109.2	88.0	64.4	73.0	116.3	47.9	101.4	119.9	259.7	125.5	44.9
	Total	13.9	16.4	13.6	11.9	10.3	17.2	7.0	16.6	19.7	23.9	13.8	6.6
2013–17	<45	3.2	3.8	2.5	2.6	1.8	4.2	1.8	4.4	4.6	8.9	2.9	1.5
	45–54	15.0	18.3	14.0	14.6	10.8	16.8	8.1	17.4	24.7	27.5	25.2	7.2
	55–64	30.1	36.4	30.6	28.7	22.1	37.4	13.1	35.5	41.9	53.3	27.8	14.3
	65–74	54.4	67.2	53.5	47.7	43.1	67.9	24.5	67.8	78.0	77.8	44.7	25.9
	75–84	81.5	90.6	76.4	66.0	51.6	106.8	37.8	93.4	107.2	105.2	104.4	38.8
	85+	108.4	126.6	99.5	67.8	78.4	135.6	55.2	116.7	133.0	295.0	137.4	51.6
	Total	14.2	16.8	13.3	12.2	9.9	17.8	6.8	17.1	20.0	25.8	15.3	6.7
2018–22	<45	3.0	3.6	2.4	2.8	1.8	4.0	1.7	4.7	4.4	11.5	2.9	1.4
	45–54	14.2	17.3	12.0	13.1	7.6	16.8	7.6	16.1	22.8	28.9	35.1	6.7
	55–64	27.8	32.7	27.7	22.1	20.2	34.5	12.9	31.1	41.1	36.6	20.5	13.2
	65–74	53.3	66.7	51.1	49.3	41.7	66.9	22.4	63.3	78.5	85.4	39.0	25.4
	75–84	84.8	98.1	80.3	66.9	54.2	110.1	38.0	101.8	113.8	97.6	102.3	40.4
	85+	116.8	125.4	118.0	90.1	80.2	147.6	57.8	140.3	137.9	212.4	156.5	55.6
	Total	13.9	16.5	12.9	11.9	9.4	17.5	6.6	17.0	19.9	25.7	15.4	6.6
2023–27	<45	2.8	3.5	2.4	2.9	1.7	3.7	1.6	4.8	4.4	13.0	2.9	1.3
	45–54	12.9	14.2	9.9	10.9	6.8	16.2	7.3	15.7	22.2	33.5	41.1	6.1
	55–64	25.1	31.2	25.4	19.5	16.7	30.2	11.3	27.1	40.6	25.6	24.4	11.9
	65–74	49.6	59.6	48.5	43.1	36.7	62.5	21.8	59.4	74.3	60.8	23.9	23.6
	75–84	84.5	98.9	82.1	68.1	58.0	111.6	35.1	94.2	113.2	79.7	77.4	40.2
	85+	120.6	139.8	111.5	82.8	86.9	150.4	61.2	143.9	159.2	173.6	137.1	57.4
	Total	13.1	15.7	12.3	11.1	8.8	16.7	6.2	16.2	19.7	23.6	14.3	6.3
2028–32	<45	2.7	3.7	2.4	3.0	1.7	3.3	1.6	4.9	4.5	14.7	2.9	1.3
	45–54	11.8	11.6	9.1	11.4	6.7	16.1	6.3	16.2	20.6	38.8	47.9	5.6
	55–64	23.2	29.0	22.3	17.5	11.8	29.3	10.3	24.6	36.6	21.5	28.9	11.0
	65–74	45.1	53.0	44.5	32.8	34.2	56.2	21.4	51.4	74.6	39.0	14.8	21.5
	75–84	81.2	95.6	79.2	68.3	56.2	107.1	32.1	88.6	113.6	76.2	59.6	38.6
	85+	121.7	141.8	126.9	86.1	89.0	150.6	58.9	155.3	157.7	149.2	117.9	57.9
	Total	12.4	14.8	11.7	10.4	8.2	15.7	5.9	15.5	19.2	23.1	14.0	5.9

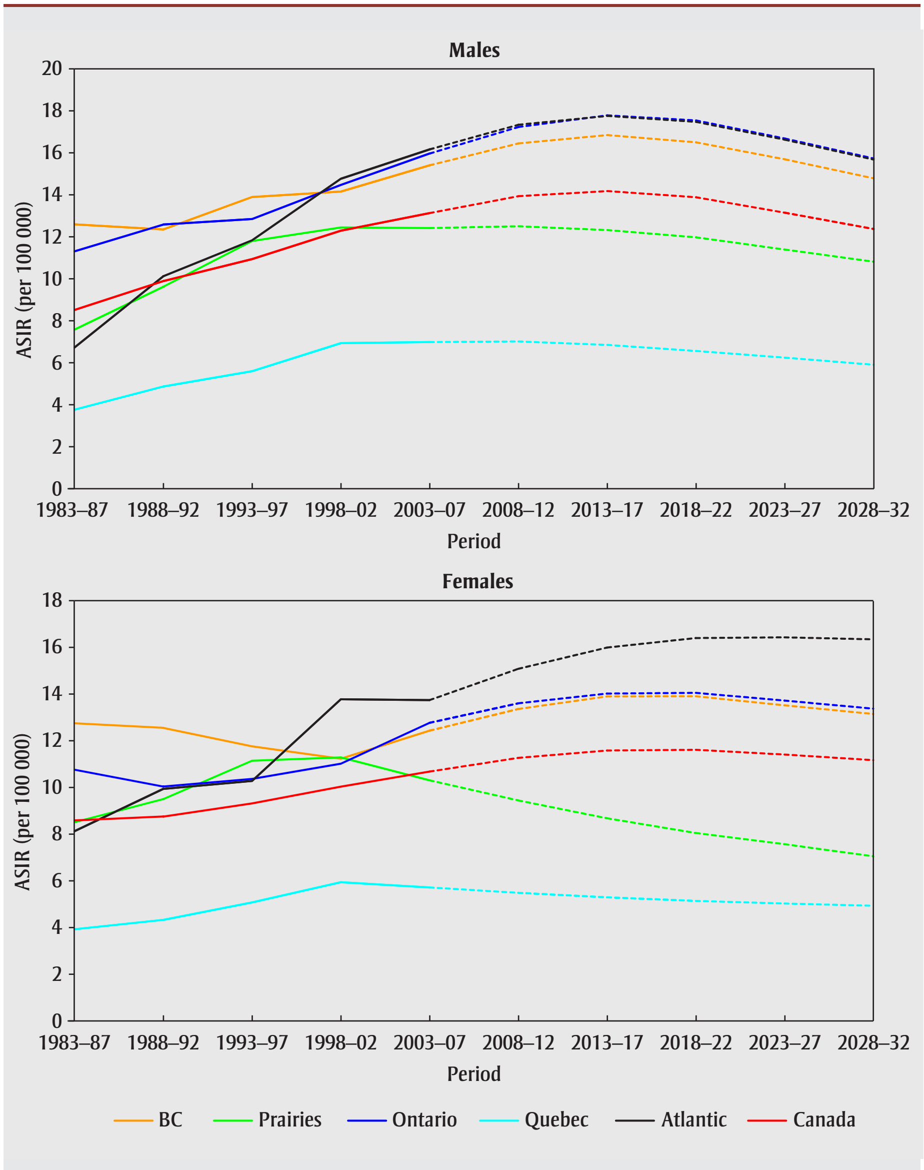
Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

TABLE 4.9.4
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), melanoma, females, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	5.3	6.4	6.1	3.6	3.6	6.2	3.0	6.1	7.5	7.4	4.6	3.0
	45–54	17.4	19.9	22.2	18.9	13.5	20.6	8.0	21.9	23.9	19.4	19.7	11.5
	55–64	20.6	24.7	20.2	16.4	15.6	24.2	11.5	22.0	40.6	39.9	19.3	17.7
	65–74	26.4	29.7	25.2	18.2	20.6	32.5	15.4	34.8	39.7	45.4	21.3	0.0
	75–84	32.6	35.4	32.8	30.8	24.5	41.4	15.3	38.9	57.7	63.0	25.8	0.0
	85+	37.1	42.4	44.5	28.1	43.7	47.8	15.3	35.6	39.9	64.3	27.4	0.0
	Total	10.7	12.4	11.7	8.5	8.0	12.8	5.7	12.6	16.5	16.7	9.6	4.9
2008–12	<45	5.4	6.6	5.1	3.7	3.6	6.5	2.9	6.3	7.3	6.5	5.6	2.5
	45–54	17.1	20.2	20.1	14.2	10.6	19.8	7.6	21.6	26.7	18.3	18.8	7.8
	55–64	22.9	28.5	21.3	18.5	15.6	27.2	10.8	28.1	39.6	24.3	23.4	10.5
	65–74	28.5	31.9	25.0	21.3	19.0	34.9	14.7	38.9	46.2	53.0	34.5	13.0
	75–84	36.9	41.8	36.6	26.0	25.3	47.0	16.8	39.1	62.0	53.6	35.9	16.8
	85+	42.3	51.5	45.4	32.3	35.7	54.9	14.3	47.2	51.3	63.9	36.3	19.3
	Total	11.3	13.4	11.0	8.4	7.6	13.6	5.5	13.6	17.2	14.7	11.9	5.1
2013–17	<45	5.4	6.6	4.3	3.7	3.6	6.7	2.7	6.4	7.4	6.8	7.6	2.5
	45–54	17.1	20.8	18.0	11.7	8.1	19.9	7.5	21.3	25.6	11.7	15.1	7.8
	55–64	22.6	28.2	19.4	18.9	15.7	26.0	9.8	30.3	38.7	18.2	23.4	10.3
	65–74	31.4	36.5	26.2	21.5	17.9	38.0	14.5	43.8	53.1	40.3	36.4	14.3
	75–84	39.6	44.7	36.8	26.6	24.3	50.4	16.9	42.2	64.4	70.4	40.8	18.1
	85+	46.3	55.9	50.8	33.9	40.3	58.5	14.7	56.0	60.7	86.1	45.2	21.1
	Total	11.6	13.9	10.2	8.2	7.2	14.0	5.3	14.4	17.8	13.7	13.3	5.3
2018–22	<45	5.2	6.5	3.4	3.9	3.6	6.7	2.6	6.4	7.5	7.0	9.4	2.4
	45–54	17.4	21.4	16.7	9.3	7.6	20.0	7.5	21.2	25.0	10.3	13.3	8.0
	55–64	22.0	26.3	19.3	16.4	14.0	25.0	9.1	31.6	37.1	20.2	19.9	10.1
	65–74	32.7	37.6	26.7	25.2	18.6	38.7	14.1	45.7	56.2	29.3	33.0	14.9
	75–84	41.4	47.6	35.4	28.7	21.1	51.8	16.7	45.3	70.5	75.8	46.4	18.9
	85+	49.5	59.7	52.6	30.7	43.7	63.3	15.8	51.9	62.6	54.3	32.4	22.6
	Total	11.6	13.9	9.4	8.2	7.0	14.0	5.1	14.7	18.1	12.9	13.9	5.3
2023–27	<45	5.0	6.5	2.6	3.9	3.7	6.6	2.6	6.1	7.5	6.7	10.5	2.3
	45–54	16.9	18.7	17.0	10.6	7.0	18.9	7.1	21.4	25.5	14.8	14.4	7.7
	55–64	21.5	25.3	17.9	14.2	11.0	24.1	9.2	30.0	35.5	15.6	12.9	9.8
	65–74	31.5	35.2	25.3	26.2	18.8	35.9	13.1	47.8	54.7	23.5	26.7	14.4
	75–84	44.5	51.1	38.8	29.9	20.1	54.7	16.9	49.0	79.9	62.9	39.1	20.3
	85+	51.5	59.2	53.5	35.5	39.2	64.5	15.6	59.5	65.1	114.5	38.3	23.5
	Total	11.4	13.5	8.8	8.3	6.7	13.7	5.0	14.8	18.3	12.6	13.5	5.2
2028–32	<45	4.7	6.2	2.0	3.8	3.7	6.2	2.6	6.3	7.6	6.5	11.6	2.1
	45–54	17.0	18.8	14.9	12.5	7.0	19.9	6.9	19.9	26.0	16.1	16.3	7.7
	55–64	21.6	25.3	16.7	11.5	10.0	23.7	9.3	29.3	34.7	12.7	9.2	9.8
	65–74	30.4	31.8	25.5	23.4	16.5	33.9	12.4	48.2	52.6	26.8	20.3	13.9
	75–84	45.3	50.7	39.0	35.7	21.1	54.1	16.6	50.2	83.3	47.3	32.4	20.7
	85+	52.8	62.9	50.8	37.6	34.2	64.9	15.7	58.9	73.5	90.1	36.5	24.1
	Total	11.2	13.1	8.1	8.2	6.4	13.4	4.9	14.7	18.3	11.8	13.5	5.1

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

FIGURE 4.9.1
Age-standardized incidence rates (ASIRs) by region, melanoma, 1983–2032



but fertility rates have stabilized.[148,149] Both oral contraceptives and hormone replacement therapy increase the incidence of breast cancer.[147,150,151] Following a 2002 Women's Health Initiative trial report about increased breast cancer risk associated with hormone replacement therapy, its use fell dramatically in Canada and elsewhere, which appears to have contributed to a temporary decrease in breast cancer incidence rates.[152,153] Obesity increases breast cancer risk in postmenopausal women, but may be protective in premenopausal women.[85,147] Breast density is strongly and independently associated with risk of breast cancer, with approximately 4-fold increased risk for highest (≥75%) versus lowest density (<10%).[154] Breast density is mainly influenced by genetic factors, and is also inversely associated with age, menopausal status and parity.[154-156] Breast density makes detecting cancer by mammography difficult and increases risk of advanced tumour stage at diagnosis.[157,158] IARC classified ''shift work that involves circadian disruption'' as a probable human carcinogen for breast cancer.[47]

Approximately 27% of breast cancer cases diagnosed in the United Kingdom (UK) in 2010 are attributable to mostly modifiable lifestyle and environmental factors.[159] A systematic analysis of 48 studies shows a modest (15%–20%) risk reduction for physically active females, with a stronger link for postmenopausal women (20%–80%).[160] The analysis also indicated a 6% reduction in breast cancer risk for each additional hour of physical activity per week. In the Canadian context, light intensity activity did not reduce breast cancer risk.[161] The occurrence of breast cancer is causally related to the consumption of alcoholic beverages.[47,162] According to the IARC, the evidence that tobacco smoking causes breast cancer is limited.[163] However, considerable evidence has suggested a potentially casual role for active smoking and early smoking initiation.[164,165] The association between passive smoking and breast cancer is still a topic of some debate, although there has been a suggestion for an elevated risk for premenopausal breast cancer.[147,165] X-radiation and gamma-radiation are associated with increased risk of breast cancer.[47] The younger the age of exposure, the greater the excess risk.[151] Changes in the modifiable factors may have also influenced the trend of breast cancer.

11. Cervix cancer

Cervix cancer was responsible for 0.9% of all new Canadian cases of cancer and 1.8% of cancer cases in females, with an average of 1345 new cases annually in 2003–2007 (Table 4.11.1). One in 145 females can expect to develop the disease in her lifetime, and 1 in 443 females are likely to die from it.[1] During 1998–2007, the ASIRs for cervix cancer decreased significantly by 1.4% per year (Figure 3.2). The 5-year relative survival rate for cervix cancer was 74% in Canada between 2006 and 2008.[1]

The pattern of age-specific rates of cervix cancer differs from those of most others cancers. Women aged 45 or older experienced almost double the incidence rate of their younger counterparts in 2003–2007 (Table 4.11.2). However, the number of cases decreased significantly with age (Table 4.11.1). The observed incidence rates decreased in all age groups, at approximately similar levels for age groups 45 and over (Figure 4.11.2). The predictions indicate that the incidence

FIGURE 4.9.2
Age-standardized incidence rates (ASIRs) for melanoma by age group (– males, – females), Canada, 1983–2032

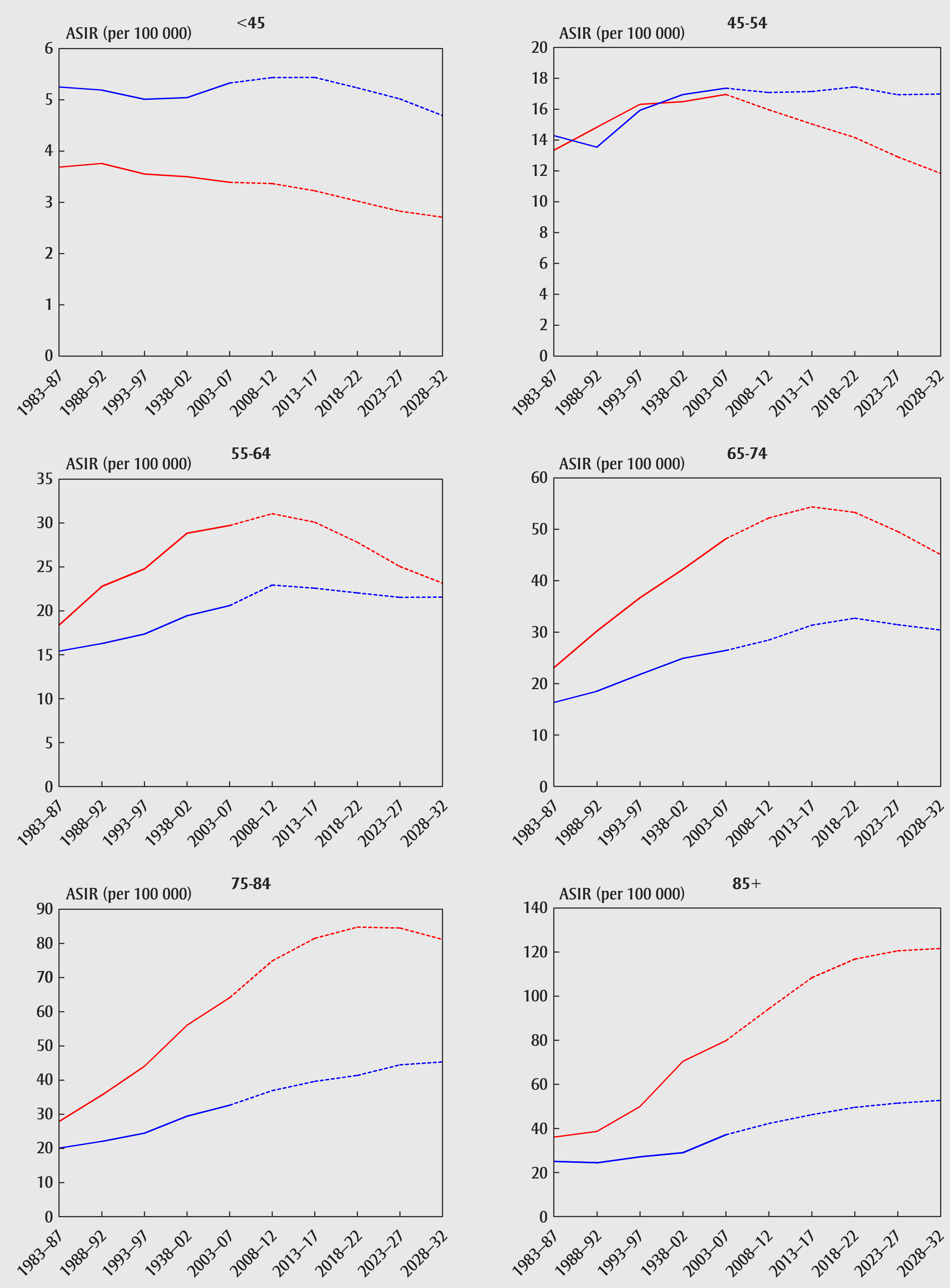


TABLE 4.10.1
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), breast cancer, females, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	2360	310	240	55	70	975	555	45	65	10	30	5
	45–54	4540	575	435	125	155	1745	1175	105	130	20	70	10
	55–64	4950	620	400	140	180	1865	1360	125	150	25	85	10
	65–74	4005	500	345	135	135	1555	1015	95	135	20	60	5
	75–84	3060	395	255	105	125	1155	765	85	115	15	40	5
	85+	1195	155	95	55	60	410	310	35	55	5	15	0
	Total	20 110	2555	1770	615	730	7705	5175	490	645	90	300	40
2008–12	<45	2135	285	225	45	70	935	445	40	50	5	25	5
	45–54	4805	635	475	125	150	1910	1160	110	145	20	65	15
	55–64	5850	750	495	165	210	2175	1575	150	180	30	95	15
	65–74	4735	600	400	145	155	1805	1255	115	155	25	85	5
	75–84	3050	375	260	105	110	1170	785	80	110	15	45	5
	85+	1360	180	110	60	60	505	335	45	55	5	15	0
	Total	21 930	2825	1970	645	755	8500	5550	535	695	100	325	45
2013–17	<45	2210	290	235	55	75	970	445	40	50	5	20	5
	45–54	4720	665	475	100	145	1965	1055	95	135	20	60	15
	55–64	6405	830	580	190	225	2405	1665	155	190	35	105	15
	65–74	5945	780	500	165	190	2245	1580	155	195	30	110	10
	75–84	3265	400	295	110	110	1250	845	85	115	20	55	5
	85+	1555	195	135	60	60	580	400	45	65	10	15	0
	Total	24 100	3160	2220	685	805	9415	5985	585	750	115	370	55
2018–22	<45	2490	325	255	65	85	1085	485	35	50	5	20	5
	45–54	4350	635	455	85	145	1915	880	90	115	15	50	15
	55–64	6950	945	645	195	225	2695	1720	170	210	35	105	20
	65–74	6935	930	615	200	220	2605	1805	180	225	40	135	15
	75–84	3965	500	365	125	130	1490	1050	105	140	25	80	5
	85+	1680	210	150	60	65	630	440	50	65	10	20	0
	Total	26 375	3545	2480	730	865	10 420	6390	630	805	130	410	60
2023–27	<45	2855	375	265	70	90	1245	525	35	50	5	20	10
	45–54	4425	645	480	105	155	1955	875	85	110	15	40	10
	55–64	6855	995	650	160	220	2800	1580	150	200	30	95	20
	65–74	7680	1050	725	230	240	2935	1935	190	245	45	150	20
	75–84	5075	665	465	145	160	1895	1350	150	180	30	110	10
	85+	1945	235	185	70	65	730	520	55	75	15	30	0
	Total	28 835	3970	2770	780	935	11 565	6785	670	865	145	445	70
2028–32	<45	3090	390	265	65	95	1295	525	35	50	5	15	10
	45–54	4990	745	525	125	175	2240	975	80	115	15	40	15
	55–64	6385	965	625	140	220	2755	1340	135	170	25	80	15
	65–74	8385	1200	810	240	240	3310	2015	205	270	50	150	20
	75–84	5970	795	575	175	190	2230	1565	170	210	40	135	15
	85+	2435	310	230	80	80	900	670	75	90	20	40	5
	Total	31 255	4405	3035	825	1000	12 730	7095	700	910	155	470	75

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

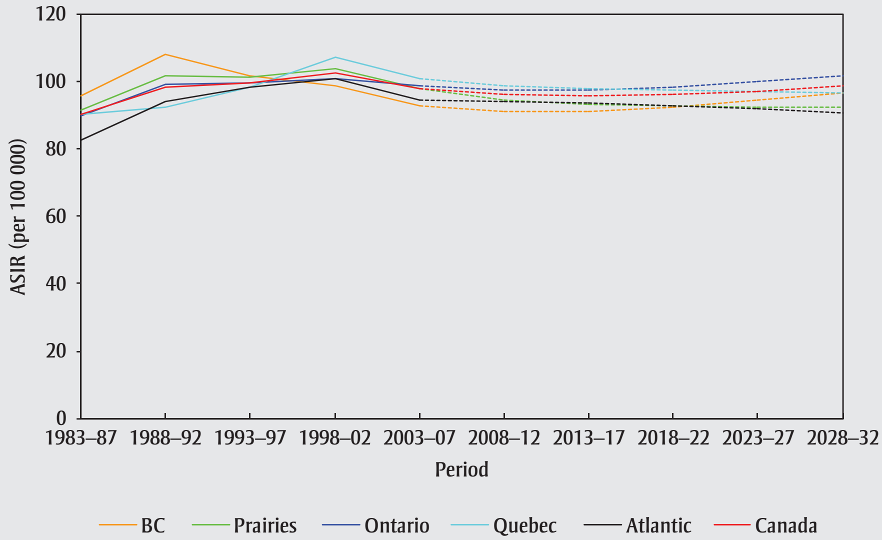
Note: Totals may not add up due to rounding.

TABLE 4.10.2
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), breast cancer, females, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	21.8	21.7	21.3	18.2	19.3	22.7	22.3	18.3	20.3	17.5	16.3	16.2
	45–54	182.2	171.0	177.1	170.1	182.4	185.7	191.2	170.4	171.6	161.1	156.4	170.1
	55–64	278.7	256.0	264.2	284.8	296.0	279.9	295.2	275.0	256.4	286.0	256.4	294.1
	65–74	338.4	318.0	357.9	363.6	328.9	341.4	336.4	321.2	361.2	357.6	316.7	318.1
	75–84	352.7	340.5	377.4	344.7	365.6	342.8	354.6	391.0	419.8	406.1	329.8	426.8
	85+	348.0	322.9	347.3	341.8	374.2	327.6	379.7	387.7	424.7	353.9	246.9	579.2
	Total	97.9	92.7	98.0	96.1	97.8	98.7	100.9	94.5	98.5	96.6	86.1	97.7
2008–12	<45	20.9	20.6	19.8	17.4	20.7	22.8	19.8	17.6	18.7	14.4	14.5	21.1
	45–54	177.2	174.2	171.5	159.7	161.7	181.4	180.7	172.0	181.3	167.0	151.7	178.5
	55–64	273.1	250.3	252.4	274.8	286.8	270.6	296.4	276.1	263.6	280.3	242.9	275.0
	65–74	349.8	324.0	360.1	367.5	342.3	350.5	359.9	335.1	358.8	395.8	354.2	352.2
	75–84	337.5	313.4	358.2	358.9	340.6	333.4	342.0	371.0	391.9	418.6	335.8	339.8
	85+	312.7	295.6	323.0	343.7	311.7	307.1	318.5	391.9	386.3	295.0	233.3	314.9
	Total	96.2	90.9	94.5	94.3	95.1	97.6	98.7	94.6	97.6	97.0	85.9	96.8
2013–17	<45	21.4	20.4	19.8	19.9	21.2	23.4	19.7	18.7	18.5	14.1	13.3	21.6
	45–54	176.9	182.7	172.2	138.6	164.2	184.0	175.2	161.3	180.8	157.6	144.0	178.1
	55–64	262.7	243.2	242.6	269.6	274.3	260.0	283.7	261.6	256.6	300.8	246.7	264.5
	65–74	351.8	330.9	345.3	361.6	337.3	350.8	369.8	360.1	354.6	376.3	361.3	354.2
	75–84	342.3	310.4	370.7	381.2	343.6	336.1	352.0	369.8	396.7	455.7	385.0	344.6
	85+	304.9	276.9	315.9	339.8	289.0	298.2	317.7	378.1	415.3	350.8	254.9	307.0
	Total	95.8	91.2	93.1	93.7	94.3	97.4	98.0	94.5	97.0	98.2	87.0	96.5
2018–22	<45	22.8	21.3	19.9	21.9	22.7	24.7	20.2	16.9	18.6	14.0	13.1	23.0
	45–54	174.5	180.8	169.8	134.9	170.9	188.0	165.3	166.3	174.2	147.3	131.2	175.7
	55–64	262.3	254.9	242.2	261.9	255.7	260.3	280.5	269.8	265.1	298.1	243.7	264.1
	65–74	340.2	320.4	329.2	350.1	328.0	336.8	365.6	342.4	345.9	384.4	364.1	342.6
	75–84	354.4	324.1	383.2	390.8	352.9	346.3	371.0	382.6	400.2	494.1	437.3	356.8
	85+	297.7	268.2	305.6	335.7	295.8	291.9	313.2	390.4	384.8	365.1	279.0	299.8
	Total	96.1	92.3	92.1	93.5	94.1	98.1	97.3	93.9	96.3	98.8	87.5	96.7
2023–27	<45	24.8	22.7	19.7	21.9	22.6	26.4	21.4	16.9	18.6	13.9	12.9	24.9
	45–54	175.7	179.1	172.3	158.6	179.8	191.4	161.7	168.8	174.5	146.4	123.3	176.9
	55–64	263.2	269.5	246.1	231.6	260.3	266.5	275.4	254.9	266.9	286.3	235.7	265.0
	65–74	330.3	316.2	319.1	346.9	314.0	329.7	352.4	331.3	340.2	410.9	372.1	332.6
	75–84	356.9	331.8	368.2	386.1	347.4	349.5	382.9	410.4	398.2	463.5	446.8	359.3
	85+	310.7	271.7	332.7	373.3	298.3	303.9	333.9	381.0	413.5	412.9	336.3	312.8
	Total	97.2	94.4	91.7	93.4	94.3	99.9	97.1	93.0	96.3	98.8	87.3	97.8
2028–32	<45	26.0	22.6	19.6	21.8	22.5	26.2	21.3	16.9	18.5	13.8	12.8	26.2
	45–54	186.1	191.0	173.8	172.9	191.4	207.0	169.5	156.1	175.6	145.6	122.4	187.3
	55–64	260.5	268.6	243.6	224.6	271.2	273.9	261.6	260.4	258.0	270.9	218.2	262.3
	65–74	331.4	333.6	322.2	335.2	294.6	331.7	352.2	338.8	352.7	410.0	369.9	333.6
	75–84	344.9	321.0	354.1	373.3	339.9	336.1	378.7	384.7	387.7	492.5	455.1	347.3
	85+	321.8	290.7	336.6	366.8	311.3	314.5	352.0	407.9	402.7	443.3	376.6	324.0
	Total	98.7	96.5	91.3	93.0	94.9	101.8	96.7	92.0	96.0	98.6	86.2	99.3

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

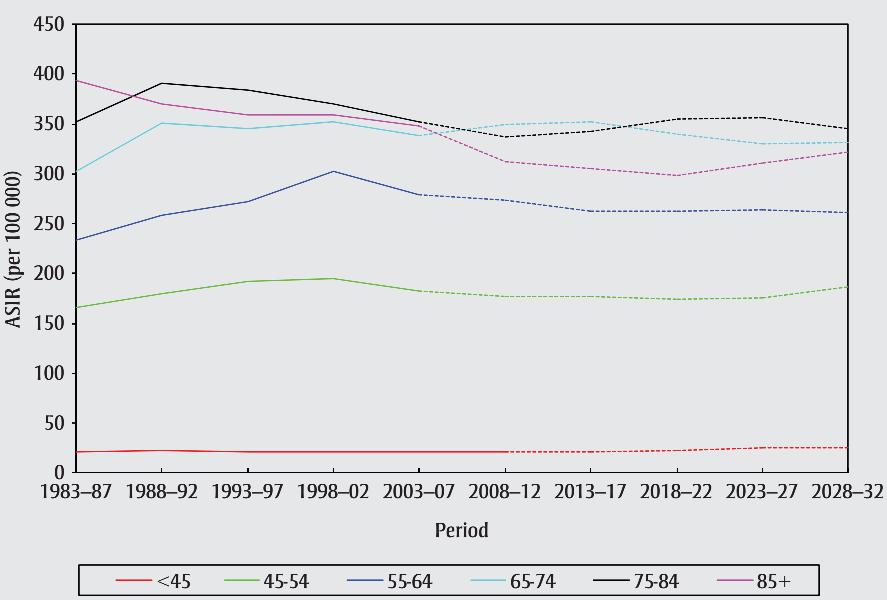
FIGURE 4.10.1
Age-standardized incidence rates (ASIRs) by region, female breast cancer, 1983–2032



rates will decrease with time and then level off in each age group. The rates are projected to decrease with age in each period for women aged 45 and over (Figure 4.11.2). Women aged 85 or older will eventually experience rates as low as those in the youngest age group.

In all regions, the incidence rates have decreased with time, at similar degrees (Figure 4.11.1). The projections show that British Columbia will continue to have the lowest rates, while the Prairies will experience the highest incidence after 2008–2012.

FIGURE 4.10.2
Age-standardized incidence rates (ASIRs) for female breast cancer by age group, Canada, 1983–2032



From 2003–2007 to 2028–2032, the ASIRs of cervix cancer for Canada are expected to decrease by 20%, from 7.6 to 6.1 per 100 000 (Table 4.11.2). With the projected Canada population growth and aging, however, the annual number of new cases is predicted to increase by 7%, from 1345 to 1435 (Table 4.11.1).

Comments

The 2013 IARC summary concludes that there is sufficient evidence for the human carcinogenicity of HPV types 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58 and 59 in the cervix.[47] Virtually all cervical cancers are causally linked to HPV.[166] HPV types 16 and 18 cause approximately 70% of all cervical cancers.[167,168] The overall HPV prevalence was estimated at 16.8% in females in British Columbia, with the prevalence of high-risk HPV at 13.9%.[169] HPV DNA point prevalence is thought to underestimate cumulative incidence of infection as many infections resolve spontaneously. People with immunosuppression caused by human immunodeficiency virus (HIV) infection or organ transplantation are also at increased risk.[170] Cigarette smoking generally doubles the risk of developing the disease, with dose-response trends for both smoking frequency and duration.[52] About 7% of cervical cancer cases were attributed to smoking in the UK in 2010.[171]

Cervical cancer incidence rate has dropped significantly due to general population screening with the Papanicolaou (Pap) test that allows early detection and treatment of precancerous lesions. The 2013 *Annual Report to the Nation on the Status of Cancer*[56] shows that the prevalence of the Pap test is negatively associated with cervical cancer incidence rates in the US but positively associated with vaccination coverage levels. Information on cervical cancer screening has not been included in the statistical projections in this report, but cervical cancer screening has been widespread in Canada for many decades and therefore its impact on future trends of cervical cancer incidence has been taken into account to some extent through observed incidence rates. Cervical cancer rates should fall even faster, as the effects of HPV vaccinations come into play. A recently introduced vaccine has

TABLE 4.11.1
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), cervix Cancer, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	580	70	75	15	20	230	115	15	25	5	10	0
	45–54	305	30	35	10	10	120	70	10	10	0	5	0
	55–64	195	25	15	5	10	80	45	5	5	0	5	0
	65–74	120	10	10	5	5	50	30	5	5	0	0	0
	75–84	110	10	10	5	5	40	30	5	5	0	0	0
	85+	35	5	5	0	0	15	10	0	0	0	0	0
	Total	1345	155	150	40	45	530	300	35	50	10	25	5
2008–12	<45	520	60	85	15	15	210	95	15	20	5	10	0
	45–54	300	30	30	10	10	120	75	5	10	0	5	0
	55–64	225	25	20	5	10	90	50	5	5	0	5	0
	65–74	130	15	15	5	5	55	30	5	5	0	0	0
	75–84	85	10	5	0	5	30	25	5	0	0	0	0
	85+	40	5	5	0	0	15	10	0	0	0	0	0
	Total	1295	145	160	40	45	520	285	30	45	5	20	5
2013–17	<45	505	55	85	20	15	210	85	10	20	5	10	0
	45–54	280	30	35	10	10	115	65	5	10	0	5	0
	55–64	245	25	25	5	10	100	60	5	10	0	5	0
	65–74	150	15	15	5	5	60	35	5	5	0	0	0
	75–84	80	10	5	0	5	30	20	5	0	0	0	0
	85+	35	5	5	0	0	10	10	0	0	0	0	0
	Total	1290	140	165	40	40	525	280	30	45	5	20	5
2018–22	<45	495	50	80	15	15	215	80	10	20	5	10	0
	45–54	270	30	35	10	5	115	60	5	10	0	0	0
	55–64	260	30	25	10	10	105	65	5	10	0	5	0
	65–74	175	20	20	5	5	70	45	5	5	0	0	0
	75–84	85	10	10	5	5	30	25	5	0	0	0	0
	85+	35	5	5	0	0	10	10	0	0	0	0	0
	Total	1320	140	175	45	40	550	280	30	45	5	15	5
2023–27	<45	500	50	65	15	15	230	75	10	20	5	10	0
	45–54	280	30	50	10	5	115	60	5	10	0	5	0
	55–64	255	30	30	10	10	105	60	5	10	0	0	0
	65–74	210	20	25	5	5	85	55	5	5	0	0	0
	75–84	105	10	10	5	5	40	30	5	0	0	0	0
	85+	35	5	5	0	0	10	10	0	0	0	0	0
	Total	1385	145	180	45	45	580	290	35	50	10	15	5
2028–32	<45	490	50	65	15	15	230	75	10	20	0	10	0
	45–54	290	25	45	10	5	120	55	5	10	0	5	0
	55–64	260	30	35	10	5	105	55	5	10	0	0	0
	65–74	225	25	25	5	5	90	65	5	5	0	0	0
	75–84	130	15	15	5	5	50	40	5	5	0	0	0
	85+	40	5	5	0	0	15	15	0	0	0	0	0
	Total	1435	150	185	50	45	610	300	35	50	10	15	5

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

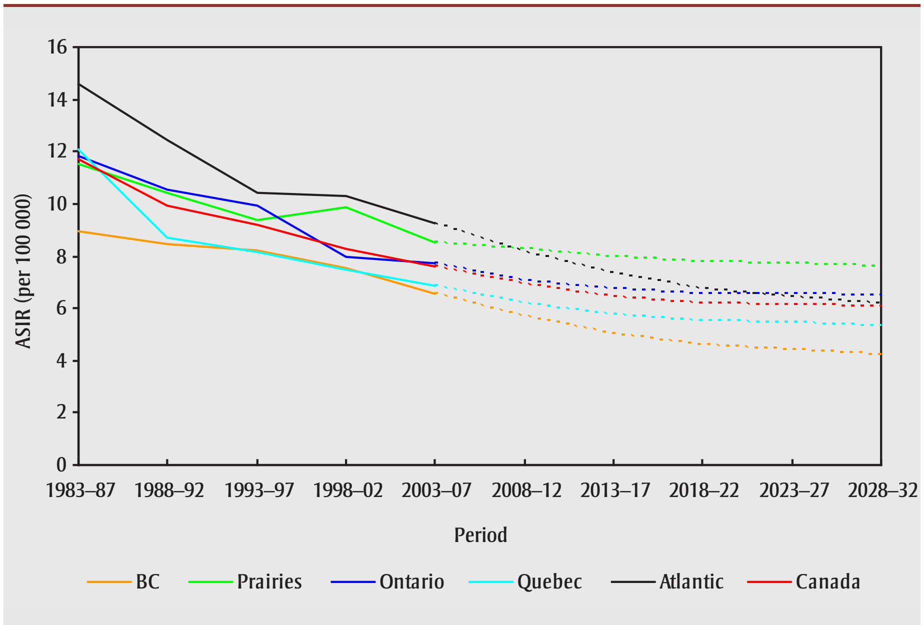
Note: Totals may not add up due to rounding.

TABLE 4.11.2
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), cervix cancer, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	5.9	5.4	7.5	6.5	5.5	5.9	5.0	6.3	9.1	8.1	7.6	4.0
	45–54	12.3	9.5	13.3	17.3	12.5	13.1	11.8	12.8	12.9	11.5	9.7	19.6
	55–64	10.8	10.8	10.8	8.7	12.6	11.8	9.3	7.5	12.3	17.2	11.6	29.3
	65–74	10.2	6.9	12.9	7.7	12.8	10.5	9.5	14.1	14.0	14.7	11.2	0.0
	75–84	12.3	10.2	13.1	9.8	10.1	11.4	14.6	19.2	14.1	14.5	11.2	0.0
	85+	10.8	7.5	13.1	8.9	6.2	10.0	13.7	10.5	11.2	32.2	11.8	96.5
	Total	7.6	6.6	9.1	8.1	7.5	7.7	6.8	8.1	10.3	10.1	8.6	8.4
2008–12	<45	5.4	4.5	7.7	6.6	4.8	5.4	4.3	6.4	8.7	7.2	6.8	6.0
	45–54	11.3	8.8	11.8	13.3	10.3	11.7	11.9	8.5	13.7	15.0	9.5	12.6
	55–64	10.3	8.8	11.0	11.1	10.9	11.2	9.4	11.2	10.8	13.7	7.7	11.4
	65–74	9.5	7.5	11.9	10.5	11.3	10.3	8.9	9.0	9.1	12.6	8.4	10.5
	75–84	9.3	7.1	8.6	7.8	13.7	9.0	10.1	15.6	8.8	12.3	12.8	10.3
	85+	8.7	8.4	10.9	8.1	6.5	7.7	11.3	9.7	5.7	11.6	9.3	9.7
	Total	6.9	5.7	8.8	8.0	6.7	7.1	6.2	7.6	9.4	9.2	7.5	7.7
2013–17	<45	5.0	3.9	7.0	6.4	4.4	5.2	3.9	5.9	8.6	6.7	6.7	5.6
	45–54	10.8	8.4	12.4	13.7	9.3	11.0	11.3	9.2	12.5	14.3	7.9	11.9
	55–64	10.0	8.0	10.6	10.7	9.8	10.7	10.2	10.1	10.1	13.3	6.9	11.1
	65–74	8.7	7.0	10.7	10.2	10.2	9.5	8.4	7.7	6.8	11.6	5.3	9.7
	75–84	8.1	6.1	8.7	8.4	12.5	7.8	8.8	12.6	7.1	10.8	8.5	9.0
	85+	6.7	6.4	7.2	4.8	5.9	6.4	8.5	9.1	4.5	8.9	7.0	7.5
	Total	6.5	5.0	8.2	7.8	6.1	6.7	5.7	7.0	8.9	8.6	6.8	7.2
2018–22	<45	4.7	3.3	6.4	5.9	4.1	5.0	3.5	5.2	8.2	6.2	6.9	5.2
	45–54	11.3	8.8	13.8	15.9	8.7	11.8	11.3	12.0	14.1	14.9	6.4	12.5
	55–64	9.7	7.8	10.3	10.7	9.2	10.0	10.6	8.8	10.5	12.9	6.0	10.8
	65–74	8.7	6.6	10.3	9.8	9.6	9.4	8.9	9.8	7.2	11.6	4.2	9.7
	75–84	7.5	5.7	8.7	11.8	11.7	7.4	8.3	9.8	5.2	10.0	5.5	8.4
	85+	5.8	4.7	8.2	5.1	5.4	5.3	7.1	6.9	2.9	7.7	8.4	6.4
	Total	6.2	4.6	7.9	7.8	5.7	6.6	5.5	6.8	8.8	8.3	6.5	6.9
2023–27	<45	4.6	3.1	5.2	5.7	4.0	5.1	3.3	5.0	7.8	6.0	6.6	5.1
	45–54	11.3	7.9	17.5	16.2	8.4	11.3	10.8	13.0	17.9	15.0	8.2	12.5
	55–64	9.8	8.1	11.3	11.7	8.9	9.9	10.6	10.5	10.9	13.0	5.3	10.9
	65–74	9.0	6.5	10.4	9.7	9.3	9.4	10.4	9.8	7.7	12.0	4.1	10.0
	75–84	7.4	5.8	8.3	11.4	11.3	7.2	8.4	9.7	4.7	9.9	3.6	8.2
	85+	5.5	5.0	8.4	6.0	5.2	4.9	6.9	6.5	3.0	7.3	4.6	6.1
	Total	6.2	4.4	7.5	7.8	5.5	6.5	5.4	6.8	9.0	8.2	6.4	6.8
2028–32	<45	4.4	3.0	5.0	5.6	3.9	5.0	3.2	4.7	7.3	5.8	6.4	4.9
	45–54	10.9	6.6	14.6	15.1	8.1	11.4	9.8	11.8	18.7	14.4	9.3	12.1
	55–64	10.6	8.8	13.0	13.7	8.6	10.7	10.9	14.3	12.9	14.0	4.4	11.7
	65–74	9.0	6.6	10.3	10.3	8.9	9.0	10.9	9.0	8.5	11.9	3.6	10.0
	75–84	7.7	5.6	8.2	11.6	11.0	7.4	9.2	12.9	5.4	10.2	3.1	8.5
	85+	5.3	4.6	8.7	9.6	5.1	5.0	6.6	4.5	1.9	7.1	3.3	5.9
	Total	6.1	4.2	7.3	7.9	5.3	6.5	5.3	6.9	9.0	8.1	6.2	6.7

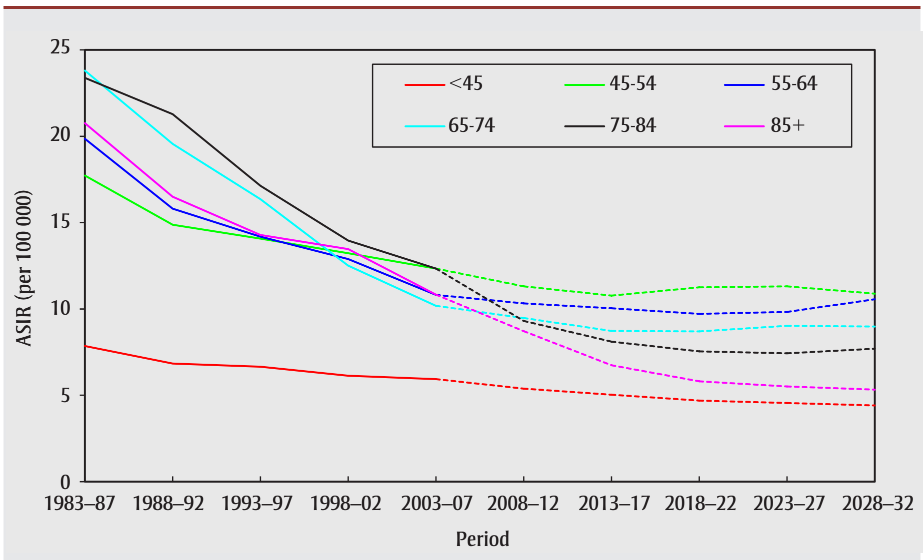
Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

FIGURE 4.11.1
Age-standardized incidence rates (ASIRs) by region, cervix cancers, 1983–2032



been shown to reduce the risk of infection with HPV types 16 and 18. The reduction in incidence rates that might be expected for newly vaccinated cohorts depends on the eligibility and coverage as well as the percentage of cancers prevented by the vaccine.[172] The primary age group recommended for HPV vaccination is females aged 9 to 13. The vaccination is also recommended for females aged 14 to 26 as there still is the potential for benefit regardless of previous history of sexual activity.[173] Women aged 20 to 24 would be included in the lower risk cohorts by 2020 and those aged 30 to 34, by 2030. If the vaccine prevents 70% of new cervical cancers[173] and population coverage is 60%,[60] the reduction in the incidence rate for all ages combined will be minimal by 2020, but the incidence rate is estimated to be reduced by about an additional 7% by 2030, from 6.1 to 5.5 per 100 000.

FIGURE 4.11.2
Age-standardized incidence rates (ASIRs) for cervix cancer by age group, Canada, 1983–2032



12. Cancer of the body of the uterus

Uterine cancer, or endometrial cancer specifically, which arises in the body of the uterus, is the fourth most common cancer in Canadian females and the most frequently diagnosed gynecological malignancy. The likelihood of developing uterine cancer is 1 in 39, and the lifetime probability of dying from the disease is 1 in 173.[1] In 2003–2007, the average annual number of new uterine cancer cases was 4105, or 5.5% of all cancer cases in females (Table 4.12.1). Uterine cancer is rarely seen before age 45 (2.0 per 100 000), but the incidence increased sharply with age, peaked at 82.0 per 100 000 in the 65–74 age group, and subsequently decreased gradually (Table 4.12.2). Approximately 57% of the new cases were diagnosed in women aged 55 to 74. Uterine cancer has the highest 5-year relative survival rate among all main gynecological cancers (including cervix, ovarian, vaginal and vulvar) in Canada, at 85% for 2006–2008.[1]

Overall rates of uterine cancer decreased marginally in the 1980s and have gradually risen slightly (Figure 4.12.1). During 1998–2007, the ASIRs increased significantly by 0.7% per year (Figure 3.2). Uterus cancer incidence in females younger than 45 has stabilized (Figure 4.12.2). The rates in women aged 45 to 64 have risen steadily since 1988–1992, being less evident in the 45–54 age range. Incidence in women aged 65 to 74 fell substantially until 1998–2002 and then increased slightly. The rates in women aged 75 or older have decreased since 1998–2002, with relatively pronounced decreases in women aged 75 to 84. Figure 4.12.1 indicates that Quebec used to have the highest rates of uterus cancer, but the rates have decreased substantially and approached the lowest level of the regions in 2003–2007. The rates in other regions have been relatively stable through the observation periods.

Figure 4.12.2 shows that the increase in the overall rates of uterine cancer will be less evident in younger females (<55) and substantial in women aged between 55 and 74. Incidence in women aged 75 to 84 will fall slightly in the first period and then increase markedly. The rates in the oldest women will decrease in the first 2 periods

TABLE 4.12.1
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), cancer of body of uterus, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	220	25	25	5	10	90	40	5	5	0	5	0
	45–54	730	100	75	20	35	275	170	15	20	5	15	0
	55–64	1355	170	135	40	55	530	320	30	45	5	20	0
	65–74	970	120	85	30	40	400	225	25	30	5	15	0
	75–84	630	80	45	20	30	255	165	15	20	0	10	0
	85+	205	25	15	10	5	70	60	5	5	0	0	0
	Total	4105	520	380	130	175	1620	980	95	125	20	60	5
2008–12	<45	230	35	25	5	10	95	40	5	5	0	5	0
	45–54	810	110	85	25	35	320	180	20	20	5	15	0
	55–64	1685	220	160	50	70	675	380	35	50	5	25	5
	65–74	1200	165	105	35	45	480	285	30	35	5	15	0
	75–84	640	80	50	20	25	265	165	15	20	5	10	0
	85+	250	35	15	5	10	90	75	5	10	0	0	0
	Total	4815	640	445	145	195	1925	1125	105	140	20	70	10
2013–17	<45	245	35	20	5	10	100	40	5	5	0	5	0
	45–54	840	120	95	20	35	350	170	10	20	5	15	0
	55–64	1915	255	190	55	75	785	420	45	45	5	25	5
	65–74	1610	225	140	50	60	645	375	35	50	5	20	5
	75–84	715	90	55	25	30	295	180	15	20	5	10	0
	85+	260	35	20	5	10	100	75	5	10	0	0	0
	Total	5590	760	520	160	215	2275	1260	120	150	20	80	10
2018–22	<45	275	35	20	5	10	110	45	5	5	0	5	0
	45–54	835	135	85	20	35	355	155	10	20	5	15	0
	55–64	2105	275	225	55	80	900	435	40	45	10	25	5
	65–74	1975	280	175	60	70	800	440	45	55	10	30	5
	75–84	885	115	70	30	35	360	225	20	30	5	15	0
	85+	290	40	20	10	10	115	85	5	10	0	0	0
	Total	6370	885	595	175	240	2640	1385	130	165	25	90	10
2023–27	<45	285	40	25	5	10	120	45	5	5	0	5	0
	45–54	860	130	75	20	35	360	155	10	20	5	15	0
	55–64	2145	300	240	50	85	950	400	30	55	5	30	5
	65–74	2235	315	205	65	80	930	485	60	50	10	25	5
	75–84	1205	155	100	35	45	490	295	25	40	5	20	0
	85+	340	50	25	10	10	135	100	10	10	0	5	0
	Total	7065	985	665	190	265	2980	1485	140	180	25	95	15
2028–32	<45	295	45	25	5	15	125	45	5	5	0	5	0
	45–54	970	140	80	25	40	395	170	10	20	5	15	0
	55–64	2105	310	220	45	85	950	375	25	45	5	25	5
	65–74	2440	335	245	65	85	1055	500	55	60	10	30	5
	75–84	1465	190	120	45	50	605	345	35	45	5	25	5
	85+	430	60	35	10	15	165	125	10	15	5	5	0
	Total	7700	1080	720	200	285	3295	1560	140	190	30	100	15

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

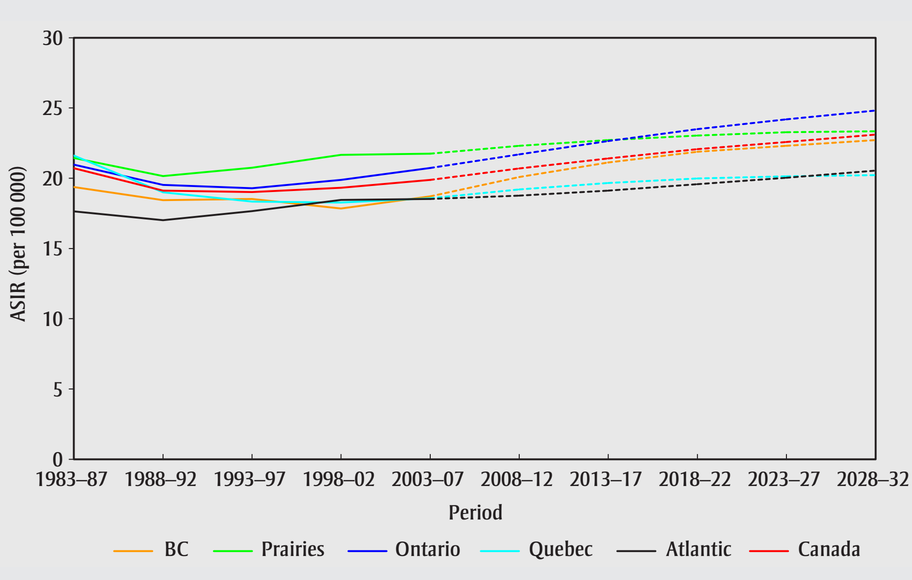
Note: Totals may not add up due to rounding.

TABLE 4.12.2
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), cancer of body of uterus, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	2.0	1.9	2.1	2.4	3.1	2.1	1.7	1.6	2.1	2.8	3.1	2.5
	45–54	28.8	28.6	30.1	30.4	39.8	29.0	27.2	27.8	22.7	27.6	30.1	34.0
	55–64	76.1	71.2	89.7	82.6	90.7	79.7	68.9	60.9	76.4	77.5	66.7	50.7
	65–74	82.0	76.5	86.3	85.5	91.7	87.9	74.1	79.7	82.9	74.8	64.8	83.7
	75–84	73.1	66.9	70.5	60.8	83.1	75.6	75.8	73.9	64.7	52.8	60.7	0.0
	85+	59.5	54.5	53.3	54.8	42.4	56.9	75.5	58.7	55.9	75.1	19.6	96.5
	Total	19.9	18.7	21.4	20.6	23.9	20.7	18.6	18.1	19.0	19.3	17.9	16.4
2008–12	<45	2.3	2.4	2.2	1.9	3.2	2.3	1.8	1.4	2.2	2.3	3.2	1.8
	45–54	29.1	29.0	30.2	30.9	35.4	30.0	27.1	26.4	22.2	25.7	30.1	23.7
	55–64	78.8	73.4	83.2	80.5	92.6	84.0	71.4	62.3	71.0	64.4	67.2	64.3
	65–74	88.6	88.9	92.6	96.7	101.8	93.2	82.2	90.1	83.7	78.3	68.1	72.2
	75–84	71.7	65.6	69.5	72.6	79.1	75.6	71.7	63.9	72.7	67.0	67.8	58.4
	85+	57.1	57.4	49.1	41.0	49.3	55.8	70.7	61.8	66.9	80.0	29.0	46.6
	Total	20.7	20.1	21.2	21.2	24.3	21.7	19.2	18.2	19.0	18.4	18.6	16.9
2013–17	<45	2.4	2.3	1.7	1.9	3.2	2.4	1.8	1.4	2.2	2.3	3.3	1.9
	45–54	30.5	32.8	32.6	30.1	38.1	31.6	27.0	18.8	27.7	25.7	36.8	24.9
	55–64	78.7	74.4	79.6	75.3	90.1	85.1	71.4	73.4	57.8	64.5	63.3	64.1
	65–74	95.3	95.6	96.2	105.2	104.1	100.8	88.1	86.4	92.3	82.4	71.0	77.7
	75–84	75.4	70.7	70.6	86.7	87.3	80.1	75.6	70.6	73.5	67.6	67.1	61.5
	85+	50.8	51.5	48.8	41.2	39.5	50.4	61.3	54.1	60.9	64.0	30.9	41.4
	Total	21.4	21.1	21.1	21.8	24.7	22.7	19.7	18.3	19.1	18.6	19.2	17.5
2018–22	<45	2.5	2.4	1.7	1.9	3.1	2.5	1.9	1.4	2.2	2.3	3.3	2.1
	45–54	32.5	37.2	30.6	30.5	41.8	33.8	28.6	18.9	27.8	25.7	37.5	26.5
	55–64	79.5	74.3	84.5	74.5	89.6	86.8	70.7	66.0	59.3	64.5	64.2	64.8
	65–74	96.9	96.3	92.1	103.2	105.8	103.7	89.4	89.9	87.0	82.5	74.7	79.0
	75–84	79.5	75.1	74.9	90.5	88.9	84.3	79.0	77.4	78.2	76.1	71.9	64.8
	85+	51.1	52.9	44.4	46.2	44.0	52.3	59.1	47.9	66.4	59.0	31.2	41.6
	Total	22.1	21.9	21.2	21.8	25.2	23.5	20.0	18.1	19.1	18.8	19.8	18.0
2023–27	<45	2.5	2.5	1.7	2.0	3.1	2.5	1.9	1.4	2.2	2.3	3.3	2.0
	45–54	33.5	34.6	25.4	30.7	41.7	34.4	28.3	18.9	27.8	25.7	37.9	27.3
	55–64	82.4	81.2	90.9	72.2	97.0	90.2	70.4	51.9	70.3	64.5	73.8	67.2
	65–74	96.2	95.0	90.8	97.8	103.8	104.6	88.9	104.6	70.7	82.5	67.6	78.4
	75–84	85.0	78.2	78.6	99.0	92.5	90.7	84.0	73.2	86.1	79.4	72.7	69.2
	85+	54.5	56.0	48.5	57.3	49.8	55.6	64.4	60.0	64.2	62.0	29.7	44.4
	Total	22.6	22.3	21.2	21.7	25.9	24.2	20.1	17.8	19.2	19.0	20.3	18.4
2028–32	<45	2.5	2.6	1.7	2.0	3.1	2.6	1.9	1.4	2.2	2.3	3.4	2.0
	45–54	35.2	35.3	25.2	31.0	41.5	35.8	28.6	18.9	27.8	25.7	38.2	28.7
	55–64	85.7	86.7	85.2	72.6	104.0	94.2	72.7	51.9	70.4	64.5	74.5	69.9
	65–74	96.4	92.7	97.1	95.3	103.9	105.6	86.5	91.0	77.6	82.5	70.3	78.6
	75–84	85.0	76.8	74.6	94.1	93.6	91.9	83.8	77.7	79.9	79.4	76.8	69.3
	85+	56.9	58.3	51.5	55.1	48.7	57.9	65.2	61.8	72.1	71.9	33.9	46.4
	Total	23.1	22.7	21.0	21.4	26.5	24.8	20.2	17.1	19.5	19.1	20.7	18.8

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

FIGURE 4.12.1
Age-standardized incidence rates (ASIRs) by region, cancer of body of uterus, 1983–2032



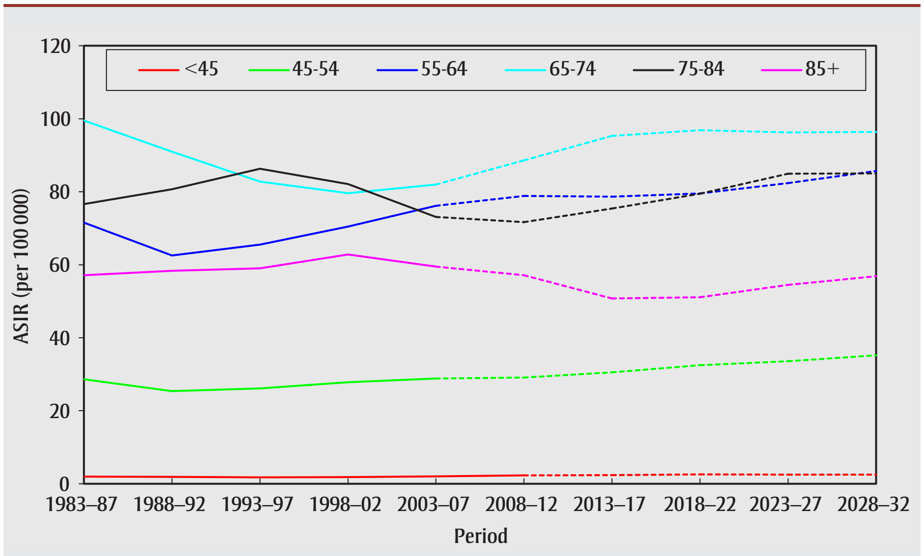
and then increase gradually. Figure 4.12.1 shows that the rates are predicted to increase slightly in each region and that geographical variation in rates is not considerable.

From 2003–2007 to 2028–2032, the ASIRs for uterine cancer in Canadian females are projected to increase by 16%, from 19.9 to 23.1 per 100 000 (Table 4.12.2). The annual number of new cases is projected to increase by 88%, from 4105 to 7700 (Table 4.12.1).

Comments

Excessive exposure to estrogen unopposed by progesterone is the most widely accepted hypothesis on the etiology of uterine cancer. Such exposure to estrogen can explain the related risk factors: early menarche, late menopause, nulliparity, hormone replacement therapy and obesity.[86] Combined oestrogen–progestagen oral contraceptives appear to have a protective effect.[174]

FIGURE 4.12.2
Age-standardized incidence rates (ASIRs) for cancer of body of uterus by age group, Canada, 1983–2032



Convincing epidemiological evidence links excess body mass and lack of sufficient physical activity to increased risk of uterine cancer. Excess weight accounts for approximately 50% of uterine cancer cases in Europe and the US,[70,175] and obesity accounts for 40% of uterine cancer incidence worldwide.[86] A meta-analysis of 18 studies published between 1989 and 2011 suggests that overweight and obese females have 32% and 154% higher risk of uterine cancer, respectively.[176] Postmenopausal obese women have higher levels of estradiol than postmenopausal normal-weight women.[175] In Canada, the prevalence rates of obesity have nearly doubled in adults from 1978/79 to 2012.[51,72,73] In addition, there is considerable evidence that a lack of sufficient physical activity, independent of BMI, is associated with an increased risk of uterine cancer.[177,178]

Changes in prevalence of overweight and obesity may partially account for the observed and predicted increase in uterine cancer incidence.[179,180] Stable prevalence rate of oral contraceptive use[181] could explain why incidence rates of uterine cancer have stabilized in females younger than 45.[182]

Maintaining a healthy weight and being physically active may represent opportunities for modifying the risk of uterine cancer in Canada.

13. Ovarian cancer

Ovarian cancer was the seventh most common cancer in Canadian females and the second most frequently diagnosed gynecological malignancy in 2003–2007. One in 68 females can expect to be diagnosed with ovarian cancer in their lifetime, and 1 in 95 females are estimated to die from it.[1] The average annual number of new ovarian cancer cases in this period was 2385, equivalent to 3.2% of all cancer cases in females (Table 4.13.1). In 2003–2007, incidence of ovarian cancer increased sharply with advancing age to a plateau in those aged 75 or older (Table 4.13.2). About 70% of the new cases were diagnosed in women aged 55 or older (Table 4.13.1). Ovarian cancer is the most lethal gynecological cancer. The 5-year

TABLE 4.13.1
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), ovarian cancer, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	290	30	20	5	10	150	55	5	5	0	5	0
	45–54	445	50	40	10	20	185	110	10	10	5	5	0
	55–64	525	60	35	15	20	210	145	15	15	0	10	0
	65–74	490	60	35	15	20	200	125	10	15	0	5	0
	75–84	450	55	30	20	20	165	130	15	15	0	0	0
	85+	185	25	15	5	10	65	55	5	5	0	0	0
	Total	2385	285	175	75	90	980	615	65	65	10	25	0
2008–12	<45	260	30	20	5	10	150	45	5	5	0	5	0
	45–54	475	60	40	10	20	220	110	15	15	0	5	0
	55–64	615	65	50	20	20	250	155	15	15	0	10	0
	65–74	540	65	40	15	20	220	140	15	15	0	5	0
	75–84	460	50	30	15	20	180	130	15	15	0	5	0
	85+	235	35	20	10	10	80	65	5	5	0	0	0
	Total	2590	300	195	75	95	1095	645	70	70	10	25	5
2013–17	<45	275	30	20	5	10	160	45	5	5	0	5	0
	45–54	455	60	35	10	15	240	90	10	15	0	5	0
	55–64	690	70	60	20	25	285	155	20	20	0	10	0
	65–74	665	75	50	15	20	260	170	20	20	0	10	0
	75–84	475	50	35	15	20	180	130	15	15	0	5	0
	85+	275	30	25	10	10	95	80	5	10	0	0	0
	Total	2830	320	220	75	100	1220	675	80	80	10	30	5
2018–22	<45	305	35	20	5	10	180	45	5	5	0	5	0
	45–54	410	55	30	10	15	240	70	10	10	0	5	0
	55–64	745	80	60	20	25	330	155	20	20	5	10	0
	65–74	780	85	65	20	25	305	185	20	25	5	10	0
	75–84	545	60	40	15	15	195	150	20	15	0	5	0
	85+	290	35	25	10	15	100	85	10	10	0	0	0
	Total	3080	345	245	80	105	1355	695	85	85	10	30	5
2023–27	<45	330	40	25	10	10	190	40	5	5	0	5	0
	45–54	430	60	30	10	15	255	70	10	10	0	5	0
	55–64	715	80	55	15	25	355	135	20	20	0	10	0
	65–74	885	90	80	25	30	355	190	30	30	5	10	0
	75–84	680	70	55	15	20	240	190	25	20	5	5	0
	85+	320	35	30	10	10	105	90	10	10	0	0	0
	Total	3360	380	270	85	110	1500	715	95	95	10	30	5
2028–32	<45	345	40	25	5	10	200	35	5	5	0	5	0
	45–54	495	70	30	10	15	295	80	10	10	0	5	0
	55–64	655	75	55	15	20	360	105	15	20	0	10	0
	65–74	965	105	85	25	30	405	190	30	35	5	10	0
	75–84	810	80	70	20	25	285	205	30	25	5	5	0
	85+	380	40	35	10	10	120	110	10	10	0	0	0
	Total	3650	415	300	90	115	1665	730	100	105	10	30	5

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

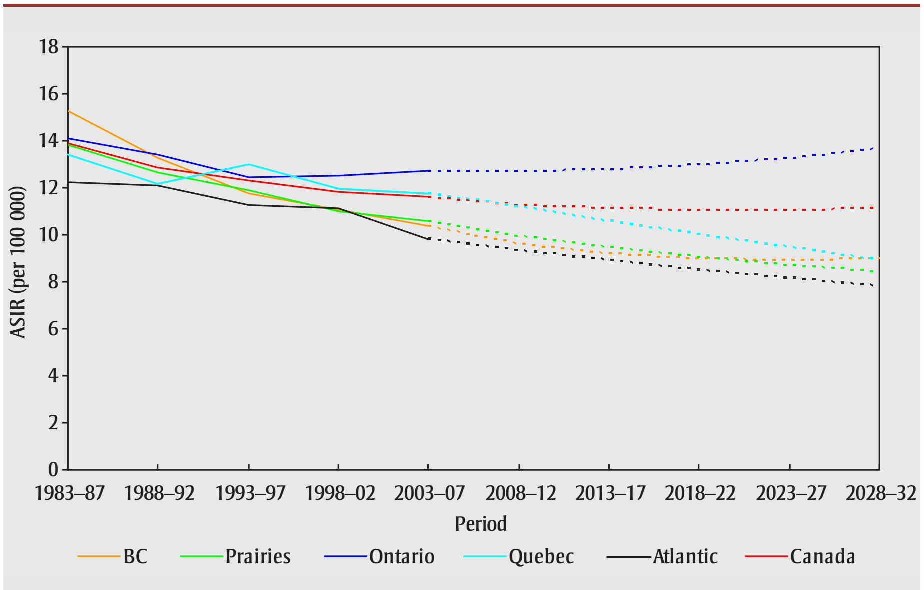
Note: Totals may not add up due to rounding.

TABLE 4.13.2
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), ovarian cancer, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	2.8	2.4	1.9	2.3	2.7	3.7	2.3	2.1	1.3	0.0	1.6	2.8
	45–54	17.8	15.0	16.4	16.4	20.5	19.6	17.5	20.0	14.6	27.9	9.9	8.5
	55–64	29.5	25.3	24.4	28.3	29.9	31.9	31.3	31.4	25.8	9.1	23.3	16.0
	65–74	41.2	39.5	36.0	41.9	45.6	43.4	40.9	40.5	37.7	44.0	30.9	13.2
	75–84	51.8	47.5	44.7	57.1	53.2	49.5	59.2	71.8	51.9	52.8	14.9	0.0
	85+	53.2	49.5	50.3	43.4	51.1	52.9	66.7	35.6	44.7	10.7	7.8	0.0
	Total	11.6	10.3	9.7	11.1	12.2	12.7	11.7	12.0	9.6	8.8	6.9	5.1
2008–12	<45	2.6	2.2	1.8	2.4	2.7	3.8	2.1	2.3	1.8	2.0	2.2	1.6
	45–54	17.5	15.8	13.3	14.8	19.9	20.7	16.6	20.0	15.9	13.2	9.8	8.1
	55–64	28.7	22.0	24.9	30.1	30.1	31.0	29.0	29.8	25.2	21.7	22.0	15.0
	65–74	40.1	34.6	35.7	34.6	40.7	42.2	40.2	47.0	36.0	30.3	28.0	23.7
	75–84	50.5	42.6	42.6	50.1	55.5	50.2	56.6	65.7	47.6	38.2	19.6	35.6
	85+	54.0	54.5	51.8	58.0	55.9	49.1	62.8	53.8	47.8	40.8	2.2	48.7
	Total	11.3	9.6	9.3	10.6	11.9	12.7	11.2	12.4	9.8	8.5	7.1	6.7
2013–17	<45	2.7	2.3	1.7	2.5	2.7	3.9	1.9	2.3	1.8	2.0	2.2	1.4
	45–54	17.0	15.5	11.8	14.0	17.7	22.4	15.1	17.5	16.6	12.8	10.4	6.9
	55–64	28.2	20.7	25.1	27.6	31.1	30.8	26.7	34.1	26.3	21.3	21.1	12.8
	65–74	39.4	32.2	35.0	35.8	37.3	41.1	39.8	41.8	36.9	29.8	25.6	20.2
	75–84	49.2	40.1	42.1	46.3	54.6	47.6	54.4	75.3	43.2	37.1	26.2	30.5
	85+	53.5	45.1	54.0	54.7	53.3	48.3	63.4	59.1	58.1	40.4	2.2	41.8
	Total	11.1	9.2	9.0	10.3	11.5	12.8	10.6	12.6	9.9	8.4	7.2	5.7
2018–22	<45	2.9	2.4	1.6	2.5	2.7	4.2	2.0	2.3	1.8	2.2	2.2	1.2
	45–54	16.3	15.2	11.5	14.8	16.8	23.7	12.6	17.4	16.4	12.3	10.3	5.9
	55–64	28.2	22.1	23.0	25.9	30.2	31.7	25.6	35.4	28.3	21.3	20.2	11.0
	65–74	38.3	28.4	35.4	36.9	38.0	39.6	37.1	42.0	38.1	28.9	27.0	17.2
	75–84	48.3	38.4	43.3	42.6	45.6	45.4	53.4	72.4	44.2	36.5	23.3	26.0
	85+	51.8	43.4	49.8	51.6	60.1	46.5	60.4	59.2	48.7	39.1	2.7	35.7
	Total	11.0	9.0	8.8	10.1	11.1	13.0	10.0	12.6	10.1	8.3	7.1	4.8
2023–27	<45	3.0	2.4	1.8	2.5	2.7	4.2	1.7	2.3	1.8	2.2	2.2	1.0
	45–54	17.0	16.8	9.9	16.0	16.8	25.2	12.6	17.4	16.3	12.8	10.2	5.0
	55–64	27.5	21.6	20.9	24.8	27.1	34.0	23.6	31.8	29.9	20.8	21.9	9.4
	65–74	38.0	27.3	36.0	34.2	39.3	39.6	34.6	47.8	40.2	28.7	25.6	14.7
	75–84	47.7	35.9	43.0	45.0	41.7	44.2	53.1	66.7	45.7	36.1	23.4	22.1
	85+	50.9	40.6	52.7	47.4	53.1	43.6	58.5	74.3	47.8	38.4	4.5	30.5
	Total	11.1	8.9	8.7	10.0	10.7	13.3	9.4	12.6	10.4	8.4	7.1	4.1
2028–32	<45	3.0	2.4	1.8	2.5	2.7	4.2	1.6	2.3	1.8	2.3	2.2	0.8
	45–54	18.3	17.7	10.1	16.0	16.9	27.1	13.5	17.3	16.1	13.9	10.1	4.3
	55–64	26.7	21.5	20.5	26.4	25.8	35.9	20.0	31.7	29.7	20.2	21.7	8.0
	65–74	38.0	29.1	33.0	32.2	37.6	40.6	33.3	49.4	43.4	28.7	25.6	12.6
	75–84	46.5	31.8	44.0	45.6	42.4	42.6	49.3	67.0	47.6	35.1	24.6	18.8
	85+	50.2	39.8	53.6	43.8	42.2	42.0	58.1	59.7	50.6	37.9	3.2	25.9
	Total	11.1	9.0	8.5	10.0	10.4	13.6	8.9	12.6	10.7	8.4	7.1	3.5

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

FIGURE 4.13.1
Age-standardized incidence rates (ASIRs) by region, ovarian cancer, 1983–2032



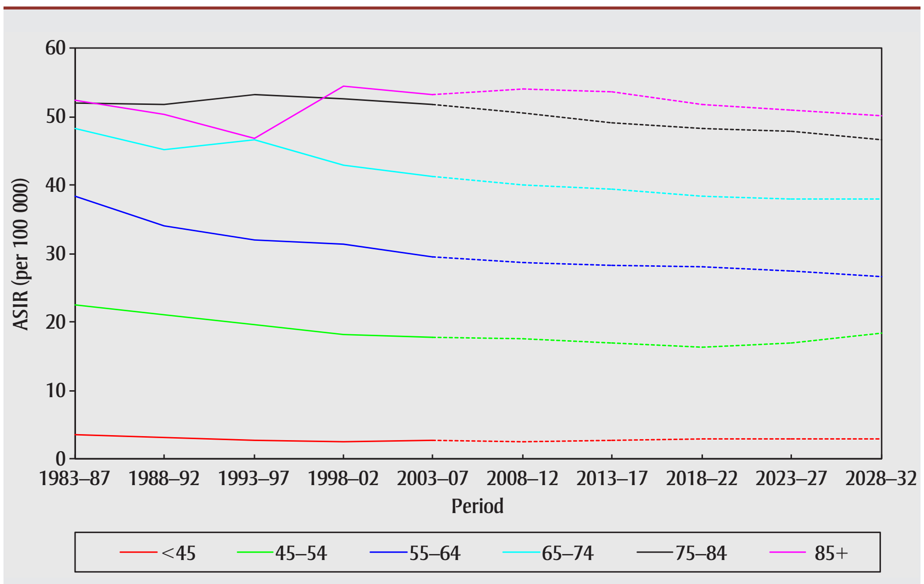
relative survival rate was 45% in 2006–2008.[1]

Incidence rates of ovarian cancer in Canada have decreased very slightly since 1983–1987 (Figure 4.13.1). During 1998–2007 ASIRs for ovarian cancer were relative stable, declining non-significantly by 0.2% per year (Figure 3.2). The trends in age-specific ASIRs shown in Figure 4.13.2 illustrate relatively stable rates over time. Regional comparison of incidence does not reveal any geographical patterns before 1998–2002 but does show that rates diverge during 2003–2007 (Figure 4.13.1). Elevated incidence rates of ovary cancer were seen in Ontario, whereas the lowest rates appeared in the Atlantic region.

The overall Canadian incidence rates of ovarian cancer are projected to stabilize in the next 25 years (Figure 4.13.1). While Quebec will experience a substantial fall in rates, the rates in other regions will be stable or decrease marginally. The age-specific incidence rates show that the predicted reduction of ASIRs in each age group is less pronounced (Figure 4.13.2).

From 2003–2007 to 2028–2032, the ASIRs for ovarian cancer for Canada are expected to decrease by 4%, from 11.6 to 11.1 per 100 000 (Table 4.13.2), but the annual number of cases is projected to increase by 53%, from 2385 to 3650 (Table 4.13.1) as the Canadian population grows and ages.

FIGURE 4.13.2
Age-standardized incidence rates (ASIRs) for ovarian cancer by age group, Canada, 1983–2032



Comments

The etiology of ovarian cancer is poorly understood;[183] however, numerous risk factors are associated with either an increased or decreased likelihood of developing the disease. The known risk factors for the disease include reproductive and genetic components.[184,185] Uninterrupted and prolonged ovulary cycles increase ovarian cancer risk.[186,187] Long-term (≥5 years) use of hormone replacement therapy increases the risk.[187-189] Oral contraceptive use and increases in the number of full-term pregnancies may have protective effects.[52,86,190] Fertility rate in Canada has recently stabilized after a long-term decrease.[149] The stable prevalence in both oral contraceptive use[181] and fertility may partly explain the recent relatively stability of ovarian cancer incidence rate in females younger than 55.

A family history of ovarian cancer confers a 3- to 5-fold increased risk of the disease in most studies,[191-193] with 5% to 10% of ovarian cancers due to heritable risk.[187,191,192] The known susceptibility genes (e.g. BRCA1 and BRCA2) explain less than 40% of the excess risk of hereditary ovarian cancer.[191]

Potential links between ovarian cancer and lifestyle exist. IARC stated in 2009 that there is sufficient evidence that smoking causes ovarian cancer.[194] Overweight and obesity are moderately associated with ovarian cancer risk.[86] Vegetables and fruit appear to be inversely related to the risk.[86]

14. Prostate cancer

Prostate cancer is the most common form of cancer and the third leading cause of cancer death in Canadian males. One in 7 can expect to be diagnosed with prostate cancer in their lifetime, and 1 in 28 males to die from it.[1] The annual number of new cases was 21 460 in 2003–2007, constituting 13.8% of all new Canadian cases of cancer and 26.6% of those in males (Table 4.14.1, Figure 3.9). During 2001–2007, the ASIRs for prostate cancer were stable (Figure 3.1). The risk of developing the disease increases with age more than for any other cancer (Table 4.14.2). Between 2003 and 2007, 66% of the overall cases were in men aged 55 to 74, while only 8% were in males younger than 55. A high 5-year relative survival rate of 96% was reported for 2006–2008.[1]

Overall incidence rates of prostate cancer increased steadily until 1993–1997, showed additional but smaller increases to 1998–2002 and then levelled off (Figure 4.14.1). This pattern was observed in the Prairies, the Atlantic region and Ontario. The rates in British Columbia reached their first peak one period sooner than in other regions, then gradually levelled off and decreased thereafter. Quebec experienced much lower rates in the last 10 observation years than other regions. The trends of age-specific ASIRs show that recent incidence rates of prostate cancer in Canada increased in the younger age groups (< 75 years) and decreased in the older age groups (75+) (Figure 4.14.2).

The Nordpred method produces extreme increases in prostate cancer incidence rates and counts, so we used a two-step approach of the short-term modelling projection followed by the long-term constant-rates projection (method ADa + AVG, see Chapter 2 for the definition). Consequently, British Columbia and the Prairies are likely to have a drop in prostate cancer incidence rates, Ontario and the Atlantic region will experience an increase, and Quebec and Canada will remain stable in the first 5 prediction years (Figure 4.14.1). The rates for each region will remain unchanged thereafter.

From 2003–2007 to 2028–2032, the ASIRs for prostate cancer in Canada are expected to be stable at about 123.3 per 100 000 (Table 4.14.2). Despite this trend in ASIRs, the aging and growth of the population mean that the annual number of new cases is projected to increase by 97%, from 21 460 to 42 225 (Table 4.14.1).

Comments

The lower prostate cancer incidence rates observed in Quebec are likely artefactual, as a result of possible underreporting of cases (see details in Chapter 5: Data quality issues).

A range of medical investigations, including digital rectal examination, transrectal ultrasonography, PSA level, fine-needle aspiration biopsy (FNAB), and magnetic resonance imaging have been considered for the early detection of prostate cancer.[195] Part of the rise in incidence in the 2 decades prior to 1990 has been attributed to detection of cancers following transurethral resection of the prostate for benign prostatic hypertrophy.[196] The 1993 and 2001 peaks in incidence mirror the 2 waves of increased PSA screening activity.[1] In 2003, the percentage of men reporting a screening PSA test in the past 12 months was highest in the 60–69 age group at just over 35%.[197]

When a slowly developing cancer is detected through screening, over-diagnosis may occur. This is concurrent with the fact that these cancers are most frequent at older ages when competing causes of death are more frequent.[198] The observed increase in prostate cancer incidence rates may be biased by such over-diagnosis from PSA screening. The benefits and harms of prostate cancer screening by PSA test is still being debated,[199] and it is important that men know the arguments in order to decide whether to screen for the disease.

Similar to England, recent incidence rates of prostate cancer in Canada increased in the younger age groups (< 75 years) because of increasing uptake of the PSA test, and decreased in the older age groups (75+) from increasing pharmacological treatment for obstructive uropathy caused by benign prostatic hypertrophy and the resulting decrease in use of transurethral resection, which had previously led to detection of many prostate cancers (Figure 4.14.2).[28,200] This pattern resulted in relatively stable crude rates in the last 2 observation periods. Therefore, the recent trends could be used for a model of short-term projections. However, such a model is less suitable for long-term projections because it would be expected that the prevalence of screening would plateau in the future. Figure 4.14.3 shows the projected ASIRs in the first 10 projection years derived from using the current 2-step approach (ADa + AVG), and using the age-specific trend model (ADa) only to project for all the 10 years. There appears to be no substantial advantage to a 10-year projection for using model ADa only. Similarity of the estimated national ASIRs between using ADa + AVG and ADa may be because the decreases in rates in older age groups were partly cancelled out by the increases in younger ages, and may also be a result of offsetting provincial differences. The projected increases in the 10-year incidence rates in the Atlantic region and Ontario, from using ADa only, seem less likely. Thus current trends were only extended to the first 5 projection years through ADa based on yearly data. The age-specific average rates of the predicted 5-year incidence data were then assumed to remain constant in the future years. Current projections of prostate cancer rates will be an overestimate if recent decreases in the rates (based on the more recent observed data, which were not available when present study was undertaken) continue.[1]

The established risk factors, which are all non-modifiable, are age, family history and ethnicity. Having a first-degree relative with prostate cancer more than doubles a man's risk of developing this tumour.[201-204] Risks to sons appeared to be lower than in brothers. Risk is further increased by early age at onset in relatives and multiple relatives with the disease.[201] A number of studies may suggest an overall contribution of inherited genes or a shared environment in the development of this disease.[201-204] Genes and family history account for about 5% to 9% of all prostate cancers.[205] White males have a lower risk of prostate cancer than Black males worldwide but have a higher risk than males of Asian ethnicity.[56,206,207] However, the risk for Asian Americans is higher than that for males of a similar

TABLE 4.14.1
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), prostate cancer, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	75	5	10	5	0	35	10	0	5	0	0	0
	45–54	1570	170	190	50	45	670	295	45	65	10	30	5
	55–64	6170	745	620	200	165	2560	1305	190	230	40	105	10
	65–74	7935	1060	740	325	245	3385	1435	250	300	55	135	10
	75–84	4515	700	395	215	160	1835	840	130	160	25	55	5
	85+	1195	175	105	60	50	390	340	25	35	5	10	0
	Total	21 460	2860	2055	850	665	8875	4225	645	790	135	335	25
2008–12	<45	100	5	10	0	0	35	10	0	0	0	0	0
	45–54	2160	170	245	65	50	1025	405	55	85	15	30	5
	55–64	8275	875	755	295	195	3650	1680	285	340	60	160	15
	65–74	9130	1200	660	345	230	4070	1695	325	370	65	165	10
	75–84	4460	710	330	175	115	1900	850	130	160	25	55	5
	85+	1370	205	105	45	40	475	430	25	35	5	10	0
	Total	25 495	3170	2100	930	630	11 155	5065	825	990	170	420	35
2013–17	<45	95	5	10	0	0	35	10	0	0	0	0	0
	45–54	2205	175	245	65	50	1085	400	55	85	15	25	5
	55–64	9455	990	915	340	225	4225	1875	305	365	65	170	15
	65–74	11 510	1525	880	415	285	5130	2080	415	465	85	210	20
	75–84	4920	785	365	175	120	2085	950	155	185	25	65	10
	85+	1740	260	140	50	45	625	560	30	40	5	10	0
	Total	29 930	3740	2560	1050	730	13 180	5870	960	1140	200	480	45
2018–22	<45	100	5	10	5	0	35	10	0	0	0	0	0
	45–54	2025	165	235	55	45	1005	350	50	70	10	25	5
	55–64	10 465	1085	1020	365	245	4830	2020	320	390	70	170	15
	65–74	13 830	1855	1135	515	350	6190	2410	490	540	100	245	25
	75–84	5975	950	450	200	140	2510	1155	195	225	35	85	10
	85+	2065	305	170	55	50	740	675	35	45	5	15	0
	Total	34 460	4375	3025	1190	830	15 310	6620	1085	1280	225	535	55
2023–27	<45	110	10	10	5	0	35	10	0	0	0	0	0
	45–54	2000	165	245	55	45	980	350	45	70	10	20	5
	55–64	10 480	1120	1020	350	240	4980	1945	305	375	70	165	15
	65–74	15 960	2120	1380	595	405	7250	2720	530	600	110	255	30
	75–84	7735	1240	615	250	185	3250	1470	260	295	45	110	15
	85+	2400	355	200	60	55	855	800	40	55	10	15	0
	Total	38 690	5010	3465	1315	930	17 350	7290	1180	1395	245	570	65
2028–32	<45	115	10	10	5	0	40	10	0	0	0	0	0
	45–54	2110	180	260	60	50	1025	375	45	65	10	20	5
	55–64	9810	1080	995	315	225	4690	1760	275	335	65	145	15
	65–74	17 645	2340	1530	635	435	8285	2910	550	640	120	265	30
	75–84	9475	1520	810	315	225	3970	1760	305	350	50	135	25
	85+	3065	450	260	70	70	1075	1040	55	70	10	20	5
	Total	42 225	5580	3865	1400	1010	19 085	7855	1230	1465	260	585	75

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

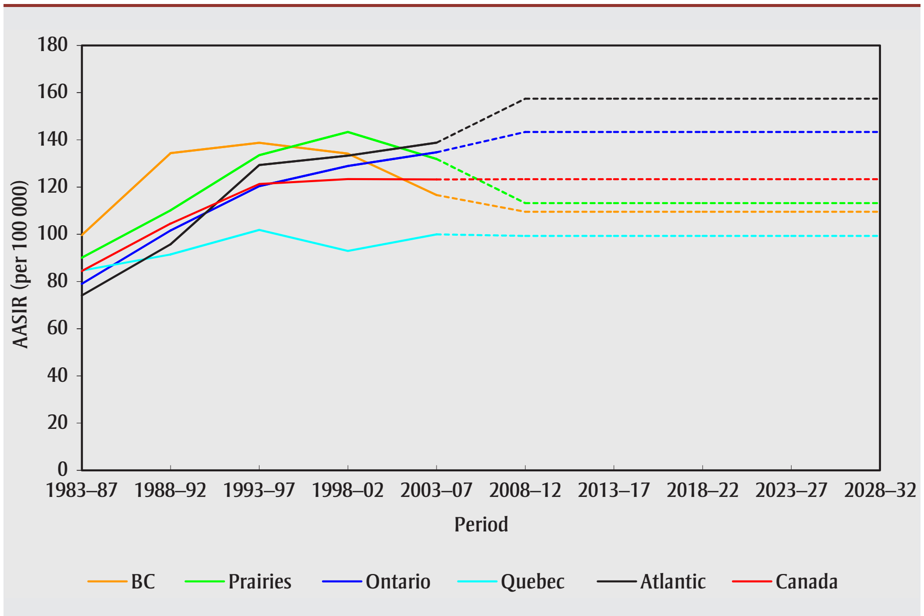
Note: Totals may not add up due to rounding.

TABLE 4.14.2
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), prostate cancer, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	0.6	0.5	0.7	0.9	0.3	0.8	0.4	0.3	0.8	2.0	0.8	0.6
	45–54	62.2	50.1	73.3	67.8	51.0	70.9	47.6	76.3	82.8	108.5	63.1	34.9
	55–64	365.2	321.5	412.1	419.6	287.8	408.1	301.5	436.3	420.0	525.9	331.7	225.9
	65–74	741.6	700.8	818.2	947.9	655.0	834.9	541.2	945.8	875.5	1041.4	719.0	529.2
	75–84	728.5	780.1	773.4	919.9	667.0	764.1	580.0	872.2	858.3	902.1	581.0	753.3
	85+	781.8	728.6	797.7	787.9	681.6	693.4	1067.4	592.6	667.3	717.3	402.0	725.7
	Total	123.3	116.6	135.6	149.7	106.0	134.7	100.0	147.8	142.9	169.1	109.9	94.1
2008–12	<45	0.9	0.5	0.7	0.9	0.3	0.8	0.4	0.3	0.8	2.0	0.8	0.6
	45–54	76.6	45.8	79.6	80.1	51.6	94.6	60.1	87.8	104.7	108.5	63.1	34.9
	55–64	402.7	305.7	376.1	496.1	276.7	478.7	332.0	542.5	522.0	638.1	423.4	225.9
	65–74	734.0	680.4	625.8	947.5	545.7	876.2	533.2	1009.2	918.4	1110.4	723.2	529.2
	75–84	643.7	700.9	561.0	763.6	465.6	714.5	503.5	826.0	785.7	746.6	542.9	753.3
	85+	652.1	628.4	607.3	547.1	469.8	588.3	933.3	466.5	554.1	582.5	344.1	725.7
	Total	123.3	109.5	110.5	149.6	88.3	143.3	99.3	159.6	153.3	176.5	116.1	94.1
2013–17	<45	0.9	0.5	0.7	0.9	0.3	0.8	0.4	0.3	0.8	2.0	0.8	0.6
	45–54	76.6	45.8	79.6	80.1	51.6	94.6	60.1	87.8	104.7	108.5	63.1	34.9
	55–64	402.7	305.7	376.1	496.1	276.7	478.7	332.0	542.5	522.0	638.1	423.4	225.9
	65–74	734.0	680.4	625.8	947.5	545.7	876.2	533.2	1009.2	918.4	1110.4	723.2	529.2
	75–84	643.7	700.9	561.0	763.6	465.6	714.5	503.5	826.0	785.7	746.6	542.9	753.3
	85+	652.1	628.4	607.3	547.1	469.8	588.3	933.3	466.5	554.1	582.5	344.1	725.7
	Total	123.3	109.5	110.5	149.6	88.3	143.3	99.3	159.6	153.3	176.5	116.1	94.1
2018–22	<45	0.9	0.5	0.7	0.9	0.3	0.8	0.4	0.3	0.8	2.0	0.8	0.6
	45–54	76.6	45.8	79.6	80.1	51.6	94.6	60.1	87.8	104.7	108.5	63.1	34.9
	55–64	402.7	305.7	376.1	496.1	276.7	478.7	332.0	542.5	522.0	638.1	423.4	225.9
	65–74	734.0	680.4	625.8	947.5	545.7	876.2	533.2	1009.2	918.4	1110.4	723.2	529.2
	75–84	643.7	700.9	561.0	763.6	465.6	714.5	503.5	826.0	785.7	746.6	542.9	753.3
	85+	652.1	628.4	607.3	547.1	469.8	588.3	933.3	466.5	554.1	582.5	344.1	725.7
	Total	123.3	109.5	110.5	149.6	88.3	143.3	99.3	159.6	153.3	176.5	116.1	94.1
2023–27	<45	0.9	0.5	0.7	0.9	0.3	0.8	0.4	0.3	0.8	2.0	0.8	0.6
	45–54	76.6	45.8	79.6	80.1	51.6	94.6	60.1	87.8	104.7	108.5	63.1	34.9
	55–64	402.7	305.7	376.1	496.1	276.7	478.7	332.0	542.5	522.0	638.1	423.4	225.9
	65–74	734.0	680.4	625.8	947.5	545.7	876.2	533.2	1009.2	918.4	1110.4	723.2	529.2
	75–84	643.7	700.9	561.0	763.6	465.6	714.5	503.5	826.0	785.7	746.6	542.9	753.3
	85+	652.1	628.4	607.3	547.1	469.8	588.3	933.3	466.5	554.1	582.5	344.1	725.7
	Total	123.3	109.5	110.5	149.6	88.3	143.3	99.3	159.6	153.3	176.5	116.1	94.1
2028–32	<45	0.9	0.5	0.7	0.9	0.3	0.8	0.4	0.3	0.8	2.0	0.8	0.6
	45–54	76.6	45.8	79.6	80.1	51.6	94.6	60.1	87.8	104.7	108.5	63.1	34.9
	55–64	402.7	305.7	376.1	496.1	276.7	478.7	332.0	542.5	522.0	638.1	423.4	225.9
	65–74	734.0	680.4	625.8	947.5	545.7	876.2	533.2	1009.2	918.4	1110.4	723.2	529.2
	75–84	643.7	700.9	561.0	763.6	465.6	714.5	503.5	826.0	785.7	746.6	542.9	753.3
	85+	652.1	628.4	607.3	547.1	469.8	588.3	933.3	466.5	554.1	582.5	344.1	725.7
	Total	123.3	109.5	110.5	149.6	88.3	143.3	99.3	159.6	153.3	176.5	116.1	94.1

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

FIGURE 4.14.1
Age-standardized incidence rates (ASIRs) by region, prostate cancer, 1983–2032

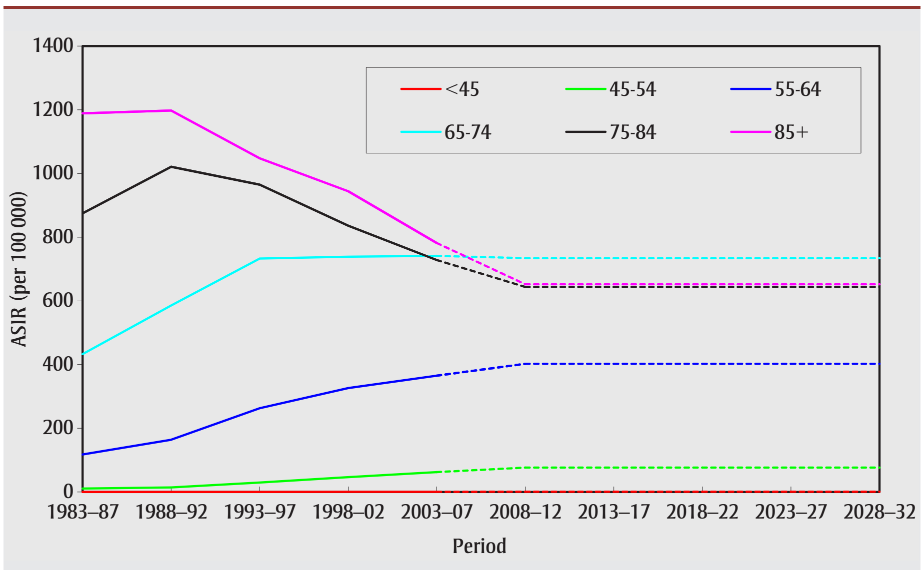


background living in Asia.[208] Ethnicity may be a surrogate for genetic, environmental or socioeconomic factors.[208]

Although a definite modifiable risk factor has not been identified, a number have been implicated in prostate cancer initiation. Potential preventative factors include physical activity and frequent intake of soy and foods containing lycopene.[209] Lycopene may reduce prostate cancer risk by preventing oxidative DNA damage in prostate tissue by mitigating exposure to cellular free radicals.[209,210] A meta-analysis shows that high soy consumption reduces the risk by 26%; however, this inverse association appears to be confined to the Asian population.[211] Possible explanations for this observation include different types or amounts of soy products consumed in Asian and Western societies.

Factors that may increase prostate cancer risk include high intakes of dairy products and meat.[209] Higher intake of calcium has been associated with a 39% increased risk,[212] possibly because of the suppression of 1,25-dihydrovitamin D, which may inhibit cancer cell invasion.[213] IARC stated that evidence of an increased risk of prostate cancer in relation to exposure to thorium-232 and its decay products is limited, as is exposure to X-radiation and gamma-radiation, use of anabolic androgenic steroids, exposure to cadmium and cadmium compounds, or exposure to arsenic and inorganic arsenic compounds and the rubber production industry.[47]

FIGURE 4.14.2
Age-standardized incidence rates (ASIRs) for prostate cancer by age group, Canada, 1983–2032



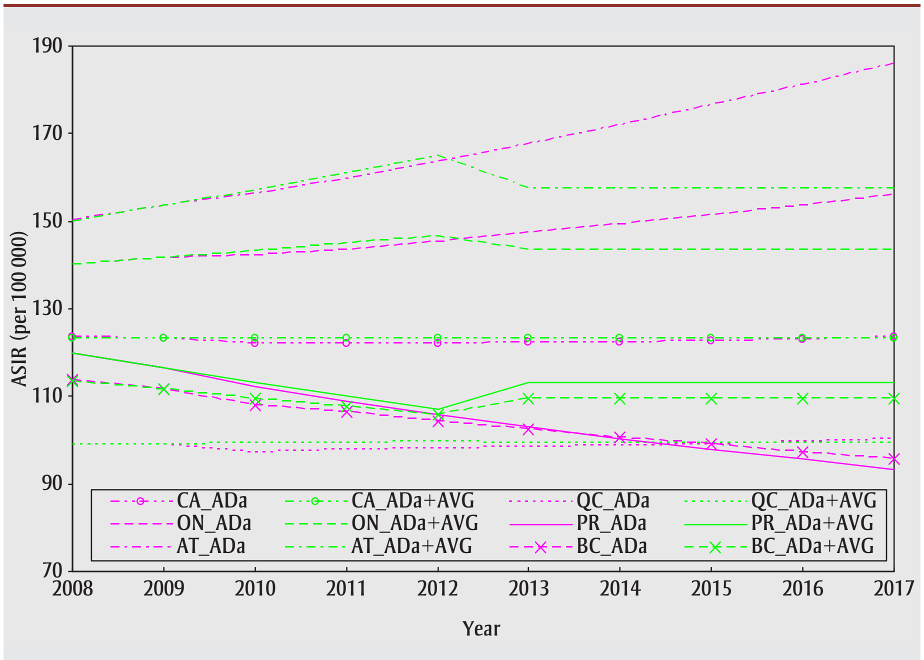
15. Testis cancer

Testis cancer was responsible for 1.0% of all new cancer cases in Canadian males, with an average of 825 new cases annually in 2003–2007 (Table 4.15.1). It was mainly diagnosed in young and middle-aged males, with just over 80% of cases found in those younger than 45. Testis cancer was the most common cancer in males under 45, representing 14.1% of the male cancer cases in that age group during 2003–2007 (Figure 3.9, Figure 4.15.1). In this period, the incidence rate rose steeply from age 10 to 14, peaked at age 25 to 34, and then decreased quickly (Figure 4.15.1).The 5-year relative survival rate is high, at 97% in 2006–2008.[1]

The overall incidence rate of testis cancer in Canada increased steadily by 39%, from 4.0 per 100 000 in 1983–1987 to 5.6 in 2003–2007 (Figure 4.15.2). However, the rate of increase has slowed slightly since 1993–1997. Between 1998 and 2007, the ASIRs for testis cancer increased significantly at 1.4% per year (Figure 3.1). The primary trends of the ASIRs in each region demonstrate increases. The ASIRs were higher in western Canada and lower in the east. The age-specific analysis indicates that ASIRs in Canada increased steadily for males under 55 and showed opposite trends for those above this age (Figure 4.15.3).

Overall incidence rates of testis cancer are projected to increase gradually until 2018–2022 and then level off (Figure 4.15.2). A similar pattern is predicted for Ontario and the Atlantic region but the turn point is 5 years later. Rates for the Prairies are expected to reach a peak 5 years sooner

FIGURE 4.14.3
Comparison of projected age-standardized incidence rates (ASIRs) derived from the two models[a] by region, prostate cancer, 2008–2017



Note: Abbreviations: CA=Canada, BC=British Columbia, PR=the Prairies, ON=Ontario, QC=Quebec, AT=the Atlantic region.

[a]Model ADa: Using ADa (see Methods) to project for the first 10 future years (2008–2017).
Model ADa +AVG: Using ADa to project for the first five projection years (2008–2012), and then using the age-specific average rates of the predicted 5-year data to estimate counts for the future years (2013–2017).

than the rest of the country, then decrease gradually, presenting the lowest incidence in the last 2 projected periods. In contrast, the rates in British Columbia and Quebec will rise persistently through the whole prediction period. British Columbia is predicted to experience the highest incidence rates from 2018–2022. Figure 4.15.3 illustrates that rates in all age groups under 75 are expected to increase, but at different levels. Rates in the youngest age group will approach a peak in 2018–2022 and then display a downward trend. The rates in men aged 75 or older are projected to stabilize or decrease slightly.

From 2003–2007 to 2028–2032, the ASIRs for testis cancer are expected to increase by 8%, from 5.6 to 6.0 per 100 000 (Table 4.15.2). The annual number of new cases is projected to rise by 30%, from 825 to 1070 (Table 4.15.1).

Comments

Similar to the trends we observed in Canada, large increases in incidence of testis cancer have been reported over the last 4 decades in many countries, including the US,[214] European countries,[215,216] and Australia.[217] The increases are also predicted in Ireland,[2] England[218] and Nordic countries.[3,35] No explanation for the increasing trends has been accepted.

The rate of testis cancer in males younger than 45 is increasing, but the longer-term trend shows a downturn. This result may be considered as a limitation of the Nordpred method in predicting rare cancers, especially for a site such as testis where rates are higher at relatively young ages. For testis cancer in Canada, the model indicates the coefficients for more recently born cohorts were positive so that assuming later birth cohorts have a zero value can result in a longer-term projection of lower rates.

The etiology of testis cancer remains unclear, possibly due to small sample sizes in the majority of studies. The major risk factor for testis cancer could hypothetically be due to an excessive exposure to certain hormones. Prenatal exposure to excess estrogens, adolescent exposure to high levels of male sex hormones and exposure to environmental hormone disruptors have been linked to elevated risk.[86] Syndromes noted for abnormal testis and urogenital development are known to increase risk. Germ cell tumours account for 95% of all testis neoplasms. Cryptorchidism causes about 5% to 10% of germ cell tumours cases and increases the relative risk by 2.5- to 15-fold.[52,53,219] A lower ratio of sex hormones (estrogens/androgens) may be associated with a reduced risk of germ cell tumours.[220] Population-wide increasing exposure to estrogenic or other hormonally active (e.g. antiandrogenic) compounds may be in part responsible for the observed increase in testis cancer incidence.[221,222]

About 2% of testis cancer cases may be explained by inherited genetic factors.[86] Males with a father diagnosed with testis cancer have a 3.8-fold increase in risk, and those with a brother diagnosed with the disease have a 7.6-fold increase in risk.[223]

16. Kidney cancer

Kidney cancer was the sixth most common type of new cancer diagnosed in Canadian males and the twelfth most common type in females in 2003–2007. The average annual number of kidney cancer cases in this period was 2580 for males and 1665 for females, accounting for 3.2% and 2.2% of all male and female cases, respectively (Tables 4.16.1 and 4.16.2). One in 56 males and 1 in 82 females can expect to be diagnosed with kidney cancer in their lifetime, and 1 in 149 males and 1 in 252 females can expect to die from it.[1] The 5-year relative survival rate for kidney cancer was 68% for both sexes combined in Canada between 2006 and 2008.[1]

During 2003–2007, the ASIRs of kidney cancer increased with age to 83.1 per 100 000 in men and 43.4 per 100 000 in women for those aged 85 or older, but for those aged 55 or older the increase was less pronounced in women than in men (Tables 4.16.3 and 4.16.4). Overall, kidney cancer incidence occurred nearly twice as often in males as in females. The male-to-female ratio increased with

TABLE 4.15.1
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), testis cancer, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	665	85	80	20	25	260	145	10	25	0	10	0
	45–54	110	15	15	5	5	45	20	5	5	0	0	0
	55–64	30	5	5	0	0	10	5	0	0	0	0	0
	65–74	10	0	0	0	0	5	0	0	0	0	0	0
	75–84	5	0	0	0	0	5	0	0	0	0	0	0
	85+	5	0	0	0	0	0	0	0	0	0	0	0
	Total	825	105	100	25	30	325	175	15	25	5	10	0
2008–12	<45	710	95	100	20	25	270	155	10	20	5	10	0
	45–54	135	15	20	5	5	55	30	5	5	0	0	0
	55–64	40	5	5	0	0	15	10	0	0	0	0	0
	65–74	10	0	0	0	0	5	0	0	0	0	0	0
	75–84	5	0	0	0	0	5	0	0	0	0	0	0
	85+	5	0	0	0	0	0	0	0	0	0	0	0
	Total	905	120	125	25	35	350	195	15	30	5	10	0
2013–17	<45	770	110	105	20	25	295	165	10	25	5	10	0
	45–54	130	15	15	5	5	55	30	5	5	0	0	0
	55–64	55	10	5	0	5	20	10	0	0	0	0	0
	65–74	15	0	0	0	0	10	5	0	0	0	0	0
	75–84	5	0	0	0	0	5	0	0	0	0	0	0
	85+	5	0	0	0	0	0	0	0	0	0	0	0
	Total	985	135	130	30	35	385	210	15	35	5	10	0
2018–22	<45	805	125	100	20	30	315	170	15	25	5	10	0
	45–54	135	15	15	5	5	55	30	5	5	0	0	0
	55–64	65	10	5	0	5	25	15	0	0	0	0	0
	65–74	20	0	0	0	0	10	5	0	0	0	0	0
	75–84	10	0	0	0	0	5	0	0	0	0	0	0
	85+	5	0	0	0	0	0	0	0	0	0	0	0
	Total	1040	150	125	25	40	415	225	20	35	5	10	0
2023–27	<45	795	135	95	20	30	320	170	15	25	5	10	0
	45–54	155	20	15	5	5	65	35	5	5	0	0	0
	55–64	65	10	5	0	5	30	15	0	0	0	0	0
	65–74	30	5	0	0	0	15	5	0	0	0	0	0
	75–84	10	0	0	0	0	5	0	0	0	0	0	0
	85+	5	0	0	0	0	0	0	0	0	0	0	0
	Total	1065	165	120	25	40	435	230	20	35	5	10	0
2028–32	<45	760	140	100	20	30	320	165	15	30	5	5	0
	45–54	185	25	15	5	5	70	40	5	5	0	0	0
	55–64	70	10	5	0	5	30	20	0	0	0	0	0
	65–74	40	5	0	0	0	20	10	0	5	0	0	0
	75–84	15	0	0	0	0	5	5	0	0	0	0	0
	85+	5	0	0	0	0	0	0	0	0	0	0	0
	Total	1070	175	125	25	40	450	240	20	40	5	10	0

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

FIGURE 4.15.1
Age-specific incidence rates of testis cancer, Canada, 2003–2007 (from average annual counts)

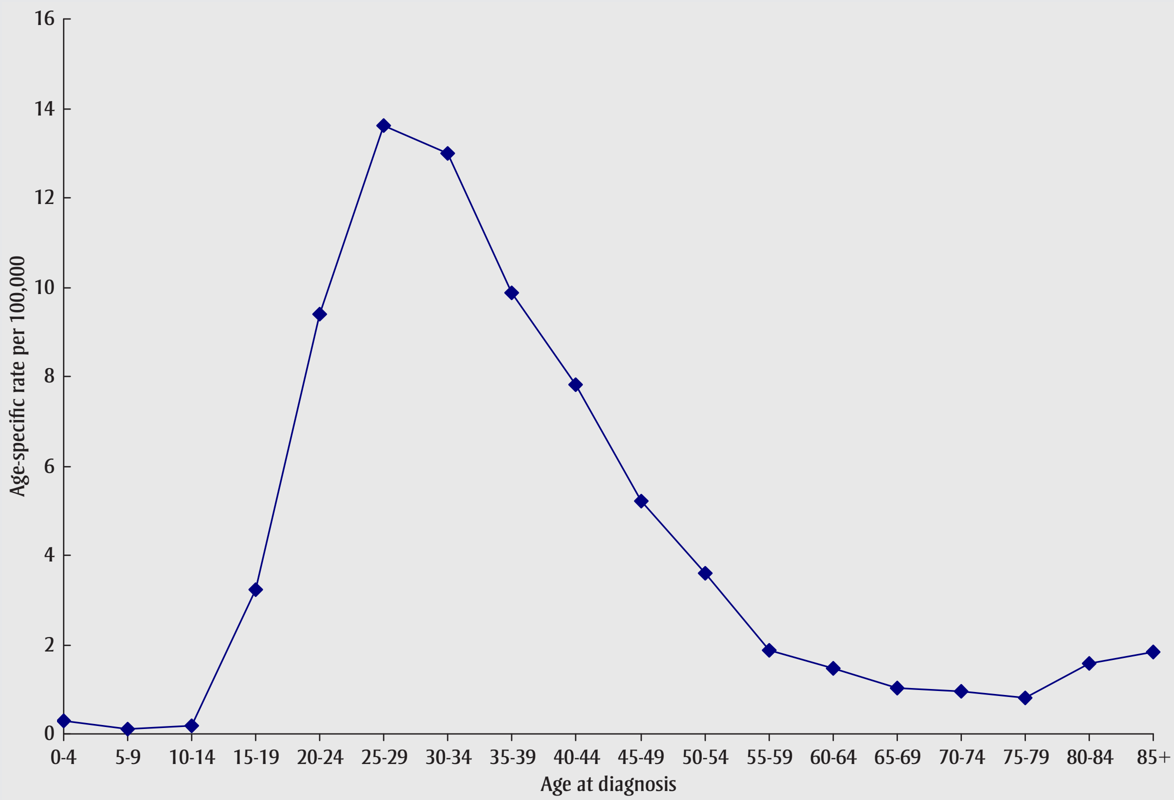


FIGURE 4.15.2
Age-standardized incidence rates (ASIRs) by region, testis cancer, 1983–2032

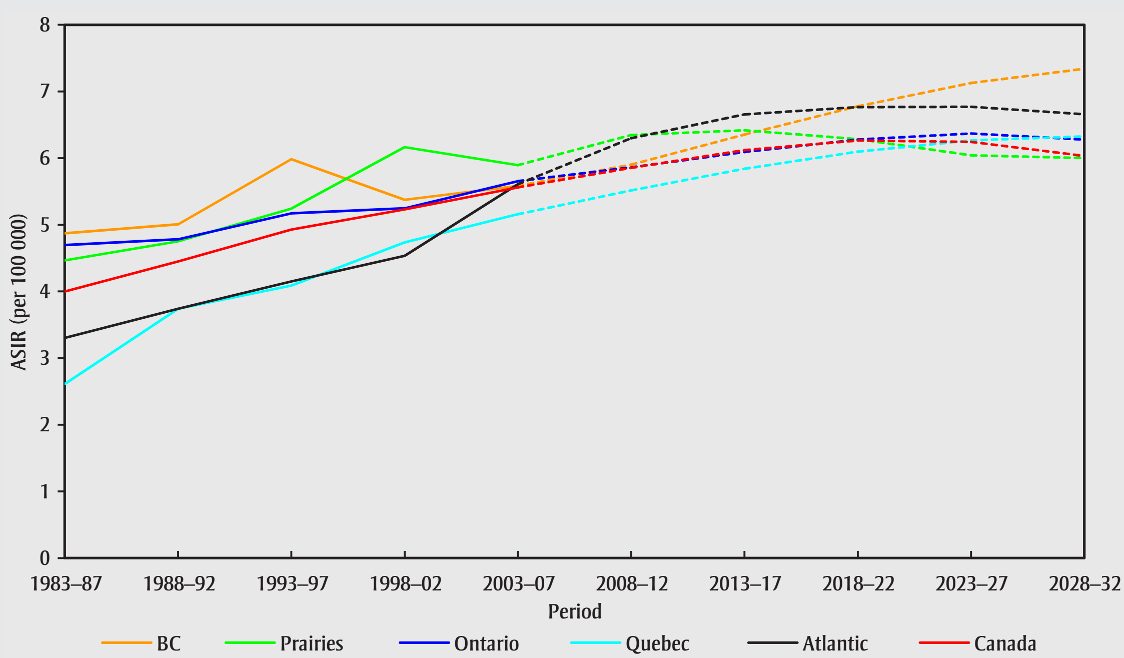
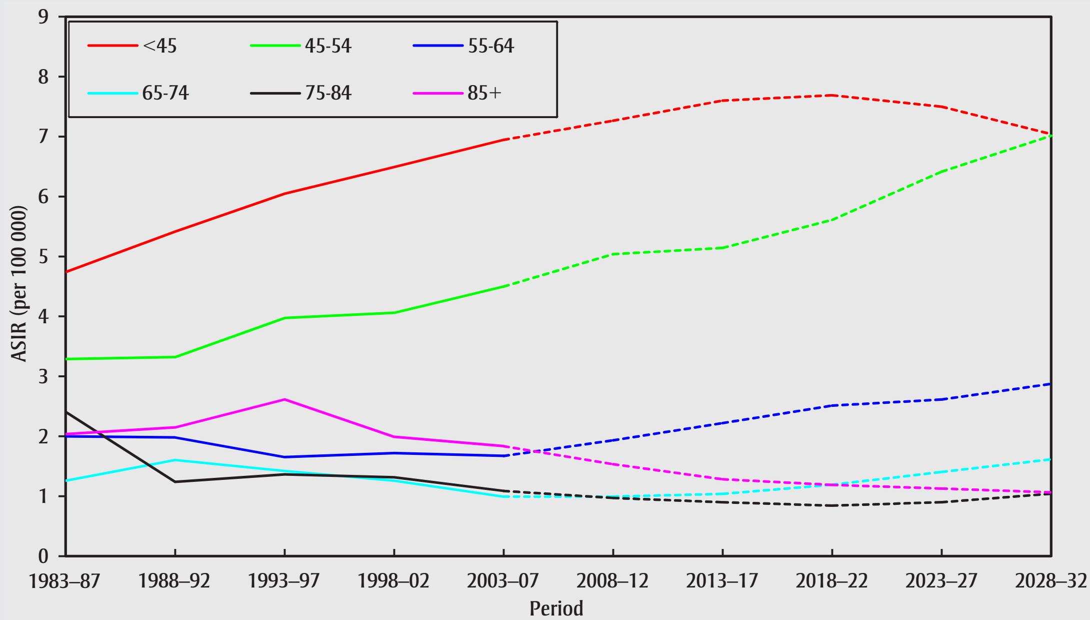


FIGURE 4.15.3
Age-standardized incidence rates (ASIRs) for testis cancer by age group, Canada, 1983–2032



age in each observation period up to the 65–74 age group and stabilized at almost 2:1 in older age groups (Figure 4.16.2). Tables 4.16.1 and 4.16.2 show that about 90% of cases were diagnosed in people aged 45 or older in 2003–2007.

Figure 4.16.1 shows that incidence rates generally increased in both sexes during the 1980s, stabilized between 1988–1992 and 1993–1997, and rose again after that. In 2003–2007, kidney cancer ASIRs in males increased significantly by 2.6% per year (a changepoint in trend was detected from 2003, Figure 3.1). During 1998–2007, ASIRs rose significantly in females by 1.9% per year (Figure 3.2). Figure 4.16.2 reveals that incidence of kidney cancer increased over the observation periods across age groups in both sexes, with stronger increases in males in the 1980s and in those (except in the 75–84 age group) during the last 2 observation periods.

The current rising trends in the rates in Canada are projected to continue in each age group (Figure 4.16.2). Figure 4.16.1 shows that the rates of kidney cancer will increase in both sexes in all regions except in British Columbia, where a gradual decrease is predicted, and in the Prairies in females, for whom the rates are forecast to stabilize. The most elevated rates are predicted for the Atlantic region, while significantly low rates are predicted in British Columbia.

From 2003–2007 to 2028–2032, the ASIRs of kidney cancer for Canada are projected to increase by roughly 7% in both sexes, from 14.4 to 15.5 per 100 000 in males and from 8.0 to 8.6 per 100 000 in females (Tables 4.16.3 and 4.16.4). The annual number of new cases is estimated to increase by 95% in males, from 2580 to 5020, and by 84% in females, from 1665 to 3070 (Tables 4.16.1 and 4.16.2).

Comments

Increases in kidney cancer incidence have been observed in the US, some European countries, Australia, New Zealand and some Asian countries.[224-230] Although the increasing use of advanced diagnostic imaging systems has probably led to the incidental detection of asymptomatic kidney cancer,[231] the incidence of cancer presenting at a later stage has not decreased.[232] This finding suggests that a true increase in kidney cancer has occurred that cannot be solely attributed to changes in diagnostic practices.[225]

The upward trend in kidney cancer in Canada may be partly explained by changes in risk factors. The major risk factors for kidney cancer include smoking, obesity and some genetic and medical conditions. Smokers have a 50% increase in risk.[86] Cigarette smoking is responsible for about 20% to 30% of kidney cancer cases in males and 10% to 24% of cases in females.[111,233-235] Smoking prevalence began to decrease in the mid-1960s in males and in the mid-1980s in females.[42,43] Smoking prior to these periods may have contributed to the earlier increases in kidney cancer rates around and immediately following these periods. The reductions in smoking are expected to curb the increase in kidney cancer incidence in the future.

Obesity is a significant risk factor for both sexes, and is responsible for about 20% of renal cell carcinoma cases, the predominant form of kidney cancer.[233,235] The prevalence rates of obesity have nearly doubled in adults from 1978/79 to 2012.[51,72,73] The rates of obesity and kidney cancer have been increasing comparably in Canada in recent decades.

Age-standardized smoking rates and overweight or obese rates have been lower in British Columbia than in other provinces.[51,73] This may partly explain the low incidence rates of kidney cancer in British Columbia.

TABLE 4.15.2
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), testis cancer, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	6.9	6.9	7.3	7.3	6.9	7.0	6.6	5.7	8.8	6.5	6.2	4.6
	45–54	4.5	4.3	5.6	4.7	5.6	4.9	3.4	5.2	3.8	3.9	1.8	7.7
	55–64	1.7	2.3	2.3	1.6	1.0	1.7	1.3	0.8	0.6	2.8	1.2	0.0
	65–74	1.0	0.9	1.1	0.0	2.7	1.1	0.6	0.0	1.8	4.0	2.1	0.0
	75–84	1.1	1.1	1.2	0.8	0.9	1.2	0.8	0.0	1.1	7.6	4.2	0.0
	85+	1.8	0.8	0.0	2.7	8.3	1.1	1.3	9.7	7.5	0.0	0.0	0.0
	Total	5.6	5.6	6.0	5.8	5.8	5.7	5.2	4.7	6.8	5.7	4.9	4.0
2008–12	<45	7.3	7.4	8.0	7.4	7.1	7.2	6.9	5.9	9.2	7.6	6.4	5.3
	45–54	5.0	4.9	6.2	5.7	5.1	5.3	4.7	5.5	5.2	5.3	4.4	3.7
	55–64	1.9	2.2	2.2	1.7	3.2	2.1	1.6	0.9	2.1	2.0	1.7	1.4
	65–74	1.0	0.6	1.3	0.7	1.9	1.4	0.6	1.3	2.8	1.0	0.9	0.7
	75–84	1.0	1.0	1.3	0.8	2.1	1.0	0.7	0.0	0.8	1.0	0.9	0.7
	85+	1.5	1.0	3.0	2.3	3.4	1.1	1.4	5.2	6.1	1.6	1.3	1.1
	Total	5.9	5.9	6.6	6.0	6.0	5.9	5.5	4.9	7.4	6.1	5.1	4.3
2013–17	<45	7.6	8.0	8.2	7.4	7.3	7.5	7.3	6.3	10.0	7.9	6.7	5.6
	45–54	5.1	4.7	5.4	5.7	5.3	5.4	5.3	6.0	5.8	5.4	4.5	3.8
	55–64	2.2	2.4	2.4	1.8	3.4	2.4	1.9	1.0	2.4	2.3	1.9	1.6
	65–74	1.0	0.7	1.1	0.6	2.0	1.5	0.7	1.4	3.2	1.1	0.9	0.8
	75–84	0.9	0.7	1.6	0.5	2.2	0.9	0.7	0.0	1.0	0.9	0.8	0.7
	85+	1.3	0.7	1.8	1.5	3.5	1.1	0.9	5.6	6.9	1.3	1.1	0.9
	Total	6.1	6.4	6.6	6.0	6.2	6.1	5.8	5.2	8.1	6.4	5.4	4.5
2018–22	<45	7.7	8.6	8.0	7.3	7.5	7.6	7.4	6.5	10.6	8.0	6.7	5.6
	45–54	5.6	4.9	5.7	4.9	5.4	5.6	6.0	6.3	6.3	5.9	4.9	4.1
	55–64	2.5	2.4	2.5	2.1	3.4	2.7	2.6	1.1	2.6	2.6	2.2	1.8
	65–74	1.2	0.8	1.1	0.5	2.1	1.7	0.9	1.5	3.5	1.2	1.0	0.9
	75–84	0.8	0.5	1.4	0.4	2.3	1.0	0.6	0.0	1.1	0.9	0.7	0.6
	85+	1.2	0.9	1.8	1.2	3.6	0.9	0.8	5.9	7.4	1.2	1.0	0.9
	Total	6.3	6.8	6.5	5.8	6.3	6.3	6.1	5.4	8.6	6.6	5.5	4.6
2023–27	<45	7.5	9.0	7.7	7.1	7.5	7.6	7.5	6.6	11.0	7.8	6.6	5.5
	45–54	6.4	5.5	5.7	4.5	5.5	6.6	6.6	6.4	6.5	6.7	5.6	4.7
	55–64	2.6	2.4	1.8	1.9	3.5	2.8	3.0	1.1	2.7	2.7	2.3	1.9
	65–74	1.4	0.9	1.0	0.4	2.1	1.9	1.2	1.6	3.6	1.5	1.2	1.0
	75–84	0.9	0.7	1.1	0.3	2.3	1.1	0.6	0.0	1.1	0.9	0.8	0.7
	85+	1.1	0.4	2.0	0.6	3.7	0.9	0.8	6.0	7.6	1.2	1.0	0.8
	Total	6.2	7.1	6.2	5.6	6.4	6.4	6.3	5.5	8.9	6.5	5.5	4.6
2028–32	<45	7.0	9.1	7.8	7.1	7.6	7.3	7.4	6.7	11.3	7.4	6.2	5.2
	45–54	7.0	6.6	5.1	4.6	5.5	6.9	7.2	6.6	6.8	7.3	6.2	5.1
	55–64	2.9	2.5	1.7	1.5	3.5	2.9	3.5	1.2	2.8	3.0	2.5	2.1
	65–74	1.6	0.9	0.9	0.5	2.2	2.2	1.6	1.6	3.8	1.7	1.4	1.2
	75–84	1.0	0.8	0.9	0.2	2.3	1.3	0.8	0.0	1.2	1.1	0.9	0.8
	85+	1.1	0.5	1.2	0.5	3.7	1.0	0.6	6.2	7.9	1.1	0.9	0.8
	Total	6.0	7.3	6.2	5.6	6.4	6.3	6.3	5.6	9.2	6.3	5.3	4.4

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

TABLE 4.16.1
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), cancer of kidney, males, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	200	20	20	5	10	80	50	5	10	0	5	0
	45–54	435	35	45	10	20	165	115	15	20	5	5	0
	55–64	690	70	65	20	25	250	190	25	30	5	15	0
	65–74	650	70	60	25	35	210	185	25	30	5	10	0
	75–84	475	50	45	20	25	155	140	15	20	0	5	0
	85+	125	20	15	5	5	35	35	5	5	0	0	0
	Total	2580	260	245	85	120	895	715	90	110	15	45	0
2008–12	<45	215	15	20	5	10	95	50	5	10	0	5	0
	45–54	495	40	55	15	25	190	125	15	20	5	10	0
	55–64	835	80	80	20	30	295	230	35	35	5	20	0
	65–74	790	80	80	25	30	260	220	30	35	5	15	0
	75–84	550	60	50	20	30	175	170	15	20	5	10	0
	85+	170	20	20	5	10	50	55	5	5	0	0	0
	Total	3050	295	305	90	130	1070	845	110	130	20	55	5
2013–17	<45	225	15	25	5	10	100	55	5	10	0	0	0
	45–54	510	40	50	10	20	215	125	15	20	5	10	0
	55–64	950	85	100	25	35	355	245	40	35	5	20	0
	65–74	1015	100	100	30	40	330	285	45	50	5	20	0
	75–84	610	65	60	20	30	195	185	20	25	5	10	0
	85+	220	25	25	5	10	70	70	5	5	0	0	0
	Total	3535	335	365	100	145	1260	960	130	145	25	60	5
2018–22	<45	235	15	25	5	10	105	60	5	10	0	0	0
	45–54	505	35	55	10	20	225	115	15	20	5	10	0
	55–64	1065	95	110	30	40	415	265	40	40	5	20	0
	65–74	1225	120	130	35	45	400	335	55	55	10	25	0
	75–84	755	75	80	25	30	240	225	25	35	5	10	0
	85+	260	30	30	5	10	80	85	5	10	0	0	0
	Total	4040	375	425	110	155	1465	1085	150	165	25	70	5
2023–27	<45	220	15	20	5	10	105	55	5	10	0	0	0
	45–54	535	35	55	10	20	235	125	15	20	5	5	0
	55–64	1085	95	105	25	35	455	260	40	40	5	20	0
	65–74	1405	135	170	45	50	480	360	60	55	10	30	0
	75–84	995	95	105	25	40	310	300	40	50	5	15	0
	85+	300	35	40	5	10	95	95	10	10	0	0	0
	Total	4545	415	490	120	170	1680	1200	170	185	30	75	5
2028–32	<45	215	15	15	5	10	100	50	5	10	0	0	0
	45–54	555	35	55	15	25	250	140	15	20	5	5	0
	55–64	1070	85	105	20	35	470	240	40	35	5	15	0
	65–74	1575	155	185	45	55	560	400	65	65	10	30	0
	75–84	1210	120	135	35	45	385	350	50	55	10	20	0
	85+	395	45	50	10	15	120	125	10	15	0	0	0
	Total	5020	455	550	125	180	1885	1305	185	200	35	75	5

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

TABLE 4.16.2
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), cancer of kidney, females, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	140	10	15	5	5	60	35	5	5	0	0	0
	45–54	235	20	25	5	10	90	60	10	10	0	5	0
	55–64	360	30	30	10	15	130	100	15	20	0	5	0
	65–74	405	40	35	10	15	150	110	15	20	5	5	0
	75–84	380	35	30	15	20	135	115	10	15	0	5	0
	85+	150	15	10	5	5	50	50	5	5	0	0	0
	Total	1665	150	145	55	70	615	465	55	75	10	25	5
2008–12	<45	140	10	15	5	5	65	35	5	5	0	0	0
	45–54	270	20	25	10	15	105	70	10	10	0	5	0
	55–64	440	35	35	15	15	170	120	20	20	0	10	0
	65–74	465	45	40	10	20	175	125	15	25	0	10	0
	75–84	415	35	30	15	20	145	125	15	20	0	5	0
	85+	195	20	15	5	10	70	60	5	5	0	0	0
	Total	1935	170	165	60	75	725	535	65	85	10	30	5
2013–17	<45	155	10	20	5	5	80	35	5	5	0	0	0
	45–54	270	15	25	10	15	110	70	10	10	0	5	0
	55–64	515	40	40	15	20	195	135	20	25	0	10	0
	65–74	580	55	45	15	20	215	155	20	30	5	10	0
	75–84	460	40	35	10	20	165	135	15	20	0	5	0
	85+	245	25	20	5	10	85	80	5	10	0	0	0
	Total	2220	185	185	65	85	850	615	75	100	10	35	5
2018–22	<45	160	10	20	5	5	90	35	5	5	0	0	0
	45–54	260	15	25	10	10	110	65	10	10	0	5	0
	55–64	560	40	45	20	25	215	155	20	25	5	10	0
	65–74	715	65	55	20	25	275	185	25	35	5	15	0
	75–84	535	50	40	10	20	190	160	20	25	0	5	0
	85+	275	25	20	5	10	95	90	10	10	0	0	0
	Total	2505	205	210	70	95	980	685	85	110	10	40	5
2023–27	<45	170	10	25	5	5	100	35	5	5	0	0	0
	45–54	270	15	25	10	10	130	60	10	10	0	5	0
	55–64	545	35	45	20	25	210	150	20	25	0	10	0
	65–74	820	70	60	25	30	315	210	30	40	5	15	0
	75–84	675	60	50	15	25	235	205	25	35	5	10	0
	85+	315	30	25	5	10	115	100	10	10	0	0	0
	Total	2795	225	230	75	105	1105	755	95	125	15	45	5
2028–32	<45	160	10	20	5	5	100	30	5	5	0	0	0
	45–54	290	15	30	10	15	150	60	10	10	0	5	0
	55–64	525	35	45	15	20	215	135	20	20	0	10	0
	65–74	895	75	70	30	35	340	230	35	45	5	15	0
	75–84	825	70	60	20	30	300	240	30	40	5	10	0
	85+	370	40	30	5	10	130	120	10	15	0	0	0
	Total	3070	245	250	85	120	1235	810	105	135	15	45	5

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

TABLE 4.16.3
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), cancer of kidney, males, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	1.9	1.4	1.7	1.8	2.1	1.9	2.0	2.4	2.7	2.6	2.1	0.0
	45–54	17.6	10.5	17.9	16.2	23.1	17.7	18.5	27.7	24.5	26.9	16.7	10.0
	55–64	40.4	29.2	41.9	38.3	43.3	39.1	43.7	54.8	53.1	58.0	49.5	20.2
	65–74	60.8	45.5	68.5	67.6	91.9	52.2	68.7	87.1	81.9	93.8	66.0	36.0
	75–84	76.3	56.3	86.2	88.4	93.3	64.0	96.1	94.8	105.9	58.9	69.1	28.8
	85+	83.1	76.1	97.4	66.5	102.9	63.0	116.7	87.4	104.4	132.8	26.8	0.0
	Total	14.4	10.5	15.5	14.7	18.3	13.1	16.4	19.6	19.5	19.6	14.8	6.3
2008–12	<45	2.1	1.1	1.8	1.8	2.3	2.4	2.2	2.4	3.4	2.7	1.8	0.9
	45–54	18.1	11.3	18.4	17.7	24.2	18.1	19.2	26.4	24.5	30.4	20.0	8.1
	55–64	40.4	27.7	38.7	36.8	44.3	38.7	45.0	70.3	56.0	61.5	46.5	18.0
	65–74	63.5	45.9	75.6	72.5	77.5	56.0	70.3	92.8	90.3	93.1	75.7	28.3
	75–84	79.3	58.4	87.8	82.1	113.6	65.2	100.2	99.5	103.3	100.6	71.6	35.3
	85+	81.2	61.6	109.6	60.4	101.1	61.6	118.9	89.3	105.9	115.6	30.8	36.2
	Total	14.9	10.2	16.0	14.8	18.4	13.7	17.0	21.4	20.8	21.6	15.5	6.6
2013–17	<45	2.2	1.1	1.7	1.9	2.3	2.4	2.3	2.5	3.5	2.8	1.8	1.0
	45–54	18.8	10.8	17.8	16.4	24.0	20.0	20.0	29.1	26.7	31.8	20.5	8.4
	55–64	40.3	26.9	41.2	39.1	43.4	39.7	43.0	69.6	50.3	63.9	47.9	18.0
	65–74	65.1	45.6	73.6	68.1	75.9	56.6	73.6	110.8	101.7	96.5	77.8	29.0
	75–84	79.8	55.6	94.6	89.8	108.4	66.5	99.2	99.3	104.9	104.2	73.6	35.5
	85+	81.6	65.7	104.8	63.6	92.6	64.4	113.4	93.9	102.8	119.6	31.8	36.4
	Total	15.1	10.0	16.1	14.9	17.9	14.2	17.2	22.9	21.3	22.4	15.9	6.7
2018–22	<45	2.1	1.0	1.6	1.9	2.4	2.5	2.4	2.5	3.5	2.9	1.8	0.9
	45–54	20.0	10.0	18.4	16.9	24.4	22.3	20.4	29.9	28.8	32.7	20.8	8.9
	55–64	40.8	27.2	40.5	37.9	44.3	40.7	43.8	70.9	51.8	65.6	48.8	18.2
	65–74	64.7	44.6	72.8	66.4	71.1	56.8	73.5	118.2	95.3	98.8	79.2	28.8
	75–84	81.5	55.7	98.9	90.6	99.6	68.5	98.6	110.2	118.1	106.6	75.0	36.3
	85+	82.0	64.6	107.2	61.5	103.4	62.8	115.7	97.0	98.5	122.4	32.5	36.6
	Total	15.3	9.8	16.2	14.8	17.5	14.6	17.3	24.1	21.7	23.0	16.1	6.8
2023–27	<45	1.9	0.9	1.4	1.9	2.4	2.2	2.2	2.5	3.5	2.9	1.8	0.8
	45–54	21.2	10.1	18.5	17.2	24.6	23.5	22.1	30.4	28.9	33.2	20.9	9.4
	55–64	41.9	26.6	39.0	34.4	43.3	44.0	44.9	74.9	55.4	66.5	49.3	18.7
	65–74	64.4	43.1	76.7	68.6	69.9	58.0	70.2	113.8	87.3	100.0	79.9	28.7
	75–84	82.7	54.9	95.3	82.9	96.4	68.6	102.7	127.6	130.6	107.9	75.7	36.9
	85+	82.0	60.6	117.7	69.7	87.3	65.3	111.3	92.1	103.1	123.8	32.8	36.5
	Total	15.4	9.6	16.1	14.5	17.1	14.9	17.4	24.7	22.0	23.3	16.3	6.9
2028–32	<45	1.8	1.0	1.2	2.0	2.4	2.0	2.0	2.6	3.5	2.9	1.8	0.8
	45–54	20.5	8.4	17.6	17.5	24.8	23.5	23.4	30.9	29.1	33.7	21.1	9.2
	55–64	44.0	24.7	40.2	34.9	43.6	48.1	45.4	75.9	58.8	67.3	49.8	19.6
	65–74	65.0	44.3	74.3	64.2	69.9	59.0	71.5	116.5	89.4	101.1	80.6	29.0
	75–84	81.9	54.2	95.0	81.1	89.5	68.7	100.7	133.0	120.4	109.2	76.4	36.5
	85+	84.4	63.4	119.0	65.3	83.8	66.6	112.2	108.9	121.0	125.2	33.2	37.6
	Total	15.5	9.3	15.9	14.2	16.9	15.3	17.4	25.4	22.3	23.5	16.4	6.9

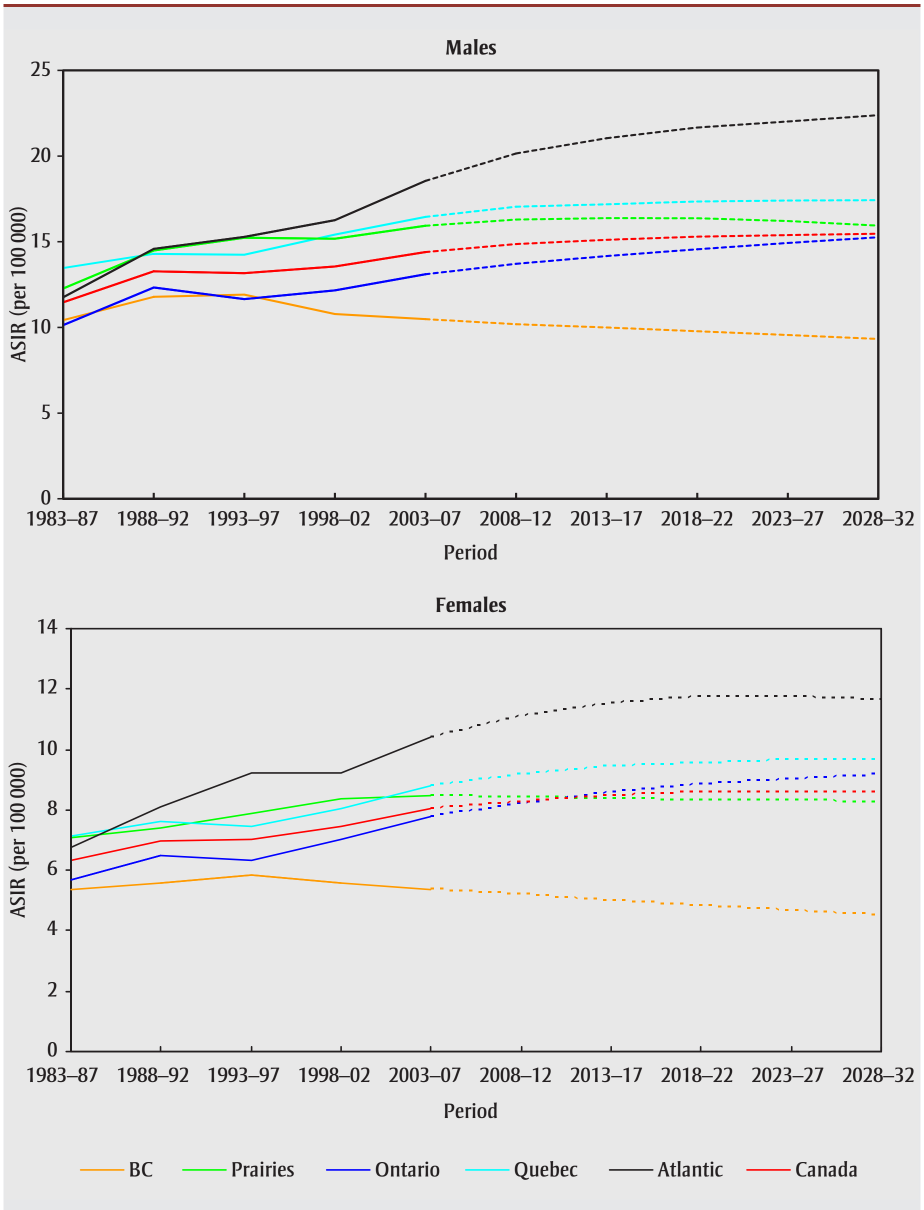
Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

TABLE 4.16.4
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), cancer of kidney, females, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	1.4	0.7	1.5	1.3	1.4	1.5	1.4	1.8	1.8	1.9	1.4	1.5
	45–54	9.4	5.5	9.5	10.0	12.7	9.6	9.4	15.4	13.4	5.5	12.7	2.9
	55–64	20.4	13.5	20.6	23.8	21.3	19.6	21.9	27.4	33.1	26.9	23.0	20.4
	65–74	33.9	24.6	37.2	28.3	37.1	32.7	35.7	55.3	48.8	47.0	26.7	68.2
	75–84	43.6	30.2	42.8	52.1	52.4	40.3	52.2	43.6	55.6	44.3	45.8	0.0
	85+	43.4	32.0	43.8	37.0	41.2	38.1	60.2	50.3	49.5	32.2	19.6	0.0
	Total	8.0	5.3	8.3	8.2	9.0	7.8	8.8	11.1	11.4	9.3	8.0	7.7
2008–12	<45	1.4	0.7	1.5	1.3	1.4	1.6	1.5	1.6	1.4	1.4	1.4	1.4
	45–54	9.9	4.9	9.2	12.7	14.1	10.1	10.8	14.3	14.9	10.0	12.7	8.4
	55–64	20.6	11.9	18.7	22.3	20.5	20.9	22.6	32.3	29.8	20.9	23.3	22.0
	65–74	34.5	24.7	35.0	29.2	40.6	33.7	35.7	51.0	52.2	34.8	36.7	35.1
	75–84	45.6	30.6	44.3	44.8	52.5	41.3	54.4	58.8	70.0	44.7	36.2	30.0
	85+	45.3	36.7	47.9	34.2	41.4	41.1	58.8	48.2	50.9	45.4	18.7	24.1
	Total	8.3	5.2	8.1	8.1	9.3	8.2	9.2	11.5	11.7	8.3	8.4	7.5
2013–17	<45	1.5	0.8	1.7	1.3	1.4	1.9	1.5	1.6	1.4	1.5	1.4	1.6
	45–54	9.9	4.1	8.8	12.1	14.3	9.9	11.6	14.7	15.4	10.2	12.9	8.4
	55–64	21.1	11.5	17.1	22.4	23.6	21.4	23.3	35.3	31.6	21.5	24.1	20.6
	65–74	34.4	23.1	31.7	35.1	37.3	33.9	36.6	48.4	53.9	35.6	37.9	33.6
	75–84	47.5	31.0	45.6	36.7	54.3	43.9	56.4	67.4	71.3	45.7	37.3	32.0
	85+	48.1	34.4	44.1	39.0	49.2	43.5	63.2	53.7	58.2	46.5	19.4	26.3
	Total	8.5	5.0	7.8	8.2	9.6	8.6	9.4	12.0	12.1	8.5	8.6	7.5
2018–22	<45	1.5	0.7	1.7	1.3	1.4	2.1	1.4	1.6	1.4	1.5	1.4	1.8
	45–54	10.3	4.3	8.7	11.7	14.4	10.9	11.6	14.9	15.7	10.3	13.1	8.6
	55–64	21.2	10.7	17.6	25.6	26.7	20.7	25.0	34.8	31.8	21.7	24.7	19.9
	65–74	34.9	21.8	29.8	35.5	35.4	35.5	37.0	51.9	54.7	36.0	38.7	31.0
	75–84	47.7	31.2	42.5	37.6	57.2	44.1	56.7	67.5	76.3	46.2	38.1	32.6
	85+	48.6	35.4	46.2	34.3	41.6	44.8	62.0	64.5	61.5	46.9	19.8	28.7
	Total	8.6	4.8	7.6	8.5	9.7	8.9	9.6	12.4	12.5	8.6	8.7	7.4
2023–27	<45	1.5	0.8	1.7	1.3	1.4	2.2	1.4	1.6	1.4	1.5	1.4	2.0
	45–54	10.5	4.2	8.6	11.5	14.4	12.5	10.7	15.0	15.8	10.4	13.2	9.2
	55–64	20.9	9.3	17.0	25.2	26.8	20.0	26.0	35.1	32.1	21.8	25.0	19.7
	65–74	35.2	21.2	27.4	37.8	39.9	35.3	37.8	55.1	56.7	36.2	39.1	28.7
	75–84	47.2	29.2	38.7	46.0	52.4	43.6	57.4	63.6	76.3	46.5	38.5	31.3
	85+	50.7	36.0	46.7	27.3	50.2	47.2	65.3	70.7	60.1	47.3	20.1	30.2
	Total	8.6	4.7	7.3	8.8	10.0	9.0	9.6	12.5	12.6	8.7	8.8	7.5
2028–32	<45	1.4	0.7	1.6	1.3	1.4	2.1	1.3	1.6	1.4	1.5	1.4	2.3
	45–54	10.7	3.9	9.6	11.3	14.5	13.9	10.1	15.1	16.0	10.4	13.3	10.1
	55–64	21.5	9.8	16.6	24.8	26.9	21.3	25.8	35.3	32.3	21.8	25.2	20.3
	65–74	35.1	20.1	27.9	42.3	44.4	33.9	39.7	54.2	56.6	36.2	39.5	27.5
	75–84	47.5	28.1	36.4	45.3	50.1	45.3	57.1	68.6	77.8	46.5	39.0	28.8
	85+	49.1	36.2	41.1	33.6	47.6	45.1	62.7	65.8	67.4	47.4	20.3	30.0
	Total	8.6	4.5	7.2	9.1	10.2	9.2	9.6	12.6	12.8	8.7	8.9	7.7

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

FIGURE 4.16.1
Age-standardized incidence rates (ASIRs) by region, kidney cancer, 1983–2032



Hypertension has been linked to an excess risk of 20% to 300%,[233,234] with a potential dose-response relationship.[86] Preventing and controlling hypertension may reduce kidney cancer incidence.[236] A meta-analysis of 24 studies suggests that diabetes is associated with an increased risk of kidney cancer, and is independent of alcohol use, obesity and smoking.[237] An increased risk of kidney cancer also has been suggested in patients with acquired renal cystic disease.[238] Hereditary predispositions, characterized as occurring at birth, are responsible for less than 5% of kidney cancer cases.[224,239] There is sufficient evidence that trichloroethylene (used primarily for metal degreasing, especially in the aerospace/aircraft industry) causes kidney cancer, according to IARC.[47] The US National Cancer Institute's recent meta-analysis of studies published from 1950 to 2011 indicates a 32% risk increase for occupational trichloroethylene exposure.[240]

17. Bladder cancer

Bladder cancer is the only site where we combine in situ and malignant cases. The provincial and territorial cancer registries, other than Ontario, have combined in situ and invasive bladder cancers when reporting to the Canadian Cancer Registry (CCR). Reasons for the reporting include the difficulty in identifying early invasion in pathology reports and the high rates of recurrence and progression of in situ tumours.[241-243]

Bladder cancer was the fourth most common type of new cancer diagnosis in Canadian males and the eleventh most common type in Canadian females in 2003–2007. One in 28 males and 1 in 78 females can expect to be diagnosed with bladder cancer in their lifetime, and 1 in 89 males and 1 in 213 females can expect to die from it.[1] The average annual number of new bladder cancer cases in 2003–2007 was 4815 for males and 1705 for females, constituting 6.0% and 2.3% of all male and female cancer cases, respectively (Table 4.17.1 and 4.17.2). The incidence increased exponentially with age for males and linearly for females in the last observation period (2003–2007) (Tables 4.17.3 and 4.17.4). As such, the male-to-female ratio of the rates increased with age, from 2.0:1 in young adults (< 45) to 3.9:1 in the oldest (85+) (Figure 4.17.2). About 71% of all bladder cancers were diagnosed in people aged 65 or older in the same period. The 5-year relative survival rate was 74% for bladder cancer diagnosed between 2006 and 2008.[1]

For males, the ASIRs in all regions were relatively stable between 1988 and 2002 but displayed a downward trend in the last 10 years (Figure 4.17.1). For females, the rates in all regions remained stable. However, in the last observed decade, the rates in females increased moderately in Quebec and the Atlantic region and decreased markedly in British Columbia. During 1998–2007, bladder cancer ASIRs decreased significantly in males by 0.7% per year, and the ASIRs in females were stable, with a non-significant decrease of only 0.1% per year (Figures 3.1 and 3.2).

The rates for males are anticipated to decrease, but at different levels, in all regions (Figure 4.17.1). Female rates are projected to increase slightly in Quebec, and stabilize in the other areas. Internal ranking of the ASIRs in geographical

FIGURE 4.16.2
Age-standardized incidence rates (ASIRs) for kidney cancer by age group (– males, – females), Canada, 1983–2032

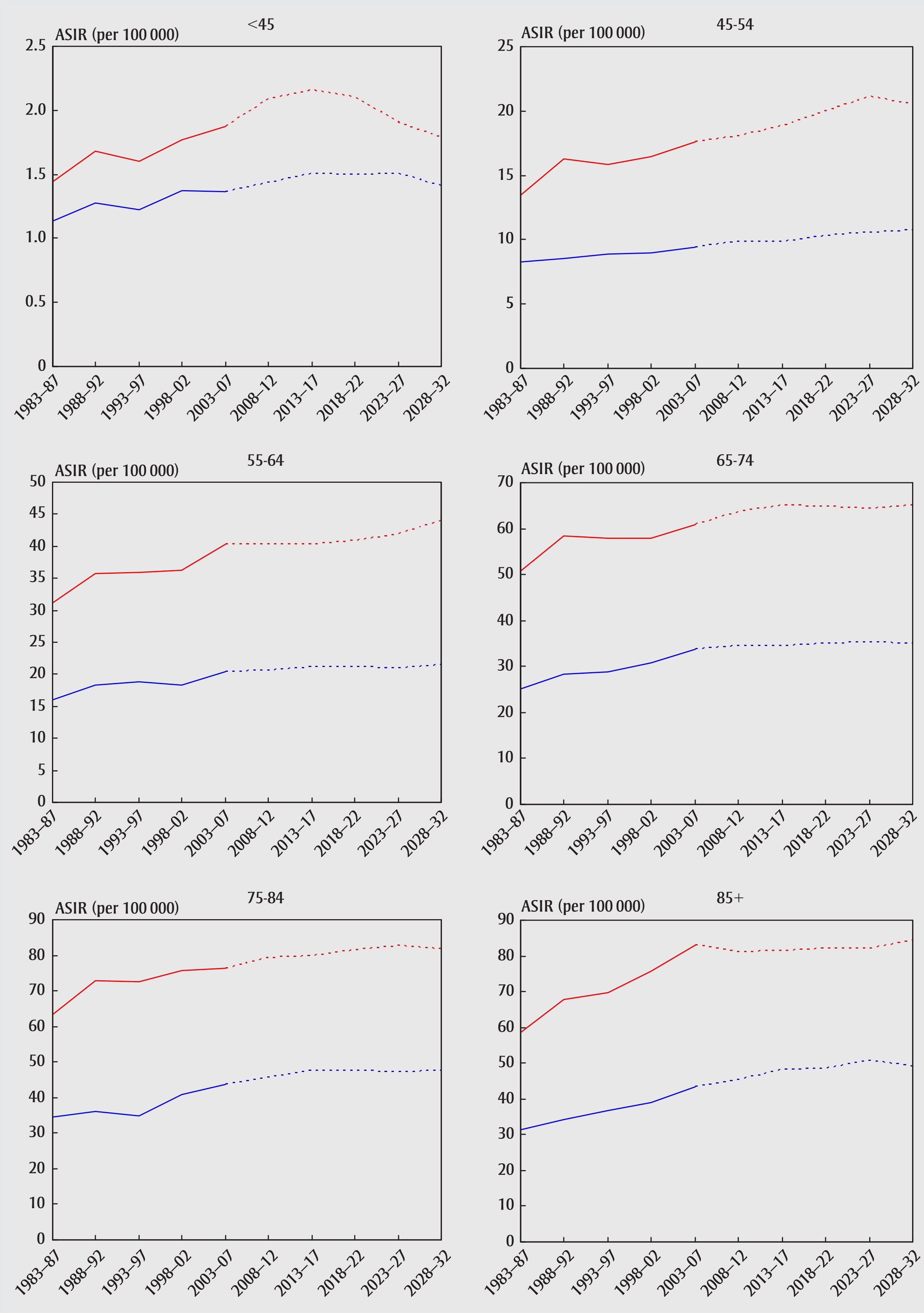


TABLE 4.17.1
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), cancer of bladder, males, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	105	15	15	0	5	25	40	5	5	0	0	0
	45–54	365	45	35	10	10	95	135	15	10	0	5	0
	55–64	910	120	90	25	35	235	330	25	40	5	10	0
	65–74	1470	210	135	45	50	420	480	40	55	10	25	0
	75–84	1495	220	125	50	65	440	465	40	55	5	25	0
	85+	465	80	40	20	20	130	120	15	20	5	10	0
	Total	4815	685	440	160	180	1345	1570	140	180	25	80	5
2008–12	<45	95	15	15	5	5	25	40	5	5	0	0	0
	45–54	360	40	40	15	10	100	140	10	10	0	5	0
	55–64	1060	135	105	35	35	275	390	35	45	5	15	0
	65–74	1595	235	150	50	55	435	555	55	60	10	25	0
	75–84	1650	245	150	50	65	490	530	45	60	10	30	0
	85+	645	115	55	25	25	200	180	20	25	5	10	0
	Total	5405	775	520	170	195	1520	1835	160	210	25	85	5
2013–17	<45	95	15	15	5	5	20	40	0	5	0	0	0
	45–54	340	40	40	15	10	95	140	10	10	0	5	0
	55–64	1150	140	125	45	40	315	415	35	50	5	15	0
	65–74	1935	270	195	55	65	515	705	65	80	5	30	0
	75–84	1760	265	170	55	65	515	580	50	70	15	30	0
	85+	825	135	75	25	35	270	240	20	30	5	10	0
	Total	6105	865	615	190	220	1725	2125	185	240	30	95	5
2018–22	<45	95	15	15	5	5	20	45	0	5	0	0	0
	45–54	305	40	35	10	10	85	120	10	10	0	5	0
	55–64	1190	135	140	50	40	335	445	35	50	5	15	0
	65–74	2310	320	240	70	85	620	835	75	100	5	35	5
	75–84	2055	300	205	60	80	585	710	65	85	15	40	0
	85+	965	165	100	30	35	305	290	25	30	5	15	0
	Total	6920	970	730	225	250	1950	2445	210	280	30	110	10
2023–27	<45	105	15	15	5	5	25	45	5	5	0	0	0
	45–54	295	35	35	10	10	80	130	10	10	0	5	0
	55–64	1160	135	135	45	40	335	440	30	50	5	15	0
	65–74	2590	340	290	95	100	720	905	85	105	5	40	5
	75–84	2615	365	275	75	100	730	925	80	115	10	50	5
	85+	1095	180	110	30	45	340	330	30	40	10	15	0
	Total	7860	1075	860	260	295	2225	2775	235	325	30	125	10
2028–32	<45	105	15	15	5	5	25	45	5	5	0	0	0
	45–54	315	40	35	15	10	80	140	10	10	0	5	0
	55–64	1065	135	130	40	35	305	390	30	45	5	15	0
	65–74	2760	340	325	105	105	795	980	80	105	5	40	5
	75–84	3205	435	350	95	130	895	1110	95	145	10	60	5
	85+	1375	220	150	35	50	415	445	45	50	5	20	0
	Total	8825	1180	1000	295	335	2515	3110	260	360	30	140	10

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: 1. Totals may not add up due to rounding.

2. Bladder cancer is the only site where in-situ and malignant cases are combined in this report. Ontario has not reported in situ bladder cancer.

TABLE 4.17.2
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), cancer of bladder, females, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	50	5	5	0	0	15	20	0	0	0	0	0
	45–54	135	20	10	5	5	35	50	5	5	0	0	0
	55–64	305	40	30	10	15	70	110	15	15	0	5	0
	65–74	420	60	40	15	15	115	140	15	15	5	10	0
	75–84	520	70	40	20	20	165	165	15	20	0	10	0
	85+	270	35	25	10	10	80	85	5	10	0	5	0
	Total	1705	230	150	60	65	485	565	50	65	10	30	5
2008–12	<45	50	5	5	0	0	15	20	0	0	0	0	0
	45–54	155	20	15	5	5	40	55	5	5	0	0	0
	55–64	345	50	30	10	15	80	125	15	10	0	10	0
	65–74	465	65	50	15	15	115	160	15	20	0	10	0
	75–84	555	70	50	20	20	170	180	15	20	5	10	0
	85+	325	45	25	10	10	105	105	10	15	0	5	0
	Total	1900	255	175	65	70	525	650	60	70	10	35	5
2013–17	<45	50	5	5	0	0	20	20	0	0	0	0	0
	45–54	150	20	15	5	5	40	55	5	5	0	0	0
	55–64	385	55	40	15	15	95	135	15	10	0	10	0
	65–74	580	80	60	15	20	135	215	20	25	5	15	0
	75–84	585	75	55	20	20	170	195	15	25	5	10	0
	85+	400	50	35	10	15	135	130	10	15	0	5	0
	Total	2145	290	210	65	80	590	750	70	75	10	40	5
2018–22	<45	45	5	5	0	0	20	20	0	0	0	0	0
	45–54	135	15	15	5	5	40	50	5	5	0	0	0
	55–64	425	65	40	15	15	110	150	20	10	0	10	0
	65–74	675	100	65	20	25	160	250	25	20	5	15	0
	75–84	680	90	70	20	25	185	235	20	30	5	10	0
	85+	460	60	45	15	15	145	160	10	15	5	5	0
	Total	2420	330	245	70	85	660	865	80	80	15	45	5
2023–27	<45	45	5	5	0	0	20	20	0	0	0	0	0
	45–54	130	15	15	5	5	50	50	5	5	0	0	0
	55–64	410	55	40	15	15	105	145	15	10	0	10	0
	65–74	760	120	80	25	30	185	270	30	20	5	20	0
	75–84	865	115	90	20	30	230	315	25	35	5	15	0
	85+	490	65	50	15	15	150	175	10	15	5	5	0
	Total	2710	375	285	75	100	745	975	85	85	15	50	5
2028–32	<45	50	5	5	0	0	20	20	0	0	0	0	0
	45–54	130	20	15	5	5	50	55	5	5	0	0	0
	55–64	375	50	40	10	15	115	135	15	10	0	10	0
	65–74	845	130	90	25	30	215	295	30	20	5	20	0
	75–84	1020	135	105	25	40	275	365	30	35	5	20	0
	85+	610	75	70	15	20	180	220	15	20	5	5	0
	Total	3030	420	330	80	115	855	1095	95	90	15	55	5

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: 1. Totals may not add up due to rounding.

2. Bladder cancer is the only site where in-situ and malignant cases are combined in this report. Ontario has not reported in situ bladder cancer.

TABLE 4.17.3
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), cancer of bladder, males, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	1.0	1.1	1.1	0.8	0.7	0.6	1.7	1.1	0.9	1.2	0.8	0.5
	45–54	14.7	13.4	14.2	15.8	12.3	10.3	22.0	22.2	14.0	23.3	12.7	7.6
	55–64	53.9	50.7	59.7	55.8	55.5	37.6	75.4	62.3	71.2	43.9	37.4	14.7
	65–74	136.0	137.0	147.8	130.8	133.9	102.1	178.2	159.8	160.6	152.3	135.0	140.9
	75–84	240.4	241.6	248.2	221.8	270.0	183.4	321.0	254.5	289.6	250.3	258.3	93.9
	85+	305.6	340.7	312.3	276.8	289.3	233.6	384.4	398.3	354.2	478.2	410.9	0.0
	Total	27.9	28.0	29.6	26.8	28.3	20.6	37.6	32.6	33.2	31.4	27.8	15.4
2008–12	<45	0.9	1.0	1.1	1.1	0.8	0.6	1.7	1.2	1.2	1.0	0.8	0.5
	45–54	13.1	10.8	13.9	17.8	11.7	9.2	21.3	18.2	13.9	19.6	13.4	7.2
	55–64	51.7	46.8	54.8	56.4	51.2	36.0	77.4	62.2	73.2	28.7	38.4	28.5
	65–74	128.8	132.1	143.8	132.7	136.0	93.5	176.3	165.5	155.8	159.3	120.1	71.1
	75–84	235.5	236.5	257.2	207.7	257.5	181.5	316.7	265.4	294.0	256.4	275.8	129.9
	85+	307.4	344.3	313.2	288.4	303.0	245.6	393.8	381.6	367.6	407.7	307.3	169.6
	Total	26.9	26.9	29.2	26.9	27.8	19.9	37.5	32.8	33.6	29.5	26.5	14.8
2013–17	<45	0.9	0.9	1.0	1.1	0.7	0.5	1.8	1.2	1.2	1.0	0.8	0.5
	45–54	12.3	10.5	12.9	17.5	10.4	8.5	21.8	17.3	15.5	19.6	13.2	6.8
	55–64	49.2	43.7	51.9	61.6	49.7	35.6	74.0	64.5	68.2	27.2	39.4	27.2
	65–74	124.3	122.2	141.0	128.5	128.3	88.6	182.1	158.3	159.6	92.1	113.1	68.6
	75–84	227.8	232.7	256.9	226.2	262.0	172.7	308.4	266.7	299.4	355.0	260.1	125.7
	85+	308.9	327.2	328.0	257.4	345.4	253.1	401.2	368.2	398.7	318.2	349.3	170.4
	Total	26.0	25.5	28.7	27.4	27.6	19.2	37.5	32.3	34.1	27.4	26.0	14.3
2018–22	<45	0.9	0.9	1.0	1.1	0.7	0.5	1.8	1.2	1.2	1.0	0.8	0.5
	45–54	11.8	10.7	12.5	17.4	9.7	8.2	21.5	17.4	15.3	19.6	13.1	6.5
	55–64	45.9	38.1	51.2	66.3	46.0	33.5	72.8	60.0	63.5	26.2	40.5	25.3
	65–74	121.8	116.0	133.7	134.2	133.3	87.0	183.1	154.3	168.3	68.6	105.6	67.2
	75–84	221.6	219.9	252.6	224.5	257.4	166.1	309.1	269.2	298.8	312.6	255.3	122.2
	85+	305.0	335.3	353.2	275.2	324.1	241.1	401.3	377.0	387.8	383.4	331.9	168.3
	Total	25.2	24.3	28.2	28.3	27.1	18.5	37.5	31.9	34.1	24.9	25.2	13.9
2023–27	<45	0.9	0.9	1.0	1.1	0.7	0.5	1.8	1.2	1.2	1.0	0.8	0.5
	45–54	11.4	10.0	11.7	17.3	9.4	7.6	22.8	17.4	15.3	19.6	13.0	6.3
	55–64	44.5	37.0	49.1	66.1	44.1	32.0	74.4	56.9	69.2	25.7	40.4	24.6
	65–74	118.2	108.8	131.3	146.1	134.4	86.8	175.7	155.8	156.1	67.5	108.9	65.2
	75–84	217.6	205.3	251.1	221.9	257.0	159.9	318.1	254.0	309.6	203.5	241.6	120.0
	85+	297.0	321.7	340.2	303.1	362.2	233.5	384.6	371.7	409.8	566.0	314.5	163.9
	Total	24.6	22.9	27.6	29.3	27.4	18.0	37.4	31.1	34.4	22.7	24.7	13.6
2028–32	<45	0.9	0.9	0.9	1.1	0.7	0.5	1.8	1.2	1.2	1.0	0.8	0.5
	45–54	11.6	9.9	11.6	17.2	9.1	7.6	23.0	17.5	15.2	19.6	12.9	6.4
	55–64	43.6	38.1	48.8	65.9	43.0	31.3	73.3	57.0	69.0	25.3	40.3	24.1
	65–74	112.7	97.5	129.4	154.6	128.6	82.7	175.6	145.9	152.3	66.5	111.3	62.2
	75–84	215.7	197.2	240.2	231.6	270.0	159.1	318.7	252.0	323.2	171.5	230.3	119.0
	85+	292.8	303.0	344.4	281.6	335.8	226.2	398.0	379.7	393.9	356.7	319.6	161.5
	Total	24.0	21.8	27.0	30.0	27.0	17.5	37.5	30.5	34.4	19.3	24.5	13.3

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Bladder cancer is the only site where in-situ and malignant cases are combined in this report. Ontario has not reported in situ bladder cancer.

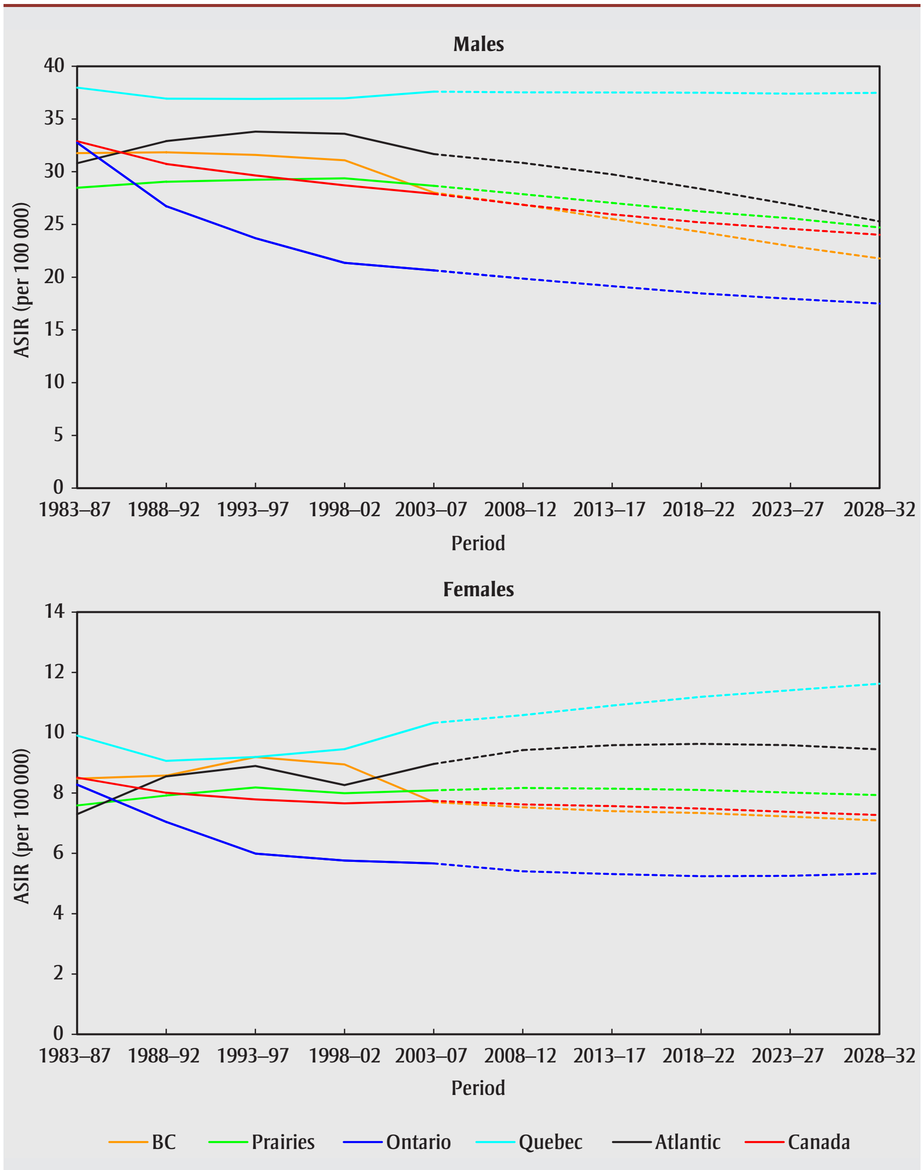
TABLE 4.17.4
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), cancer of bladder, females, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	0.5	0.4	0.5	0.7	0.4	0.4	0.8	0.5	0.6	0.4	0.0	1.0
	45–54	5.3	5.3	4.5	6.3	5.7	3.6	7.8	6.2	7.1	8.9	5.0	5.7
	55–64	17.5	16.3	19.9	17.8	20.7	10.9	24.3	28.3	22.1	16.7	19.9	50.7
	65–74	35.1	37.9	41.8	40.8	33.7	24.6	45.0	46.2	37.4	48.9	41.9	28.7
	75–84	59.4	58.0	57.3	57.1	59.5	48.4	75.7	69.2	72.0	45.1	67.9	0.0
	85+	78.0	76.6	86.1	63.8	57.4	65.5	106.5	48.2	81.4	96.5	54.9	0.0
	Total	7.7	7.7	8.3	8.2	7.7	5.7	10.3	9.6	9.0	8.6	8.1	7.6
2008–12	<45	0.5	0.4	0.6	0.7	0.3	0.4	0.9	0.7	0.6	0.5	0.5	0.5
	45–54	5.6	5.8	4.9	6.4	6.1	3.7	8.6	6.5	5.8	6.2	5.1	5.5
	55–64	16.3	16.1	16.4	18.6	17.2	10.2	24.1	27.7	16.6	18.0	22.5	16.0
	65–74	34.2	35.0	42.9	40.0	38.4	21.9	46.2	48.1	43.0	37.7	43.1	33.5
	75–84	60.8	58.9	67.1	60.1	61.3	47.5	78.5	69.6	75.3	66.9	61.4	59.5
	85+	75.1	74.6	74.4	63.1	63.4	64.3	98.9	70.3	88.2	82.7	56.8	73.6
	Total	7.6	7.5	8.4	8.3	7.8	5.4	10.6	10.1	9.0	8.4	8.5	7.5
2013–17	<45	0.5	0.4	0.6	0.7	0.3	0.5	0.9	0.7	0.6	0.5	0.5	0.5
	45–54	5.4	4.8	4.6	6.5	5.9	3.5	9.1	6.5	5.8	5.9	5.1	5.3
	55–64	15.8	16.6	15.9	19.7	18.7	10.2	23.1	28.2	12.3	17.4	22.9	15.5
	65–74	34.4	35.0	41.4	35.9	36.2	21.1	50.0	50.2	41.6	37.9	43.7	33.7
	75–84	60.3	57.7	70.7	60.1	62.9	44.8	80.5	68.1	78.6	66.4	62.2	59.1
	85+	78.3	73.0	82.5	64.6	71.5	68.4	103.7	67.2	87.3	86.2	57.6	76.7
	Total	7.6	7.4	8.4	8.2	7.9	5.3	10.9	10.2	8.7	8.3	8.7	7.4
2018–22	<45	0.4	0.4	0.6	0.7	0.3	0.5	0.8	0.7	0.6	0.5	0.5	0.4
	45–54	5.2	4.4	5.0	6.6	5.7	4.0	9.6	6.5	5.8	5.8	5.1	5.1
	55–64	16.1	17.5	15.6	17.8	18.2	10.4	24.1	28.5	12.4	17.8	23.1	15.8
	65–74	33.0	33.8	36.0	35.3	36.0	20.4	50.2	49.4	33.8	36.3	44.1	32.3
	75–84	60.1	56.4	75.3	59.1	67.8	42.7	81.9	71.3	79.4	66.2	62.7	58.9
	85+	81.3	76.2	91.8	72.4	73.2	67.4	112.2	76.5	86.4	89.6	58.1	79.6
	Total	7.5	7.3	8.3	8.0	8.0	5.2	11.2	10.3	8.1	8.2	8.7	7.3
2023–27	<45	0.4	0.4	0.6	0.7	0.3	0.5	0.8	0.7	0.6	0.5	0.5	0.4
	45–54	5.1	4.4	4.9	6.7	5.7	4.8	9.2	6.5	5.8	5.6	5.1	5.0
	55–64	15.6	15.0	14.9	17.9	17.9	10.1	25.3	28.7	12.4	17.1	23.2	15.3
	65–74	32.6	35.9	35.6	35.7	39.3	20.8	49.0	49.6	26.3	35.9	44.3	31.9
	75–84	60.6	56.6	72.0	51.7	64.4	41.8	88.7	72.5	76.9	66.7	63.0	59.4
	85+	78.7	71.7	93.4	66.6	77.5	62.8	110.9	67.6	92.8	86.7	58.4	77.1
	Total	7.4	7.2	8.2	7.7	8.1	5.3	11.4	10.3	7.6	8.1	8.8	7.2
2028–32	<45	0.4	0.4	0.6	0.7	0.3	0.4	0.8	0.7	0.6	0.5	0.5	0.4
	45–54	4.8	4.4	4.9	6.7	5.6	4.7	9.2	6.5	5.8	5.3	5.1	4.7
	55–64	15.3	14.0	15.9	17.9	17.6	11.4	26.5	28.8	12.4	16.9	23.3	15.0
	65–74	33.0	36.1	34.6	32.9	38.8	21.2	50.8	49.9	26.3	36.3	44.5	32.3
	75–84	58.0	54.7	64.2	52.7	66.8	40.7	87.4	71.3	61.3	63.9	63.3	56.8
	85+	80.4	72.5	102.6	68.1	85.8	61.9	115.1	77.6	89.8	88.6	58.7	78.8
	Total	7.3	7.1	8.0	7.6	8.2	5.3	11.6	10.4	7.0	8.0	8.8	7.1

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Bladder cancer is the only site where in-situ and malignant cases are combined in this report. Ontario has not reported in situ bladder cancer.

FIGURE 4.17.1
Age-standardized incidence rates (ASIRs) by region, bladder cancer[a], 1983–2032



[a]Bladder cancer is the only site where in-situ and malignant cases are combined in this report. Ontario has not reported in situ bladder cancer.

regions is predicted to be similar for both sexes, with the highest rates in Quebec and the lowest in British Columbia. From 2003–2007 to 2028–2032, the ASIRs of bladder cancer for Canada are projected to decrease by 14% in males, from 27.9 to 24.0 per 100 000, and to drop by 6% in females, from 7.7 to 7.3 per 100 000 (Tables 4.17.3 and 4.17.4). With the aging and growth of the population, however, the annual number of new cases in males will increase by 83%, from 4815 to 8825, and in females by 78%, from 1705 to 3030 (Tables 4.17.1 and 4.17.2).

Allowing for the expected number of Ontario in situ cases, the increase for Canada as a whole from 2003–2007 to 2028–2032 would be from approximately 5510 to 10 135 cases annually in males and from 2005 to 3560 cases in females. The annual number of new Ontario cases adjusted for in situ cases would rise over this period from about 2045 to 3825 in males and from 785 to 1385 in females. The corresponding prediction for the adjusted Ontario ASIRs would be a decrease from 31.1 to 26.4 per 100 000 in males and a decrease from 9.4 to 8.8 per 100 000 in females.

Comments

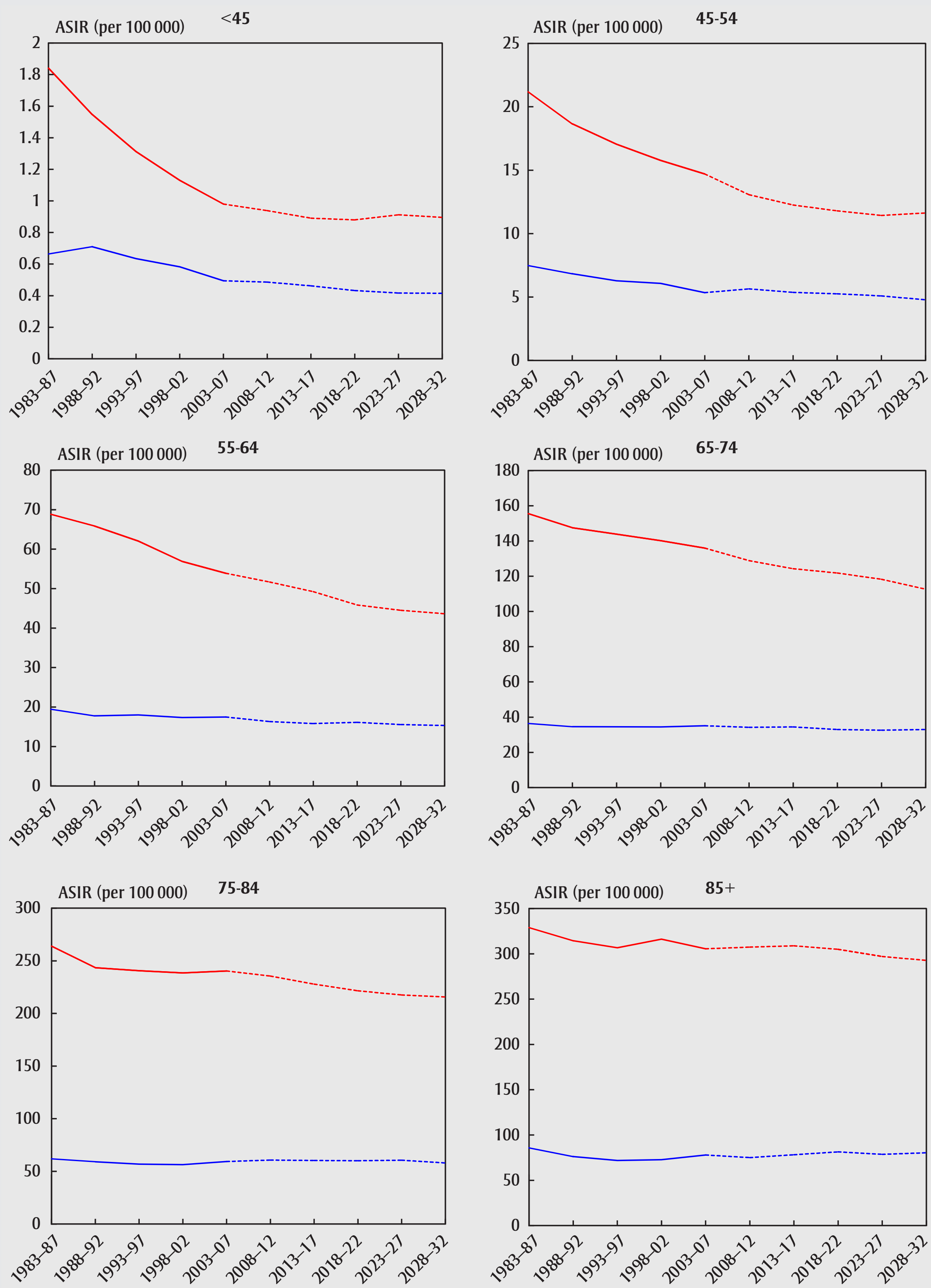
For the data used in this monograph, Ontario has not reported in situ bladder cancer, resulting in the lower bladder cancer rates observed for Ontario. Ontario will start including these cases in future data releases. Based on data collected for 2000–2002 (but not included in the Ontario Registry),[1] it is expected that this reporting change in Ontario will result in observed bladder cancer rates close to those of the Prairie region and British Columbia, representing an increase in Ontario cases of 52% in males and 62% in females with a similar increase in rates.

Cigarette smoking is the major and preventable risk factor for bladder cancer.[47,86] Smoking accounted for about 50% of male bladder cancer cases and 30% of female bladder cancer cases in Europe.[244,245] Current smokers have up to 4-fold higher risk of bladder cancer than non-smokers,[246,247] with dose-response relationships for both smoking frequency and duration.[86,248] As previously mentioned, reductions in smoking prevalence occurred 20 years earlier in males than in females in Canada.[42,43] The impact of the reduction in tobacco consumption has been presented in the observed incidence data for males, and accordingly contributed to the predicted declining incidence trends, but has largely not yet been seen in the female trends given the lag of 20 to 30 years between the drop in smoking rates and subsequent decrease in cancer incidence rates.[249] Consequently, incidence rates of bladder cancer in females are likely to begin to decrease over the longer term.

Epidemiological studies have linked bladder cancer to occupational exposures for over 100 years.[248] A case-control study in Montreal reported that 6.5% of bladder cancer incidence were attributed to occupational exposures (including motor vehicle drivers, textile dyers, motor transport and aromatic amines).[250] Another Canadian study found statistically significant increased risks of bladder cancer in male primary metal workers and automechanics, and female general office clerks, with a duration-response effect.[251]

Two pooled analyses of epidemiological studies, conducted in Canada, the US,

FIGURE 4.17.2
Age-standardized incidence rates (ASIRs) for bladder cancer[a] by age group (– males, – females), Canada, 1983–2032



[a]Bladder cancer is the only site where in-situ and malignant cases are combined in this report. Ontario has not reported in situ bladder cancer.

Finland, France and Italy, found a significant association between tap water consumption and risk of bladder cancer, particularly in males.[252,253] The summarized dose-response relation suggests that carcinogenic chemicals (such as chloroform and other trihalomethanes) in tap water are responsible for the increased risk.

18. Central nervous system cancers

Cancers of the brain and nervous system are referred to collectively as central nervous system (CNS) cancers. During 2003–2007, the average annual number of CNS cancers was 1365 for males and 1055 for females in Canada, making up 1.7% and 1.4% of all new male and female cancer cases, respectively (Tables 4.18.1 and 4.18.2). One in 117 Canadian males and 1 in 150 females can expect to be diagnosed with CNS cancers in their lifetime, and 1 in 165 males and 1 in 220 females are likely to die from it.[1]

CNS cancers have a bimodal age distribution, with one peak in the pediatric population and another, much larger, in people in their 70s. In 2003–2007, the age-specific incidence was higher during early childhood (0–4 years) than young adulthood, increased gradually to peak at age 75 to 79, and then decreased (Figure 4.18.1). CNS cancer is the second most common childhood malignancy (after leukemia), representing 20% of all cancers diagnosed in 0 to 14 year olds.[254] CNS cancers are the most common cause of cancer death in children. In 2003–2007, nearly 60% of CNS cancers were diagnosed in people aged 55 and over (Tables 4.18.1 and 4.18.2). Males and females had similar rates up to their late 30s, after which the rates were higher in males and the divergence increased consistently with age (Figure 4.18.1). The 5-year relative survival rates for CNS cancers diagnosed between 2006 and 2008 were 23% for males and 28% for females.[1] Survival is significantly higher in children and younger adults.[36,254]

The overall incidence rates of CNS cancers in males have decreased consistently since 1988–1992, but to a very small degree, while the rates in females were relatively stable until 1998–2002 and then decreased slightly (Figure 4.18.2). During 1998–2007, ASIRs of CNS cancer were stable: decreased in males by 0.4% per year and by 0.8% in females (Figures 3.1 and 3.2). When the Atlantic region is excluded, an east–west gradient in ASIRs appears in both sexes starting from 1993–1997, with the highest rates in Quebec and the lowest rates in British Columbia (Figure 4.18.2). The ASIRs in the Atlantic region, which had been in the lower regional rates, approached the national level in the last observation period (2003–2007).

We based the CNS cancer projections on the trends in all the observation quinquennia. This produced downward trends in the predicted rates in males in Canada and its regions, decreasing by 4% in Quebec and 9% to 20% in the other regions from 2003–2007 to 2028–2032 (Figure 4.18.2). For females, the rates are expected to be stable in Quebec and the Atlantic region, and to decrease by 8% to 13% in the other regions. For both males and females, Quebec and British Columbia will remain in their respective highest and lowest ranking in the regional rates. The overall age-specific ASIRs are expected to stabilize in the youngest age group and decrease in each of the other age groups (Figure 4.18.3).

From 2003–2007 to 2028–2032, the ASIRs of CNS cancers are expected to decrease by 10% in males, from 7.9 to 7.1 per 100 000, and decrease by 8% in females, from 5.6 to 5.2 per 100 000 (Tables 4.18.3 and 4.18.4). Nevertheless, the aging and growth of the population means that the annual number of male cases is projected to rise by 44%, from 1365 to 1965, and the number of female cases, by 40%, from 1055 to 1470 (Tables 4.18.1 and 4.18.2).

Comments

Investigators have suggested that the increase in CNS cancer rates in people aged 75 or older in the observed periods until 1998–2002 was due to improved diagnostic techniques.[255] X-radiation and gamma-radiation are the only established risk factors for CNS cancers, according to IARC.[47] This conclusion was mainly based on studies of atomic bomb survivors and of patients with radiation diagnosis and treatment. IARC classifies radiofrequency non-ionizing radiation from telecommunications as a possible cause of CNS cancers, with limited evidence.[47,86] Genetic and hereditary conditions are also linked to an increased risk. Having a parent with the disease confers a 1.7-fold increased risk, and having an affected sibling doubles the risk.[256]

19. Thyroid cancer

The average annual number of thyroid cancer in 2003–2007 was 795 in males and 2810 in females, representing 1.0% and 3.8% of all new Canadian male and female cancer cases, respectively (Tables 4.19.1 and 4.19.2). Whereas incidence rates for all cancers combined and for most specific types of cancer in Canada are stable or decreasing, thyroid cancer rates are rising significantly in both sexes. Though relatively uncommon in Canada, thyroid cancer is the most rapidly increasing of all cancers in both sexes. This increase has been particularly rapid in females over the past 25 years, such that thyroid cancer was the sixth most common cancer in females in Canada during the last observation period (2003–2007) (Table 4.19.3 and 4.19.4). Over the entire observation period, Ontario experienced the fastest growth in rates, British Columbia had the slowest linear increase, and other regions had similar moderate increases in between (Figure 4.19.1).

One in 223 males and 1 in 71 females can expect to be diagnosed with thyroid cancer in their lifetime, and 1 in 1937 males and 1 in 1374 females can expect to die from it.[36] Thyroid cancer has the highest 5-year relative survival rate of all cancers in Canada, at 98% in 2006–2008.[1]

Joinpoint analysis (data not shown, but the similar annual percent changes for males and the annual percent changes for females in their respective most recent observation periods are shown in Figure 3.1 or 3.2) further showed that the ASIRs of thyroid cancer in males in Canada increased 2.7% per year from 1986 to 1997 and then rose more quickly at 6.7% per year through 2007. The rates for females increased 4.4% per year during 1986 through 1998, accelerated to an 11.4% annual increase from 1998 to 2002 and thereafter rose more

TABLE 4.18.1
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), central nervous system cancers, males, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	350	40	40	10	10	140	90	5	10	0	5	0
	45–54	225	30	25	5	5	85	65	5	5	0	5	0
	55–64	290	30	20	10	10	105	80	10	10	0	10	0
	65–74	280	30	20	5	5	115	75	5	10	0	5	0
	75–84	180	25	15	5	5	70	50	5	5	0	0	0
	85+	40	5	5	0	0	15	15	0	0	0	0	0
	Total	1365	165	120	35	40	525	375	35	40	5	25	0
2008–12	<45	355	35	40	10	10	140	95	5	10	0	5	0
	45–54	245	30	25	5	5	90	65	5	5	0	5	0
	55–64	335	35	30	10	10	125	95	10	15	0	5	0
	65–74	305	35	25	10	10	115	90	10	10	0	5	0
	75–84	205	25	15	5	5	80	65	5	5	0	0	0
	85+	55	5	5	0	0	20	20	0	0	0	0	0
	Total	1495	175	140	40	40	565	420	35	45	10	25	0
2013–17	<45	360	35	45	10	10	140	100	5	10	0	5	0
	45–54	235	30	30	5	5	90	55	5	5	0	5	0
	55–64	375	40	35	10	10	140	105	10	15	0	5	0
	65–74	365	45	30	10	10	135	110	10	15	0	10	0
	75–84	225	30	15	5	5	85	70	5	5	0	0	0
	85+	65	10	5	0	0	25	25	0	0	0	0	0
	Total	1630	190	160	40	45	615	460	40	50	10	30	0
2018–22	<45	375	35	45	10	10	150	100	10	10	0	5	0
	45–54	210	25	25	5	5	80	55	5	5	0	5	0
	55–64	405	50	45	10	10	155	105	5	15	0	10	0
	65–74	425	45	40	10	10	160	125	10	15	0	10	0
	75–84	260	35	20	5	5	95	80	5	10	0	5	0
	85+	80	10	5	0	0	30	30	0	0	0	0	0
	Total	1760	205	175	45	50	665	495	35	55	10	30	0
2023–27	<45	385	40	45	10	10	155	105	10	10	0	5	0
	45–54	200	25	25	5	5	75	50	5	5	0	5	0
	55–64	390	45	45	10	10	155	95	5	15	0	10	0
	65–74	480	55	50	10	15	180	135	5	15	5	5	0
	75–84	320	40	25	10	10	115	100	5	10	0	5	0
	85+	90	10	5	0	0	30	30	0	0	0	0	0
	Total	1870	215	195	45	50	720	515	35	60	10	30	0
2028–32	<45	390	40	45	10	10	160	110	10	10	0	5	0
	45–54	205	25	25	5	5	85	50	5	5	0	5	0
	55–64	355	40	40	10	10	145	85	5	15	0	10	0
	65–74	525	65	60	10	15	200	140	5	20	5	10	0
	75–84	380	45	35	10	10	140	115	5	15	0	5	0
	85+	110	15	10	5	5	35	40	0	0	0	0	0
	Total	1965	225	210	50	55	765	535	30	65	10	30	0

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

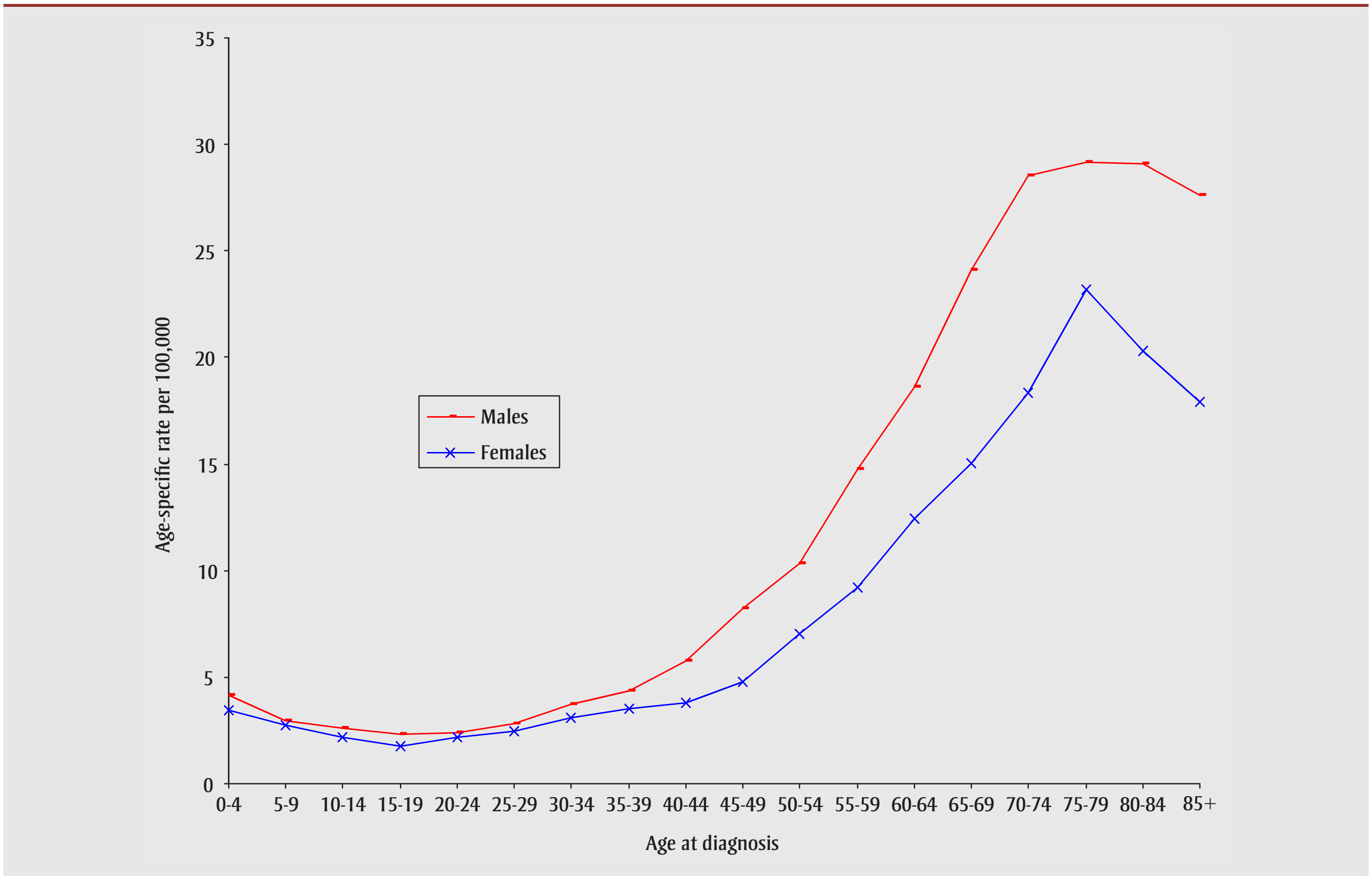
TABLE 4.18.2
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), central nervous system cancers, females, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	270	30	25	10	10	110	65	5	5	0	5	0
	45–54	145	15	15	5	5	60	40	5	5	0	5	0
	55–64	190	20	15	5	5	75	55	5	5	0	5	0
	65–74	195	20	15	5	5	75	60	5	5	0	0	0
	75–84	190	25	10	5	5	75	55	5	5	0	0	0
	85+	60	5	5	5	0	20	20	5	0	0	0	0
	Total	1055	120	85	30	30	415	295	30	30	5	15	0
2008–12	<45	280	30	30	10	10	115	70	5	10	0	5	0
	45–54	160	15	15	5	5	65	45	5	5	0	5	0
	55–64	225	25	20	5	5	80	60	5	10	0	5	0
	65–74	210	25	15	5	5	75	70	5	5	0	5	0
	75–84	190	20	10	5	5	75	60	5	5	0	0	0
	85+	70	10	5	0	0	25	20	0	0	0	0	0
	Total	1135	130	95	35	35	435	325	30	35	5	15	0
2013–17	<45	290	30	30	10	10	115	80	5	10	0	5	0
	45–54	150	15	15	5	5	60	40	5	5	0	5	0
	55–64	255	30	25	10	10	95	70	5	5	0	5	0
	65–74	250	30	20	5	10	85	80	10	10	0	5	0
	75–84	190	25	10	5	5	70	60	5	5	0	0	0
	85+	85	10	5	0	5	30	30	0	0	0	0	0
	Total	1225	140	105	35	35	465	355	35	35	5	15	0
2018–22	<45	305	35	30	10	10	125	80	5	10	0	5	0
	45–54	145	15	15	5	5	60	35	5	5	0	0	0
	55–64	275	30	25	10	10	105	75	5	5	0	5	0
	65–74	295	35	30	10	10	100	85	10	10	0	5	0
	75–84	205	25	15	5	5	75	65	10	5	0	0	0
	85+	85	10	5	0	5	30	30	5	0	0	0	0
	Total	1310	150	115	35	40	495	375	35	40	5	15	0
2023–27	<45	315	35	30	10	10	130	85	5	10	0	5	0
	45–54	145	15	15	5	5	60	40	5	5	0	0	0
	55–64	260	30	20	10	10	100	70	5	5	0	5	0
	65–74	335	35	35	10	10	115	100	10	10	0	5	0
	75–84	245	30	15	5	5	90	75	10	10	0	5	0
	85+	90	10	5	0	5	30	35	5	0	0	0	0
	Total	1395	160	125	40	45	525	395	40	40	5	20	0
2028–32	<45	320	35	30	10	10	130	85	5	10	0	5	0
	45–54	155	15	15	5	5	65	40	5	5	0	0	0
	55–64	250	25	25	5	5	100	60	5	5	0	5	0
	65–74	355	40	35	10	10	130	105	15	10	0	5	0
	75–84	290	40	25	5	10	100	85	10	10	0	5	0
	85+	100	15	5	0	5	35	35	5	0	0	0	0
	Total	1470	170	135	40	45	560	410	45	40	5	20	0

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

FIGURE 4.18.1
Age-specific incidence rates of central nervous system cancers, Canada, 2003–2007 (from average annual counts)



slowly by 6.9% annually. Cases are generally diagnosed at younger ages relative to other cancers. In 2003–2007, approximately 44% of new thyroid cancer cases in females were diagnosed in those aged under 45, 25% in those aged 45 to 54, 17% in those aged 55 to 64 and 15% in those aged 65 or older. For males, the corresponding percentages for the same age groups were 32%, 24%, 22% and 21% (Tables 4.19.1 and 4.19.2).

Through the entire observation period, the ASIRs were higher in females than in males in all age groups. The female-to-male ratio was highest in the youngest age group (< 45), decreased steadily with age up to age 74 and increased slightly for the older age groups (Figure 4.19.2). Furthermore, the female-to-male ratio increased with time for each age group, with the most pronounced increases in those younger than 55. In the last observation period (2003–2007), the rates in the youngest females (under age 45) were nearly 5 times higher than those in males of the same age.

The observed increasing pattern of thyroid cancer ASIRs continued into the prediction periods in each age group in both sexes. However, the rates for both sexes are expected to reach their peak after 10 years in the youngest age group and after 20 years in 45–54 year age group (Figure 4.19.2). The rates are projected to increase in all regions, with the most prominent increase in Ontario and the least evident one in British Columbia (Figure 4.19.1). Internal ranking of ASIRs according to region is projected to be similar for males and females, with the highest rates in Ontario and the lowest in British Columbia.

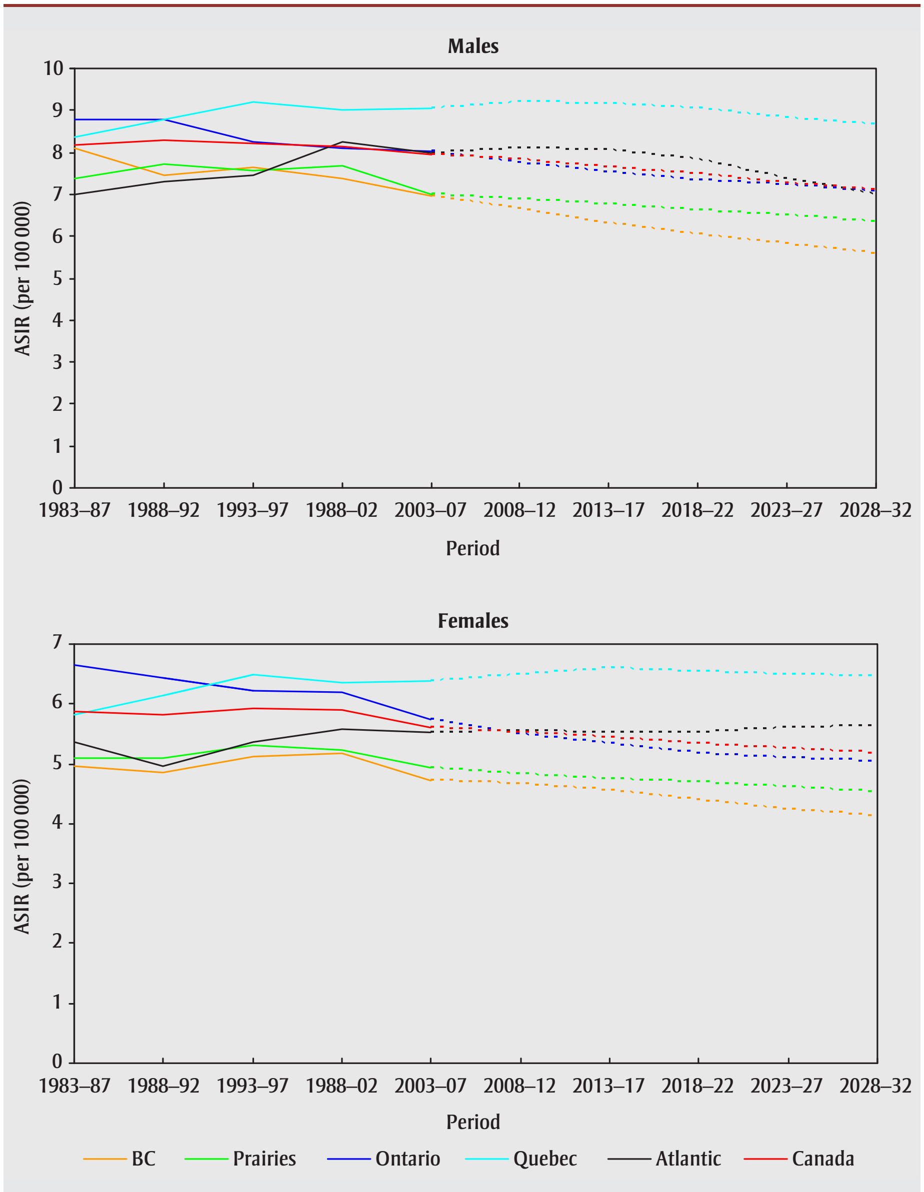
From 2003–2007 to 2028–2032, the ASIRs of thyroid cancer for Canada are projected to increase by 55% in males, from 4.5 to 7.0 per 100 000, and by 65% in females, from 16.1 to 26.5 per 100 000 (Tables 4.19.3 and 4.19.4). The annual number of new cases is estimated to increase by 139% in males, from 795 to 1895, and by 146% in females from 2810 to 6910 (Tables 4.19.1 and 4.19.2).

Comments

The significantly increasing thyroid cancer incidence rates in Canada are similar to trends observed in other developed nations.[257-259] Increased diagnostic scrutiny may have resulted in this observed increase. Advanced diagnostic technologies (e.g. ultrasonography, computed tomography scan, magnetic resonance imaging and fine-needle aspiration biopsy) have facilitated the detection of small, subclinical thyroid carcinomas.[260] More frequent use of these technologies to diagnose benign thyroid diseases, which affect more females than males, may account for the more rapid increase of thyroid cancer in females.[260,261]

Although US evidence supports the theory that the increase in thyroid cancer incidence reflects the increased detection of

FIGURE 4.18.2
Age-standardized incidence rates (ASIRs) by region, central nervous system cancers, 1983–2032



subclinical disease,[258] some investigators suggest that this increase is not based simply on greater detection, and that the changing prevalence of a known or an emerging risk factor may also explain this rise.[259] Risk of thyroid cancer has been linked to environmental sources of ionizing radiation, insufficient or excess iodine consumption, and heredity.[111,262,263] Increasing population exposure to diagnostic ionizing radiation may have increased the risk of thyroid cancer. Ionizing radiation was used to treat benign conditions in children and adolescents between 1930 and 1960.[264,265] This use may explain some of the increase in thyroid cancer incidence in older women. A recent systematic review also supported a positive association of BMI with thyroid cancer risk.[266] Obesity rates have been increasing over the last 30 years in Canada,[51,72,73] and the increasing trend in obesity in the general population may be an important contributing factor in the rising thyroid cancer incidence.

20. Hodgkin lymphoma

Hodgkin lymphoma (HL) is a relatively rare cancer. In 2003–2007, the average annual number of new HL cases was 490 for males and 395 for females, constituting 0.6% and 0.5% of all new male and female cancer cases in Canada, respectively (Tables 4.20.1 and 4.20.2). HL is classified into 2 main groups: classical HL, the most common type, and nodular lymphocyte-predominant HL, which represents about 1 in 20 cases.[111,267] The 5-year relative survival rates for HL diagnosed between 2006 and 2008 were 83% for males and 87% for females.[1]

HL has a bimodal age distribution, with peaks at age 20 to 24 and 75 to 79 for both sexes in 2003–2007 (Figure 4.20.1). The disease was more common in men than in women beginning in adulthood, although the rates corresponded at ages 10 to 19. Tables 4.20.1 and 4.20.2 show that more than 70% of all HL cases occurred in those younger than 55. The age distribution between males and females was nearly identical (Figure 4.20.1).

Figure 4.20.2 indicates that overall ASIRs of HL decreased modestly in both sexes until 1998–2002. During 1998–2007, the ASIRs increased non-significantly in males by 0.4% per year and by 0.9% per year in females (Figures 3.1 and 3.2). Quebec, Ontario, the Atlantic region and the country had similar trends for males, British Columbia showed an opposite pattern from 1988–1992, and the rates in the Prairies seemed to stabilize (Figure 4.20.2). For females, the ASIRs in British Columbia and Quebec were similar to the entire country, and the rates in Ontario have decreased steadily since 1988–1992. The rates for females in the Prairies and the Atlantic region seem random, likely because of the small numbers of annual cases and the unusual age distribution of the cancer occurrence, making it complicated to interpret the trends.

The overall incidence rates for HL are projected to decrease slightly in both sexes (Figure 4.20.2), whereas the overall ASIRs are projected to increase steadily in the 45–54 age group and decrease or level off in other age groups (Figure 4.20.3). The ASIRs in males and females are predicted to converge in the age groups older than 54. Rates of HL in British Columbia males are projected to decrease significantly and diverge from those in other regions, where the rates will tend to remain unchanged and consistent (Figure 4.20.2). For females, the

FIGURE 4.18.3
Age-standardized incidence rates (ASIRs) for central nervous system cancers by age group (– males, – females), Canada, 1983–2032

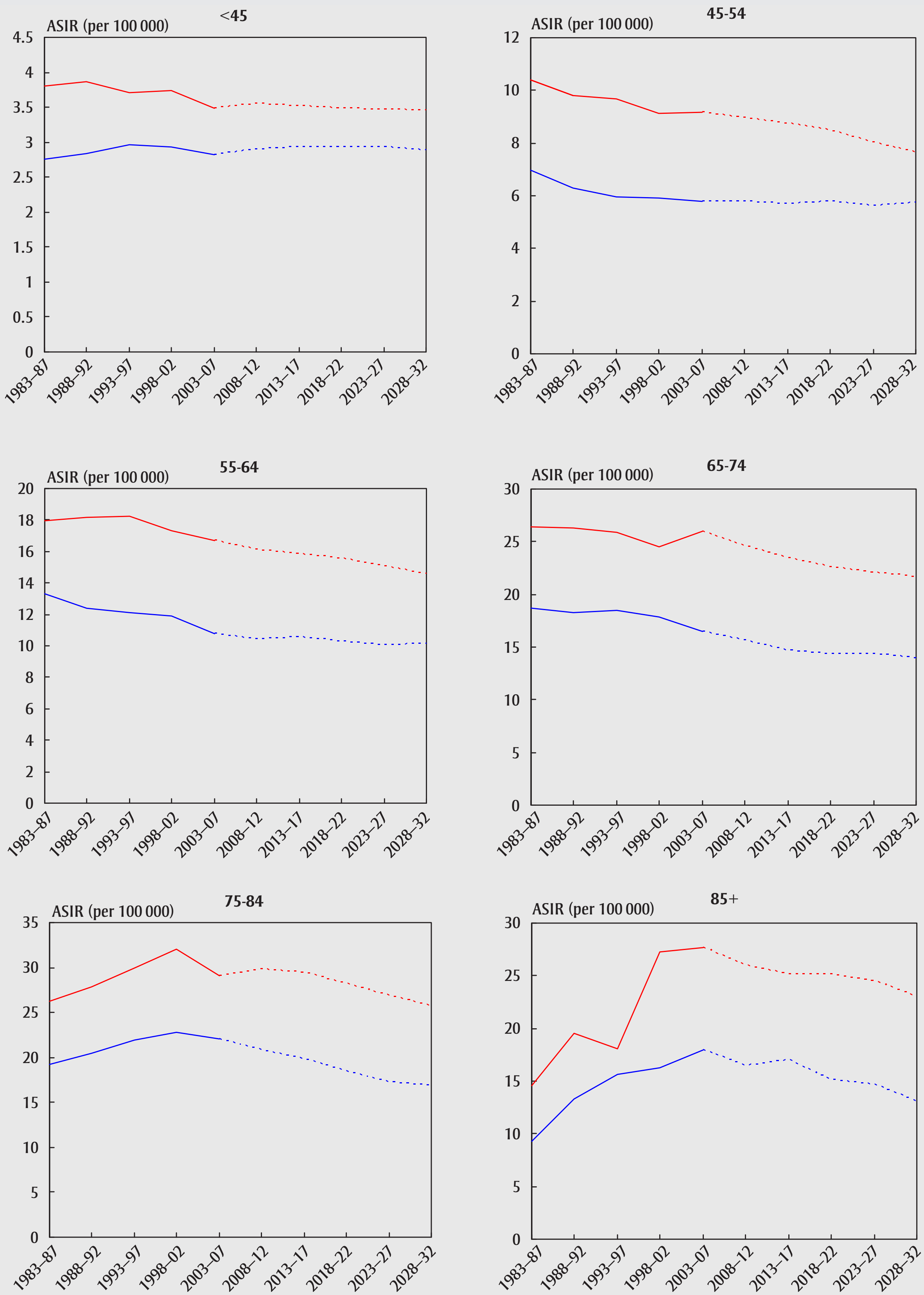


TABLE 4.18.3
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), central nervous system cancers, males, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	3.5	3.0	3.4	2.8	3.1	3.5	3.9	3.0	3.7	4.5	3.6	2.9
	45–54	9.2	9.0	9.2	6.5	6.8	9.0	10.4	9.2	9.9	9.4	6.8	0.0
	55–64	16.7	13.6	14.3	18.1	13.4	16.5	18.4	18.4	20.0	19.7	26.8	7.3
	65–74	26.0	21.0	23.0	21.6	19.0	27.8	29.0	26.5	22.3	39.3	25.5	10.9
	75–84	29.1	27.9	24.6	24.5	23.8	29.9	34.1	29.5	21.5	22.2	14.5	0.0
	85+	27.7	25.6	23.2	16.0	22.3	23.0	44.2	43.7	14.9	26.6	17.9	0.0
	Total	7.9	6.9	7.3	6.7	6.4	8.0	9.0	7.9	7.8	9.6	8.0	3.4
2008–12	<45	3.6	2.9	3.4	3.0	3.0	3.6	4.2	3.2	3.8	4.3	3.6	1.6
	45–54	9.0	9.0	9.5	8.0	7.3	8.5	9.7	7.2	9.2	10.9	14.1	3.9
	55–64	16.1	12.4	14.4	13.9	14.1	16.6	18.2	17.3	20.0	19.5	19.1	7.1
	65–74	24.6	21.2	23.1	21.5	18.3	24.3	28.2	29.3	25.1	29.8	28.1	10.8
	75–84	29.8	26.7	23.6	24.5	20.4	29.1	37.6	33.2	27.7	36.1	22.3	13.1
	85+	26.0	21.7	21.1	25.3	18.0	22.4	41.6	29.8	16.1	31.5	11.3	11.4
	Total	7.8	6.6	7.2	6.8	6.2	7.7	9.2	8.0	8.2	9.5	8.5	3.4
2013–17	<45	3.5	2.7	3.4	3.0	2.9	3.5	4.3	3.5	3.9	4.3	3.6	1.5
	45–54	8.7	8.4	9.5	8.8	7.1	8.3	9.5	8.5	9.4	10.6	16.8	3.8
	55–64	15.8	12.9	14.4	12.3	13.7	16.0	18.1	13.6	20.4	19.2	18.7	6.9
	65–74	23.5	19.6	22.1	20.7	17.9	23.1	27.7	24.1	25.5	28.5	30.7	10.3
	75–84	29.5	24.7	25.2	24.3	19.9	28.8	37.1	34.3	28.2	35.8	19.5	13.0
	85+	25.1	22.3	20.1	17.8	17.5	21.6	39.7	29.5	16.4	30.5	11.2	11.0
	Total	7.7	6.3	7.2	6.6	6.0	7.5	9.2	7.7	8.4	9.3	8.8	3.4
2018–22	<45	3.5	2.6	3.3	3.0	2.8	3.5	4.3	3.8	3.9	4.2	3.6	1.5
	45–54	8.5	7.4	8.8	8.7	6.9	8.0	9.8	10.5	9.6	10.3	19.0	3.7
	55–64	15.6	13.8	15.6	12.7	13.4	15.4	17.3	8.3	20.6	18.9	22.7	6.8
	65–74	22.6	17.1	22.1	18.3	17.5	22.7	27.3	21.0	25.8	27.4	22.8	9.9
	75–84	28.2	24.7	26.0	25.4	19.5	26.9	35.2	28.1	28.5	34.2	20.2	12.4
	85+	25.2	21.3	17.8	20.3	17.2	22.0	39.6	30.1	16.6	30.5	11.4	11.1
	Total	7.5	6.1	7.2	6.5	5.9	7.4	9.1	7.2	8.5	9.1	8.9	3.3
2023–27	<45	3.5	2.5	3.2	3.0	2.8	3.5	4.4	3.9	4.0	4.2	3.6	1.5
	45–54	8.0	7.0	8.5	8.7	6.8	7.7	9.3	11.5	9.6	9.7	20.2	3.5
	55–64	15.1	13.0	15.7	13.9	13.3	15.1	16.3	8.0	20.8	18.3	24.9	6.6
	65–74	22.1	18.1	21.9	16.5	17.4	22.0	26.4	13.0	25.9	26.8	18.6	9.7
	75–84	26.8	22.3	24.7	24.1	19.4	25.7	33.8	19.4	28.7	32.5	17.1	11.8
	85+	24.5	19.2	21.4	18.7	17.0	21.5	37.6	25.1	16.7	29.7	6.6	10.7
	Total	7.3	5.8	7.1	6.4	5.8	7.2	8.8	6.5	8.5	8.8	8.7	3.2
2028–32	<45	3.5	2.5	3.2	3.0	2.7	3.4	4.5	4.1	4.0	4.2	3.6	1.5
	45–54	7.6	6.1	7.8	8.7	6.8	8.1	8.1	12.7	9.7	9.3	21.5	3.4
	55–64	14.6	11.6	14.5	13.9	13.2	14.6	16.6	8.9	20.9	17.7	27.3	6.4
	65–74	21.7	18.9	23.7	17.3	17.2	21.3	24.9	7.6	26.1	26.3	20.5	9.5
	75–84	25.8	19.8	24.7	21.6	19.2	25.4	33.0	15.3	28.8	31.3	10.6	11.3
	85+	23.0	20.5	20.0	21.2	16.9	19.4	35.0	16.8	16.8	27.9	7.9	10.1
	Total	7.1	5.6	7.0	6.4	5.8	7.1	8.7	6.2	8.6	8.6	9.0	3.1

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

TABLE 4.18.4
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), central nervous system cancers, females, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	2.8	2.4	2.5	2.7	2.5	2.9	3.1	3.3	2.6	2.9	2.4	1.4
	45–54	5.8	4.3	5.5	4.9	5.3	6.4	6.2	4.6	4.8	2.0	8.3	2.8
	55–64	10.8	9.2	9.0	11.5	8.9	11.1	11.9	11.8	10.2	15.1	12.0	7.1
	65–74	16.5	13.8	15.1	14.9	15.7	16.0	19.9	16.3	15.5	18.6	9.3	0.0
	75–84	22.1	19.9	15.6	20.0	14.7	22.3	26.3	24.6	22.4	29.8	17.7	0.0
	85+	17.9	12.9	15.3	16.6	12.5	17.7	23.1	31.4	19.2	10.7	0.0	0.0
	Total	5.6	4.7	4.9	5.3	4.8	5.7	6.4	6.1	5.3	6.0	4.9	1.9
2008–12	<45	2.9	2.4	2.5	2.9	2.4	3.0	3.4	3.3	3.2	3.1	2.5	1.0
	45–54	5.8	4.5	4.9	5.4	5.1	6.1	6.7	5.1	3.7	6.2	6.3	2.0
	55–64	10.5	9.1	10.2	11.8	9.5	10.2	11.4	11.5	12.3	11.3	11.6	3.6
	65–74	15.7	13.7	14.1	15.9	14.6	14.6	19.8	19.7	14.5	16.9	13.5	5.5
	75–84	20.9	17.4	16.0	15.9	15.9	21.3	25.3	26.6	20.7	22.6	12.5	7.3
	85+	16.4	15.0	13.3	11.3	12.5	15.9	20.6	18.3	16.9	17.8	4.8	5.7
	Total	5.5	4.7	4.8	5.4	4.7	5.5	6.5	6.3	5.6	6.0	4.8	1.9
2013–17	<45	2.9	2.4	2.4	2.9	2.4	2.9	3.6	3.3	3.2	3.2	2.4	1.0
	45–54	5.7	4.6	4.7	5.3	5.0	5.9	6.6	5.1	4.8	6.1	6.1	2.0
	55–64	10.5	8.4	10.7	11.7	9.4	10.2	12.0	11.7	9.2	11.4	11.2	3.7
	65–74	14.7	12.8	13.8	15.8	14.4	13.6	18.2	20.2	15.5	15.9	13.0	5.1
	75–84	19.8	18.1	15.0	15.7	15.8	19.1	24.8	27.2	21.6	21.4	12.1	6.9
	85+	17.0	12.9	13.2	11.1	12.3	15.9	25.3	18.7	11.6	18.4	4.6	5.9
	Total	5.4	4.6	4.7	5.3	4.7	5.3	6.6	6.4	5.5	5.9	4.6	1.9
2018–22	<45	2.9	2.4	2.4	2.9	2.4	2.9	3.6	3.3	3.2	3.2	2.3	1.0
	45–54	5.8	4.3	5.1	5.3	4.9	5.9	6.7	5.1	4.8	6.2	6.0	2.0
	55–64	10.3	8.0	9.0	11.6	9.3	10.2	12.4	11.8	7.7	11.1	10.9	3.6
	65–74	14.4	12.2	15.2	15.7	14.3	12.8	17.6	20.5	17.9	15.5	12.8	5.0
	75–84	18.4	17.2	14.1	15.6	15.6	17.2	23.6	27.7	18.5	19.9	11.8	6.4
	85+	15.1	13.0	12.2	11.1	12.2	14.2	20.2	19.1	13.3	16.3	4.5	5.3
	Total	5.3	4.4	4.6	5.3	4.6	5.2	6.6	6.4	5.4	5.8	4.5	1.9
2023–27	<45	2.9	2.4	2.3	2.9	2.4	3.0	3.6	3.3	3.2	3.2	2.3	1.0
	45–54	5.6	3.7	4.9	5.3	4.9	5.7	7.0	5.1	4.8	6.1	5.9	2.0
	55–64	10.0	8.1	8.6	11.6	9.3	9.7	11.9	11.9	9.4	10.9	10.8	3.5
	65–74	14.4	11.2	15.4	15.6	14.2	13.0	17.9	20.7	13.0	15.5	12.6	5.0
	75–84	17.3	16.1	13.7	15.5	15.6	16.3	21.3	27.9	20.4	18.7	11.7	6.0
	85+	14.7	13.6	11.2	11.0	12.2	12.7	21.7	19.2	13.1	15.8	4.4	5.1
	Total	5.2	4.2	4.5	5.3	4.6	5.1	6.5	6.4	5.3	5.7	4.5	1.8
2028–32	<45	2.9	2.4	2.2	2.9	2.4	2.9	3.7	3.3	3.2	3.1	2.2	1.0
	45–54	5.7	3.8	4.9	5.3	4.9	6.0	6.7	5.1	4.9	6.2	5.8	2.0
	55–64	10.1	7.5	9.2	11.5	9.2	9.8	11.9	11.9	9.4	11.0	10.7	3.5
	65–74	13.9	10.6	13.1	15.6	14.2	12.8	18.3	20.9	11.6	15.0	12.5	4.8
	75–84	16.9	15.1	15.4	15.5	15.5	15.3	20.6	28.1	22.9	18.2	11.6	5.9
	85+	13.1	12.0	10.5	11.0	12.1	11.4	18.7	19.4	9.9	14.2	4.3	4.6
	Total	5.2	4.1	4.4	5.3	4.6	5.0	6.5	6.5	5.3	5.6	4.4	1.8

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

TABLE 4.19.1
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), cancer of thyroid, males, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	255	20	25	5	5	130	50	5	5	0	0	0
	45–54	190	15	20	5	5	95	40	5	5	0	5	0
	55–64	175	15	15	5	5	80	45	5	5	0	5	0
	65–74	115	10	10	0	5	50	25	5	5	0	0	0
	75–84	50	5	5	0	0	20	10	0	5	0	0	0
	85+	5	0	0	0	0	5	0	0	0	0	0	0
	Total	795	60	75	15	20	380	180	20	25	5	10	0
2008–12	<45	295	20	30	5	5	150	60	5	5	0	0	0
	45–54	245	15	25	5	5	125	50	5	5	0	5	0
	55–64	240	15	25	5	5	120	60	5	5	0	5	0
	65–74	170	15	15	5	5	80	45	5	5	0	5	0
	75–84	75	5	5	0	0	30	20	0	0	0	0	0
	85+	15	0	0	0	0	10	5	0	0	0	0	0
	Total	1035	75	100	15	20	515	240	30	30	5	15	0
2013–17	<45	320	20	25	5	5	175	70	10	5	0	0	0
	45–54	275	15	30	5	5	145	60	5	5	0	5	0
	55–64	320	20	30	5	5	170	75	10	10	0	5	0
	65–74	255	15	20	5	5	125	65	10	10	0	5	0
	75–84	95	10	10	0	0	40	25	5	5	0	0	0
	85+	20	0	0	0	0	10	5	0	0	0	0	0
	Total	1290	85	120	15	25	665	300	35	35	5	15	0
2018–22	<45	335	25	25	5	5	190	70	10	10	0	0	0
	45–54	290	20	30	5	5	145	70	10	5	0	0	0
	55–64	395	20	40	5	5	210	95	5	10	0	5	0
	65–74	340	20	35	5	5	175	85	10	10	0	5	0
	75–84	135	10	15	0	0	60	40	5	5	0	0	0
	85+	30	0	0	0	0	15	5	0	0	0	0	0
	Total	1525	95	145	15	25	800	365	40	40	5	15	0
2023–27	<45	325	25	25	5	10	190	65	10	10	0	0	0
	45–54	305	15	25	5	5	160	75	10	5	0	0	0
	55–64	420	20	50	5	5	220	105	5	10	0	5	0
	65–74	425	20	45	5	5	230	105	10	15	0	5	0
	75–84	195	15	20	0	0	90	60	5	5	0	5	0
	85+	40	0	5	0	0	20	10	0	0	0	0	0
	Total	1710	100	170	15	25	905	425	40	45	5	10	0
2028–32	<45	330	25	25	5	10	205	65	15	10	0	0	0
	45–54	310	15	25	5	5	160	75	10	5	0	0	0
	55–64	425	20	45	5	5	215	115	5	10	0	0	0
	65–74	510	25	55	5	5	275	135	5	15	0	5	0
	75–84	255	15	30	0	0	125	75	5	5	0	0	0
	85+	60	5	5	0	0	35	15	0	0	0	0	0
	Total	1895	105	190	20	25	1010	485	45	50	5	10	0

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

TABLE 4.19.2
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), cancer of thyroid, females, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	1225	80	125	15	30	670	240	30	25	0	10	0
	45–54	695	45	65	10	15	360	155	20	15	0	10	0
	55–64	470	30	35	10	10	240	110	15	10	0	10	0
	65–74	250	15	20	5	5	125	70	5	5	0	5	0
	75–84	130	15	10	5	5	55	35	5	5	0	5	0
	85+	35	5	5	0	0	10	10	0	0	0	0	0
	Total	2810	185	260	45	60	1460	615	75	65	5	35	5
2008–12	<45	1440	90	150	20	30	785	285	35	35	0	15	5
	45–54	985	55	90	10	20	550	210	35	20	0	10	0
	55–64	755	40	60	10	15	410	175	20	15	0	15	0
	65–74	385	20	30	5	5	195	100	10	10	0	5	0
	75–84	180	15	10	5	5	80	50	10	5	0	5	0
	85+	55	5	5	0	0	20	15	0	0	0	0	0
	Total	3805	230	345	50	75	2045	830	110	85	5	50	5
2013–17	<45	1570	100	155	20	40	860	310	45	40	0	15	5
	45–54	1230	65	110	10	20	725	245	40	20	0	10	0
	55–64	1065	55	85	10	15	600	250	25	20	0	15	0
	65–74	610	30	45	5	10	325	155	20	15	0	10	0
	75–84	245	15	15	5	5	115	65	10	5	0	5	0
	85+	75	5	10	0	0	30	20	5	0	0	0	0
	Total	4800	270	420	55	90	2655	1045	150	105	5	60	5
2018–22	<45	1620	100	155	20	40	900	320	50	40	5	20	5
	45–54	1320	70	120	10	20	780	260	50	20	0	15	0
	55–64	1385	65	110	15	20	815	315	40	25	0	15	0
	65–74	895	45	65	10	15	500	225	25	20	0	10	0
	75–84	345	20	25	5	5	170	90	20	10	0	5	0
	85+	100	5	10	0	0	45	30	5	0	0	0	0
	Total	5670	300	485	60	100	3205	1240	185	115	5	65	10
2023–27	<45	1570	90	145	20	45	890	295	55	45	5	20	5
	45–54	1355	75	120	10	25	780	280	55	20	0	15	0
	55–64	1580	70	125	10	20	970	340	45	20	0	15	0
	65–74	1165	50	90	10	15	660	290	35	20	0	10	0
	75–84	510	25	30	5	10	260	135	25	10	0	10	0
	85+	135	5	15	0	0	60	40	5	5	0	0	0
	Total	6315	325	530	65	115	3620	1385	215	120	10	70	10
2028–32	<45	1520	80	130	20	45	875	290	55	50	5	20	5
	45–54	1395	85	130	10	30	800	285	60	20	0	15	0
	55–64	1630	75	130	10	20	1000	345	50	20	0	15	0
	65–74	1455	60	110	10	15	860	360	45	20	0	10	0
	75–84	725	40	45	10	10	385	185	30	15	0	10	0
	85+	185	10	20	5	5	85	55	10	5	0	0	0
	Total	6910	345	565	65	125	4005	1515	250	125	10	70	10

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

TABLE 4.19.3
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), cancer of thyroid, males, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	2.5	1.4	2.3	1.4	1.8	3.3	2.2	2.1	2.1	5.5	1.2	2.1
	45–54	7.7	4.3	7.0	4.6	4.9	10.2	6.8	10.7	7.7	6.4	6.4	0.0
	55–64	10.0	5.4	9.6	6.5	7.0	12.0	10.4	10.9	9.6	4.9	11.4	5.5
	65–74	10.9	7.2	12.6	6.3	7.1	12.5	10.3	17.4	12.3	24.1	8.5	0.0
	75–84	8.5	6.0	11.8	5.3	7.4	8.9	8.6	9.7	14.1	0.0	4.2	0.0
	85+	4.3	3.3	4.6	5.3	2.8	5.3	3.8	4.9	3.7	0.0	0.0	0.0
	Total	4.5	2.6	4.5	2.7	3.1	5.7	4.2	5.1	4.5	6.6	3.2	1.9
2008–12	<45	3.0	1.5	2.3	1.6	1.6	3.9	2.7	3.1	2.7	2.5	0.7	1.2
	45–54	9.0	4.5	8.3	4.3	4.4	12.1	8.0	10.0	8.6	8.0	7.0	3.7
	55–64	11.5	5.3	11.7	5.4	8.1	15.3	11.4	13.3	10.9	11.4	12.2	4.8
	65–74	13.8	7.5	13.5	7.1	8.5	16.9	13.7	22.7	16.6	14.2	15.8	5.7
	75–84	10.6	7.0	12.8	5.5	5.7	12.0	11.7	13.9	11.9	10.5	6.0	4.4
	85+	7.4	3.9	6.3	5.2	4.0	10.3	6.3	9.0	9.0	8.3	18.1	3.1
	Total	5.4	2.8	4.9	2.8	3.1	7.0	5.2	6.5	5.4	5.0	3.7	2.2
2013–17	<45	3.1	1.6	2.1	1.6	1.8	4.3	3.0	4.0	3.1	2.9	0.8	1.3
	45–54	10.4	4.6	10.3	4.3	3.8	13.5	10.0	11.6	9.8	9.1	6.3	4.3
	55–64	13.4	5.7	12.3	5.7	8.3	18.8	13.0	14.0	12.4	13.0	9.0	5.6
	65–74	16.3	7.6	15.7	6.2	7.9	21.3	16.9	23.8	18.7	16.1	18.8	6.8
	75–84	12.4	7.6	14.8	5.5	6.5	13.9	14.2	19.5	13.4	12.0	10.2	5.2
	85+	7.8	3.2	7.4	3.8	3.7	10.6	8.1	8.7	10.2	9.3	8.6	3.2
	Total	6.1	2.9	5.3	2.7	3.2	8.1	6.0	7.7	6.1	5.7	3.8	2.5
2018–22	<45	3.1	1.6	2.0	1.6	1.9	4.5	2.8	4.9	3.4	3.1	0.9	1.3
	45–54	11.6	5.1	10.0	4.2	4.7	14.7	12.5	15.4	10.7	10.0	2.6	4.8
	55–64	15.1	5.8	14.6	5.6	6.1	20.6	15.5	10.4	13.5	14.2	9.0	6.3
	65–74	18.0	6.9	18.8	5.1	6.9	24.7	19.1	23.4	20.2	17.6	15.4	7.5
	75–84	14.8	8.0	15.8	6.2	5.8	17.5	17.1	23.7	14.6	13.1	13.0	6.2
	85+	9.7	4.4	8.3	4.5	4.1	13.5	10.3	7.8	11.2	10.3	6.6	4.0
	Total	6.6	2.9	5.7	2.7	3.1	8.9	6.7	8.4	6.7	6.2	3.3	2.7
2023–27	<45	3.0	1.6	2.0	1.6	2.0	4.3	2.8	5.3	3.5	3.3	1.0	1.2
	45–54	12.2	4.8	8.8	4.2	5.2	16.1	13.6	17.3	11.2	10.5	2.9	5.1
	55–64	16.3	5.7	17.8	5.6	4.4	21.2	18.3	9.5	14.1	14.8	8.0	6.8
	65–74	19.6	7.3	19.5	5.6	5.8	27.5	20.9	19.6	20.9	18.3	9.6	8.2
	75–84	16.3	7.8	18.6	4.6	4.3	19.9	20.2	19.4	15.2	13.7	12.6	6.8
	85+	10.3	4.1	10.0	4.2	3.7	13.4	11.8	10.4	11.7	10.7	10.5	4.3
	Total	6.8	2.9	6.0	2.6	2.9	9.3	7.2	8.5	7.0	6.5	2.9	2.8
2028–32	<45	3.0	1.6	2.0	1.6	2.1	4.6	2.8	5.9	3.7	3.4	1.1	1.2
	45–54	11.5	4.5	8.3	4.2	5.8	14.9	12.3	19.3	11.7	11.0	3.3	4.8
	55–64	17.6	6.2	17.4	5.6	4.9	21.9	21.9	11.4	14.7	15.6	2.6	7.3
	65–74	21.2	7.0	23.1	5.6	3.8	28.8	24.4	13.2	21.7	19.3	10.6	8.8
	75–84	17.5	6.9	21.8	4.4	3.3	22.4	22.3	17.7	15.8	14.4	8.3	7.3
	85+	12.5	4.5	10.0	5.1	2.7	17.8	14.5	10.8	12.2	11.2	11.8	5.2
	Total	7.0	2.9	6.3	2.6	2.9	9.6	7.8	8.8	7.3	6.8	2.5	2.9

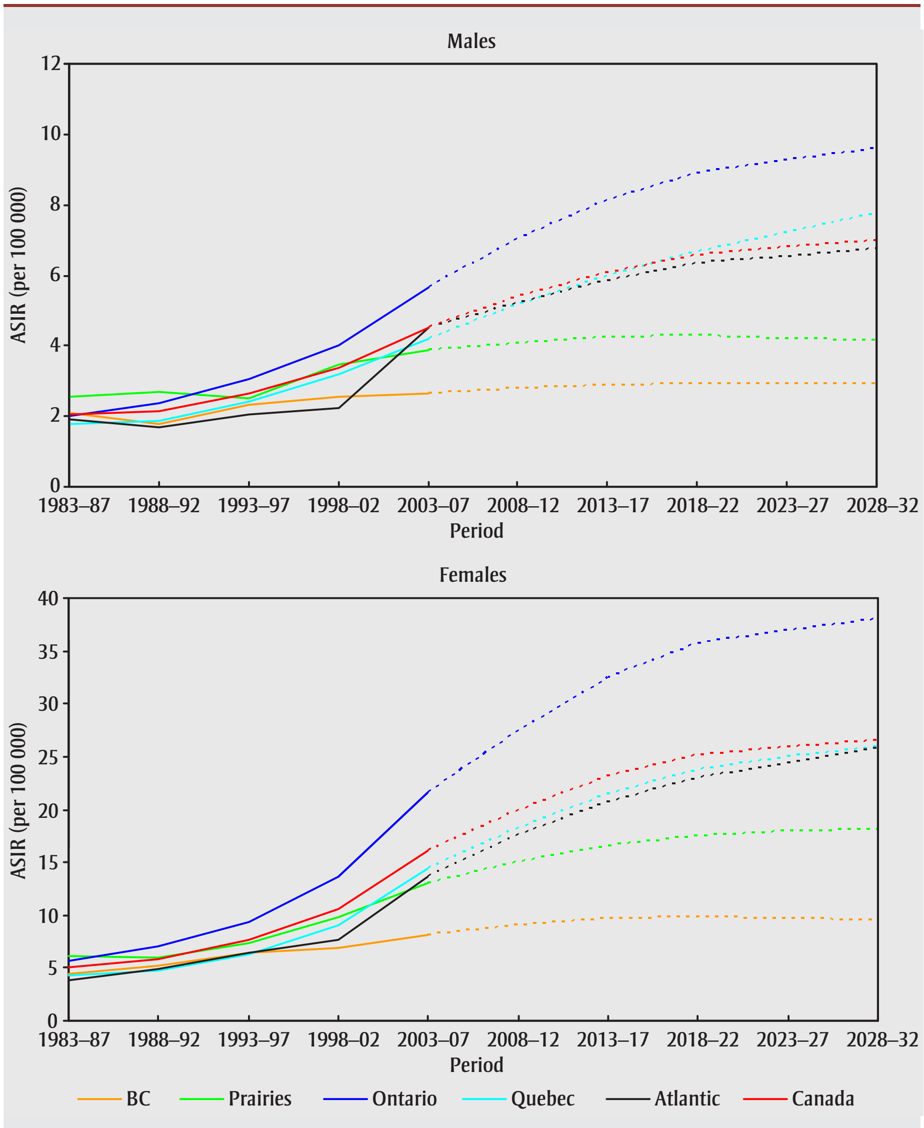
Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

TABLE 4.19.4
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), cancer of thyroid, females, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	12.6	6.6	11.9	5.9	8.3	17.1	10.8	13.2	9.2	6.0	6.8	5.8
	45–54	28.1	13.6	26.5	13.7	15.5	38.8	25.2	31.1	21.2	13.7	20.9	20.0
	55–64	26.2	12.2	23.7	16.9	16.6	35.7	23.6	31.7	18.2	7.6	26.0	33.0
	65–74	21.5	8.2	22.5	12.2	9.3	27.1	22.7	23.1	20.2	7.3	20.6	0.0
	75–84	15.2	11.6	12.2	14.4	12.9	16.1	15.5	22.8	20.3	6.0	23.1	0.0
	85+	9.9	5.8	17.5	7.7	8.7	8.1	12.1	10.5	12.8	21.4	15.7	0.0
	Total	16.1	8.1	15.3	8.5	10.0	21.6	14.4	17.7	12.4	7.2	11.6	9.0
2008–12	<45	14.7	7.1	13.3	6.8	9.5	20.0	13.1	17.8	12.9	5.9	9.7	8.1
	45–54	36.9	15.5	31.9	14.6	19.7	53.2	32.8	52.4	23.4	10.8	24.9	20.2
	55–64	34.9	14.0	29.9	15.7	18.1	50.8	32.5	34.5	24.8	8.6	32.0	19.1
	65–74	28.6	11.1	28.4	12.8	12.6	37.9	28.9	37.0	25.2	8.6	28.5	15.6
	75–84	20.2	12.2	15.3	15.4	13.0	23.4	21.2	36.8	19.2	9.3	26.7	11.1
	85+	13.0	6.6	19.6	10.3	10.3	12.6	16.2	16.5	13.3	10.5	11.9	7.1
	Total	20.0	9.1	17.9	9.1	11.7	27.5	18.3	24.9	16.1	7.0	15.2	10.9
2013–17	<45	15.6	7.1	13.1	7.2	10.7	21.3	14.0	22.2	15.1	6.3	12.4	8.5
	45–54	47.2	18.1	40.7	15.5	22.0	69.0	42.0	71.4	27.4	12.0	30.4	25.8
	55–64	43.5	15.7	35.9	16.6	19.0	64.7	41.9	45.1	29.9	9.8	33.9	23.8
	65–74	36.1	12.8	30.8	13.5	16.3	50.8	36.9	49.2	26.8	9.7	34.0	19.8
	75–84	26.0	12.3	21.5	16.3	13.1	31.7	27.0	45.9	24.8	10.6	32.7	14.2
	85+	15.2	8.4	18.8	10.9	11.5	15.2	17.8	24.5	14.3	12.0	19.0	8.3
	Total	23.1	9.6	19.6	9.7	13.1	32.5	21.5	32.2	18.9	7.6	18.4	12.7
2018–22	<45	15.3	6.7	12.5	7.5	11.4	21.1	13.9	24.6	16.6	6.5	14.5	8.4
	45–54	53.5	20.0	44.2	16.1	24.6	77.3	49.5	91.9	33.1	13.0	37.5	29.3
	55–64	52.3	17.0	41.0	17.2	21.6	78.6	51.5	64.8	29.2	11.0	34.5	28.6
	65–74	44.1	14.8	35.8	14.1	18.6	64.7	45.2	49.6	29.2	11.0	31.6	24.1
	75–84	31.1	12.5	24.3	16.9	14.6	39.5	32.3	65.0	27.2	12.2	37.4	17.0
	85+	18.0	8.4	19.0	11.4	9.3	20.0	21.9	32.4	11.4	13.8	14.7	9.8
	Total	25.1	9.8	20.5	10.0	14.2	35.7	23.8	38.5	20.6	8.2	20.7	13.8
2023–27	<45	14.3	5.9	11.3	7.6	11.4	19.8	12.8	25.9	18.0	6.8	15.8	7.8
	45–54	54.0	21.3	43.1	16.4	29.7	76.6	52.1	107.4	30.4	13.8	41.9	29.6
	55–64	61.1	18.9	48.5	17.5	23.3	92.4	60.1	78.1	28.9	12.2	32.8	33.4
	65–74	50.2	15.6	40.0	14.3	18.6	74.5	53.5	58.0	29.4	12.5	27.5	27.4
	75–84	36.2	13.7	24.8	17.2	18.1	48.3	38.1	72.8	24.3	13.8	35.4	19.8
	85+	21.8	7.9	27.3	11.6	9.9	24.7	25.7	34.2	15.5	15.9	17.9	11.9
	Total	25.9	9.6	20.5	10.2	15.1	37.0	24.9	43.1	21.2	8.7	21.6	14.2
2028–32	<45	13.7	5.2	10.2	7.7	11.6	18.9	12.5	27.2	19.5	7.0	17.1	7.5
	45–54	51.9	21.7	42.8	16.7	30.9	74.1	48.9	112.9	28.2	14.3	46.7	28.4
	55–64	66.6	20.4	51.2	17.9	25.0	99.5	67.8	95.5	31.8	13.3	36.0	36.5
	65–74	57.9	16.6	44.2	14.6	21.0	86.8	62.7	77.6	26.1	14.1	24.3	31.7
	75–84	42.4	15.4	28.6	17.5	19.6	58.9	44.8	69.0	24.5	15.6	29.4	23.2
	85+	24.5	8.1	26.6	11.9	10.9	29.2	29.3	52.1	13.2	18.2	16.6	13.4
	Total	26.5	9.5	20.4	10.4	15.8	37.9	25.9	47.5	22.0	9.2	22.9	14.5

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

FIGURE 4.19.1
Age-standardized incidence rates (ASIRs) by region, thyroid cancer, 1983–2032



rates are projected to increase slightly in Quebec, the Atlantic region and the Prairies, and to decrease marginally in Ontario and British Columbia. The projected rates for HL in both sexes will be lowest in British Columbia and highest in Quebec.

From 2003–2007 to 2028–2032, the ASIRs of HL for Canada are expected to decrease by 3% in males, from 3.1 to 3.0 per 100 000, and by 7% in females, from 2.5 to 2.3 per 100 000 (Tables 4.20.3 and 4.20.4). Due to the projected Canada population growth and aging, the annual number of newly diagnosed cases is predicted to increase by roughly 26% in both sexes, from 490 to 615 in males and from 395 to 500 in females (Tables 4.20.1 and 4.20.2).

Comments

The etiology of HL remains incompletely characterized. Known risk factors for HL include infectious agents, a compromised immune system, genetic factors, and social and environmental factors. EBV, a ubiquitous virus infecting 80% to 100% of people worldwide, plays a causative role in the etiology of the neoplasm.[52,268,269] The EBV genome is present in approximately 50% of the lymphoma cells of cases.[86] Patients with immunodeficiences or autoimmune diseases are at elevated risk of HL.[86] For instance, a systematic review shows an 11-fold increase in risk of HL in people with HIV/AIDS.[270] Familial aggregation of HL has been observed. Having a parent with the disease increases the risk 3-fold.[271] The familial risks are higher in males and in siblings.[271]

Recent reviews report that ever smoking is associated with a 10% to 15% increased risk of HL,[272,273] functioning in a dose-dependent manner.[272] Socioeconomic status in childhood is also linked to the risk. High childhood socioeconomic status, single family housing, small family size and high maternal education increase HL risk.[274] It has been speculated that these social environments delay exposure to common infections which facilitate immune maturation.[274]

The bimodal age distribution of the incidence is expected to be the same in developed countries.[275] EBV is more commonly associated with HL cases in older adults or younger children, possibly suggesting an alternate age-dependent pathway.[268] HIV plays a role in developing HL in young people.[275]

21. Non-Hodgkin lymphoma

In 2003–2007, non-Hodgkin lymphoma (NHL) was the fifth most common type of new cancer diagnosis in Canadian males and females, and the most common lymphohematopoietic cancer. The average annual number of newly diagnosed NHL cases in this period was 3455 for males and 2915 for females, representing 4.3% and 3.9% of all new male and female cancer cases, respectively (Tables 4.21.1 and 4.21.2). The lifetime risk for developing NHL is 2.4% in males and 1.9% in females.[1] NHL was the second most common (9.4%) incident cancer in males younger than 45 in 2003–2007 (Figure 3.9). The ASIRs of NHL increased with age to 122.0 per 100 000 in men aged 85 and over and to a maximum of 81.7 per 100 000 in women aged 75 to 84; the increase was less pronounced in women than in men (Tables 4.21.3 and 4.21.4). Overall, NHL occurred nearly 1.5 times as often in males as in females. More than 70% of all incident NHL cases occurred in people aged 55 or older (Tables 4.21.1 and 4.20.2). NHL has an intermediate 5-year relative survival rate among all cancers in Canada, at 65% in males and 69% in females for 2006–2008.[1]

FIGURE 4.19.2
Age-standardized incidence rates (ASIRs) for thyroid cancer by age group (– males, – females), Canada, 1983–2032

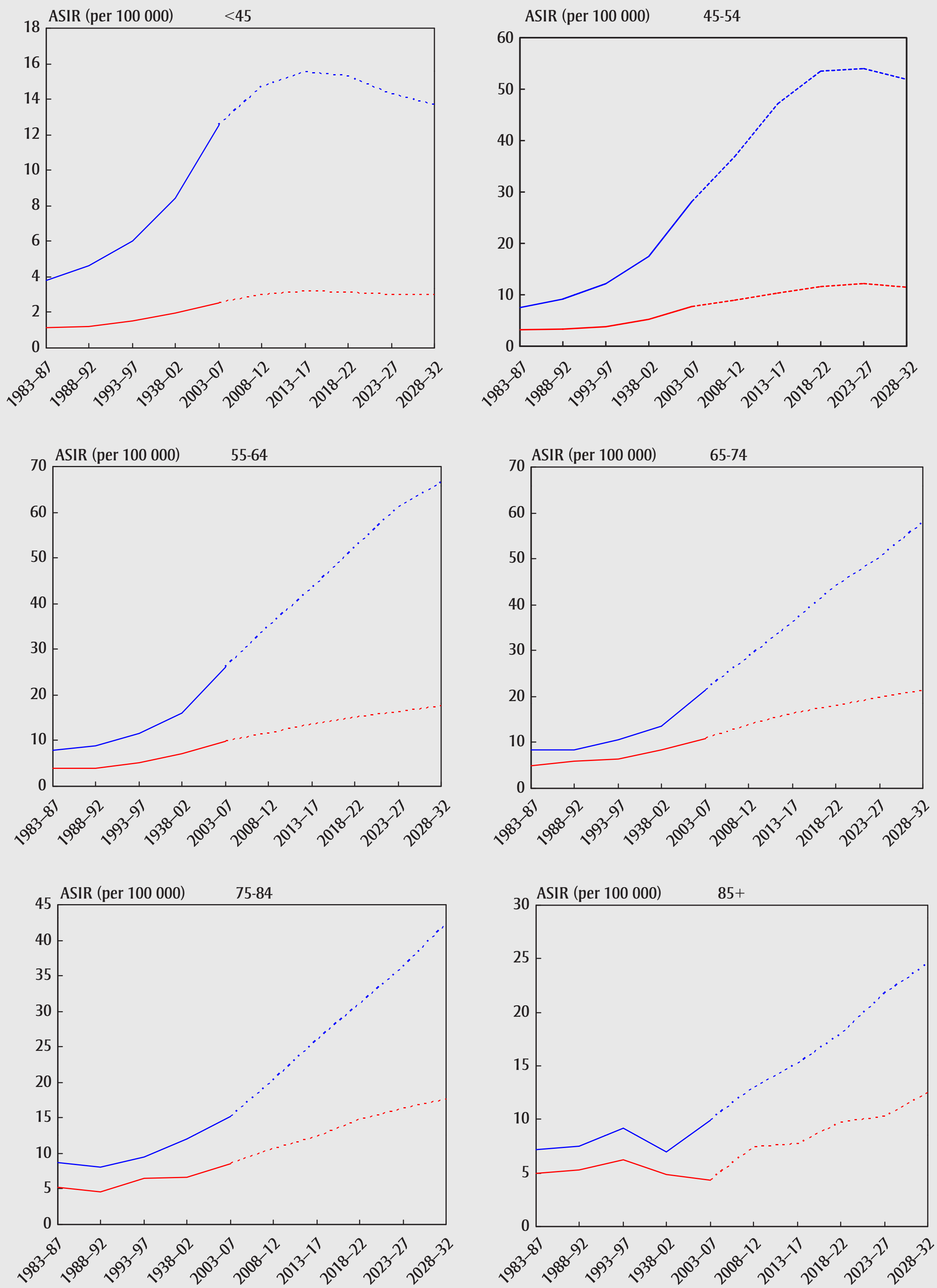


TABLE 4.20.1

Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), Hodgkin lymphoma, males, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	300	35	30	10	10	115	80	10	10	0	5	0
	45–54	65	5	5	0	0	30	15	0	0	0	0	0
	55–64	50	5	5	0	0	20	15	0	0	0	0	0
	65–74	40	5	5	0	0	20	10	0	0	0	0	0
	75–84	25	5	5	0	0	10	5	0	0	0	0	0
	85+	5	0	0	0	0	0	0	0	0	0	0	0
	Total	490	50	50	15	15	195	125	15	15	0	5	0
2008–12	<45	295	30	35	10	10	110	75	5	10	0	5	0
	45–54	75	10	10	5	0	30	20	0	0	0	0	0
	55–64	60	5	5	0	5	25	15	0	0	0	0	0
	65–74	45	5	5	0	0	20	10	0	0	0	0	0
	75–84	25	5	5	0	0	10	5	0	0	0	0	0
	85+	5	0	0	0	0	0	0	0	0	0	0	0
	Total	505	55	55	15	15	200	125	15	15	0	5	0
2013–17	<45	295	30	35	10	10	115	80	5	10	0	5	0
	45–54	75	5	10	0	0	30	15	0	0	0	0	0
	55–64	65	5	10	0	5	30	15	0	0	0	0	0
	65–74	55	5	5	0	0	25	10	0	0	0	0	0
	75–84	25	5	5	0	0	10	5	0	0	0	0	0
	85+	5	0	0	0	0	5	0	0	0	0	0	0
	Total	520	55	60	15	20	215	130	15	15	0	5	0
2018–22	<45	300	25	35	10	10	120	80	5	5	0	0	0
	45–54	70	10	10	0	0	30	15	0	0	0	0	0
	55–64	75	10	10	0	5	35	15	5	0	0	0	0
	65–74	60	5	5	0	5	30	15	0	0	0	0	0
	75–84	30	5	5	0	0	15	5	0	0	0	0	0
	85+	10	0	0	0	0	5	0	0	0	0	0	0
	Total	545	55	60	15	20	235	130	15	15	0	5	0
2023–27	<45	305	25	35	10	10	130	75	5	5	0	0	0
	45–54	75	10	10	0	0	30	20	0	0	0	0	0
	55–64	75	5	10	0	5	35	15	0	0	0	0	0
	65–74	70	5	10	0	5	35	15	5	5	0	0	0
	75–84	40	5	5	0	0	20	5	0	0	0	0	0
	85+	10	0	0	0	0	5	0	0	0	0	0	0
	Total	580	55	65	20	20	255	135	15	15	0	5	0
2028–32	<45	315	25	35	10	10	135	75	5	5	0	0	0
	45–54	85	10	10	5	0	30	25	0	0	0	0	0
	55–64	75	10	10	0	5	35	15	0	0	0	0	0
	65–74	85	10	10	5	5	45	15	5	5	0	0	0
	75–84	50	5	5	0	0	25	10	0	0	0	0	0
	85+	10	0	0	0	0	5	0	0	0	0	0	0
	Total	615	60	70	20	20	275	140	15	15	0	5	0

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

TABLE 4.20.2
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), Hodgkin lymphoma, females, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	245	30	30	5	10	95	55	5	10	0	0	0
	45–54	40	5	5	0	0	15	10	0	0	0	0	0
	55–64	45	5	5	0	0	20	10	0	0	0	0	0
	65–74	30	5	0	0	0	10	10	0	0	0	0	0
	75–84	30	0	0	0	0	15	10	0	0	0	0	0
	85+	5	0	0	0	0	0	0	0	0	0	0	0
	Total	395	45	40	10	15	160	95	10	15	0	5	0
2008–12	<45	260	30	35	5	10	100	65	5	10	0	0	0
	45–54	45	5	5	0	0	20	10	0	0	0	0	0
	55–64	45	5	5	0	0	20	10	0	0	0	0	0
	65–74	35	5	5	0	0	15	10	0	0	0	0	0
	75–84	30	5	0	0	0	15	5	0	0	0	0	0
	85+	10	0	0	0	0	5	5	0	0	0	0	0
	Total	420	50	50	10	20	170	100	10	15	0	5	0
2013–17	<45	255	30	35	5	10	100	65	5	10	0	0	0
	45–54	45	5	5	0	0	20	10	0	0	0	0	0
	55–64	50	5	5	0	5	25	10	0	0	0	0	0
	65–74	45	5	5	0	0	20	10	0	0	0	0	0
	75–84	30	5	5	0	0	15	5	0	0	0	0	0
	85+	10	0	0	0	0	5	5	0	0	0	0	0
	Total	440	55	55	10	20	180	105	10	20	0	5	0
2018–22	<45	250	35	35	5	10	95	70	5	10	0	0	0
	45–54	50	5	5	0	0	20	10	0	0	0	0	0
	55–64	55	5	5	0	5	30	10	0	0	0	0	0
	65–74	60	10	5	0	5	25	10	0	5	0	0	0
	75–84	35	5	5	0	0	15	5	0	0	0	0	0
	85+	10	0	0	0	0	5	5	0	0	0	0	0
	Total	455	55	60	10	20	195	110	10	20	0	5	0
2023–27	<45	240	35	35	5	10	95	70	5	10	0	0	0
	45–54	50	5	5	0	0	20	10	0	0	0	0	0
	55–64	60	5	10	0	5	35	10	0	0	0	0	0
	65–74	65	10	5	0	5	30	10	0	5	0	0	0
	75–84	45	5	5	0	0	25	10	0	0	0	0	0
	85+	10	0	0	0	0	5	5	0	0	0	0	0
	Total	475	60	65	10	20	215	115	10	20	0	5	0
2028–32	<45	240	35	35	5	10	100	75	5	10	0	0	0
	45–54	55	5	5	0	0	20	10	0	0	0	0	0
	55–64	65	5	10	0	5	35	10	0	0	0	0	0
	65–74	70	10	5	0	5	40	10	0	5	0	0	0
	75–84	55	5	5	0	5	35	10	0	5	0	0	0
	85+	15	0	5	0	0	5	5	0	0	0	0	0
	Total	500	65	70	10	25	235	120	10	20	0	5	0

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

FIGURE 4.20.1
Age-specific incidence rates of Hodgkin lymphoma, Canada, 2003–2007 (from average annual counts)

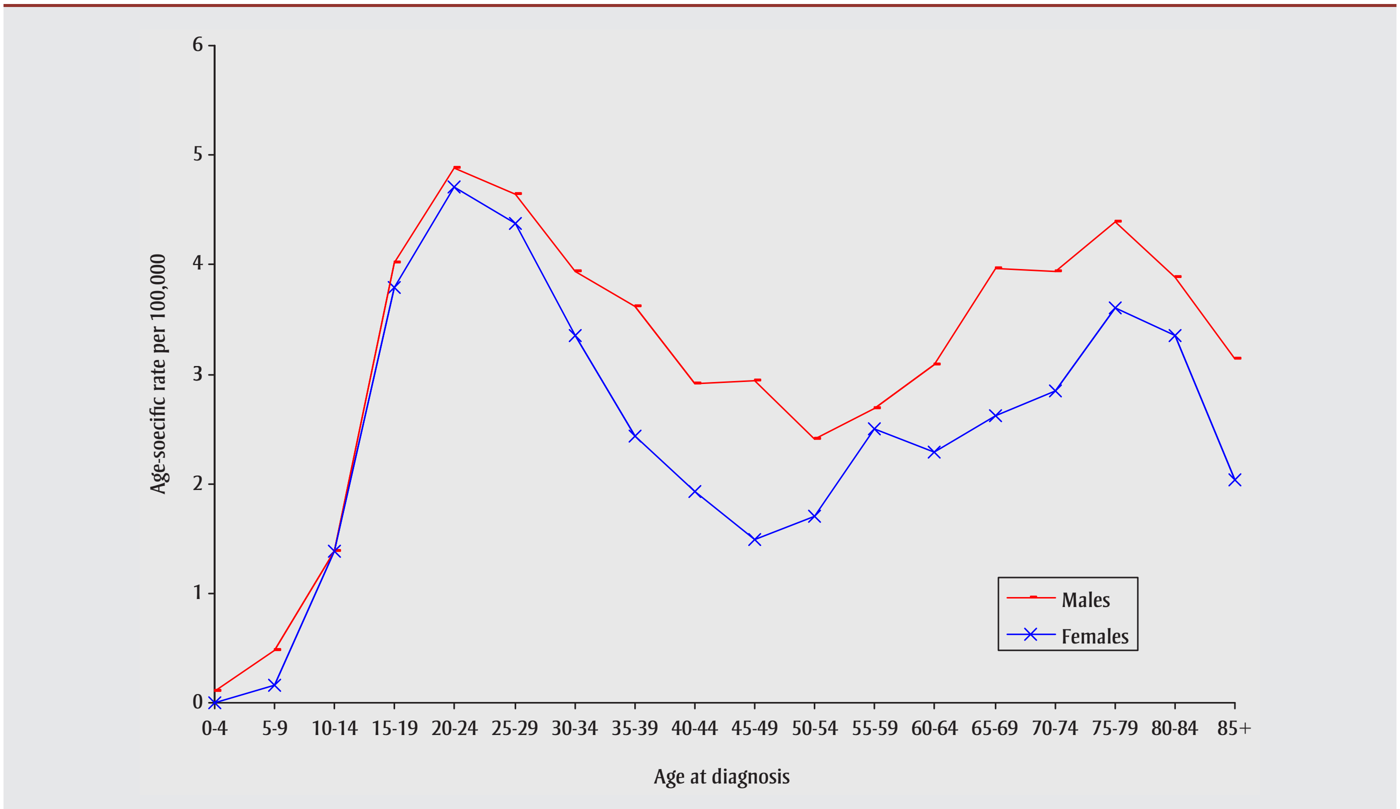


Figure 4.21.1 indicates that overall incidence rates increased modestly in both sexes during the entire observation period. During 1998–2007, the ASIRs for NHL increased significantly in males by 0.8% per year and increased non-significantly in females by 0.5% (Figures 3.1 and 3.2). Figure 4.21.2 reveals that the incidence of NHL increased over the observation periods for age groups above 55 in both sexes. For age groups below 55, the rates increased to their peaks in 1993–1997 for men under 45 and women aged 45 to 54, and in 1998–2002 for the opposite age–sex combinations, and then rates decreased.

The incidence rates of NHL in males are predicted to peak (at 19.9 per 100 000) in 2008–2012 and then decrease slightly, while the rates in females will peak in 2013–2017 and then level off (Figure 4.21.1). The projected flat trajectory of the rates might be because of a decrease in rates in later birth cohorts, especially in males.

Even though the rates were very similar for all regions in the most recent 2 to 3 observed periods, the rates in the Atlantic region are predicted to diverge slightly in the future in females. The Atlantic region had the most marked increase, and these rates are projected to stabilize. The rates in the other regions are expected to be consistent, changing marginally with the same pattern as for the country.

Figure 4.21.2 shows that the ASIRs in males and females are projected to converge in age groups under 75 and to diverge in older age groups.

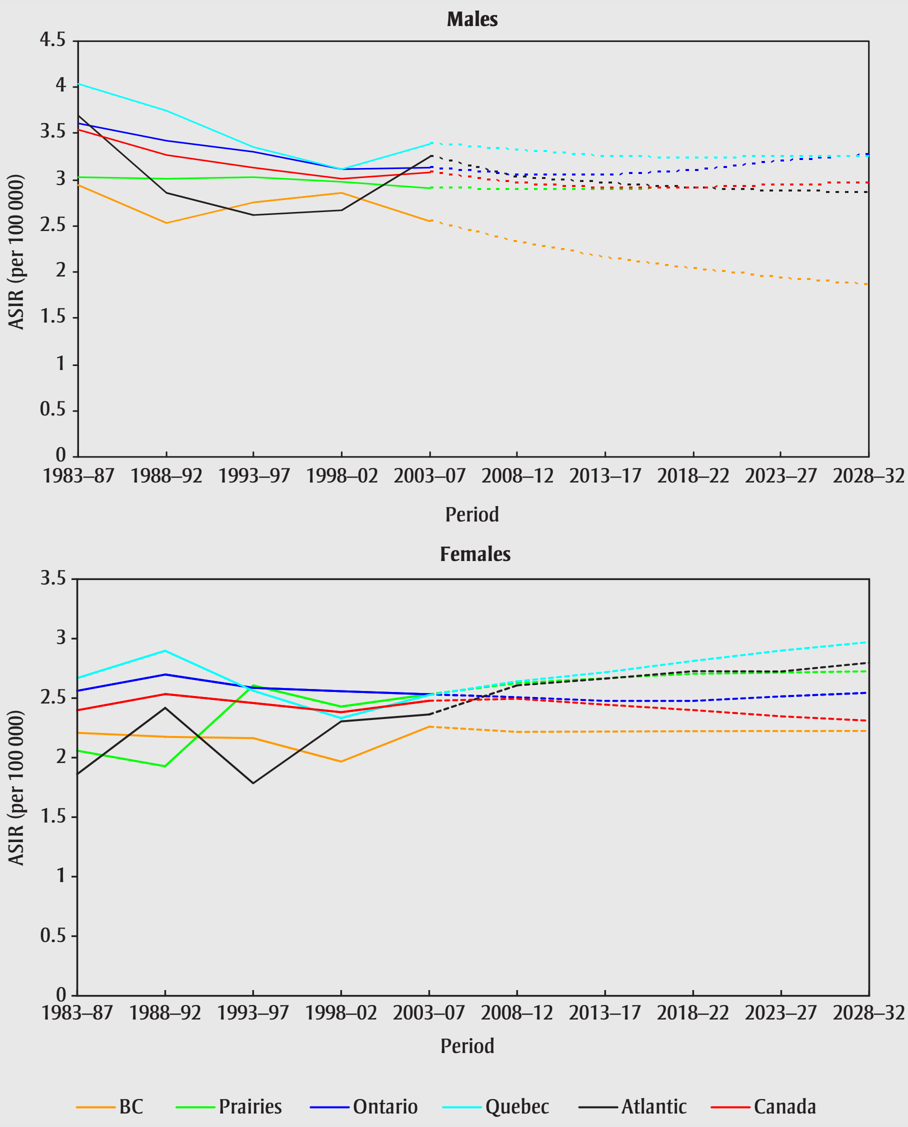
From 2003–2007 to 2028–2032, the ASIRs for NHL in Canada are projected to decrease by 8% in males, from 19.7 to 18.1 per 100 000, and to remain relatively stable in females, from 14.1 to 14.3 per 100 000 (Tables 4.21.3 and 4.21.4). The annual number of new male cases is estimated to increase by 75%, from 3455 to 6050, and the annual number of new female cases, by 78%, from 2915 to 5180 (Tables 4.21.1 and 4.21.2).

Comments

The observed incidence patterns likely result from a combination of improved detection and classification of this complex set of diseases, as well as changes in suspected risk factors because most of the risks for NHL are unknown.[36] Familial aggregations of NHL have been observed.[276,277] Immunodeficiency is one of the best characterized and strongest known risk factors for NHL. Risk is increased whether the immunodeficiency is congenital, iatrogenic or acquired.[278] NHL is over 50 times more common in patients with congenital or acquired immunodeficiency than in the general population.[278] The increase in the prevalence of acquired immunodeficiency syndrome (AIDS) in the 1980s is responsible in part for increased incidence rates during that period.

Infectious agents of human T-cell lymphotropic virus type 1 (HTLV-1), EBV and HCV have also been associated with an increased risk of NHL.[47] A number of studies have pointed to a positive association between HCV infection and NHL,[279,280] but a causal relationship is inconclusive.[281] A meta-analysis of 23 epidemiological studies presented a pooled odds ratio of 5.7 (95% CI: 4.1–8.0).[279] A more recent systematic review which included only studies with

FIGURE 4.20.2
Age-standardized incidence rates (ASIRs) by region, Hodgkin lymphoma, 1983–2032



≥100 cases reported a pooled relative risk of 2.5 (95% CI = 2.1–3.0), with consistent risks for B- and T-cell subtypes.[280]

The projected increases of the Atlantic region's rates in females were based on the long-term steeply rising trends starting with much lower levels in earlier periods and are therefore less likely to continue and result in rates higher than for all other regions. Incidence data from the early 1990s should be accurate.[282]

The causes of NHL are still largely unknown. Recent analyses describe the biological and clinical heterogeneity within the NHLs according to histology, suggesting that future epidemiological investigations need to focus on NHL risks and causal factors according to subtype.[283]

22. Multiple myeloma

Multiple myeloma (MM), or plasma cell myeloma, is the third most common lymphohematopoietic cancer, after NHL and leukemia. During 2003–2007, the average annual number of newly diagnosed MM cases was 1065 for males and 875 for females in Canada, which represented 1.3% and 1.2% of all new male and female cancer cases, respectively (Tables 4.22.1 and 4.22.2). The estimated lifetime risk of developing MM is 1 in 131 for males and 1 in 157 for females.[1] Incidence was rare below age 45, accounting for 2.8% and 2.3% of the respective male and female cases in 2003–2007, while nearly 56% to 58% of the cases were diagnosed in people aged 65 to 84 (Tables 4.22.1 and 4.22.2). The incidence rates increased gradually with age (Tables 4.22.3 and 4.22.4). The overall male-to-female ratio was 1.5. MM has a poor prognosis among all lymphohematopoietic cancers, with a 5-year survival rate of 43% in 2006–2008.[1]

The overall incidence rates of MM have increased marginally throughout the whole observation period in males (Figure 4.22.1). The similar magnitude of the increase in females showed levelling off in the last 10 years. During 1998–2007, the ASIRs for MM increased non-significantly in males by 0.4% per year and were stable in females (Figures 3.1 and 3.2). Rate stabilization has been observed in all regions, the only variation being a decrease in British Columbia in the last period. The interregional differences in ASIRs were small, ranged from 5.0 to 6.7 per 100 000 in males and 3.0 to 4.5 in females.

The incidence rates of MM in males are expected to increase by 3% to 13% in all regions from 2003–2007 to 2028–2032 (Figure 4.22.1). When the Atlantic region is not considered, the observed east–west gradient in male rates that started in 1998–2002 will remain over the next 25 years, with the highest rates in Quebec and the lowest rates in British Columbia. The rates in females are projected to stabilize in the Atlantic region and Ontario and increase marginally (4%–8%) in the other regions. Females in Ontario are predicted to experience the highest incidence, whereas those in British Columbia will have the lowest rates. The age-specific analysis illustrated in Figure 4.22.2 indicates that the ASIRs in Canada are expected to increase slightly or stabilize in each age group, resulting from continuation of their observed long-term trends.

From 2003–2007 to 2028–2032, the ASIRs of MM for the country are projected to increase by 11% in males, from 6.1 to 6.8 per 100 000, and by 4% in females, from

FIGURE 4.20.3
Age-standardized incidence rates (ASIRs) for Hodgkin lymphoma by age group (– males, – females), Canada, 1983–2032

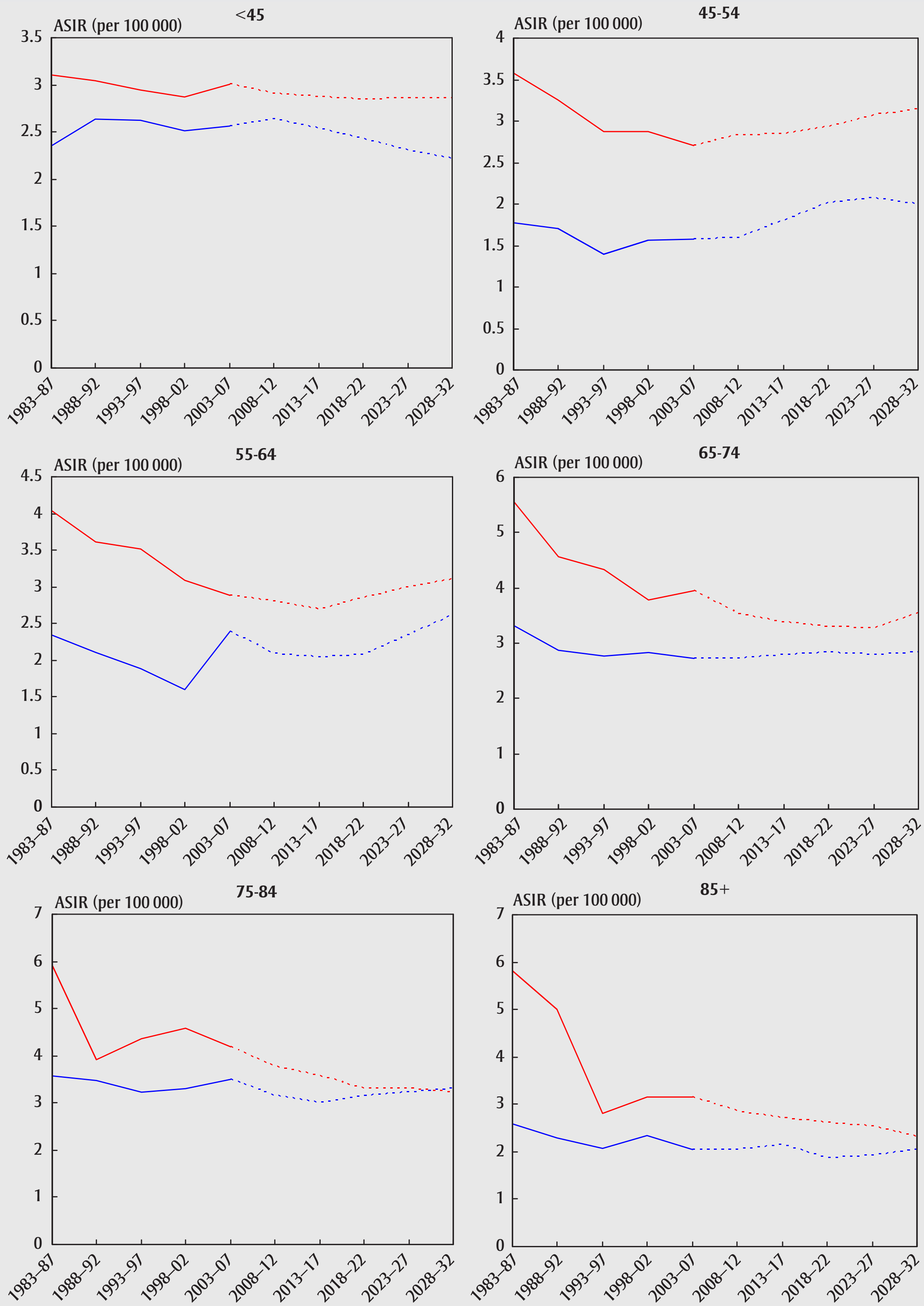


TABLE 4.20.3
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), Hodgkin lymphoma, males, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	3.0	2.6	2.7	3.6	2.7	2.9	3.4	3.5	4.0	2.8	2.2	1.1
	45–54	2.7	1.9	2.4	2.8	1.6	3.1	2.8	3.5	3.1	1.8	1.0	2.6
	55–64	2.9	1.8	3.0	4.5	3.0	3.2	2.9	3.1	2.9	0.0	3.0	0.0
	65–74	4.0	3.3	3.3	1.7	4.3	4.4	4.1	5.3	2.3	3.8	4.3	10.9
	75–84	4.2	2.9	5.9	1.7	5.3	4.7	4.4	2.8	3.2	7.6	0.0	0.0
	85+	3.1	2.5	3.1	5.3	2.8	3.5	3.8	0.0	0.0	0.0	0.0	0.0
	Total	3.1	2.5	2.9	3.4	2.8	3.1	3.4	3.6	3.7	2.7	2.2	1.8
2008–12	<45	2.9	2.3	2.6	3.3	2.6	2.9	3.4	3.1	3.1	2.5	2.1	1.6
	45–54	2.8	2.3	2.7	3.6	1.5	3.0	2.8	3.8	3.1	2.5	2.0	1.6
	55–64	2.8	2.0	3.4	2.7	3.8	3.3	2.7	4.3	2.7	2.5	2.0	1.5
	65–74	3.5	2.4	3.7	3.8	4.3	4.1	3.6	5.1	4.5	3.1	2.5	1.9
	75–84	3.8	3.6	5.0	3.8	3.9	4.3	3.2	6.0	4.2	3.3	2.7	2.1
	85+	2.9	4.1	3.5	3.4	4.3	3.0	3.0	1.6	0.9	2.5	2.0	1.6
	Total	3.0	2.3	2.9	3.3	2.7	3.1	3.3	3.5	3.2	2.6	2.1	1.6
2013–17	<45	2.9	2.1	2.6	3.2	2.5	2.8	3.4	3.2	3.0	2.5	2.1	1.6
	45–54	2.8	2.1	2.7	3.6	1.4	3.0	2.9	3.9	2.9	2.5	2.0	1.6
	55–64	2.7	2.0	3.5	2.7	3.8	3.2	2.4	4.3	2.5	2.4	1.9	1.5
	65–74	3.4	2.1	3.7	3.8	4.3	4.3	3.2	5.2	4.2	3.0	2.4	1.9
	75–84	3.6	3.4	5.1	3.7	3.9	4.2	3.0	6.1	3.9	3.1	2.6	2.0
	85+	2.7	3.0	3.5	3.4	4.2	3.4	2.6	1.7	0.8	2.4	1.9	1.5
	Total	2.9	2.2	2.9	3.3	2.7	3.0	3.3	3.6	3.0	2.5	2.1	1.6
2018–22	<45	2.8	1.9	2.6	3.2	2.5	2.9	3.4	3.2	2.9	2.5	2.0	1.6
	45–54	2.9	2.3	2.7	3.5	1.4	3.0	3.3	3.9	2.8	2.6	2.1	1.6
	55–64	2.9	2.1	3.5	2.6	3.8	3.5	2.4	4.4	2.4	2.5	2.0	1.6
	65–74	3.3	2.3	3.7	3.7	4.2	4.2	3.0	5.2	4.1	2.9	2.4	1.8
	75–84	3.3	2.9	5.1	3.7	3.9	4.0	2.7	6.1	3.7	2.9	2.4	1.8
	85+	2.6	3.8	3.5	3.3	4.2	3.1	2.2	1.7	0.7	2.3	1.9	1.4
	Total	2.9	2.0	2.9	3.2	2.7	3.1	3.2	3.6	3.0	2.5	2.1	1.6
2023–27	<45	2.9	1.8	2.6	3.2	2.5	3.0	3.4	3.2	2.9	2.5	2.0	1.6
	45–54	3.1	2.5	2.7	3.5	1.4	3.0	3.8	3.9	2.8	2.7	2.2	1.7
	55–64	3.0	2.1	3.5	2.6	3.8	3.6	2.6	4.4	2.4	2.6	2.1	1.7
	65–74	3.3	2.4	3.7	3.7	4.2	4.3	2.8	5.2	4.0	2.9	2.3	1.8
	75–84	3.3	2.7	5.1	3.7	3.8	4.5	2.6	6.1	3.7	2.9	2.4	1.8
	85+	2.5	3.2	3.5	3.3	4.2	3.3	2.3	1.7	0.7	2.2	1.8	1.4
	Total	2.9	1.9	2.9	3.2	2.7	3.2	3.3	3.6	2.9	2.6	2.1	1.6
2028–32	<45	2.9	1.6	2.6	3.2	2.5	3.1	3.2	3.2	2.8	2.5	2.0	1.6
	45–54	3.1	2.3	2.7	3.5	1.4	2.8	4.1	4.0	2.7	2.7	2.2	1.7
	55–64	3.1	2.2	3.5	2.6	3.7	3.7	3.0	4.4	2.3	2.7	2.2	1.7
	65–74	3.5	2.5	3.7	3.7	4.2	4.7	2.8	5.2	3.9	3.1	2.5	2.0
	75–84	3.2	2.9	5.1	3.7	3.8	4.3	2.5	6.1	3.6	2.8	2.3	1.8
	85+	2.3	2.8	3.5	3.3	4.2	3.0	2.0	1.7	0.7	2.0	1.6	1.3
	Total	3.0	1.9	2.9	3.2	2.7	3.3	3.2	3.6	2.9	2.6	2.1	1.6

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

TABLE 4.20.4
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), Hodgkin lymphoma, females, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	2.6	2.4	2.8	2.4	2.6	2.5	2.6	2.3	3.3	1.7	1.5	1.2
	45–54	1.6	1.4	1.1	0.8	2.8	1.7	1.8	1.1	1.3	0.0	0.9	0.0
	55–64	2.4	1.8	2.1	2.1	2.6	2.8	2.2	2.9	3.2	0.0	0.7	7.1
	65–74	2.7	2.6	2.3	2.3	3.4	2.7	2.9	3.5	2.0	0.0	3.0	0.0
	75–84	3.5	2.0	3.4	2.9	4.7	4.0	3.7	4.7	2.3	0.0	1.4	0.0
	85+	2.0	1.2	2.2	2.6	2.5	1.8	2.5	2.1	4.8	0.0	0.0	0.0
	Total	2.5	2.3	2.5	2.2	2.7	2.5	2.5	2.4	3.0	1.2	1.5	1.4
2008–12	<45	2.6	2.4	2.9	2.1	2.9	2.5	2.9	2.5	3.6	1.3	1.6	1.4
	45–54	1.6	1.5	1.6	1.4	1.8	1.7	1.7	1.7	2.1	0.8	0.9	0.9
	55–64	2.1	1.5	2.1	1.6	3.2	2.6	1.8	2.2	2.2	1.0	1.2	1.1
	65–74	2.7	2.6	2.9	2.8	3.6	2.8	2.6	2.8	3.7	1.3	1.6	1.5
	75–84	3.2	2.4	3.3	2.4	4.6	3.8	2.9	3.4	4.4	1.5	1.9	1.7
	85+	2.0	1.3	3.0	1.1	3.1	1.6	2.6	2.1	6.3	1.0	1.2	1.1
	Total	2.5	2.2	2.7	2.0	2.9	2.5	2.6	2.4	3.4	1.2	1.5	1.4
2013–17	<45	2.5	2.4	2.9	2.0	3.0	2.4	3.1	2.5	3.9	1.2	1.5	1.4
	45–54	1.8	1.5	2.4	1.3	1.9	1.9	1.7	1.7	2.3	0.9	1.1	1.0
	55–64	2.1	1.5	2.0	1.5	3.3	2.7	1.7	2.2	2.4	1.0	1.2	1.1
	65–74	2.8	2.6	3.0	2.7	3.7	3.2	2.3	2.8	4.0	1.3	1.6	1.5
	75–84	3.0	2.4	3.8	2.3	4.7	3.5	2.8	3.3	4.8	1.5	1.8	1.6
	85+	2.2	1.3	3.9	1.0	3.2	1.8	2.3	2.1	6.9	1.0	1.3	1.2
	Total	2.4	2.2	2.8	1.9	3.0	2.5	2.7	2.4	3.7	1.2	1.4	1.3
2018–22	<45	2.4	2.4	2.9	2.0	3.0	2.3	3.2	2.4	4.1	1.2	1.4	1.3
	45–54	2.0	1.5	2.4	1.3	1.9	2.2	2.0	1.7	2.4	1.0	1.2	1.1
	55–64	2.1	1.5	2.6	1.4	3.3	2.8	1.6	2.2	2.6	1.0	1.2	1.1
	65–74	2.8	2.6	2.6	2.6	3.7	3.4	2.3	2.8	4.3	1.4	1.7	1.5
	75–84	3.1	2.4	4.4	2.2	4.8	4.0	2.4	3.3	5.1	1.5	1.9	1.7
	85+	1.9	1.3	3.2	1.0	3.2	1.7	2.2	2.0	7.2	0.9	1.1	1.0
	Total	2.4	2.2	2.9	1.9	3.0	2.5	2.8	2.4	3.9	1.2	1.4	1.3
2023–27	<45	2.3	2.4	2.9	1.9	3.0	2.3	3.3	2.4	4.3	1.1	1.4	1.3
	45–54	2.1	1.5	2.2	1.3	1.9	2.1	2.2	1.7	2.5	1.0	1.2	1.1
	55–64	2.3	1.5	3.6	1.4	3.4	3.2	1.6	2.1	2.7	1.1	1.4	1.3
	65–74	2.8	2.6	2.3	2.6	3.7	3.6	2.2	2.7	4.4	1.4	1.7	1.5
	75–84	3.2	2.4	4.3	2.2	4.8	4.6	2.2	3.3	5.2	1.6	1.9	1.8
	85+	1.9	1.3	4.3	1.0	3.2	1.6	2.1	2.0	7.4	0.9	1.1	1.0
	Total	2.3	2.2	2.9	1.8	3.0	2.5	2.9	2.4	4.0	1.1	1.4	1.3
2028–32	<45	2.2	2.4	2.9	1.9	3.0	2.3	3.4	2.4	4.4	1.1	1.3	1.2
	45–54	2.0	1.5	2.4	1.2	1.9	1.9	2.1	1.7	2.6	1.0	1.2	1.1
	55–64	2.6	1.5	3.4	1.4	3.4	3.6	1.9	2.2	2.8	1.3	1.5	1.4
	65–74	2.8	2.6	2.9	2.5	3.8	3.8	2.1	2.7	4.5	1.4	1.7	1.5
	75–84	3.3	2.4	3.5	2.2	4.8	4.9	2.2	3.3	5.4	1.6	2.0	1.8
	85+	2.0	1.3	4.4	0.9	3.3	2.1	1.7	2.0	7.6	1.0	1.2	1.1
	Total	2.3	2.2	2.9	1.8	3.1	2.5	3.0	2.4	4.1	1.1	1.4	1.3

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

TABLE 4.21.1
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), non-Hodgkin lymphoma, males, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	445	60	45	10	15	185	100	10	15	0	5	0
	45–54	495	60	45	15	15	200	115	15	20	0	5	0
	55–64	740	105	65	20	30	280	180	25	25	5	10	0
	65–74	860	115	80	30	35	340	195	20	30	5	10	0
	75–84	730	110	60	25	30	280	175	20	20	5	10	0
	85+	185	30	20	10	5	70	35	5	5	0	0	0
	Total	3455	480	310	110	130	1355	800	95	110	15	45	5
2008–12	<45	400	55	45	10	10	165	90	10	10	0	5	0
	45–54	530	65	50	20	20	210	120	15	20	0	10	0
	55–64	880	120	80	25	30	345	195	25	30	5	15	0
	65–74	1025	150	90	30	35	395	235	30	35	5	15	0
	75–84	855	125	75	30	30	335	205	20	25	5	5	0
	85+	275	50	25	10	10	100	65	10	10	0	0	0
	Total	3970	555	365	125	145	1550	915	105	130	20	50	10
2013–17	<45	395	60	40	10	10	165	85	10	10	0	5	0
	45–54	490	55	50	15	15	200	105	15	20	0	10	0
	55–64	955	130	95	30	30	370	210	30	35	5	15	5
	65–74	1295	185	115	35	45	510	290	35	45	5	15	5
	75–84	1005	145	85	30	40	390	240	25	30	5	10	0
	85+	375	60	35	15	15	145	90	10	10	0	0	0
	Total	4515	630	420	140	155	1775	1025	120	145	20	55	10
2018–22	<45	400	65	40	15	10	165	85	10	10	0	5	0
	45–54	410	40	45	15	15	170	90	10	15	0	10	0
	55–64	995	130	95	35	35	400	210	25	35	5	15	5
	65–74	1545	210	145	45	55	615	335	40	55	10	20	5
	75–84	1245	185	110	35	45	470	300	30	35	5	10	0
	85+	470	70	45	15	15	180	110	10	15	0	0	0
	Total	5060	700	475	155	170	2000	1140	130	165	25	60	10
2023–27	<45	410	70	40	15	10	170	90	10	10	0	5	0
	45–54	380	45	35	15	15	155	85	10	10	0	5	0
	55–64	930	110	95	30	35	385	190	25	35	5	15	0
	65–74	1685	225	165	55	50	670	365	45	55	10	20	5
	75–84	1605	230	140	40	55	615	380	35	50	10	15	5
	85+	580	90	50	15	20	220	140	15	15	0	0	0
	Total	5590	765	525	175	185	2215	1250	140	180	25	65	10
2028–32	<45	405	70	40	15	10	175	85	10	10	0	5	0
	45–54	385	50	40	20	10	150	85	10	10	0	5	0
	55–64	795	85	80	30	30	330	165	25	25	5	15	0
	65–74	1790	230	170	60	60	725	375	45	65	10	25	5
	75–84	1940	265	180	55	65	750	450	45	60	10	15	5
	85+	735	115	70	20	20	275	180	20	20	5	5	0
	Total	6050	820	570	195	200	2405	1345	150	195	30	70	15

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

TABLE 4.21.2
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), non-Hodgkin lymphoma, females, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	290	35	30	10	10	125	60	5	10	0	5	0
	45–54	355	45	30	10	15	140	80	15	10	5	5	0
	55–64	595	70	50	15	20	235	145	20	20	5	10	0
	65–74	680	85	55	20	25	270	175	15	20	5	10	0
	75–84	715	100	55	25	30	270	170	20	25	5	10	0
	85+	275	35	25	10	20	100	75	10	10	0	0	0
	Total	2915	375	245	95	115	1145	705	75	95	15	40	5
2008–12	<45	300	35	30	10	10	130	60	5	10	0	5	0
	45–54	420	50	40	15	15	165	95	15	15	0	10	0
	55–64	685	85	60	20	25	270	165	20	25	5	15	0
	65–74	795	110	65	20	25	310	195	20	25	5	15	0
	75–84	775	100	65	25	30	300	190	20	20	5	10	0
	85+	350	50	30	15	15	130	85	10	10	0	0	0
	Total	3330	430	295	100	120	1300	790	90	110	15	50	5
2013–17	<45	300	35	35	10	10	135	65	5	10	0	5	0
	45–54	425	50	40	15	15	170	90	10	15	0	10	0
	55–64	785	100	70	20	25	305	185	25	30	5	15	0
	65–74	985	135	85	25	30	380	235	25	30	5	15	0
	75–84	855	110	75	25	25	330	210	20	25	5	10	0
	85+	430	60	45	15	20	160	105	10	10	0	0	0
	Total	3780	490	350	110	130	1475	880	95	120	15	55	5
2018–22	<45	300	40	35	10	10	135	60	5	10	0	5	0
	45–54	420	45	40	10	20	165	85	10	15	0	10	0
	55–64	870	110	80	25	25	340	195	25	30	5	15	0
	65–74	1160	160	110	30	35	450	265	30	40	5	20	5
	75–84	1005	140	90	25	30	380	240	25	30	5	10	0
	85+	505	65	55	15	20	190	125	10	10	0	0	0
	Total	4255	555	410	115	140	1660	975	110	135	20	65	10
2023–27	<45	300	40	40	10	15	140	65	5	10	0	5	0
	45–54	415	45	40	10	20	165	85	10	15	0	10	0
	55–64	865	110	85	20	30	345	180	25	30	5	15	0
	65–74	1320	185	125	30	40	505	300	30	45	5	25	5
	75–84	1250	170	110	30	35	480	290	35	40	5	15	0
	85+	565	80	60	15	20	210	140	10	15	0	5	0
	Total	4720	630	465	120	155	1840	1060	120	145	20	70	10
2028–32	<45	295	45	40	10	15	140	65	5	10	0	5	0
	45–54	420	50	45	15	20	165	85	10	15	0	10	0
	55–64	850	105	80	20	35	335	175	20	25	5	15	0
	65–74	1455	205	140	35	40	565	315	35	45	5	25	5
	75–84	1475	205	145	30	40	565	335	40	45	5	20	5
	85+	685	95	70	15	25	255	165	15	15	5	5	0
	Total	5180	700	520	125	175	2025	1135	130	160	25	70	10

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

TABLE 4.21.3
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), non-Hodgkin lymphoma, males, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	4.3	4.5	3.8	3.9	4.1	4.5	4.1	4.7	4.3	4.2	3.7	2.2
	45–54	20.0	18.6	18.1	20.3	16.9	21.4	19.1	22.9	25.8	13.6	16.9	13.0
	55–64	43.2	44.6	41.9	40.9	49.1	44.4	40.7	51.4	44.0	66.9	29.4	25.6
	65–74	80.0	77.5	85.6	82.7	91.5	83.8	72.8	80.0	81.3	89.2	54.3	101.6
	75–84	117.8	121.1	117.9	116.5	123.3	116.8	119.3	122.0	114.1	95.7	89.7	122.7
	85+	122.0	124.0	140.7	135.8	100.2	122.8	117.4	160.3	104.4	79.7	53.6	0.0
	Total	19.7	19.8	19.7	19.6	20.6	20.4	18.9	21.6	20.2	20.5	14.4	16.4
2008–12	<45	4.0	4.1	3.6	4.0	3.2	4.3	4.0	4.6	4.1	4.2	3.9	4.2
	45–54	19.3	17.6	17.7	23.8	19.3	19.8	18.3	22.9	26.4	20.2	21.2	18.4
	55–64	42.8	42.0	41.0	42.1	45.9	45.3	38.8	47.2	48.4	44.8	34.5	37.5
	65–74	82.9	84.1	85.0	79.0	89.4	85.8	75.5	95.7	84.7	86.8	56.4	78.7
	75–84	122.8	120.8	128.4	125.7	131.4	123.7	122.4	110.2	120.0	128.6	62.9	119.7
	85+	131.8	146.8	133.7	128.6	132.0	122.9	139.4	153.1	118.9	138.0	48.9	126.1
	Total	19.9	19.9	19.7	20.1	20.4	20.5	19.0	21.8	21.1	20.9	14.5	19.0
2013–17	<45	3.8	4.3	3.2	4.1	3.1	4.1	3.8	4.7	4.1	4.0	4.0	4.1
	45–54	17.9	14.2	17.8	23.1	18.4	18.3	17.2	22.5	25.3	18.8	22.1	18.2
	55–64	40.5	39.7	38.3	44.2	37.1	42.1	37.3	50.5	46.8	42.4	35.9	37.4
	65–74	83.0	82.0	83.6	78.9	87.1	87.2	74.8	86.8	91.3	87.0	58.5	78.2
	75–84	130.7	130.1	132.8	129.4	151.4	131.5	128.5	125.8	120.1	136.9	65.2	118.5
	85+	140.1	140.5	150.4	145.5	133.7	134.8	148.2	125.3	137.5	146.7	50.8	124.9
	Total	19.9	19.6	19.4	20.6	20.1	20.5	18.9	21.8	21.5	20.8	15.1	18.9
2018–22	<45	3.7	4.5	3.1	4.1	2.7	3.9	3.6	4.8	4.1	3.9	4.0	4.1
	45–54	16.3	11.7	15.0	24.6	17.5	16.6	16.4	23.2	20.5	17.0	22.8	18.0
	55–64	38.3	36.4	34.7	45.0	38.5	39.5	34.9	46.8	47.5	40.1	36.9	37.0
	65–74	81.5	77.1	81.1	81.6	83.6	86.4	73.6	81.5	91.9	85.4	60.0	77.7
	75–84	134.1	135.7	134.0	124.5	143.7	133.8	131.6	137.5	126.3	140.4	66.8	118.2
	85+	148.4	144.6	159.1	159.9	139.7	143.9	154.1	130.5	156.9	155.4	52.1	123.8
	Total	19.5	19.1	18.7	21.0	19.4	20.1	18.6	21.7	21.6	20.4	15.4	18.8
2023–27	<45	3.7	4.5	2.9	4.1	2.8	3.9	3.7	4.9	4.2	3.8	4.1	4.0
	45–54	15.0	12.2	12.4	25.7	15.5	15.4	14.7	23.6	20.1	15.7	23.2	17.5
	55–64	35.8	30.2	34.1	43.8	38.1	36.8	33.0	44.5	46.1	37.5	37.4	36.0
	65–74	77.1	72.0	74.2	85.3	70.1	80.4	71.0	83.4	87.0	80.7	60.7	75.6
	75–84	133.4	129.5	128.6	125.8	143.9	135.4	130.6	119.2	133.8	139.7	67.6	114.8
	85+	156.8	156.5	158.0	157.6	170.3	151.0	162.6	151.5	140.6	164.2	52.7	120.3
	Total	18.9	18.2	17.6	21.3	18.5	19.4	18.1	21.2	21.2	19.8	15.6	18.2
2028–32	<45	3.6	4.5	2.8	4.1	2.8	3.9	3.5	4.9	4.2	3.7	4.1	3.9
	45–54	14.4	13.1	12.0	25.7	12.9	14.3	14.6	24.0	20.2	15.1	23.5	17.0
	55–64	32.6	24.8	29.4	46.3	35.3	33.5	31.7	45.2	37.6	34.1	37.9	35.0
	65–74	73.3	66.1	68.1	86.1	73.2	76.0	67.0	76.7	90.5	76.8	61.4	72.9
	75–84	130.5	122.0	124.8	129.0	134.3	133.1	128.8	115.1	134.0	136.7	68.4	111.2
	85+	156.6	157.8	158.6	149.3	134.0	149.5	163.0	156.6	164.3	164.0	53.4	116.6
	Total	18.1	17.2	16.5	21.6	17.5	18.6	17.6	20.8	21.0	19.0	15.8	17.7

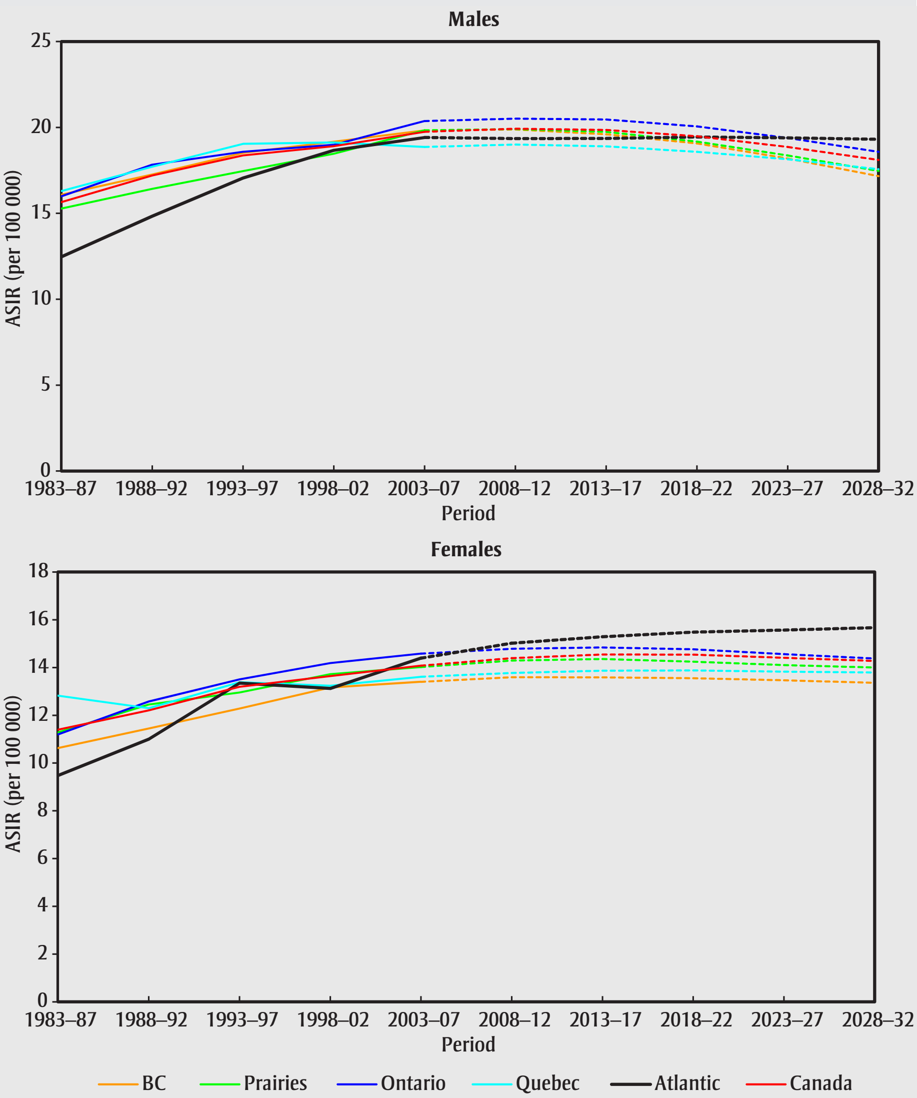
Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

TABLE 4.21.4
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), non-Hodgkin lymphoma, females, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	2.9	2.7	2.6	3.6	2.6	3.2	2.5	2.9	3.3	2.5	2.8	2.7
	45–54	14.2	13.2	12.9	13.6	16.7	14.7	13.3	21.4	15.8	23.6	15.0	2.9
	55–64	33.7	30.1	32.4	31.3	33.4	35.9	32.1	40.2	38.7	31.8	33.1	13.3
	65–74	57.2	55.0	57.8	55.7	55.6	58.7	57.3	45.4	58.5	58.2	53.0	67.0
	75–84	81.7	86.0	79.8	86.0	92.4	80.6	79.4	80.9	84.9	98.8	66.6	151.6
	85+	80.9	69.1	87.5	74.0	111.0	79.5	89.7	81.7	70.2	21.4	23.5	0.0
	Total	14.1	13.4	13.7	14.3	14.7	14.6	13.6	14.6	15.0	14.7	12.6	13.3
2008–12	<45	3.0	2.6	2.7	3.1	3.5	3.3	2.8	3.4	3.5	3.0	2.2	2.7
	45–54	15.4	13.5	14.3	17.9	15.2	15.5	14.6	20.3	20.8	16.7	22.3	15.3
	55–64	32.1	29.1	30.9	29.8	31.6	33.7	30.9	38.0	38.9	32.4	34.6	29.6
	65–74	58.8	59.2	58.9	56.3	58.0	59.7	56.3	53.9	57.5	54.4	55.0	56.9
	75–84	85.2	82.2	90.4	87.6	84.4	85.5	82.0	90.9	81.6	81.7	58.3	86.1
	85+	80.9	84.9	92.5	77.3	92.6	79.6	79.2	78.3	71.7	72.7	30.5	66.4
	Total	14.4	13.6	14.3	14.4	14.7	14.8	13.8	15.6	15.6	14.0	13.1	13.7
2013–17	<45	3.0	2.6	2.8	3.3	3.4	3.3	2.8	3.5	3.5	3.0	2.2	2.8
	45–54	15.9	13.5	15.3	17.5	17.3	15.5	14.8	20.7	21.1	16.9	23.1	15.5
	55–64	32.2	29.7	30.3	28.9	32.3	32.8	31.5	38.5	39.4	32.8	35.9	30.3
	65–74	58.4	56.9	58.0	57.0	54.4	59.8	54.7	54.7	58.3	54.8	56.8	58.0
	75–84	88.5	86.0	94.3	85.6	81.5	87.9	85.6	92.1	82.6	82.2	60.2	87.7
	85+	84.4	83.2	103.1	84.5	97.4	82.0	81.6	79.4	72.6	73.3	31.6	67.3
	Total	14.5	13.6	14.6	14.4	14.6	14.8	13.9	15.8	15.8	14.1	13.5	14.0
2018–22	<45	2.8	2.6	2.9	3.4	3.3	3.2	2.7	3.5	3.5	3.0	2.2	2.8
	45–54	16.7	13.0	15.3	17.2	21.1	16.0	16.1	20.9	21.3	16.9	23.7	15.7
	55–64	32.9	30.2	30.3	32.7	31.1	32.9	31.5	38.9	39.8	32.8	36.7	30.3
	65–74	56.6	54.6	58.1	50.1	50.4	57.9	53.6	55.2	58.8	55.1	58.0	58.5
	75–84	89.2	89.2	91.5	77.7	83.1	88.6	84.3	92.9	83.3	82.7	61.5	88.7
	85+	89.7	82.7	110.3	86.5	89.0	88.0	88.1	80.1	73.2	73.2	32.4	67.9
	Total	14.5	13.6	14.6	14.1	14.6	14.8	13.9	15.9	15.9	14.2	13.7	14.1
2023–27	<45	2.7	2.7	3.1	3.4	3.3	3.1	2.7	3.6	3.5	3.0	2.2	2.8
	45–54	16.4	12.2	14.1	17.5	20.7	16.1	15.6	21.0	21.4	16.9	24.0	15.5
	55–64	33.2	30.0	31.6	30.7	34.4	32.6	31.4	39.1	40.0	32.8	37.2	30.2
	65–74	56.5	55.3	55.9	48.6	52.4	56.4	54.5	55.4	59.0	54.8	58.7	58.2
	75–84	87.6	84.8	89.0	76.5	78.3	87.8	81.9	93.3	83.7	82.5	62.1	87.7
	85+	90.7	88.9	110.1	78.0	90.5	87.3	89.3	80.4	73.5	73.5	32.8	67.3
	Total	14.4	13.5	14.5	13.7	14.8	14.6	13.8	16.0	16.0	14.2	13.9	14.0
2028–32	<45	2.6	2.7	3.1	3.5	3.3	3.0	2.7	3.6	3.6	3.0	2.2	2.7
	45–54	15.4	12.4	14.6	17.9	20.6	15.3	14.6	21.1	21.6	16.8	24.4	15.4
	55–64	34.6	29.0	31.3	29.8	41.8	33.4	33.8	39.3	40.2	32.5	37.6	29.9
	65–74	57.1	55.9	55.8	52.6	49.8	56.3	53.9	55.7	59.3	54.6	59.3	57.6
	75–84	84.7	82.1	88.3	65.8	73.7	84.8	80.1	93.7	84.0	81.8	62.8	87.5
	85+	90.4	89.7	102.9	68.9	93.1	88.3	85.9	80.8	73.8	72.6	33.2	66.9
	Total	14.3	13.4	14.4	13.5	15.1	14.4	13.8	16.1	16.0	14.1	14.0	13.9

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

FIGURE 4.21.1
Age-standardized incidence rates (ASIRs) by region, non-Hodgkin lymphoma, 1983–2032



4.0 to 4.2 per 100 000 (Tables 4.22.3 and 4.22.4). The annual number of new male cases is projected to increase by 125%, from 1065 to 2395, and the number of new female cases is projected to increase by 92%, from 875 to 1685 (Tables 4.22.1 and 4.22.2).

Comments

In accordance with recent reports from Sweden, England and US,[284-286] the overall incidence rates for MM increased marginally throughout the whole observation period in Canada. The apparent increasing trends of MM in Canada and worldwide may be due to improved diagnostic practices and better case ascertainment. The role of risk factors responsible for the trends in the disease frequency should also not be ruled out.

Other than older age, male gender, Black ethnicity, family history of lymphohematopoietic cancer, and monoclonal gammopathy of undetermined significance (MGUS), there are few known risk factors for the clinical entity.[287] However, several factors have been implicated as potentially etiologic, although findings are inconsistent.

Numerous studies have reported increased risk of developing MM in people with a family history of cancer, specifically lymphohematopoietic cancer, although the underlying mechanisms remain elusive and family history may be responsible for a relatively small proportion of new cases.[287,288] MGUS, a condition of excessive plasma cell growth, has consistently been observed to progress to MM.[287] Annual risk of progression from MGUS to MM is about 1%.[289]

Obesity has been associated consistently with an elevated risk of MM. Researchers at the Karolinsksa Institute, Stockholm, conducted a meta-analysis of 11 cohort studies and 4 case–control studies published from 1994 to May 2007.[290] In the cohort studies, overweight and obese people have a 12% and 27% increase in risk of MM, respectively. For case-control studies, the summary estimates were significantly higher. This effect was independent of age, sex and ethnicity. Their recent systematic review of 15 cohort studies is in line with these findings.[291]

Chronic immune stimulation conditions or autoimmune disorders have not been consistently related to MM; however, the incidence of MM appears to be elevated in people with AIDS.[287] A meta-analysis published in 2008 found that MM was 2.6 times more prevalent in HIV-infected people than the general population.[292]

23. Leukemia

Leukemia is the second most common lymphohematopoietic cancer diagnosed in Canadians, after NHL. During 2003–2007, the average annual number of new leukemia cases was 2570 for males and 1875 for females, making up 3.2% and 2.5% of all new male and female cancer cases, respectively (Tables 4.23.1 and 4.23.2). The lifetime risk of developing leukemia is 1 in 53 for males and 1 in 72 for females.[1] The lifetime probability of dying from the disease is 1 in 96 for males and 1 in 125 for females. The 5-year relative survival rate for leukemia is intermediate among cancers, at 59% in males and females for 2006–2008 in Canada.[1]

Leukemia is the most frequently diagnosed childhood malignancy, representing 72% of the lymphohematopoietic cancers in children and youth aged 0 to 14, and 33% of all childhood cancers in Canada

FIGURE 4.21.2
Age-standardized incidence rates (ASIRs) for non-Hodgkin lymphoma by age group (– males, – females), Canada, 1983–2032

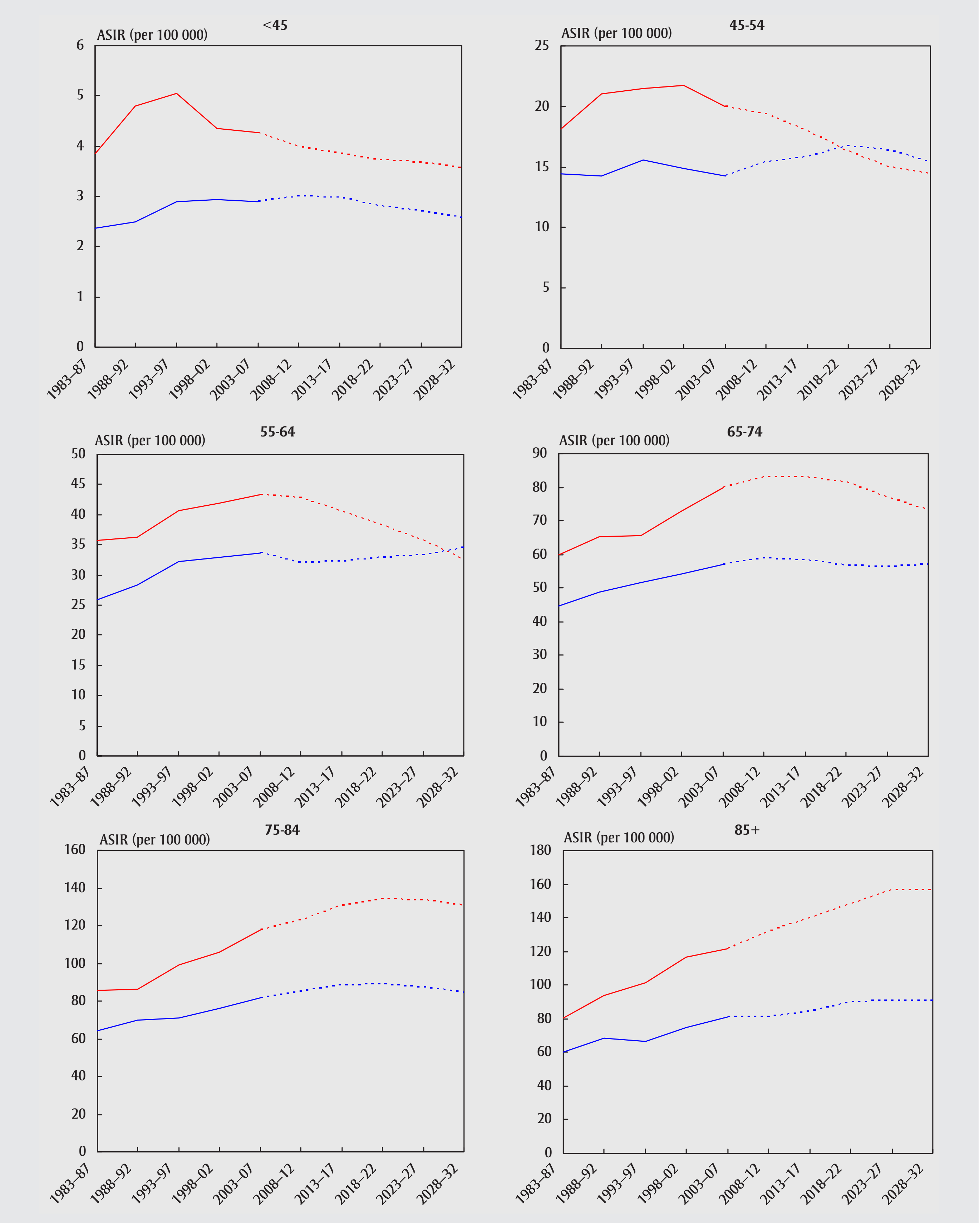


TABLE 4.22.1
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), multiple myeloma, males, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	30	5	5	0	0	15	5	0	0	0	0	0
	45–54	110	10	10	5	5	45	25	0	0	0	0	0
	55–64	240	30	20	10	5	95	60	5	10	0	5	0
	65–74	295	30	30	10	10	110	80	10	10	0	5	0
	75–84	300	40	20	10	10	120	80	5	10	0	0	0
	85+	90	15	10	5	5	35	25	5	0	0	0	0
	Total	1065	130	95	35	35	425	270	25	30	10	10	0
2008–12	<45	30	5	5	0	0	10	10	0	0	0	0	0
	45–54	130	15	10	5	5	60	30	0	5	0	0	0
	55–64	290	35	30	10	10	115	70	10	10	0	5	0
	65–74	365	40	35	10	10	140	95	10	10	5	5	0
	75–84	335	40	30	10	10	135	90	5	10	5	0	0
	85+	125	20	10	5	5	50	35	5	5	0	0	0
	Total	1270	150	115	35	40	510	330	30	35	10	10	5
2013–17	<45	35	5	5	0	0	10	10	0	0	0	0	0
	45–54	130	10	10	5	5	60	35	0	5	0	0	0
	55–64	335	40	35	10	10	140	80	10	10	5	5	0
	65–74	480	55	45	10	15	185	120	15	15	5	5	0
	75–84	380	45	35	10	10	145	105	10	10	5	5	0
	85+	155	20	15	5	5	65	45	5	5	0	0	0
	Total	1515	175	135	40	45	615	385	35	40	10	15	5
2018–22	<45	40	5	5	0	0	10	10	0	0	0	0	0
	45–54	120	10	10	5	5	50	30	0	5	0	0	0
	55–64	385	45	35	10	10	175	85	10	10	5	5	0
	65–74	585	70	60	15	15	230	140	15	15	5	5	0
	75–84	475	55	40	10	15	190	135	10	15	5	5	0
	85+	190	25	20	5	5	75	55	5	5	0	0	0
	Total	1790	205	165	45	50	730	455	40	45	15	15	5
2023–27	<45	40	5	5	0	0	15	10	0	0	0	0	0
	45–54	130	10	10	5	5	50	30	0	5	0	0	0
	55–64	385	40	30	10	10	175	90	10	10	5	5	0
	65–74	680	80	75	20	20	285	160	20	20	5	5	0
	75–84	630	75	60	15	15	250	165	15	15	5	5	0
	85+	225	30	20	5	5	90	65	5	5	0	0	0
	Total	2085	240	195	50	55	860	520	45	55	15	15	5
2028–32	<45	40	5	5	0	0	15	10	0	0	0	0	0
	45–54	135	15	10	5	5	50	35	0	5	0	0	0
	55–64	355	40	30	10	10	145	80	5	10	5	5	0
	65–74	780	90	75	20	20	350	175	20	20	5	5	0
	75–84	780	90	80	20	20	310	200	15	20	5	5	0
	85+	300	40	25	5	5	125	90	5	5	0	0	0
	Total	2395	275	225	55	65	995	585	50	60	20	15	5

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

TABLE 4.22.2
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), multiple myeloma, females, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	20	0	0	0	0	10	5	0	0	0	0	0
	45–54	75	5	5	5	5	35	20	0	0	0	0	0
	55–64	165	15	15	5	5	65	45	5	5	0	0	0
	65–74	230	20	20	10	5	100	60	5	5	0	5	0
	75–84	275	30	20	10	10	115	70	5	5	0	5	0
	85+	110	10	5	0	5	45	30	0	5	0	0	0
	Total	875	90	70	25	30	370	230	20	25	5	10	0
2008–12	<45	20	0	0	0	0	10	5	0	0	0	0	0
	45–54	95	10	10	5	5	45	20	0	0	0	0	0
	55–64	190	15	15	5	5	80	50	5	5	0	0	0
	65–74	265	25	25	10	5	110	65	5	5	0	5	0
	75–84	290	30	25	10	10	120	80	5	5	0	5	0
	85+	145	15	10	5	5	65	45	0	5	0	0	0
	Total	1000	100	85	30	30	425	265	25	25	5	10	0
2013–17	<45	15	0	0	0	0	10	5	0	0	0	0	0
	45–54	100	10	10	5	5	55	20	0	0	0	0	0
	55–64	215	20	20	5	5	85	60	5	5	0	5	0
	65–74	335	35	30	10	10	135	85	10	10	0	5	0
	75–84	310	30	30	10	10	130	80	10	10	0	5	0
	85+	175	15	15	5	5	75	55	0	5	0	0	0
	Total	1150	115	100	30	35	485	300	25	30	5	15	0
2018–22	<45	20	0	0	0	0	10	5	0	0	0	0	0
	45–54	90	10	10	0	5	40	15	0	0	0	0	0
	55–64	250	25	25	5	5	110	60	10	10	0	5	0
	65–74	395	40	35	10	10	160	100	10	10	0	5	0
	75–84	365	40	35	10	10	150	95	10	10	0	5	0
	85+	190	20	15	5	5	80	60	5	5	0	0	0
	Total	1310	130	120	35	40	555	335	30	35	5	15	0
2023–27	<45	20	0	0	0	0	10	5	0	0	0	0	0
	45–54	85	10	10	0	5	40	15	0	0	0	0	0
	55–64	265	25	25	5	5	120	55	5	5	0	5	0
	65–74	445	45	40	15	10	175	115	10	10	0	5	0
	75–84	470	50	40	10	15	190	125	10	10	0	5	0
	85+	210	20	20	5	5	95	60	5	5	0	0	0
	Total	1495	155	140	40	45	630	375	35	40	5	15	0
2028–32	<45	20	0	0	0	0	10	5	0	0	0	0	0
	45–54	90	10	10	5	5	45	20	0	0	0	0	0
	55–64	245	25	25	5	5	95	50	5	5	0	0	0
	65–74	515	60	50	15	15	225	120	10	10	0	5	0
	75–84	555	55	50	15	20	225	145	15	15	0	5	0
	85+	260	25	20	5	10	110	80	5	5	0	5	0
	Total	1685	180	155	45	50	710	415	35	45	5	20	0

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

TABLE 4.22.3
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), multiple myeloma, males, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	0.3	0.2	0.2	0.2	0.4	0.3	0.3	0.2	0.4	0.0	0.2	0.0
	45–54	4.3	3.6	3.9	4.3	4.2	5.0	4.4	3.0	1.8	11.8	4.4	0.0
	55–64	14.2	12.0	14.7	17.2	12.9	15.2	13.4	15.0	13.9	31.3	11.4	3.6
	65–74	27.3	21.1	31.8	25.8	22.9	27.0	29.6	37.8	26.2	47.1	19.2	59.5
	75–84	48.3	43.6	41.5	37.7	48.0	50.9	53.8	33.2	51.1	67.0	16.8	57.5
	85+	59.3	53.8	61.8	42.6	36.2	61.9	72.4	72.9	37.3	79.7	8.9	0.0
	Total	6.1	5.1	6.1	5.6	5.5	6.4	6.5	6.2	5.7	10.4	3.6	6.4
2008–12	<45	0.3	0.2	0.2	0.3	0.4	0.3	0.3	0.2	0.4	0.5	0.1	0.3
	45–54	4.6	3.6	3.5	4.8	4.2	5.5	4.7	3.9	4.1	7.9	3.4	5.3
	55–64	14.0	11.9	14.2	14.5	11.2	14.9	13.5	14.6	12.9	23.9	9.6	15.8
	65–74	29.4	23.9	32.5	27.9	25.4	30.4	30.4	34.0	27.2	50.1	19.3	33.2
	75–84	47.9	38.5	48.4	41.5	43.8	49.7	54.0	43.9	45.1	81.8	21.9	54.2
	85+	59.9	57.6	58.7	41.6	46.5	60.6	74.6	56.8	47.8	102.2	7.0	67.7
	Total	6.2	5.2	6.3	5.8	5.5	6.5	6.7	6.3	5.8	10.7	3.4	7.1
2013–17	<45	0.3	0.2	0.2	0.3	0.4	0.3	0.4	0.2	0.4	0.6	0.1	0.4
	45–54	4.7	3.3	2.8	4.8	4.2	5.3	5.2	3.8	4.1	8.0	3.4	5.3
	55–64	14.2	11.8	13.6	14.7	11.1	15.9	13.8	14.4	13.0	24.3	9.6	16.1
	65–74	30.7	25.4	32.8	28.4	25.3	32.1	30.5	34.4	27.3	52.3	19.0	34.7
	75–84	49.1	38.4	53.2	42.1	43.6	49.9	56.6	44.7	45.3	83.9	21.0	55.6
	85+	58.6	50.8	55.8	42.2	46.3	62.5	72.1	57.3	48.0	100.0	6.6	66.3
	Total	6.4	5.2	6.3	5.9	5.5	6.7	6.8	6.3	5.8	10.9	3.4	7.3
2018–22	<45	0.3	0.2	0.2	0.3	0.4	0.3	0.4	0.2	0.4	0.6	0.1	0.4
	45–54	4.6	3.3	2.7	4.9	4.2	4.7	5.3	3.8	4.1	7.9	3.4	5.3
	55–64	14.8	12.2	12.3	14.9	11.1	17.3	14.3	14.2	13.0	25.2	9.6	16.7
	65–74	31.0	24.8	34.3	28.7	25.2	32.5	30.6	34.3	27.4	53.0	18.8	35.1
	75–84	50.9	40.1	51.9	42.5	43.4	53.3	57.9	45.4	45.4	86.9	20.5	57.6
	85+	60.5	51.9	63.3	42.6	46.1	61.6	76.2	58.4	48.1	103.4	6.4	68.5
	Total	6.6	5.2	6.3	5.9	5.4	6.9	7.0	6.3	5.8	11.2	3.3	7.4
2023–27	<45	0.3	0.2	0.2	0.3	0.4	0.3	0.4	0.2	0.4	0.6	0.1	0.4
	45–54	5.0	3.3	2.7	4.9	4.2	4.7	5.3	3.7	4.1	8.5	3.4	5.7
	55–64	14.7	11.4	10.6	15.0	11.1	16.6	15.2	14.0	13.1	25.1	9.6	16.6
	65–74	31.2	25.2	33.5	28.8	25.1	34.2	30.7	33.8	27.4	53.3	18.7	35.3
	75–84	52.3	42.4	53.9	42.7	43.3	55.1	57.2	45.8	45.5	89.2	20.2	59.1
	85+	60.9	51.1	68.3	42.8	46.1	62.0	77.9	59.4	48.2	104.0	6.3	68.9
	Total	6.7	5.3	6.3	5.9	5.4	7.1	7.1	6.3	5.9	11.4	3.3	7.5
2028–32	<45	0.4	0.2	0.2	0.3	0.4	0.3	0.4	0.2	0.4	0.6	0.1	0.4
	45–54	5.0	3.3	2.7	4.9	4.2	4.8	5.4	3.7	4.1	8.6	3.4	5.7
	55–64	14.5	11.4	10.5	15.1	11.0	14.9	15.3	13.8	13.1	24.7	9.6	16.4
	65–74	32.1	25.5	30.5	29.0	25.1	36.5	31.8	33.3	27.4	54.9	18.6	36.4
	75–84	52.6	41.3	55.5	42.9	43.3	55.6	57.2	45.6	45.5	89.8	19.9	59.5
	85+	63.8	55.8	62.7	43.0	46.0	68.0	78.8	60.2	48.2	108.9	6.2	72.2
	Total	6.8	5.3	6.0	6.0	5.4	7.2	7.2	6.2	5.9	11.5	3.3	7.6

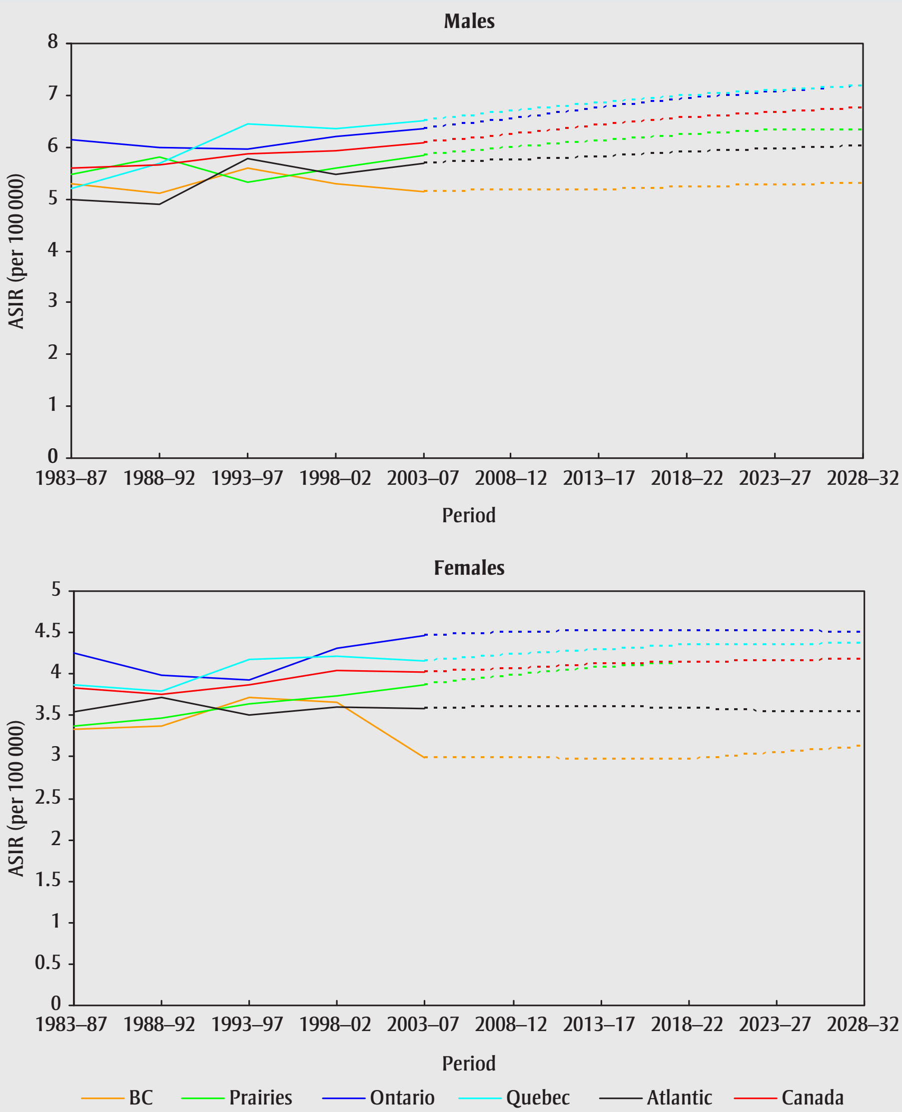
Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

TABLE 4.22.4
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), multiple myeloma, females, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	0.2	0.1	0.2	0.1	0.2	0.2	0.2	0.1	0.3	0.4	0.1	0.0
	45–54	3.1	2.2	2.7	3.7	3.0	3.5	3.1	2.2	2.6	1.7	2.3	2.8
	55–64	9.4	6.4	10.7	10.8	7.5	9.8	9.6	15.9	10.0	13.9	3.2	0.0
	65–74	19.1	14.0	20.2	20.1	13.3	21.5	18.9	21.1	15.2	18.6	18.5	14.3
	75–84	31.2	26.6	30.0	23.9	33.0	33.9	33.1	25.4	24.7	11.9	21.6	0.0
	85+	32.3	23.3	26.3	14.0	36.2	37.8	38.7	21.0	25.5	10.7	7.8	0.0
	Total	4.0	3.0	4.1	3.8	3.6	4.5	4.2	4.2	3.6	3.5	2.7	1.3
2008–12	<45	0.2	0.1	0.2	0.1	0.1	0.2	0.2	0.1	0.3	0.3	0.1	0.1
	45–54	3.4	2.8	2.7	3.6	3.2	4.3	3.0	2.7	2.6	3.1	2.3	1.1
	55–64	9.0	5.9	9.1	8.5	7.1	10.0	9.6	12.1	9.7	8.9	6.1	2.9
	65–74	19.4	14.6	21.2	20.8	15.7	21.3	18.9	18.4	15.8	16.0	13.1	6.3
	75–84	31.7	24.9	32.2	28.7	32.2	33.2	33.8	34.1	26.3	21.5	21.3	10.3
	85+	33.4	21.5	32.7	20.5	29.5	38.9	42.2	14.3	27.5	24.7	22.5	10.9
	Total	4.1	3.0	4.1	3.8	3.6	4.5	4.2	4.0	3.6	3.4	2.7	1.3
2013–17	<45	0.2	0.1	0.2	0.1	0.1	0.2	0.2	0.1	0.3	0.3	0.1	0.1
	45–54	3.7	2.7	2.8	3.6	3.2	4.7	2.9	2.7	2.6	3.0	2.5	1.2
	55–64	8.9	5.5	9.0	8.7	7.1	9.4	9.9	12.1	9.8	8.3	6.0	2.9
	65–74	19.8	15.0	19.5	21.1	15.6	21.5	20.3	17.9	15.9	15.1	13.3	6.4
	75–84	31.9	24.5	36.5	29.2	32.1	34.2	32.4	33.5	26.5	20.8	21.5	10.4
	85+	33.9	22.4	33.0	20.9	29.3	37.8	42.3	17.9	27.7	24.0	22.8	11.0
	Total	4.1	3.0	4.2	3.9	3.5	4.5	4.3	4.0	3.6	3.2	2.8	1.3
2018–22	<45	0.2	0.1	0.2	0.1	0.1	0.2	0.2	0.1	0.3	0.3	0.1	0.1
	45–54	3.6	2.6	2.9	3.6	3.2	3.9	3.0	2.7	2.6	2.8	2.4	1.2
	55–64	9.5	7.1	9.3	8.8	7.0	10.7	9.9	12.1	9.8	7.8	6.4	3.1
	65–74	19.2	13.3	19.1	21.3	15.6	20.7	20.4	17.6	16.0	14.2	12.9	6.3
	75–84	32.5	24.1	34.8	29.5	32.0	34.9	33.3	32.5	26.7	19.9	21.9	10.6
	85+	33.5	22.5	34.3	21.1	29.3	36.7	41.2	19.8	27.9	23.3	22.6	10.9
	Total	4.1	3.0	4.1	3.9	3.5	4.5	4.3	3.9	3.7	3.1	2.8	1.3
2023–27	<45	0.2	0.1	0.2	0.1	0.1	0.2	0.2	0.1	0.3	0.2	0.1	0.1
	45–54	3.2	2.6	3.0	3.6	3.2	3.9	3.1	2.7	2.6	2.7	2.2	1.0
	55–64	10.1	7.1	9.4	8.8	7.0	11.2	9.5	12.1	9.9	7.4	6.8	3.3
	65–74	19.0	13.9	18.5	21.5	15.5	19.7	20.6	17.4	16.0	13.3	12.8	6.2
	75–84	32.8	25.4	32.1	29.6	32.0	34.9	34.6	32.3	26.7	18.7	22.1	10.7
	85+	33.9	22.3	39.5	21.2	29.2	38.8	38.4	18.7	27.9	22.4	22.8	11.0
	Total	4.2	3.0	4.1	4.0	3.5	4.5	4.3	3.9	3.7	2.9	2.8	1.4
2028–32	<45	0.2	0.1	0.2	0.1	0.1	0.2	0.2	0.1	0.3	0.2	0.1	0.1
	45–54	3.2	2.5	3.0	3.6	3.2	3.9	3.1	2.7	2.6	2.5	2.2	1.1
	55–64	9.9	7.0	9.6	8.9	7.0	9.6	9.6	12.1	9.9	7.0	6.7	3.2
	65–74	20.2	16.7	18.8	21.6	15.5	22.3	20.3	17.3	16.1	12.4	13.6	6.6
	75–84	31.6	22.2	30.7	29.8	31.9	33.4	34.4	32.0	26.8	17.5	21.3	10.3
	85+	34.5	22.1	32.6	21.3	29.2	38.4	41.5	18.5	28.0	21.3	23.3	11.2
	Total	4.2	3.1	4.0	4.0	3.5	4.5	4.4	3.9	3.7	2.7	2.8	1.4

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

FIGURE 4.22.1
Age-standardized incidence rates (ASIRs) by region, multiple myeloma, 1983–2032



during 2003–2007 (data not shown). Figure 4.23.1 shows how age-specific incidence rates varied with age in 2003–2007. The incidence rate had a small peak in children aged 0 to 4, then decreased and remained stable until age 30 when it started to increase slowly to the early 50s. The rate then escalated rapidly and reached its peak in people aged 85 and over. Almost three-quarters (74%) of leukemia cases occurred in those aged 55 or older. Males and females had similar rates up to age 50, after which the rates were higher in males and the divergence between sexes increased consistently with advancing age (Figure 4.23.1). The male-to-female ratio of ASIRs increased steadily from 1.3:1 in the under 45 age group to 1.9:1 in those aged 85 or older.

The overall ASIRs for leukemia decreased slightly from 1983–1987 until 1993–1997 (Figure 4.23.2). Thereafter, the incidence rates increased slightly to the same level in 2003–2007 as in the earliest observation period 20 years before. During 1998–2007, leukemia ASIRs increased non-significantly in males by 0.6% per year and increased significantly in females by 1.2% per year (Figures 3.1 and 3.2). Most of the increases occurred in men aged 65 or older and in women aged 65 to 74. The regional trends in ASIRs of leukemia were very similar for males and females (Figure 4.23.2). In the last observation period (2003–2007), the internal ranking of the regional ASIRs was similar for males and females, with significantly low rates in Atlantic Canada and elevated rates in the Prairies.

The predicted regional trends of leukemia ASIRs are similar in males and females (Figure 4.23.2). The ASIRs are expected to increase slightly in British Columbia, in the Atlantic region, and most evidently in Ontario. The rates will decrease marginally or stabilize in the Prairies and Quebec. The ranking of the regions in ASIRs will be the same for males and females. The rates for Ontario are projected to surpass those for the Prairies within the next 5 years. The Atlantic region will continue to experience the lowest rates. Figure 4.23.3 shows that the ASIRs of leukemia are predicted to increase or level off across the age groups but the difference between males and females persists over time.

From 2003–2007 to 2028–2032, leukemia ASIRs for Canada are projected to increase by 5% in males, from 15.1 to 15.8 per 100 000, and by 7% in females, from 9.2 to 9.8 per 100 000 (Tables 4.23.3 and 4.23.4). The annual number of newly diagnosed male cases is projected to increase by 98%, from 2570 to 5095, and the number of new female cases, by 88%, from 1875 to 3520 (Tables 4.23.1 and 4.23.2).

Comments

Leukemia is a cancer of the white blood cells. It has 4 main subtypes: acute lymphocytic leukemia (ALL), chronic lymphocytic leukemia (CLL), acute myeloid leukemia (AML) and chronic myeloid leukemia (CML).

The overall observed incidence rates for leukemia were generally modest, decreasing slightly during 1983–1997 and then increasing slightly, a pattern consistent with that observed in the US.[293] The etiology of leukemia remains largely unknown. The established and suspected risk factors include environmental exposures, genetic (inherited) susceptibility and lifestyle category.

FIGURE 4.22.2
Age-standardized incidence rates (ASIRs) for multiple myeloma by age group (– males, – females), Canada, 1983–2032

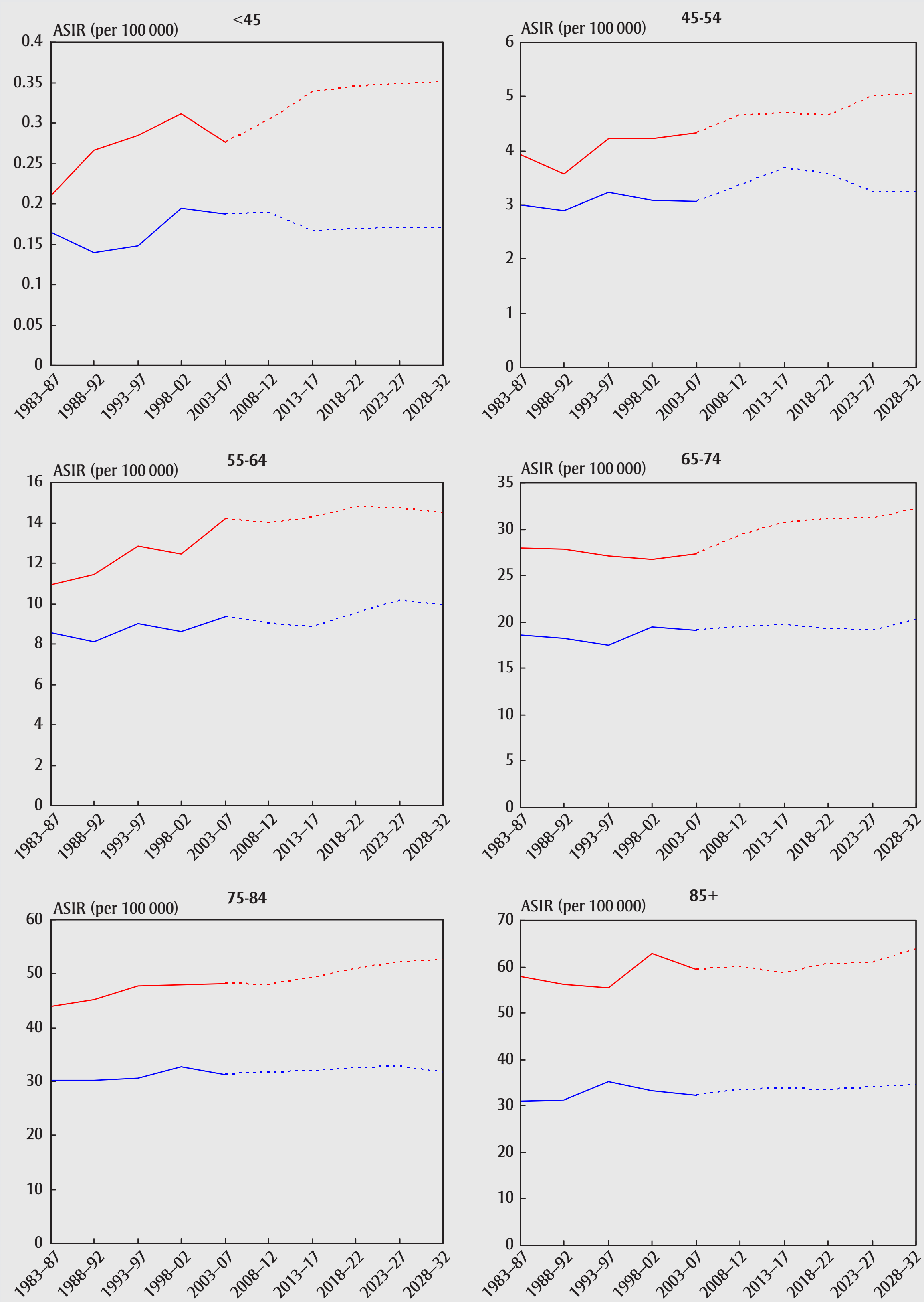


TABLE 4.23.1
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), leukemia, males, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	395	45	45	15	10	165	85	10	10	5	5	0
	45–54	265	35	30	10	10	105	50	5	10	0	5	0
	55–64	460	65	45	15	15	190	95	10	15	5	5	0
	65–74	615	80	55	20	25	245	150	15	20	5	5	0
	75–84	620	80	55	25	25	250	155	10	15	5	0	0
	85+	215	30	15	10	10	75	60	5	5	0	0	0
	Total	2570	330	250	100	95	1030	600	55	75	15	20	5
2008–12	<45	415	50	50	15	10	180	90	5	10	0	5	0
	45–54	300	40	35	10	10	135	55	5	10	0	0	0
	55–64	570	75	65	20	20	230	115	20	20	5	5	0
	65–74	710	90	65	25	25	290	170	15	20	5	5	0
	75–84	695	90	65	25	25	275	180	10	15	5	5	0
	85+	285	45	20	10	10	115	75	5	5	0	0	0
	Total	2980	390	295	105	100	1220	680	60	80	15	20	5
2013–17	<45	440	55	50	20	15	190	90	10	10	0	5	0
	45–54	310	40	35	10	5	145	55	5	10	0	0	0
	55–64	660	85	75	20	25	275	125	20	20	5	5	0
	65–74	885	120	85	25	35	365	200	20	25	5	5	0
	75–84	780	105	70	25	25	315	195	15	20	5	5	0
	85+	365	55	30	10	15	145	100	5	10	0	0	0
	Total	3440	450	350	110	115	1430	775	70	90	15	20	5
2018–22	<45	465	60	50	20	15	205	95	10	10	0	5	0
	45–54	295	35	35	10	5	140	50	0	5	0	0	0
	55–64	725	90	85	20	20	320	135	15	25	5	5	0
	65–74	1095	145	115	25	40	450	235	30	30	5	5	0
	75–84	940	125	85	25	30	385	235	15	20	5	5	0
	85+	430	65	35	10	15	170	120	5	10	0	0	0
	Total	3950	520	410	115	125	1675	870	80	100	15	20	5
2023–27	<45	485	65	55	20	15	215	95	10	10	0	5	0
	45–54	295	35	30	10	5	140	55	0	5	0	0	0
	55–64	740	95	85	20	20	340	135	10	20	5	5	0
	65–74	1270	165	145	25	45	535	265	35	35	5	5	0
	75–84	1210	165	120	30	40	495	285	25	30	5	5	0
	85+	515	75	45	15	15	215	135	5	10	0	0	0
	Total	4515	595	480	120	145	1940	975	90	115	20	25	10
2028–32	<45	500	65	55	20	15	225	100	10	10	0	5	0
	45–54	320	45	35	10	10	150	60	5	5	0	0	0
	55–64	705	85	85	20	20	330	125	10	20	5	5	0
	65–74	1410	180	160	30	45	625	280	30	35	5	5	0
	75–84	1515	205	160	35	50	620	345	35	40	5	5	0
	85+	645	95	55	10	20	265	175	10	15	5	0	0
	Total	5095	680	550	125	160	2220	1085	95	125	20	25	10

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

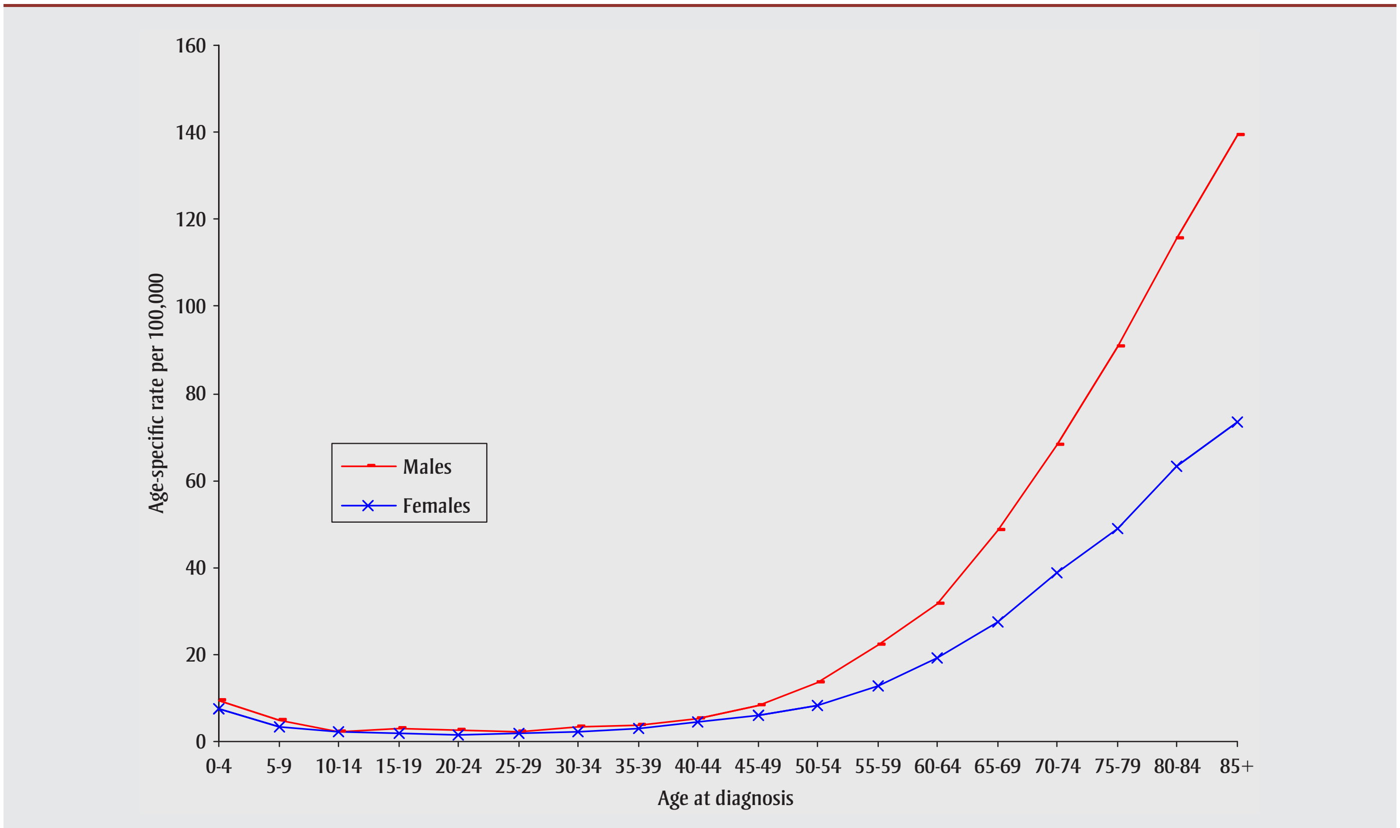
TABLE 4.23.2
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), leukemia, females, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	300	35	35	10	10	120	65	5	5	0	5	0
	45–54	180	20	20	10	5	75	35	5	5	0	0	0
	55–64	280	35	30	10	15	110	60	5	10	0	5	0
	65–74	390	50	35	15	15	155	95	10	10	0	0	0
	75–84	480	55	40	20	20	190	125	10	15	0	0	0
	85+	250	35	15	10	10	95	75	5	10	0	0	0
	Total	1875	230	175	70	75	750	455	40	55	10	15	5
2008–12	<45	315	35	35	10	10	135	70	5	5	0	5	0
	45–54	200	25	20	10	5	85	40	5	5	0	0	0
	55–64	335	40	35	10	15	145	65	5	10	0	5	0
	65–74	450	55	45	15	15	185	105	10	10	0	5	0
	75–84	520	65	50	20	15	210	135	10	15	0	0	0
	85+	340	45	25	10	15	135	100	5	10	0	0	0
	Total	2155	270	205	75	75	895	510	50	55	10	15	5
2013–17	<45	330	40	35	10	10	140	70	5	5	0	5	0
	45–54	200	25	20	10	5	95	35	10	5	0	0	0
	55–64	380	45	40	15	15	170	75	10	10	0	5	0
	65–74	565	75	55	15	25	230	125	15	15	0	5	0
	75–84	565	70	55	20	15	235	145	10	15	0	5	0
	85+	400	60	30	10	15	160	110	5	10	0	0	0
	Total	2445	310	240	80	80	1035	560	55	60	10	20	5
2018–22	<45	345	45	35	10	10	150	75	5	5	0	5	0
	45–54	195	20	20	5	5	100	35	10	5	0	0	0
	55–64	425	50	50	20	15	195	75	15	10	0	5	0
	65–74	670	90	70	20	25	285	140	15	20	5	5	0
	75–84	680	85	65	20	20	280	165	15	20	5	5	0
	85+	455	65	40	10	15	180	125	10	10	0	0	0
	Total	2770	355	280	90	90	1190	615	65	70	10	20	5
2023–27	<45	360	45	35	10	10	160	75	5	5	0	5	0
	45–54	200	20	20	5	5	95	40	5	5	0	0	0
	55–64	430	50	50	20	15	210	70	15	10	0	5	0
	65–74	765	100	80	30	25	335	160	20	20	5	5	0
	75–84	855	115	85	25	30	355	200	20	25	5	5	0
	85+	520	75	45	10	15	215	140	10	15	5	0	0
	Total	3130	405	320	100	100	1365	680	75	75	15	20	5
2028–32	<45	370	50	35	10	10	165	75	5	5	0	5	0
	45–54	205	20	20	10	5	95	45	5	5	0	0	0
	55–64	415	45	45	15	10	215	70	15	10	0	5	0
	65–74	855	105	90	35	30	380	165	25	20	5	5	0
	75–84	1025	140	110	30	35	440	225	20	30	5	5	0
	85+	645	100	55	15	20	260	165	15	15	5	0	0
	Total	3520	460	360	115	115	1555	745	85	85	15	25	10

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

FIGURE 4.23.1
Age-specific incidence rates of leukemia, Canada, 2003–2007 (from average annual counts)



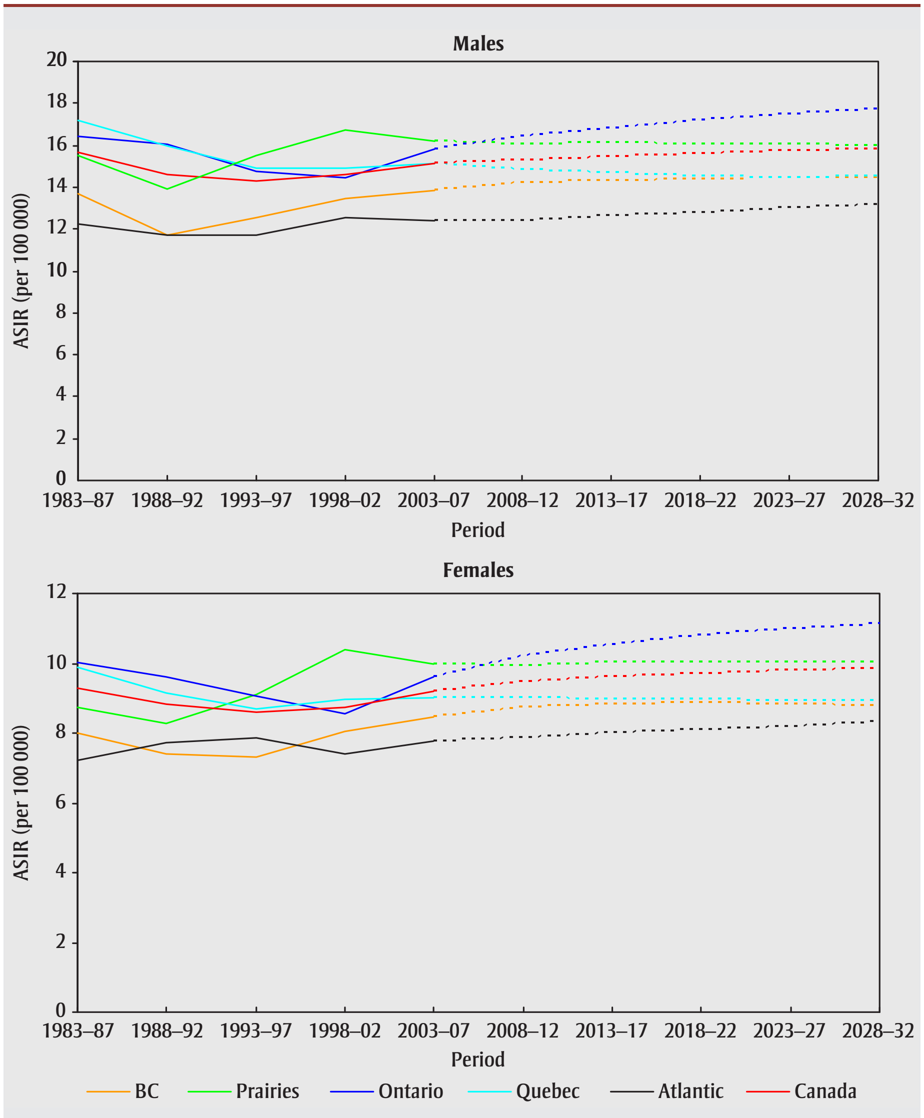
In 2008, IARC documented that exposure to ionizing radiation, alkylating agents (used in chemotherapy) and benzene had been consistently associated with leukemia risk.[86] Ionizing radiation is linked to increased incidence of AML, ALL and CML, but not CLL. Exposures include atomic bomb exposure (Hiroshima and Nagasaki), nuclear power plant accidents and therapeutic radiation exposure.[52,53,86,294,295] Findings from exposure to electromagnetic fields are inconsistent. IARC has concluded that occupational benzene exposure causes leukemia, particularly AML.[47,86] Benzene is also present in tobacco smoke and gasoline. Smoking, accounting for 20% of AML cases, is associated with a 2-fold increase in AML risk including in a Canadian cohort.[52,111,295,296] The prevalence of these exposures has been stable or decreasing during the study period and can explain the relative stable and the decreased component of the incidence trend of leukemia.

Viruses, particularly retroviruses, have been linked to the development of leukemia. IARC considers HTLV-1 infection to be causally associated with leukemia.[47] HTLV-1 infects 5 to 10 million people in the world,[297] with clusters in certain ethnic/geographical concentrations in Japan, Africa, South America, the Caribbean and Melanesia.[297,298] EBV is the etiological agent of acute infectious mononucleosis and is associated with adult ALL and aggressive NK-cell leukemia.[53,298,299]

Some identified chromosomal anomalies are related to leukemia. CLL, the most common adult leukemia in the West, is estimated to have one of the highest familial risks for a hematological malignancy.[300] A 7.5-fold increased risk of CLL has been observed in people with a first-degree relative with CLL.[301] Cytogenetic abnormalities occur in around 50% of CLL cases.[302] A reciprocal chromosomal translocation known as the Philadelphia chromosome is present in 95% of CML cases.[303] Philadelphia chromosome is also seen in about 20% to 30% of adult ALL cases.[304] Children with Down syndrome have a 10- to 30-fold increased risk of ALL and AML.[52,53,111,294,305] Inherited genetic syndromes have been linked to 5% of ALL and AML cases.[306]

Lifestyle factors have been implicated in the development of leukemia.[307] A meta-analysis showed an increased risk for each of the 4 major subtypes of leukemia in obese people.[308] A Canadian case-control study estimated that, compared with normal weight, the odds ratios of leukemia were 1.3 (95% CI: 1.1–1.5) for overweight and 1.6 (CI: 1.3–2.0) for obesity.[309] Overweight and obesity together accounted for 18% of all leukemias in Canada—9% from overweight and 8% from obesity.[309] The prevalence of obesity has increased in Canada.[51,72,73,110] However, current data are not sufficient to conclude whether the increased prevalence of obesity explains some of the recent increase in leukemia incidence. Based on the same population-based Canadian data, the researchers observed a 25% risk reduction for adult leukemia associated with the highest category of vigorous physical activity (OR = 0.75; CI: 0.57–0.99). Risk reductions asso-

FIGURE 4.23.2
Age-standardized incidence rates (ASIRs) by region, leukemia, 1983–2032



ciated with high levels of vigorous activity were greater with higher BMI.[310]

Changes in coding practice and the clinical ability to identify leukemia may contribute to some of the increase. In addition, changes in classification could also influence the trends.[295]

24. All other cancers

In 2003–2007, the average annual number of all other cancers in Canada was 7005 for males and 6995 for females, representing 8.7% and 9.4% of all new male and female cancer cases, respectively (Tables 4.24.1 and 4.24.2). During the same period, the ASIRs of these cancers increased with age from 6.2 per 100 000 in those aged 44 or younger to 466.4 in those aged 85 or older in males and from 6.3 to 345.4 in females in the same age groups. For those aged 54 or younger, the increase was less pronounced (Table 4.24.3 and 4.24.4). The ASIRs were virtually the same for males and females younger than age 55 but were higher in men than in women after this age. Overall, all other cancers occurred nearly 1.3 times as often in males as in females. Tables 4.24.1 and 4.24.2 show that more than 80% of all other cancer cases occurred in people aged 55 or older.

Figure 4.24.1 illustrates that overall incidence rates for this group increased modestly in males during the first 3 observation periods and then stabilized. For females, the overall rates increased steadily throughout the whole observation period. During 1998–2007, the ASIRs for all other cancers increased non-significantly in males by 0.1% per year and increased significantly by 0.6% in females (data not shown). The inter-regional comparison indicated that, in the last 10 years of observation, male ASIRs increased in Ontario and Quebec, and decreased in other regions (Figure 4.24.1). For females, the ASIRs have increased gradually since the early 1990s in most regions. Figure 4.24.2 shows that the ASIRs increased consistently in females of all age groups since 1988–1992, and in males aged 65 or older.

For males, the incidence rates of all other cancers are projected to stabilize (at about 40 per 100 000) for Canada as a whole (Figure 4.24.1). At the regional level, the rates in Ontario are expected to continue to increase consistently, whereas the incidence in Quebec will tend to increase marginally in the next 5 years and thereafter decrease steadily. The rates in other regions will continue to decrease. For females, the overall rates are projected to increase until 2013–2017 and then level off. Similar trends will occur in British Columbia, the Prairies and Quebec. The rates in females will increase slightly in Ontario and the Atlantic region. Figure 4.24.2 shows that the ASIRs in Canada are estimated to increase and then level off in all age groups except in men aged 45 to 74, for whom the rates will decrease.

From 2003–2007 to 2028–2032, the ASIRs of all other cancers for Canada are projected to fall by 5% in males, from 40.7 to 38.7 per 100 000, and to rise by 7% in females, from 32.3 to 34.6 per 100 000 (Tables 4.24.3 and 4.24.4). The annual number of new cases in males is projected to increase by 91%, from 7005 to 13 390, and the number of new cases in females, by 92%, from 6995 to 13 405 (Tables 4.24.1 and 4.24.2).

Comments

''All other cancers'' is a heterogeneous category. The distributions of the most common types of non-sex-specific cancers in this group were generally the same for males and females between 2003 and

FIGURE 4.23.3
Age-standardized incidence rates (ASIRs) for leukemia by age group (– males, – females), Canada, 1983–2032

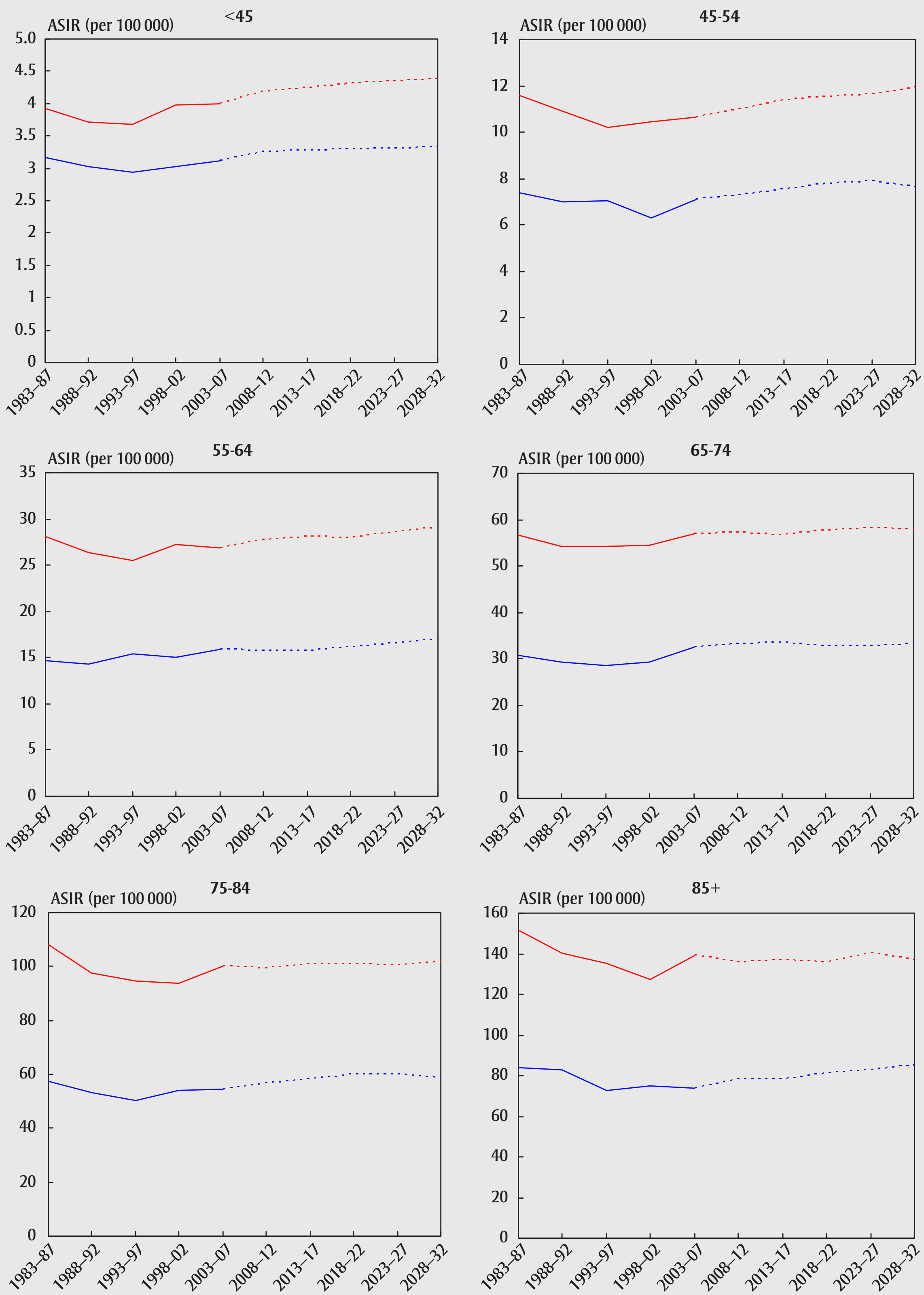


TABLE 4.23.3
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), leukemia, males, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	4.0	3.8	4.2	5.5	3.0	4.2	3.8	4.0	3.7	6.3	3.5	3.1
	45–54	10.6	10.2	12.3	12.1	13.5	11.5	8.3	9.9	11.8	19.4	6.2	17.8
	55–64	26.9	27.0	30.3	33.1	25.2	29.5	21.9	27.0	29.2	36.0	15.5	14.5
	65–74	57.0	51.5	62.2	63.8	62.5	59.8	56.4	49.0	52.6	77.5	17.0	32.8
	75–84	100.1	86.6	104.6	107.7	104.0	104.1	108.7	66.7	83.3	132.0	20.8	61.3
	85+	139.3	116.6	115.9	141.1	153.0	133.1	194.9	82.6	108.1	132.8	17.9	145.1
	Total	15.1	13.9	16.0	17.6	15.3	15.8	15.1	12.7	14.0	20.9	6.5	11.2
2008–12	<45	4.2	4.0	3.9	5.6	3.2	4.6	4.0	3.7	3.8	4.2	3.6	3.1
	45–54	11.0	10.3	11.5	12.5	9.4	12.8	8.4	6.9	12.4	11.2	5.3	8.1
	55–64	27.7	26.4	31.6	30.9	28.2	30.3	22.4	33.9	29.8	28.2	12.7	20.4
	65–74	57.2	51.8	62.5	63.1	65.8	62.4	53.7	44.7	45.9	55.0	19.8	42.1
	75–84	99.2	89.2	109.0	110.8	91.2	101.0	107.7	71.6	81.8	97.6	24.4	72.9
	85+	135.9	131.5	113.9	132.4	128.2	140.1	165.5	68.5	115.8	131.0	27.3	99.9
	Total	15.3	14.2	16.0	17.5	14.7	16.4	14.8	12.5	13.8	15.1	6.6	11.3
2013–17	<45	4.2	4.0	3.8	5.9	3.2	4.7	4.0	3.9	3.9	4.2	3.6	3.1
	45–54	11.4	10.5	11.6	14.7	7.7	13.3	8.9	4.9	11.7	11.2	5.2	8.4
	55–64	28.1	26.5	31.7	26.4	27.7	31.2	22.5	35.7	31.2	28.4	12.5	20.6
	65–74	56.8	52.7	62.6	54.2	63.9	62.4	51.9	52.5	45.7	55.3	19.6	41.8
	75–84	101.0	90.1	108.1	111.0	99.7	106.7	104.2	67.3	80.4	98.2	24.0	74.3
	85+	136.8	130.3	139.5	117.8	126.5	135.4	170.4	71.5	122.0	131.4	27.0	100.6
	Total	15.5	14.3	16.2	16.8	14.6	16.8	14.7	13.0	13.9	15.2	6.6	11.4
2018–22	<45	4.3	4.1	3.8	6.0	3.2	4.8	4.1	4.0	4.0	4.3	3.6	3.2
	45–54	11.5	9.9	11.7	16.2	8.1	13.8	9.1	4.7	10.8	11.4	5.2	8.5
	55–64	28.0	25.7	30.9	26.3	25.0	31.9	21.9	26.8	31.0	28.7	12.4	20.5
	65–74	57.7	53.2	64.4	48.6	61.4	63.5	51.5	64.3	49.2	56.1	19.4	42.4
	75–84	101.1	91.8	107.8	98.6	106.7	109.1	101.8	69.1	77.7	99.2	23.8	74.3
	85+	136.0	130.7	131.0	120.7	119.4	136.9	166.2	77.0	114.2	133.2	26.8	100.0
	Total	15.6	14.4	16.2	16.2	14.5	17.2	14.5	13.2	13.9	15.4	6.5	11.5
2023–27	<45	4.3	4.2	3.9	5.8	3.3	4.9	4.1	4.2	4.0	4.3	3.6	3.2
	45–54	11.6	9.9	10.7	17.7	7.8	14.2	9.6	4.9	11.1	11.4	5.2	8.6
	55–64	28.6	25.8	31.4	30.3	21.2	32.7	22.7	20.5	29.4	28.9	12.4	21.0
	65–74	58.1	53.1	64.9	41.8	61.3	64.6	51.3	65.2	51.0	56.2	19.3	42.7
	75–84	100.4	92.9	109.2	86.0	104.4	108.5	98.5	81.2	78.4	99.6	23.7	73.8
	85+	140.4	132.1	136.3	118.1	143.4	147.0	160.5	67.3	116.6	133.9	26.7	103.2
	Total	15.7	14.5	16.2	15.7	14.4	17.5	14.5	13.2	14.0	15.4	6.5	11.5
2028–32	<45	4.4	4.1	3.9	6.2	3.3	4.9	4.1	4.5	4.0	4.3	3.6	3.2
	45–54	11.9	11.5	10.5	15.6	8.5	14.4	9.7	4.9	11.7	11.4	5.1	8.8
	55–64	29.0	24.7	31.8	32.6	22.1	33.6	23.4	20.1	27.6	29.0	12.3	21.3
	65–74	57.8	51.5	63.6	43.4	55.6	65.6	50.3	49.5	50.8	56.6	19.2	42.5
	75–84	101.9	93.5	112.2	77.4	101.5	110.1	98.5	98.7	83.8	100.1	23.6	74.9
	85+	137.1	134.8	132.5	96.6	143.4	144.1	158.6	77.2	109.0	134.3	26.5	100.7
	Total	15.8	14.5	16.3	15.5	14.0	17.7	14.5	13.1	14.0	15.5	6.5	11.6

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

TABLE 4.23.4
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), leukemia, females, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	3.1	2.9	3.3	3.2	3.0	3.2	3.1	3.4	2.5	3.6	3.2	3.7
	45–54	7.1	6.1	7.3	10.8	7.6	8.1	6.0	8.2	5.5	5.5	4.1	0.0
	55–64	15.9	14.7	20.4	20.4	22.6	16.8	13.1	12.5	15.7	14.5	10.3	20.4
	65–74	32.4	30.7	37.2	38.8	31.0	33.8	31.1	31.6	29.3	32.8	9.0	39.5
	75–84	54.3	48.7	57.8	55.6	57.3	56.0	56.6	43.3	53.7	55.4	16.6	61.8
	85+	73.6	69.5	54.0	61.2	58.6	75.7	91.0	48.2	78.2	75.1	11.8	0.0
	Total	9.2	8.5	10.0	10.4	9.6	9.6	9.0	8.5	8.4	9.3	4.9	9.2
2008–12	<45	3.3	3.1	2.9	3.4	2.5	3.5	3.2	3.6	2.6	3.4	2.9	3.1
	45–54	7.3	6.2	7.5	10.9	7.3	8.1	6.0	11.7	5.7	7.1	5.3	6.8
	55–64	15.7	14.2	18.9	19.1	18.9	18.0	12.4	13.0	14.8	14.6	9.6	15.0
	65–74	33.3	30.8	39.4	38.3	37.1	35.6	30.6	30.8	26.4	26.7	14.5	30.8
	75–84	56.4	51.3	64.7	64.0	50.1	58.8	57.0	52.3	54.3	45.9	17.4	55.4
	85+	78.3	76.9	64.8	65.2	67.1	81.0	94.3	46.4	67.1	72.1	13.6	71.5
	Total	9.5	8.7	10.1	10.7	9.2	10.2	9.0	9.3	8.1	8.6	5.1	9.0
2013–17	<45	3.3	3.0	2.9	3.4	2.5	3.6	3.3	3.4	2.5	3.7	3.0	3.1
	45–54	7.5	6.3	7.4	10.9	7.7	9.0	5.8	13.5	5.7	7.3	5.5	6.9
	55–64	15.7	13.5	17.4	22.6	15.5	18.6	12.4	15.6	14.3	14.6	9.8	15.1
	65–74	33.5	31.8	38.7	37.6	40.8	36.1	29.8	33.2	26.6	26.6	14.9	31.1
	75–84	58.3	53.0	69.0	62.0	50.9	62.0	58.1	47.7	53.3	46.8	17.8	56.0
	85+	78.5	82.6	74.3	67.1	63.5	82.5	86.6	55.8	69.1	74.4	14.0	72.3
	Total	9.6	8.8	10.2	11.0	9.1	10.6	9.0	9.7	8.0	8.9	5.3	9.1
2018–22	<45	3.3	3.1	2.8	3.5	2.5	3.6	3.2	3.4	2.3	4.1	3.0	3.2
	45–54	7.8	5.7	7.4	10.0	6.0	9.5	6.8	14.6	5.3	7.7	5.6	7.1
	55–64	16.1	13.0	18.0	27.5	16.9	18.9	12.5	20.5	13.6	14.7	10.0	15.4
	65–74	32.7	30.9	36.9	35.5	36.3	36.8	28.3	30.1	27.0	26.4	15.1	31.7
	75–84	60.1	55.9	69.1	64.9	58.7	64.9	57.7	49.0	52.0	47.0	18.1	57.0
	85+	80.9	86.3	81.5	64.7	65.1	83.1	88.3	75.3	76.3	76.3	14.2	73.6
	Total	9.7	8.9	10.1	11.3	9.1	10.8	8.9	10.3	7.9	9.2	5.4	9.3
2023–27	<45	3.3	3.2	2.7	3.6	2.3	3.6	3.2	3.6	2.3	4.6	3.1	3.2
	45–54	7.9	5.2	7.9	10.0	6.4	9.1	7.6	12.6	5.5	8.2	5.6	7.0
	55–64	16.5	13.2	18.0	27.5	18.3	20.1	11.9	23.3	13.9	15.1	10.1	15.5
	65–74	32.7	29.4	34.7	41.9	32.0	37.4	28.5	35.7	26.5	26.2	15.2	31.8
	75–84	59.8	57.1	68.5	62.0	64.2	64.7	56.2	50.8	52.8	46.7	18.2	57.3
	85+	83.0	87.8	85.4	62.8	67.0	88.9	89.5	50.9	69.7	77.1	14.3	73.4
	Total	9.8	8.8	10.0	11.7	9.0	11.0	8.9	10.6	7.8	9.6	5.4	9.3
2028–32	<45	3.3	3.2	2.8	3.7	2.2	3.7	3.2	3.6	2.3	5.1	3.1	3.3
	45–54	7.7	5.6	7.0	10.3	8.1	8.5	7.5	11.3	4.6	9.0	5.7	7.2
	55–64	17.0	12.2	17.8	25.6	15.0	21.1	13.5	24.8	13.2	15.9	10.2	15.7
	65–74	33.3	28.8	36.1	49.2	36.0	37.7	28.2	44.5	25.5	26.5	15.4	32.3
	75–84	58.6	55.6	65.3	60.1	57.4	65.9	53.4	46.7	53.9	46.2	18.4	58.2
	85+	85.2	94.3	83.0	68.8	83.0	90.4	87.5	70.8	72.3	77.1	14.5	75.2
	Total	9.8	8.8	9.8	12.1	9.0	11.1	8.9	11.3	7.7	10.1	5.5	9.5

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

TABLE 4.24.1
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), all other cancers, males, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	635	75	65	15	20	260	155	10	20	5	5	0
	45–54	730	90	65	15	25	315	170	15	20	5	10	0
	55–64	1245	155	105	30	40	500	320	25	45	5	20	5
	65–74	1790	215	150	55	65	705	470	35	60	10	25	5
	75–84	1895	235	155	60	75	705	535	35	65	10	20	0
	85+	710	90	55	25	35	240	215	20	25	5	5	0
	Total	7005	865	595	205	260	2725	1865	135	230	30	80	10
2008–12	<45	615	65	65	10	20	275	155	10	15	0	5	0
	45–54	800	95	75	15	20	380	180	15	20	5	10	0
	55–64	1520	185	125	35	45	660	375	30	45	5	20	0
	65–74	2025	235	160	55	65	825	535	35	70	10	25	5
	75–84	2165	270	180	60	70	810	645	40	65	15	15	0
	85+	1015	135	75	35	40	350	340	20	30	5	5	0
	Total	8140	975	680	205	255	3300	2220	145	245	40	80	15
2013–17	<45	630	65	65	10	15	310	155	10	15	0	5	0
	45–54	755	80	70	15	20	385	160	15	20	5	5	0
	55–64	1775	200	155	35	45	830	415	30	45	5	20	0
	65–74	2480	290	195	60	70	1045	645	45	80	15	30	5
	75–84	2380	290	190	60	70	910	715	45	70	20	20	5
	85+	1315	160	105	35	45	475	455	20	30	5	5	0
	Total	9340	1085	780	210	265	3960	2540	160	260	50	85	15
2018–22	<45	660	70	55	10	15	340	160	10	15	0	5	0
	45–54	660	65	75	10	15	355	130	15	15	5	5	0
	55–64	1915	215	160	35	45	980	415	30	45	10	20	5
	65–74	3010	350	250	65	75	1330	740	50	90	15	35	5
	75–84	2810	335	225	65	80	1095	840	45	85	20	20	5
	85+	1550	190	125	40	45	560	550	25	35	10	5	0
	Total	10 605	1220	890	225	275	4655	2835	175	280	60	90	15
2023–27	<45	695	75	50	10	15	380	165	10	15	0	5	0
	45–54	630	60	75	5	15	355	120	10	10	0	5	0
	55–64	1815	200	155	35	45	965	370	30	45	10	15	5
	65–74	3515	405	310	70	85	1635	815	50	90	20	40	5
	75–84	3525	430	285	80	95	1400	1025	60	105	25	30	5
	85+	1780	210	140	40	50	660	620	30	40	10	5	0
	Total	11 960	1375	1020	240	300	5400	3115	195	305	70	100	20
2028–32	<45	725	75	50	10	20	405	175	10	15	0	5	0
	45–54	645	65	70	5	15	380	115	10	15	0	5	0
	55–64	1605	165	165	25	35	885	305	30	35	10	15	0
	65–74	3830	440	330	75	90	1905	825	50	95	25	40	10
	75–84	4360	535	380	90	105	1790	1200	75	120	30	35	5
	85+	2225	265	180	50	60	820	790	30	50	10	10	0
	Total	13 390	1545	1170	255	325	6185	3415	210	330	75	105	20

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

TABLE 4.24.2
Observed (2003–2007) and projected average annual new cases by age and province/territories combined (TC), all other cancers, females, Canada, 2003–2032

Period	Age	New cases											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	625	65	60	20	20	280	135	10	15	0	10	0
	45–54	740	85	70	20	20	305	185	15	25	0	10	0
	55–64	1070	130	100	30	35	410	275	20	35	5	20	5
	65–74	1425	180	115	45	50	555	380	25	50	10	20	0
	75–84	1955	235	150	65	70	715	585	40	65	10	20	0
	85+	1185	155	85	45	40	385	405	25	40	5	5	0
	Total	6995	845	585	220	245	2645	1965	135	225	30	90	10
2008–12	<45	645	70	70	15	20	280	135	15	15	5	10	0
	45–54	825	95	85	25	25	355	195	15	25	5	15	0
	55–64	1360	165	135	40	40	525	350	25	40	5	25	5
	65–74	1660	215	140	50	55	635	440	30	60	10	25	5
	75–84	2100	250	185	70	70	775	645	35	70	10	20	0
	85+	1610	205	120	50	55	535	565	25	45	5	10	0
	Total	8195	1000	735	245	270	3110	2330	145	255	35	105	15
2013–17	<45	690	75	80	20	25	305	140	15	15	5	10	0
	45–54	820	95	90	20	25	380	165	20	20	5	15	0
	55–64	1625	195	170	50	50	640	415	25	50	5	30	5
	65–74	2085	265	195	60	65	790	555	35	70	10	40	5
	75–84	2250	280	205	70	70	840	685	35	80	10	25	5
	85+	1920	245	150	60	65	635	710	30	50	10	10	0
	Total	9395	1155	895	275	295	3590	2670	165	285	45	125	15
2018–22	<45	725	80	90	20	25	325	140	15	15	5	10	0
	45–54	790	95	90	20	25	370	150	25	20	5	15	0
	55–64	1775	215	195	55	50	740	410	35	55	10	30	5
	65–74	2580	320	265	75	75	985	680	45	80	15	50	5
	75–84	2615	335	235	75	80	965	800	45	95	10	30	5
	85+	2145	270	190	60	70	725	785	30	55	10	10	0
	Total	10 625	1315	1070	305	320	4115	2965	190	320	50	150	20
2023–27	<45	750	85	95	20	25	340	140	15	15	5	10	0
	45–54	810	95	95	25	25	390	140	20	15	5	15	0
	55–64	1715	215	195	50	50	770	345	40	45	10	35	5
	65–74	3010	375	325	90	90	1180	775	55	95	15	60	5
	75–84	3275	410	325	90	95	1200	995	60	115	15	45	5
	85+	2355	315	195	65	65	805	875	35	65	10	10	0
	Total	11 920	1495	1230	340	350	4685	3270	220	355	55	175	25
2028–32	<45	760	90	100	20	25	345	140	15	15	5	10	0
	45–54	840	105	100	25	25	420	130	20	15	5	15	0
	55–64	1640	210	195	50	50	755	305	45	40	5	35	5
	65–74	3270	405	360	100	95	1355	770	65	105	15	65	10
	75–84	4050	500	435	115	115	1505	1215	75	130	20	60	10
	85+	2840	375	255	75	80	960	1055	40	80	15	15	5
	Total	13 405	1685	1445	385	390	5345	3610	260	385	60	200	25

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

Note: Totals may not add up due to rounding.

TABLE 4.24.3
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), all other cancers, males, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	6.2	6.0	5.6	4.8	5.8	6.5	6.7	5.5	6.3	5.9	3.9	4.3
	45–54	29.4	27.7	25.6	22.0	27.4	34.0	28.2	22.3	24.9	23.9	20.6	20.6
	55–64	72.9	65.7	67.4	66.5	66.8	78.9	73.4	53.1	77.7	74.0	63.4	71.5
	65–74	165.9	140.7	164.6	158.8	177.3	172.3	175.5	131.2	179.5	163.8	120.3	151.8
	75–84	305.2	261.1	307.1	257.5	304.0	294.1	370.2	228.3	340.1	315.8	189.6	241.5
	85+	466.4	370.5	432.8	364.7	470.1	424.7	677.0	427.4	439.9	584.5	214.4	145.1
	Total	40.7	35.5	39.0	35.2	40.5	41.6	46.1	32.2	42.7	41.4	27.6	31.8
2008–12	<45	6.1	5.0	5.3	3.9	4.9	7.0	6.7	5.3	5.7	5.1	4.9	2.8
	45–54	29.2	25.7	24.7	19.5	22.4	36.0	27.3	21.0	25.2	24.3	19.3	28.4
	55–64	73.8	63.5	63.1	57.4	60.4	86.4	73.4	56.9	69.3	62.7	52.7	34.6
	65–74	163.6	132.9	152.4	145.4	155.5	177.9	171.2	109.8	171.8	180.2	113.3	215.5
	75–84	308.4	261.3	307.0	253.4	289.6	298.9	381.3	240.0	317.1	436.3	156.3	232.8
	85+	484.5	403.0	433.8	386.2	432.8	433.5	736.5	373.0	492.6	644.4	147.4	239.3
	Total	40.9	34.3	37.6	32.7	36.4	43.4	46.8	30.7	40.8	46.0	24.9	33.5
2013–17	<45	6.1	4.7	4.9	3.1	4.5	7.7	6.7	4.9	5.1	5.1	4.7	2.8
	45–54	27.5	21.9	23.4	17.9	19.7	34.9	25.7	23.6	27.9	24.3	14.6	30.0
	55–64	75.5	62.1	63.9	51.3	54.6	94.0	73.2	51.2	61.6	72.7	54.5	28.9
	65–74	159.5	130.0	141.3	133.1	136.9	180.0	165.8	104.6	159.5	167.9	99.9	197.6
	75–84	307.1	252.8	290.8	249.3	269.2	307.3	377.4	232.4	306.1	501.6	146.0	298.3
	85+	492.1	386.2	455.2	387.7	439.7	446.0	756.9	348.1	448.3	694.8	124.3	258.6
	Total	40.6	32.9	36.1	30.5	33.4	45.0	46.3	29.4	38.2	48.9	22.9	34.5
2018–22	<45	6.2	4.7	4.1	2.8	4.2	8.1	6.9	4.9	5.3	5.1	4.6	2.8
	45–54	26.0	17.9	25.4	14.4	17.9	34.7	23.5	25.2	23.2	24.3	12.8	31.1
	55–64	73.7	60.4	58.9	48.1	51.7	97.0	68.1	49.0	59.2	80.3	51.1	38.2
	65–74	159.1	128.6	138.8	120.1	120.5	187.6	162.1	104.5	147.7	187.9	98.8	130.0
	75–84	302.3	244.1	279.7	248.9	258.3	310.3	367.9	202.2	297.0	436.5	139.8	311.2
	85+	489.1	388.1	446.1	379.6	408.6	444.2	755.6	361.5	418.1	816.6	123.5	404.3
	Total	40.1	31.9	34.7	28.6	30.9	46.1	45.1	28.4	36.2	49.8	22.0	32.7
2023–27	<45	6.3	4.8	3.8	2.7	4.0	8.6	7.0	4.9	5.1	5.1	4.6	2.8
	45–54	24.7	16.2	25.1	10.0	18.0	35.4	21.1	22.5	19.9	24.3	12.0	31.7
	55–64	69.6	54.2	57.0	46.9	49.1	92.5	63.0	53.6	65.2	84.3	45.0	38.9
	65–74	160.6	128.7	141.2	113.4	115.3	197.1	157.6	96.6	133.8	198.6	110.9	104.6
	75–84	293.2	243.5	262.7	235.8	236.7	307.8	351.1	198.7	279.1	389.7	133.7	277.4
	85+	483.8	373.5	421.0	391.2	401.7	454.4	728.1	335.1	419.7	811.6	123.7	418.1
	Total	39.4	31.1	33.6	27.2	29.4	46.8	43.3	27.5	34.7	49.2	21.9	30.1
2028–32	<45	6.4	4.8	3.5	2.6	4.3	8.9	7.3	4.9	4.9	5.1	4.5	2.8
	45–54	24.0	17.3	21.4	8.5	15.3	35.9	19.3	22.4	22.6	24.3	11.2	32.3
	55–64	66.0	46.2	61.4	40.2	46.1	90.4	57.9	58.2	57.6	88.5	42.7	39.6
	65–74	156.4	126.2	132.5	109.8	112.4	199.4	146.6	92.9	131.7	209.7	107.9	131.8
	75–84	292.9	242.8	264.0	219.7	216.7	317.8	342.5	196.1	261.4	408.8	141.4	183.0
	85+	473.0	368.1	416.9	392.1	391.7	446.8	710.7	282.4	399.4	603.4	123.2	428.4
	Total	38.7	30.2	32.7	25.6	28.0	47.3	41.7	27.0	33.2	48.8	21.7	28.8

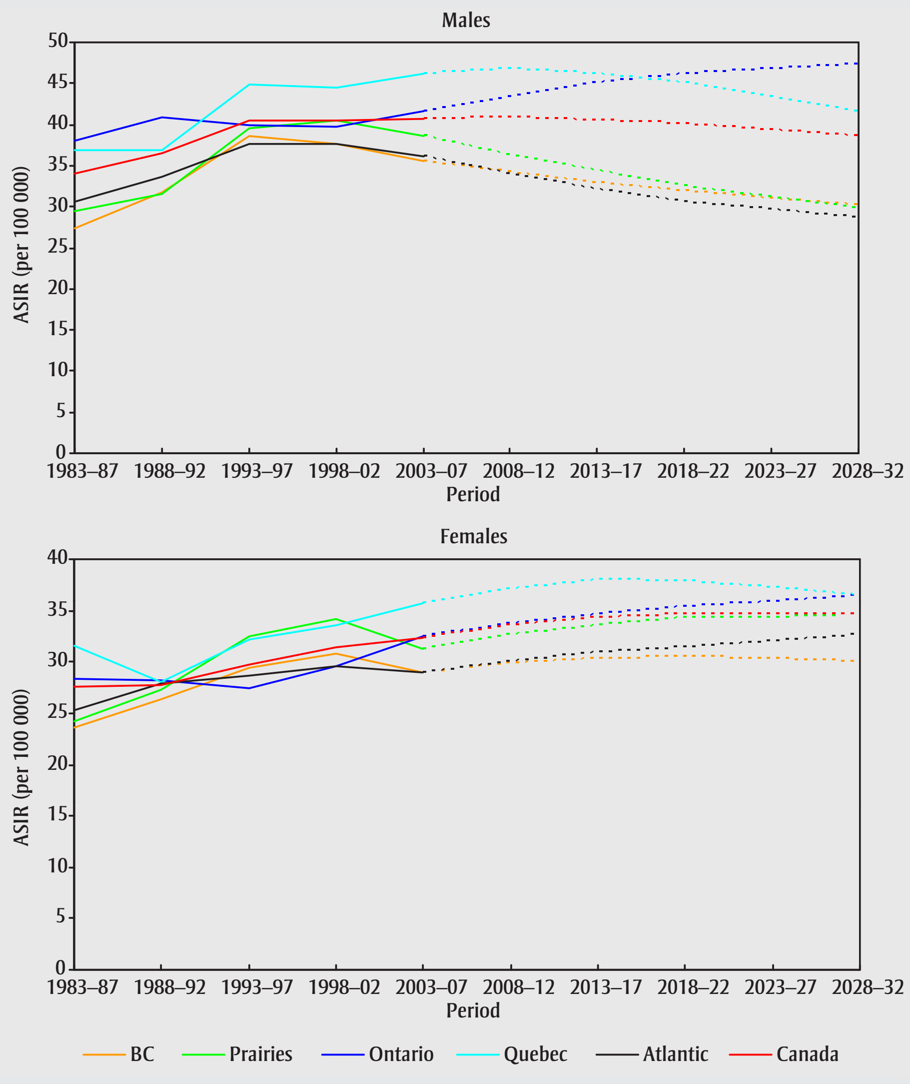
Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

TABLE 4.24.4
Observed (2003–2007) and projected age-standardized incidence rates (ASIRs) by age and province/territories combined (TC), all other cancers, females, Canada, 2003–2032

Period	Age	ASIRs											
		CA	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	TC
2003–07	<45	6.3	5.0	5.8	6.3	6.2	7.1	6.1	5.3	5.3	4.6	6.7	4.0
	45–54	29.6	25.1	29.1	27.2	25.6	32.4	30.4	21.3	30.3	15.2	22.1	20.0
	55–64	60.7	54.9	66.2	63.9	60.3	62.4	59.9	47.1	64.6	47.2	62.7	71.1
	65–74	119.1	112.9	119.9	114.0	118.7	120.2	123.1	82.1	128.3	176.1	111.7	112.4
	75–84	221.1	199.2	218.1	204.5	202.5	208.4	265.3	168.2	233.9	270.9	166.8	244.3
	85+	345.4	318.3	307.9	281.9	258.2	305.1	497.9	268.3	304.9	235.9	121.5	289.6
	Total	32.3	29.0	32.0	30.8	30.2	32.5	35.6	24.4	32.7	33.0	27.2	30.4
2008–12	<45	6.5	5.5	6.3	6.1	5.9	7.2	6.2	6.8	5.2	6.4	6.7	4.6
	45–54	30.3	25.3	30.1	29.4	26.6	33.8	29.8	26.3	30.3	27.4	29.2	27.9
	55–64	63.6	54.7	69.0	64.9	55.3	65.5	66.4	44.5	61.5	64.3	66.2	69.0
	65–74	122.5	116.3	124.9	125.2	117.6	123.3	126.6	88.0	138.1	129.6	115.0	139.7
	75–84	227.1	204.1	248.4	222.2	212.9	216.3	273.3	156.9	250.2	221.6	165.6	216.7
	85+	369.8	338.8	351.1	293.3	303.1	324.7	539.5	227.5	308.1	328.6	134.8	257.2
	Total	33.5	29.9	34.6	32.5	30.5	33.7	37.2	25.3	33.6	33.1	28.6	32.1
2013–17	<45	6.8	5.6	6.7	6.7	6.3	7.6	6.3	6.7	5.4	6.6	6.7	4.5
	45–54	30.3	26.0	32.0	29.2	26.6	35.0	27.4	37.0	26.8	28.1	34.1	27.1
	55–64	66.8	57.0	72.7	68.8	58.3	69.5	70.6	45.2	66.3	65.7	70.8	66.7
	65–74	123.7	112.5	135.3	127.9	115.1	123.5	129.7	86.6	131.8	132.4	131.1	137.5
	75–84	230.2	212.1	249.9	233.3	211.0	220.9	277.9	156.9	261.3	226.6	157.3	216.8
	85+	376.8	345.8	357.8	320.4	304.1	327.0	565.5	229.8	335.6	335.0	143.4	263.1
	Total	34.3	30.4	36.2	34.0	30.8	34.7	37.9	26.4	34.1	33.8	30.4	31.6
2018–22	<45	6.8	5.7	7.1	6.5	6.2	7.6	6.0	6.6	5.4	6.6	6.7	4.5
	45–54	31.6	26.8	34.2	32.6	29.0	36.5	27.6	43.0	26.7	28.3	39.5	26.6
	55–64	67.1	57.7	72.8	72.3	58.7	71.8	66.9	53.3	68.6	66.3	76.0	64.6
	65–74	126.1	110.0	141.4	131.2	111.3	127.0	136.4	88.9	127.0	133.7	139.5	134.0
	75–84	230.9	214.4	247.3	238.2	212.9	222.2	279.3	158.6	262.0	228.3	162.2	214.9
	85+	380.1	344.1	395.9	332.1	314.5	335.0	557.5	211.0	348.4	338.0	153.5	265.3
	Total	34.6	30.5	37.4	35.1	30.9	35.4	37.9	27.7	34.1	34.1	32.3	31.1
2023–27	<45	6.8	5.6	7.4	6.4	5.9	7.6	6.0	6.6	5.6	6.6	6.7	4.4
	45–54	31.8	26.6	32.9	36.7	31.1	38.1	25.2	42.7	26.7	28.3	39.4	26.3
	55–64	65.6	57.6	73.7	70.9	57.7	73.1	60.0	72.9	60.8	66.3	85.8	63.0
	65–74	128.8	111.8	143.5	136.5	114.1	131.6	139.6	91.3	134.7	133.8	149.2	129.7
	75–84	228.4	204.1	257.9	240.1	203.6	219.6	278.9	159.0	247.2	228.8	183.4	211.7
	85+	376.8	359.1	356.5	344.5	296.3	335.2	562.6	228.0	357.2	338.5	134.5	264.1
	Total	34.6	30.3	37.7	35.9	30.5	35.9	37.3	29.7	33.7	34.1	34.4	30.4
2028–32	<45	6.8	5.6	7.7	6.0	5.8	7.5	6.0	6.6	5.6	6.6	6.7	4.3
	45–54	31.1	26.5	32.8	35.9	30.1	38.6	22.1	42.4	25.5	28.4	39.4	25.9
	55–64	66.9	58.5	76.9	77.3	60.7	74.9	59.3	84.9	59.5	66.4	98.0	61.8
	65–74	127.5	111.6	140.8	141.3	114.1	134.9	130.5	107.0	135.4	133.6	157.4	125.7
	75–84	230.8	199.2	264.1	244.2	198.5	225.0	288.3	163.5	238.4	228.5	193.1	206.2
	85+	375.4	348.9	372.4	343.1	311.4	335.1	551.9	220.9	348.1	338.7	155.0	261.1
	Total	34.6	30.1	38.4	36.6	30.5	36.5	36.5	31.8	33.1	34.1	36.5	29.7

Abbreviations: AB, Alberta; BC, British Columbia; CA, Canada; MB, Manitoba; NB, New Brunswick; NL, Newfoundland and Labrador; NS, Nova Scotia; ON, Ontario; PE, Prince Edward Island; QC, Quebec; SK, Saskatchewan; TC, All Territories (Yukon, Northwest Territories and Nunavut).

FIGURE 4.24.1
Age-standardized incidence rates (ASIRs) by region, all other cancers, 1983–2032



2007. During this period, the most frequently diagnosed cancers were cancers of other digestive system (10% in males and 12% in females), soft tissue including heart (8% in males and 6% in females), and all other and unspecified primary sites (47% in both males and females). Mesothelioma accounted for a larger proportion of cancers in males (5%) compared with females (1%). The number of Canadian males diagnosed with mesothelioma rose from 153 cases in 1984 to 420 cases in 2007 (data not shown) because of exposure to asbestos in the 1950s, 1960s and 1970s.[311] The incidence rate also increased from 1.4 to 2.3 per 100 000.

Cancer of other female genital system organs accounted for 11% of this category in females. The remaining represented cancers of minor sites, in particular the digestive and respiratory systems, and the urinary organs. The vast diversity of this category makes it difficult to identify the reason for the projected trends.

The presence of numerous types of rare and complex cancers in this category makes it a challenge for either the cancer care system or researchers to deal with. One implication is that there may be value in research that examines multiple rare cancers that contribute to this group.

Chapter 5: Discussion

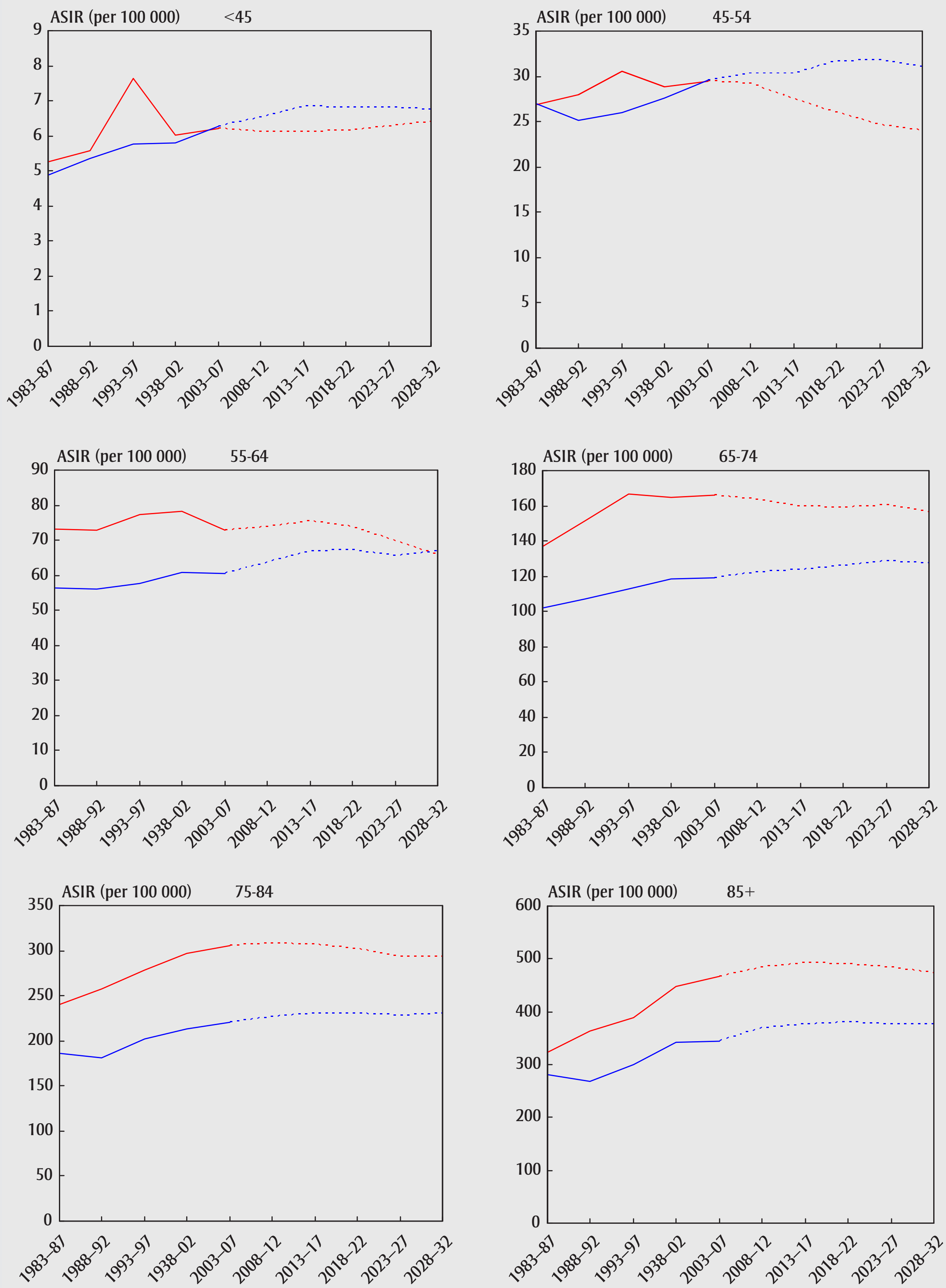
Main findings

In this monograph we show that the ASIRs for all cancers combined in Canada are not projected to change substantially from 2003–2007 to 2028–2032. The rates are expected to decrease by 5% in males, from 464.8 to 443.2 per 100 000, and to increase by 4% in females, from 358.3 to 371.0 per 100 000 (Figure 3.3). The decrease in lung cancer rates in males 65 or older and of prostate cancer in those 75 or older will contribute to the overall decrease in cancer rates in males, given that these 2 cancers account for about 40% of all new cancer cases in Canadian males. The predicted overall increase in cancer rates for females is primarily the result of increasing lung cancer rates in women aged 65 or older; it also represents the expected increase in cancers of uterus, thyroid, breast (in females under 45), leukemia, pancreas, kidney and melanoma.

The annual number of newly diagnosed cancer cases is projected to increase by 84% in males, from 80 810 in 2003–2007 to 148 370 in 2028–2032, and by 74% in females, from 74 165 to 128 830 over the same period. Our decomposition analysis of the drivers of change illustrated that the projected rise in the number of new cancer cases will primarily come from the structural aging of the Canadian population and, to a lesser extent, the increase in population size. Changes in the risk of cancer will contribute little to the increase in new cases, especially for males.

Between 2003–2007 and 2028–2032, significant risk reductions are projected for major common tobacco-related cancers, albeit with relatively lower reductions or delayed downturns in females. The incidence of smoking-related cancers is projected to decrease by 2% to 59% for oral cancer in males, cervical and esophageal cancer in females, and larynx, lung, stomach and bladder cancers in both sexes, while an increase of 0.6% to 7% is expected for kidney cancer, leukemia and pancreas cancer in both sexes, oral cancer in females, and esophageal cancer in males. The differences in incidence trends of the tobacco-related cancers

FIGURE 4.24.2
Age-standardized incidence rates (ASIRs) for all other cancers by age group (– males, – females), Canada, 1983–2032



between males and females reflect the differences in histories of tobacco use.[42,43] Given the lag of 20 years or more between the drop in smoking rates and the decrease in cancer incidence rates, it is likely that incidence rates in females will begin to drop more noticeably for the tobacco-related cancers with projected stable or marginally decreased trends over the longer term.

Over the 25-year projection period, the incidence rates for cancers associated with excess weight and physical inactivity are estimated to rise by 0.6% to 16% for cancers of uterus, kidney, pancreas, female breast and male esophagus, in descending order. Incidence rates for colorectal and female esophageal cancer, also associated with excess weight and physical inactivity, are estimated to fall by 2% to 6%. Increased obesity prevalence in Canada may contribute to the increased incidence trends of these cancers.[51,72,73,110] Weight control and physical activity may represent opportunities for modifying the risk of developing these cancers.

The most common cancers caused by chronic infections are cancers of cervix, caused by human papilloma virus (HPV), stomach, caused by *Helicobacter pylori (H. pylori)*, and liver, caused by hepatitis B virus (HBV) and hepatitis C virus (HCV). The ongoing increasing trend of liver cancer incidence in Canada is possibly linked to the historical increase and continued high incidence in HCV infection,[98] the aging of the population previously infected and increasing immigration from areas where risk factors, such as HBV, are prevalent.[75,104,105] The persisting decrease in incidence of stomach cancer may be explained by improved healthy behaviours, such as decreased smoking and changes in diet,[82] and increased recognition and treatment of infection with *H. pylori*.[36,83] The continuing downward trend in the rates of cervical cancer is mainly attributable to general population screening with the Papanicolaou (Pap) test and successful treatment of screening-detected precancerous lesions. The immunization of school-aged children with HPV vaccine is anticipated to further reduce incidence of cervical cancer.

The incidence rates for all cancers combined are projected to continue to be highest for males in the Atlantic region and for females in Quebec in 15 years but in Ontario thereafter, and lowest in British Columbia. The cancer-specific analysis shows that the highest incidence rates in males are projected to be in the Atlantic region for cancers of oral, esophagus, stomach, colorectum, pancreas, larynx, melanoma, prostate, kidney and non-Hodgkin lymphoma (NHL); in Ontario for melanoma, thyroid, NHL and leukemia; and in Quebec for cancers of larynx, lung, bladder, central nervous system (CNS), Hodgkin lymphoma and multiple myeloma. For females, the elevated incidence rates are predicted in the Prairies for cervical cancer; in Ontario for multiple myeloma, leukemia, oral, stomach, breast, uterus, ovary and thyroid cancers; in Quebec for cancers of pancreas, lung, bladder, CNS and Hodgkin lymphoma; and in the Atlantic region for cancers of colorectal, larynx, melanoma, kidney and NHL.

While British Columbia is projected to continue to have the lowest incidence rates for majority of cancers in both males and females, this province will continue to experience the highest rates of esophageal cancer in females, liver cancer in both sexes, and testis cancer. The Atlantic region is projected to have the lowest rates for breast, uterus and ovarian cancers, and for liver and leukemia in both sexes, but elevated rates in males for about half the cancers studied (listed above).

The differences in incidence rates in regions are influenced in part by variation in the past prevalence of risk factors across the country, in keeping with lengthy time lags between exposure and cancer outcomes. Cancer risk factors include cigarette smoking, alcohol consumption, obesity, physical inactivity, diet/nutrition, radiation, some chronic infections, medicinal drugs, immunosuppression, occupational and environmental contaminants, and genetic susceptibility. The historically higher smoking rates in Quebec and Atlantic Canada likely account for the higher incidence rates of lung cancer in these regions. The higher rates of liver cancer in British Columbia is possibly linked to the higher HCV rates in this province.[297] In addition, the high incidence rates of liver cancer and of esophagus cancer in females in British Columbia could partially be explained by high number of immigrants from South Asia and China where HBV is endemic.[75-78] Significantly higher incidence rates of liver cancer have been found in immigrants from South-East Asia and North-East Asia in Canada.[104] Compared to Canada, the rate of esophageal cancer is significantly higher in Asia, including China and Central Asia, especially in females.[312] The geographical variation in cancer incidence may also be due to the availability of screening and diagnostic services for breast, colorectal, prostate and cervical cancers, and the different rates of participation in formal screening programs (e.g. mammographic screening for breast cancer) or other screening procedures (e.g. prostate-specific antigen [PSA] testing for prostate cancer). Finally, the variation in cancer registry practices could also explain some of the geographical differences in cancer distribution (see the section ''Data quality issues'' below). Low rates of prostate cancer and melanoma in Quebec are likely the result of the registry relying on hospitalization data and missing cancers diagnosed and treated outside the hospitals.[130]

Prostate, colorectal, lung and bladder cancers figure among the top 4 most common cancers newly diagnosed in males in 1983–1987, 2003–2007 and 2028–2032. However, prostate cancer replaced lung cancer as the most frequent in 2003–2007, and colorectal cancer is projected to overtake lung cancer as the second most frequently diagnosed cancer in males by 2028–2032. For females, breast, lung, colorectal and uterine cancers are the leading incident cancers in these 3 periods, but colorectal cancer—the second most common type of cancer in 1983–1987—is ranked third as of 2003–2007. Thyroid cancer will replace NHL as the fifth most common cancer in females by 2028–2032.

TABLE 5.1
Changes in average annual new cases and age-standardized incidence rates (ASIRs) for cancers by sex, Canada, from 2003–2007 to 2028–2032

Cancer Type	Males						Females					
	Number of cases			ASIR (per 100 000)			Number of cases			ASIR (per 100 000)		
	2003–07	2028–32	change (%)[a]	2003–07	2028–32	change (%)	2003–07	2028–32	change (%)[a]	2003–07	2028–32	change (%)
All cancers	80 810	148 370	83.6	464.8	443.2	−4.6	74 165	128 830	73.7	358.3	371.0	3.6
Oral	2285	3595	57.5	12.6	11.8	−6.0	1085	1760	62.4	5.2	5.3	1.6
Esophagus	1095	2110	92.7	6.2	6.2	0.6	385	690	79.5	1.7	1.7	-2.3
Stomach	1925	2680	39.1	11.1	7.7	−30.0	1080	1425	31.6	4.9	3.7	-23.7
Colorectal	10 620	19 815	86.6	60.8	57.0	−6.3	9010	15 260	69.4	41.0	38.6	-6.1
Liver	1025	2845	177.8	5.7	8.2	43.3	350	760	116.6	1.6	1.9	15.1
Pancreas	1810	3635	100.7	10.3	10.5	1.4	1900	3730	96.2	8.5	9.1	7.1
Larynx	900	900	0.0	5.1	2.7	−47.5	195	145	-25.9	1.0	0.4	-58.8
Lung	12 245	16 420	34.1	70.7	46.4	−34.4	9865	15 945	61.6	47.1	39.6	-15.9
Melanoma	2320	4065	75.4	13.1	12.4	−5.8	2055	3465	68.7	10.7	11.2	4.6
Breast							20 110	31 255	55.4	97.9	98.7	0.7
Cervix							1345	1435	6.8	7.6	6.1	-20.2
Body of uterus							4105	7700	87.6	19.9	23.1	16.2
Ovary							2385	3650	53.1	11.6	11.1	-4.0
Prostate	21 460	42 225	96.8	123.3	123.3	0.1						
Testis	825	1070	29.7	5.6	6.0	8.5						
Kidney	2580	5020	94.7	14.4	15.5	7.4	1665	3070	84.4	8.0	8.6	6.8
Bladder	4815	8825	83.4	27.9	24.0	−13.9	1705	3030	78.0	7.7	7.3	-6.1
Central nervous system	1365	1965	43.8	7.9	7.1	−10.4	1055	1470	39.1	5.6	5.2	-7.6
Thyroid	795	1895	138.8	4.5	7.0	54.5	2810	6910	145.9	16.1	26.5	64.8
Hodgkin lymphoma	490	615	26.6	3.1	3.0	−3.4	395	500	26.3	2.5	2.3	-6.8
Non-Hodgkin lymphoma	3455	6050	75.0	19.7	18.1	−8.3	2915	5180	77.7	14.1	14.3	1.4
Multiple myeloma	1065	2395	125.1	6.1	6.8	11.3	875	1685	92.2	4.0	4.2	4.0
Leukemia	2570	5095	98.3	15.1	15.8	4.5	1875	3520	87.6	9.2	9.8	6.9
All other cancers	7005	13 390	91.1	40.7	38.7	−5.1	6 995	13 405	91.6	32.3	34.6	7.0

[a] change was calculated before rounding.

Mistry et al.[4] projected cancer incidence in the UK for 2008–2030 based on 1975–2007 data and using a method similar to the Nordpred package. The years 2007 and 2030 are used here to approximate the periods 2003–2007 and 2028–2032, and correspondingly, to compare projections between Canada and the UK. As in Canada (Table 5.1), almost no change is projected in the ASIRs of all cancers combined from 2007 to 2030 in the UK. Sites with similar projected decreases in ASIRs in both countries included cancers of stomach and CNS. Oral cancer incidence rates in Canada are projected to decrease in males by 6% from 2007 to 2030 and remain stable in females, in contrast to the increases of 25% in males and 21% in females in the UK. However, the rates for 2007 in Canada were higher than those in the UK by 15% in males and 13% in females. The predicted changes in ASIRs for colorectal cancer are below the medians in all cancers, with a decrease of 6% for both sexes in Canada, whereas the rates in the UK are expected to decrease by a similar amount in males but increase by 2% in females. The incidence rates of laryngeal cancer are estimated to decrease about 2 times faster in Canada than in the UK in both sexes. For lung cancer, the ASIRs are projected to decrease by 34% in males and 16% in females in Canada, compared with a predicted decrease of 8% in males and increase of 7% in females in the UK. The ASIR of ovarian cancer is expected to decrease to a greater extent in the UK than in Canada (28% vs. 4%). Breast cancer incidence is expected to show the smallest change (increase of less than 1%) over the entire 25-year forecasting horizon in all cancer sites in Canadian females. Similar to Canada, breast cancer incidence rate in females is not predicted to change substantially in the next 25 years in the UK.

The ASIRs of liver cancer in males are projected to rise by 43% in Canada and 27% in the UK from the similar level in 2007, whereas the rates in females are estimated to increase by 15% in Canada but level off with a 2% fall in the UK. However, the UK rate in females for 2007 was 69% higher than the Canadian rate. A 52% increase in melanoma rates is projected for males and females in the UK from 2007 to 2030, while Canadian rates are predicted to decrease by 6% in males and increase by 5% in females. Melanoma incidence rates in the UK were similar to Canadian rates in males and slightly higher in females in 2007. The ASIR of uterus cancer is projected to rise more rapidly in Canada (16% vs. 4%) from the same level in 2007. Increases in kidney cancer rates in females are projected in both the UK and Canada to about the same level, but the rate in 2007 in Canada was 10% higher than that in the UK. Conversely, the rates in males were the same in the both countries in 2007, but are estimated to increase 4 times faster in the UK between 2007 and 2030. The ASIRs of thyroid cancer are estimated to increase at 55% for Canadian males and 65% for Canadian females, but are not shown in the UK study. In both sexes, the rates of multiple myeloma and leukemia are projected to decrease by 14% to 23% from 2007 to 2030 in the UK but increase by 4% to 11% in Canada. Recent relatively stable rates of multiple myeloma in Canada have been mapped to these future trends.

Data quality issues

Although the standardization of case ascertainment, definition and classification has improved the registration of cancer cases and comparability of data across the country, reporting procedures, accuracy and completeness still vary.[1] International Agency for Research on Cancer (IARC) rules[313] for multiple primaries were used for cases from the Canadian Cancer Registry (CCR), whereas during the period covered by the National Cancer Incidence Reporting System (NCIRS), registries other than Quebec and Ontario used multiple primary rules that allowed a small percentage of additional cases.

Non-melanoma skin cancer is difficult to register completely because it is quite plentiful and may be diagnosed and treated in a variety of settings. Most provincial and territorial cancer registries do not register these cases. For this reason, non-melanoma skin cancer is excluded from our analysis.

For the observed data years covered by this analysis, death certificate only (DCO) cases were not reported to CCR by Quebec and Newfoundland and Labrador, with the exception of the 2000–2006 Quebec data and 2007 Newfoundland and Labrador data. The number of DCO cases for 2007 in Quebec was estimated by averaging the numbers in 2002–2006. This missing reporting has likely led to underestimates of the incidence rates in these provinces, especially for highly fatal cancers such as lung and pancreas. In Canada, the number of DCO cases is less than 2% of the total new cancer cases. In addition, the incidence of some cancers in Quebec, particularly for those that rely more heavily on pathological diagnosis, are underestimated as a result of the registry's dependence on hospitalization data. Prostate cancer, melanoma and bladder cancer estimates are affected.[130] Owing to changes to the Quebec registry that increase registration for data after 2007, the number of melanoma cases is underestimated in the current report.

Comments on methods and results

Our model comparison exercise, based on the more recent observed data (2008–2010) which were not available when present study was undertaken, addressed the accuracy of the projection methods used in this monograph. For example, Table 5.2 presents the medians of the absolute relative differences between the observed and projected average annual number of cases at the national level only and across the provinces in 1992–2010 by length of projection for the combinations of cancer site (excluding prostate cancer), sex and province (excluding Quebec, see Chapter 2 for details), not listed in Table 2.3. The projected numbers were calculated by the projection method used in this monograph (denoted as PHACpred, which therefore only includes the Nordpred APC models (NP_ADPC) with the Nordpred standard drift (D) reduction and its modifications), and the 3 versions of NP_ADPC with its standard drift reduction: using the average trend over the whole observation period for projections (M0F); using the slope between the 2 most recent periods for projections (M0T); and automatically determining whether the recent trend (or the average trend) is projected based on a significance test for departure from a linear trend (M0A). The medians are shown with and without all male cancers combined. The table shows that the medians from PHACpred are the smallest in the 4 models for any length of projection period. The differences in the medians among the 4 models or between PHACpred and M0A are not statistically significant when across the provinces (each $p \geq .05$), but are statistically significant for national-level 15- and 20-year projections. The performances of M0F and M0T were published for the population of the 4 Nordic countries.[15] In this study, Moller et al.[15] made projection model comparisons for 20 cancer sites in each sex for Denmark, Finland, Norway and Sweden for 1983–1997 based on 1958–1977 data. The respective median deviations (over the combinations of site, sex and country) of M0F and M0T are 13% and 12% for 10-year projections, and 20% and 18% for 20-year projections. The median numbers are similar to ours for M0T model in the scenario from across the provinces, but M0F seems to perform better for our specified data. Consequently, we can see that our PHACpred multiple modelling approach produced more accurate projections than the default Nordpred method applied uniformly.

Validation of the predicted incidence counts and rates is critical. Incidence data for some cancers were subject to changes in classification/coding practices, introduction or expansion of screening programs, and use of new diagnostic technologies. A model created on cohorts in early periods for these cancers may give inaccurate predictions when applied to contemporary cohorts. Because the datasets for model creation and application in this study were largely from different periods, we examined the projections from the selected models using our knowledge of data quality, trends in cancer rates, risk factors or interventions, which guided selection of the final models.

Our results were compared with the projections using the default Nordpred model, M0A, for each of the combinations of cancer site, sex and geographical area. The medians of the absolute relative differences between the projected average annual numbers of cases from PHACpred and M0A models (relative to the M0A) across all the combinations are 1.9% and 3.8% for 10-year and 25-year projections, respectively. In 25-year projections, the respective medians for breast cancer in females, colorectum and lung are 10.3%,

TABLE 5.2
Median of absolute relative difference (%) between observed and projected number of average annual cancer cases in 1992–2010, Canada[a]

Projection method	Length of projection					
	10 years		15 years		20 years	
	National level	Across provinces	National level	Across provinces	National level	Across provinces
Exclusion of prostate cancer						
M0F	10.6	11.1	13.6	15.5	10.3	15.2
M0T	7.8	11.8	10.6	16.1	14.9	18.3
M0A	7.8	11.6	10.6	14.6	16.0	16.3
PHACpred	5.8	10.9	6.9	13.9	7.6	15.1
p-value[b] of differences among the 4 models	0.02	0.36	<0.01	0.12	<0.01	0.06
p-value of differences between PHACpred and M0A	0.12	0.35	<0.01	0.4	<0.01	0.53
Exclusion of prostate cancer and all male cancers combined						
M0F	10.6	11.7	14.3	15.8	10.4	15.8
M0T	7.8	12.3	10.9	16.7	15.2	18.9
M0A	8.5	11.8	12.0	15.5	16.1	17.1
PHACpred	6.3	11.3	7.0	14.4	7.6	15.5
p-value of differences among the 4 models	0.03	0.34	<0.01	0.17	<0.01	0.05
p-value of differences between PHACpred and M0A	0.12	0.42	<0.01	0.52	<0.01	0.61

Note: 1. Comparisons were presented for the combination of cancer site, sex and area not listed in Table 2.3.

2. PHACpred, the method used in this monograph, only include Nordpred APC models (NP_ADPC) with varied drift reductions for this table. Three versions of NP_ADPC with its default drift reduction: using the average trend over the whole observation period for projections (M0F); using the slope between the two most recent periods for projections (M0T); and automatically determining whether the recent trend (or the average trend) is projected based on a significance test for departure from linear trend (M0A).

[a] Excluding Quebec, see Methods.

[b] *p*-value of Friedman's test.

TABLE 5.3
Prevalence of hysterectomy in women aged 40 and older by geographical area, Canada, 2003

Province/territory	Prevalence (%)	
	Estimate	95% CI
Newfoundland and Labrador	28.7	(25.4–32.0)
Prince Edward Island	33.5	(28.2–38.8)
Nova Scotia	37.4	(34.2–40.6)
New Brunswick	35.2	(32.2–38.2)
Quebec	28.1	(26.7–29.4)
Ontario	23	(22.1–23.9)
Manitoba	21.7	(19.3–24.1)
Saskatchewan	26.8	(24.2–29.4)
Alberta	26.2	(24.3–28.2)
British Columbia	25	(23.4–26.5)
Yukon	29.8[a]	(15.8–43.8)
Northwest Territories	15.2	(10.3–20.2)
Nunavut	19.9[a]	(9.8–29.9)
Canada	25.8	(25.2–26.4)

Source: Canadian Community Health Survey Cycle 2.1 (2003), Share File, using sample weights

Abbreviation: CI, Confidence interval

[a] With large sampling variability

0.8% and 0%. The largest medians of the disagreement of the 2 methods are found in cancers of prostate (40.2%), thyroid (21.2%) and stomach (21.4%). However, M0A produces extreme increases in prostate cancer rates and new cases and therefore is not applicable to our projections (see discussions in the third paragraph below).

The principal projection models used are based on decomposition of the observed incidence data into 3 time dimensions of age, period and cohort. While the effects of risk factors, screening and intervention were not incorporated into the models because of insufficient data in most circumstances, they have been modelled indirectly to some extent, through the period and cohort effects in the model.[3] However, the models will be insensitive to any recent changes not foreshadowed in the observed time series of cancers because of the long latency between exposure and cancer outcomes.

The observed incidence rates for the cancers of female genital system also reflect the fact that many females who underwent a hysterectomy or bilateral salpingo-oophorectomy were not at risk of developing the disease. Table 5.3 shows that the prevalence of hysterectomy was high in the Atlantic provinces and Quebec based on the 2003 Canadian Community Health Survey (Cycle 2.1). Using all females as the denominator in the rate calculation can result in artefactual differences in regional rates. In addition, changes in trends of the rates of these procedures can impact the cancer projections. For example, if surgery rates decrease more than expected based on current trends, the incidence rates of cervical, uterine and ovarian cancers would be greater than our projections.

It is useful to acknowledge that forecasting prostate cancer incidence is subject to some uncertainty as a result of over-diagnosis of this cancer because of the PSA test. The common Nordpred approach would predict extreme increases in prostate cancer incidence rates, so this necessitated a model adjustment and/or exclusion of the observed data for certain periods. We used the 2-step approach of the short-term modelling projection following by the long-term constant-rates projection for projecting prostate cancer incidence in this report (see Chapter 2 for details). Several publications have adopted the projection method where future numbers of prostate cancer are affected only by demographic changes.[28,35,314] Quon et al.[314] assumed that the age-specific incidence rates of prostate cancer in the current year would remain in the future in their ''best-case'' scenario and predicted that the number of new prostate cancers will increase to 35 121 cases by 2021 in Canada. This is consistent with our estimate of 34 460 new cases annually in 2018–2022. Moller et al.[28,35] used the 5-year average method for their projections of prostate cancer incidence in England and Norway. These constant-rate projection methods would result in underestimates of the future burden of prostate cancer if the prevalence of screening is increased or the diagnosis is improved. The future use of the PSA test will principally determine the accuracy of our projections for prostate cancer incidence.

Projections for a cancer with low frequency (whether rare or from a small population) may be subjective and unreliable. Although our projections are based on comparisons of the various models (see Chapter 2 for details) for each of such cancers, they are limited in that the number of cases only met the minimum requirements for some models.

Long-term cancer incidence projections inherently carry some uncertainty as they depend on an assumption about the continuity of past trends. Although this assumption seems reasonable based on historical data, it is likely that increasing focus on lifecourse cancer prevention, especially primordial and primary prevention through reducing risk factors while promoting protective ones, and secondary preventions through screening and early detection, will exert an influence on future incidence rates of preventable cancers. On the other hand, the projections are useful in evaluating the effects of preventive interventions. If rates observed in the future differ from those projected, this suggests that the risk/preventions influencing the rates have changed. The reliability of projections also depends on the accuracy of population forecast. The predicted populations were based on the assumptions on rates of fertility, mortality, interprovincial and international migration, and so on.[10] Elements of subjectivity may enter the population projection method. The justifiability of these assumptions can only be decided when the data are available.

Projection, a way to map out possible future cancer scenarios, naturally associates with uncertainty. However, we believe that the results of this study, which are the most reasonable for our present data and the limitations discussed, will provide a useful source for future health planning and evaluation of interventions in Canada.

Implications for future cancer control strategies

The projected aging and growth of the population are expected to cause a progressive and significant increase in the total number of new cases of cancer in Canada over the next 25 years. Consequently, these data indicate the need to continue to strengthen cancer control strategies and leverage resources to meet future health care requirements and reduce the burden of cancer in Canada. Although incidence rates are projected to decrease for many cancers, the rates for some cancers, for example, thyroid, liver, uterus, pancreas, kidney and leukemia, are estimated to increase. Additional etiological research to better understand risk factors and guide prevention efforts is needed.

This monograph underscores the increasing importance of nutrition/diet, physical activity and obesity in relation to cancer prevention as well as the need for continuing efforts to tackle smoking, improve uptake of cancer screening, and increase use of HPV vaccination. The expected effect of future changes in our demographic profiles and cancer trends should be addressed from multidisciplinary perspectives, embracing prevention and early detection, research and surveillance, treatment and psychosocial, palliative and medical care.

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References

1. Canadian Cancer Society's Advisory Committee on Cancer Statistics. Canadian cancer statistics 2013. Toronto (ON): Canadian Cancer Society; 2013.

2. National Cancer Registry. Trends in Irish cancer incidence 1994–2002 with predictions to 2020 [Internet]. Cork (IE): National Cancer Registry; 2006 [cited 2013 Oct 28]. Available from: http://www.ncri.ie/publications/cancer-trends-and-projections/trends-irish-cancer-incidence-1994-2002-predictions-2020

3. Møller B, Fekjær H, Hakulinen T, et al. Prediction of cancer incidence in the Nordic countries up to the year 2020. Eur J Cancer Prev. 2002;Suppl 11:S1-96.

4. Mistry M, Parkin DM, Ahmad AS, Sasieni P. Cancer incidence in the United Kingdom: projections to the year 2030. Br J Cancer. 2011;105:1795-803.

5. New Zealand: Ministry of Health. Cancer in New Zealand: trends and projections [Internet]. New Zealand: Ministry of Health; 2002 [cited 2013 Oct 28]. Available from: http://www.moh.govt.nz/notebook/nbbooks.nsf/0/B005B6A9C2BB332DCC256C83006CF13D?opendocument

6. World Health Organization. International classification of diseases, 9th revision. Volumes 1 and 2. Geneva (CH): World Health Organization; 1977.

7. Fritz A, Percy C, Jack A, et al. International classification of diseases for oncology, 3rd ed. Geneva (CH): World Health Organization; 2000.

8. National Cancer Institute. SEER incidence site recode [Internet]. Bethesda (MD): National Cancer Institute; 2003 [cited 2013 Oct 28]. Available from: http://seer.cancer.gov/siterecode/icdo3_d01272003/

9. Statistics Canada. Demographic estimates compendium 2010. Ottawa (ON): Ministry of Industry; 2010. CANSIM table 051-0001 released on September 29, 2010.

10. Statistics Canada. Population projections for Canada, provinces and territories: 2009 to 2036 [Internet]. Ottawa: Ministry of Industry; 2010 [cited 2013 Oct 28]. [Statistics Canada, Catalogue No. 91-520-X] Available from: http://www.statcan.gc.ca/pub/91-520-x/91-520-x2010001-eng.htm

11. Breslow N, Day N. Statistical methods in cancer research. Volume 2: The design and analysis of cohort studies. Lyon (FR): IARC Scientific Publications no. 82; 1987.

12. Hakulinen T, Dyba T. Precision of incidence predictions based on Poisson distributed observations. Stat Med. 1994;13:1513-23.

13. Dyba T, Hakulinen T. Comparison of different approaches to incidence prediction based on simple interpolation techniques. Stat Med. 2000;19:1741-52.

14. Holford TR. The estimation of age, period and cohort effects for vital rates. Biometrics. 1983;39:311-24.

15. Moller B, Fekjaer H, Hakulinen T, et al. Prediction of cancer incidence in the Nordic countries: Empirical comparison of different approaches. Stat Med. 2003;22:2751-66.

16. Osmond C. Using age, period and cohort models to estimate future mortality rates. Int J Epidemiol. 1985;14:124-9.

17. McCullagh P, Nelder JA. Generalized linear models, 2nd ed. London (UK): Chapman and Hall; 1989.

18. Hastie TJ, Tibshirani RJ. Generalized additive models. London (UK): Chapman and Hall; 1990.

19. Wood SN. Generalized additive models: an introduction with R. Boca Raton (Fl): Chapman and Hall; 2006.

20. Verdecchia A, De Angelis G, Capocaccia R. Estimation and projections of cancer prevalence from cancer registry data. Stat Med. 2002;21:3511-26.

21. Carstensen B. Age-period-cohort models for the lexis diagram. Stat Med. 2007;26:3018-45.

22. Bray I. Application of Markov chain Monte Carlo methods to projecting cancer incidence and mortality. J R Stat Soc Ser C, Appl Stat. 2002;51:151-64.

23. Robert CP, Casella G. Monte Carlo Statistical Methods. New York: Springer-Verlag; 1999.

24. Smith BD, Smith GL, Hurria A, Hortobagyi GN, Buchholz TA. Future of cancer incidence in the United States: burdens upon an aging, changing nation. J Clin Oncol. 2009;27:2758-2765.

25. Cancer Registry of Norway. Nordpred software package [software]. Oslo (NO): Institute of Population-Based Research; 2009 [cited 2013 Oct 28]. Available from: http://www.kreftregisteret.no/software/nordpred

26. Clayton D, Schifflers E. Models for temporal variation in cancer rates. II: Age-period-cohort models. Stat Med. 1987;6:469-81.

27. Lee TC, Dean CB, Semenciw R. Short-term cancer mortality projections: a comparative study of prediction methods. Stat Med. 2011;30:3387-402.

28. Moller H, Fairley L, Coupland V, et al. The future burden of cancer in England: incidence and numbers of new patients in 2020. Br J Cancer. 2007;96:1484-8.

29. Coupland VH, Okello C, Davies EA, Bray F, Møller H. The future burden of cancer in London compared with England. J Public Health (Oxf). 2010;32:83-9.

30. Aitken R, Morell S, Barraclough H, et al. Cancer incidence and mortality projections in New South Wales, 2007 to 2011. New South Wales: Cancer Institute; 2008.

31. Olsen AH, Parkin DM, Sasieni P. Cancer mortality in the United Kingdom: Projections to the year 2025. Br J Cancer. 2008;99:1549-54.

32. Lunn DJ, Thomas A, Best N, Spiegelhalter D. WinBUGS - a Bayesian modelling framework: concepts, structure, and extensibility. Statistics and Computing. 2000;10:325-37.

33. Ntzoufras I. Bayesian Modeling Using WinBUGS. Hoboken, New Jersey (NY): John Wiley & Sons; 2009.

34. Spiegelhalter DJ, Thomas A, Best NG, Lunn D. BUGS Examples Volume 2 [Internet]. Cambridge (UK): The BUGS Project; 1996 [cited 2013 Oct 28]. Available from: http://www.mrc-bsu.cam.ac.uk/bugs/winbugs/Vol2.pdf.

35. Cancer Registry of Norway. Cancer in Norway 2005—Special issue: Predictions of cancer incidence by health region 2010–2020 [Internet]. Oslo (NO): Cancer Registry of Norway; 2012 [cited 2013 Oct 28]. Available from: http://www.kreftregisteret.no/en/General/Publications/Cancer-in-Norway/Cancer-in-Norway-2005/.

36. Canadian Cancer Society's Steering Committee on Cancer Statistics. Canadian cancer statistics 2011. Toronto (ON): Canadian Cancer Society; 2011.

37. Band PR, Gaudette LA, Hill GB, et al. The making of the Canadian Cancer Registry: cancer incidence in Canada and its regions, 1969 to 1988. Ottawa: Minister of Supply and Services; 1993.

38. Pelletier G. La survie reliéé au cancer. Étude des nouveau cas de cancer déclarés au Québec au cours des années 1984, 1985, et 1986. Collection Données statistiques et Indicateurs. Quebec: Government of Quebec, Ministry of Health and Social Services, Planning and Evaluation Branch; 1993.

39. Larsen RJ, Marx ML. An introduction to mathematical statistics and its applications, 3rd ed. Upper Saddle River (NJ): Prentice Hall; 2001.

40. Kim HJ, Fay MP, Feuer EJ, Midthune DN. Permutation tests for joinpoint regression with applications to cancer rates. Stat Med. 2000;19:335-51.

41. National Cancer Institute. Joinpoint regression program [Internet software]. Bethesda (MD): National Cancer Institute; 2013 [updated 2013 May 6; cited 2013 Oct 30]. Available from: http://surveillance.cancer.gov/joinpoint/.

42. National Cancer Institute of Canada. Canadian cancer statistics 2000. Toronto (ON): Canadian Cancer Society; 2000.

43. Health Canada. Canadian Tobacco Use Monitoring Survey (CTUMS) 2011 [Internet]. Ottawa (ON): Health Canada; 2011 [cited 2013 Sept 4]. Available from: http://www.hc-sc.gc.ca/hc-ps/tobac-tabac/research-recherche/stat/ctums-esutc_2011-eng.php

44. Weiss W. Cigarette smoking and lung cancer trends. A light at the end of the tunnel? Chest. 1997;111:1414-6.

45. Canadian Partnership Against Cancer. Cervical cancer screening in Canada: programs and strategies [Internet]. Toronto (ON): Canadian Partnership Against Cancer; 2013 [updated 2013 Mar; cited 2013 Oct 28]. Available from: http://www.cancerview.ca/idc/groups/public/documents/webcontent/cervical_cancer_screen_pro.pdf

46. Canadian Partnership Against Cancer. Cervical cancer control in Canada [Internet]. Toronto (ON): Canadian Partnership Against Cancer; 2013 [updated 2012 Aug 20; cited 2013 Oct 28]. Available from: http://www.cancerview.ca/cv/portal/Home/PreventionAndScreening/PSProfessionals/PSScreeningAndEarlyDiagnosis/CervicalCancerControlInCanada?_afrLoop = 2134228682807000&lang = en&_afrWindowMode = 0&_adf.ctrl-state = 18nxh7zwbr_890

47. International Agency for Research on Cancer. Agents classified by the IARC monographs, Volumes 1-109 IARC Monographs on the evaluation of carcinogenic risks to humans [Internet]. Lyon (FR): International Agency for Research on Cancer; 2013 [updated 2013 Oct 30; cited 2013 Dec 21]. Available from: http://monographs.iarc.fr/ENG/Classification/index.php

48. Turati F, Garavello W, Tramacere I, et al. A meta-analysis of alcohol drinking and oral and pharyngeal cancers: results from subgroup analyses. Alcohol Alcohol. 2013;48:107-18.

49. Gandini S, Botteri E, Iodice S, et al. Tobacco smoking and cancer: a meta-analysis. Int J Cancer. 2008;122:155-64.

50. Bagnardi V, Blangiardo M, La Vecchia C, Corrao G. A meta-analysis of alcohol drinking and cancer risk. Br J Cancer. 2001;85:1700-5.

51. Statistics Canada. Health trends 2013 [Internet]. Ottawa (ON): Statistics Canada; 2013 [cited 2013 Oct 28]. [Statistics Canada Catalogue No. 82-213-XWE]. Available from: http://www12.statcan.gc.ca/health-sante/82-213/index.cfm?Lang = eng

52. Kufe DW, Bast Jr RC, Hait WN, et al. Cancer medicine, 7th ed. Hamilton (ON): BC Decker Inc.; 2006.

53. Haskell CM. Cancer treatment, 5th ed. Philadelphia (PA): WB Saunders Company; 2001.

54. Forte T, Niu J, Lockwood GA, Bryant HE. Incidence trends in head and neck cancers and human papillomavirus (HPV)-associated oropharyngeal cancer in Canada, 1992-2009. Cancer Causes Control. 2012;23(8):1343-8.

55. Johnson-Obaseki S, McDonald JT, Corsten M, Rourke R. Head and neck cancer in Canada: trends 1992 to 2007. Otolaryngol Head Neck Surg. 2012;147(1):74-8.

56. Jemal A, Simard EP, Dorell C, et al. Annual Report to the Nation on the Status of Cancer, 1975-2009, featuring the burden and trends in human papillomavirus(HPV)-associated cancers and HPV vaccination coverage levels. J Natl Cancer Inst. 2013;105(3):175-201.

57. Blomberg M, Nielsen A, Munk C, Kjaer SK. Trends in head and neck cancer incidence in Denmark, 1978-2007: focus on human papillomavirus associated sites. Int J Cancer. 2011;129(3):733-41.

58. Shin A, Jung YS, Jung KW, Kim K, Ryu J, Won YJ. Trends of human papillomavirus-related head and neck cancers in Korea: National cancer registry data. Laryngoscope. 2013 Nov;123(11):E30-7.

59. National Advisory Committee on Immunization (NACI). Update on human papillomavirus (HPV) vaccines. An Advisory Committee Statement (ACS). CCDR. 2012:38 (ACS-1). Ottawa (ON): Public Health Agency of Canada; [updated 2012 Aug 27; cited 2013 Dec 21]. Available from: http://www.phac-aspc-.gc.ca/publicat/ccdr-rmtc/12vol38/acs-dcc-1/index-eng.php

60. Wilson SE, Harris T, Sethi P, Fediurek J, Macdonald L, Deeks SL. Coverage from Ontario, Canada's school-based HPV vaccine program: the first three years. Vaccine. 2013;31(5):757-62.

61. Canadian Cancer Society's Steering Committee on Cancer Statistics. Canadian cancer statistics 2010. Toronto (ON): Canadian Cancer Society; 2010.

62. Lagergren J. Etiology and risk factors for oesophageal adenocarcinoma: possibilities for chemoprophylaxis? Best Pract Res Clin Gastroenterol. 2006;20:803-12.

63. Blot WJ, McLaughlin JK, Fraumeni JF Jr. Esophageal cancer. In: Schottenfeld D, Fraumeni JF Jr, editors. Cancer epidemiology and prevention, 3rd ed. New York (NY): Oxford University Press; 2006. p. 697-706.

64. Thrift AP, Whiteman DC. The incidence of esophageal adenocarcinoma continues to rise: analysis of period and birth cohort effects on recent trends. Ann Oncol. 2012; 23:3155-62.

65. Freedman ND, Abnet CC, Leitzmann MF, et al. A prospective study of tobacco, alcohol, and the risk of esophageal and gastric cancer subtypes. Am J Epidemiol. 2007;165:1424-33.

66. Lee YC, Marron M, Benhamou S, et al. Active and involuntary tobacco smoking and upper aerodigestive tract cancer risks in a multicenter case-control study. Cancer Epidemiol Biomarkers Prev. 2009;18:3353-61.

67. Engel LS, Chow WH, Vaughan TL, et al. Population attributable risks of esophageal and gastric cancers. J Natl Cancer Inst. 2003;95:1404-13.

68. Lagergren J, Lagergren P. Recent developments in esophageal adenocarcinoma. CA Cancer J Clin. 2013;63:232-48.

69. Fedorak RN, van Zanten SV, Bridges R. Canadian Digestive Health Foundation Public Impact Series: gastroesophageal reflux disease in Canada: incidence, prevalence, and direct and indirect economic impact. Can J Gastroenterol. 2010;24:431-4.

70. Renehan AG, Tyson M, Egger M, Heller RF, Zwahlen M. Body-mass index and incidence of cancer: a systematic review and meta-analysis of prospective observational studies. Lancet. 2008;371:569-78.

71. Steffen A, Schulze MB, Pischon T, et al. Anthropometry and esophageal cancer risk in the European prospective investigation into cancer and nutrition. Cancer Epidemiol Biomarkers Prev. 2009;18:2079-89.

72. Tjepkema, M. Adult obesity in Canada: measured height and weight. In: Nutrition: findings from the Canadian Community Health Survey, no. 1. [Statistics Canada Catalogue No. 82-620-MWE]. Ottawa (ON): Statistics Canada; 2006.

73. Public Health Agency of Canada. Obesity in Canada [Internet]. Ottawa (ON): Public Health Agency of Canada; 2011[updated 2011 Jun 23; cited 2013 Oct 28]. Available from: http://www.phac-aspc.gc.ca/hp-ps/hl-mvs/oic-oac/adult-eng.php#figure-1

74. El-Serag HB. Time trends of gastroesophageal reflux disease: a systematic review. Clin Gastroenterol Hepatol. 2007;5:17-26.

75. Statistics Canada. Population by selected ethnic origins, by province and territory (2006 Census). [Internet]. Ottawa (ON): Statistics Canada [updated 2009 Jul 28; cited 2009 Jul 28]. Available from: http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/demo26k-eng.htm

76. World Health Organization. Hepatitis B. Fact sheet no. 204 [Internet]. Geneva (CH): World Health Organization; 2013 [updated 2013 Jul; cited 2013 Oct 28]. Available from: http://www.who.int/mediacentre/factsheets/fs204/en/

77. Ott JJ, Stevens GA, Groeger J, Wiersma ST. Global epidemiology of hepatitis B virus infection: new estimates of age-specific HBsAg seroprevalence and endemicity. Vaccine. 2012;30:2212-9.

78. Burak KW, Coffin CS, Myers RP. Hepatitis B awareness and education: a failing grade. Can J Gastroenterol. 2011;25:125-6.

79. Nagini S. Carcinoma of the stomach: a review of epidemiology, pathogenesis, molecular genetics and chemoprevention. World J Gastrointest Oncol. 2012;4(7):156-69.

80. D'Elia L, Rossi G, Ippolito R, Cappuccio FP, Strazzullo P. Habitual salt intake and risk of gastric cancer: a meta-analysis of prospective studies. Clin Nutr. 2012;31(4):489-98.

81. Statistics Canada. Food statistics 2009. Ottawa (ON): Statistics Canada; 2009 [cited 2013 Oct 28]. [Statistics Canada, Catalogue No. 21-020-XWE]. Available from: http://www.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno = 21-020-XWE&lang = eng

82. Howson CP, Hiyama T, Wynder EL. The decline in gastric cancer: epidemiology of an unplanned triumph. Epidemiol Rev. 1986;8:1-27.

83. International Agency for Research on Cancer. Schistosomes, liver flukes and Helicobacter pylori. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Vol. 61. Lyon (FR): IARC Press; 1994.

84. Public Health Agency of Canada. Colorectal cancer [Internet]. Ottawa (ON): Public Health Agency of Canada; 2013 [updated 2013 Apr 22; cited 2013 Oct 28]. Available from: www.phac-aspc.gc.ca/cd-mc/cancer/colorectal_cancer-cancer_colorectal-eng.php

85. Cancer Research UK. Bowel cancer risk factors [Internet]. London (UK): Cancer Research UK; 2012 [updated 2012 Jan 31; cited 2013 Oct 28]. Available from: http://www.cancerresearchuk.org/cancer-info/cancerstats/types/bowel/riskfactors/#sourcep

86. Boyle P, Levin B, editors. World Cancer report 2008 [Internet]. Lyon (FR): International Agency for Research on Cancer; 2008 [cited 2013 Oct 28]. Available from: http://www.iarc.fr/en/publications/pdfs-online/wcr/2008/wcr_2008.pdf

87. Aune D, Lau R, Chan DS, et al. Nonlinear reduction in risk for colorectal cancer by fruit and vegetable intake based on meta-analysis of prospective studies. Gastroenterology. 2011;141:106-18.

88. Labonte R, Muhajarine N, Winquist B, Quail J. Healthy populations: a report of the Canadian index of wellbeing (CIW) [Internet]. Waterloo (ON): Waterloo University; September 2010 [cited 2013 Oct 28]. Available from: http://uwaterloo.ca/canadian-index-wellbeing/sites/ca.canadian-index-wellbeing/files/uploads/files/HealthyPopulation_DomainReport.sflb_.pdf

89. Lin KJ, Cheug WY, Lai JY, Giovannucci EL. The effect of estrogen vs. combined estrogen-progestogen therapy on the risk of colorectal cancer. Int J Cancer. 2012;130:419-30.

90. Garriguet D. Canadians' eating habits. Health Rep. 2007;18:17-32.

91. Nesbitt A, Majowicz S, Finley R. Food consumption patterns in the Waterloo Region, Ontario, Canada: a cross-sectional telephone survey. BMC Public Health. 2008;8:370.

92. Edwards BK, Ward E, Kohler BA, et al. Annual report to the nation on the status of cancer, 1975-2006, featuring colorectal cancer trends and impact of interventions (risk factors, screening, and treatment) to reduce future rates. Cancer. 2010;116:544-573.

93. Edwards BK, Noone AM, Mariotto AB, et al. Annual Report to the Nation on the status of cancer, 1975-2010, featuring prevalence of comorbidity and impact on survival among persons with lung, colorectal, breast, or prostate cancer. Cancer. 2014;120;1290-314.

94. Canadian Partnership Against Cancer. Colorectal cancer screening - 2010 [Internet]. Toronto (ON): Canadian Partnership Against Cancer; 2010 [cited 2013 Dec 21]. Available from: http://www.cancerview.ca/idc/groups/public/documents/webcontent/rl_cancer_1crcscreen.pdf

95. Kadiyala S, Strumpf EC. Are United States and Canadian cancer screening rates consistent with guideline information regarding the age of screening initiation? Int J Qual Health Care. 2011;23:611-20.

96. El-Seraq HB. Hepatocellular carcinoma. N Engl J Med. 2011;365:1118-27.

97. Yang JD, Kim B, Sanderson SO, et al. Hepatocellular carcinoma in Olmsted County, Minnesota, 1976-2008. Mayo Clin Proc. 2012;87:9-16.

98. Dyer Z, Peltekian K, van Zanten SV. Review article: the changing epidemiology of hepatocellular carcinoma in Canada. Aliment Pharmacol Ther. 2005;22:17-22.

99. Public Health Agency of Canada. Hepatitis C in Canada: 2005-2010 surveillance report [Internet]. Ottawa (ON): Public Health Agency of Canada; 2012 [cited 2013 Dec 21]. Available from: http://www.phac-aspc.gc.ca/sti-its-surv-epi/hepc/surv-eng.php

100. Bosch FX, Rives J, Diaz M, Cléries R. Primary liver cancer: worldwide incidence and trends. Gastrenterology. 2004;127:S7-16.

101. Zou S, Tepper M, El Saadany S. Prediction of hepatitis C burden in Canada. Can J Gastroenterol. 2000;14:575-80.

102. Public Health Agency of Canada. National immunization strategy: final report 2003. Ottawa (ON): Public Health Agency of Canada; 2004 [updated 2004 Jun 16; cited 2013 Oct 28]. Available from: http://www.phac-aspc.gc.ca/publicat/nis-sni-03/b2-eng.php

103. Public Health Agency of Canada. Vaccine-preventable diseases [Internet]. Ottawa (ON): Public Health Agency of Canada; 2012 [updated 2012 Jul 20; cited 2013 Oct 28]. Available from: http://www.phac-aspc.gc.ca/im/vpd-mev/index-eng.php

104. McDermott S, DesMeules M, Lewis R, et al. Cancer incidence among Canadian immigrants, 1980-1998: results from a national cohort study. J Immigr Minor Health. 2011;13:15-26.

105. Statistics Canada. Immigrant population by place of birth, by province and territory (2006 Census) [Internet]. Ottawa (ON): Statistics Canada; 2007 [updated 2007 Dec 11; cited 2013 Oct 28]. Available from: http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/demo34a-eng.htm

106. Statistics Canada. Selected trend data for Canada, 1996, 2001 and 2006 censuses [Internet]. Ottawa (ON): Statistics Canada; 2010 [updated 2010 Feb 6; cited 2013 Oct 28]. Available from: www12.statcan.gc.ca/census-recensement/2006/dp-pd/92-596/P1-2.cfm?Lang = eng&T = PR&PRCODE = 01&GEOCODE = 01&GEOLVL = PR&TID = 0

107. Nordenstedt H, White DL, El-Serag HB. The changing pattern of epidemiology in hepatocellular carcinoma. Dig Liver Dis. 2010;42 Suppl 3:S206-14.

108. Eheman C, Henley SJ, Ballard-Barbash R, et al. Annual Report to the Nation on the status of cancer, 1975-2008, featuring cancers associated with excess weight and lack of sufficient physical activity. Cancer. 2012;118:2338-66.

109. Mittal S, El-Serag HB. Epidemiology of hepatocellular carcinoma: consider the population. J Clin Gastroenterol. 2013;47 Suppl:S2-6.

110. Shields M, Tremblay MS, Laviolette M, Craig CL, Janssen I, Connor Gorber S. Fitness of Canadian adults: results from the 2007-2009 Canadian Health Measures Survey. Health Rep. 2010;21:21-35.

111. Devita VT Jr, Hellman S, Rosenberg SA. Cancer: principles & practice of oncology, 7th ed. Philadelphia (PA): Lippincott Williams & Wilkins; 2005.

112. Villeneuve PJ, Johnson KC, Mao Y, Hanley AJ. Environmental tobacco smoke and the risk of pancreatic cancer: findings from a Canadian population-based case-control study. Can J Public Health. 2004;95:32-7.

113. Gallicchio L, Kouzis A, Genkinger J, et al. Active cigarette smoking, household passive smoke exposure, and the risk of developing pancreatic cancer. Prev Med. 2006;42:200-5.

114. Weiss W, Benarde MA. The temporal relation between cigarette smoking and pancreatic cancer. Am J Public Health. 1983;73:1403-4.

115. Silverman DT, Schiffman M, Everhart J, et al. Diabetes mellitus, other medical conditions and familial history of cancer as risk factors for pancreatic cancer. Br J Cancer. 1999;80:1830-7.

116. Ghadirian P, Lynch HT, Krewski D. Epidemiology of pancreatic cancer: an overview. Cancer Detect Prev. 2003;27:87-93.

117. World Cancer Research Fund/American Institute for Cancer Research. Continuous Update Project: keeping the science current. Pancreatic cancer 2012 report: food, nutrition, physical activity, and the prevention of pancreatic cancer [Internet]. World Cancer Research Fund; 2012 [cited 2013 Dec 21]. Available from: http://www.dietandcancerreport.org/cup/current_progress/pancreatic_cancer.php

118. Bao Y, Michaud DS, Spiegelman D. Folate intake and risk of pancreatic cancer: pooled analysis of prospective cohort studies. J Natl Cancer Inst. 2011;103:1840-50.

119. Aune D, Greenwood DC, Chan DS, et al. Body mass index, abdominal fatness and pancreatic cancer risk: a systematic review and non-linear dose-response meta-analysis of prospective studies. Ann Oncol. 2012;23:843-52.

120. O'Rorke M, Cantwell MM, Cardwell CR, Mulholland HG, Murray LJ. Can physical activity modulate pancreatic cancer risk? a systematic review and meta-analysis. Int J Cancer. 2010;126:2957-68.

121. Bao Y, Michaud DS. Physical activity and pancreatic cancer risk: a systematic review. Cancer Epidemiol Biomarkers Prev. 2008;17:2671-82.

122. Ben Q, Xu M, Ning X, et al. Diabetes mellitus and risk of pancreatic cancer: A meta-analysis of cohort studies. Eur J Cancer. 2011;47:1928-37.

123. Elena JW, Steplowski E, Yu K, et al. Diabetes and risk of pancreatic cancer: a pooled analysis from the pancreatic cancer cohort consortium. Cancer Causes Control. 2013;24:13-25.

124. Cancer Research UK. Pancreatic cancer incidence statistics [Internet]. London (UK): Cancer Research UK; 2013 [updated 2013 Oct 18; cited 2013 Oct 28]. Available from: http://www.cancerresearchuk.org/cancer-info/cancerstats/types/pancreas/incidence/#trends

125. Berrino F, Crosignani P. [Epidemiology of malignant tumors of the larynx and lung]. Ann Ist Super Sanita. 1992;28:107-20.

126. Burch JD, Howe GR, Miller AB, Semenciw R. Tobacco, alcohol, asbestos, and nickel in the etiology of cancer of the larynx: a case-control study. J Natl Cancer Inst. 1981;67:1219-24.

127. Health Canada. Canadian Alcohol and Drug Use Monitoring Survey: summary of results for 2011. Ottawa (ON): Health Canada; 2012 [updated 2012 Jul 03; cited 2013 Oct 28]. Available from: http://www.hc-sc.gc.ca/hc-ps/drugs-drogues/stat/_2011/summary-sommaire-eng.php#alc

128. Surgeon General. Reducing the health consequences of smoking: 25 years of progress. Washington (DC): U.S. Department of Health and Human Services, Centers for Disease Control; 1989.

129. Shopland DR. Tobacco use and its contribution to early cancer mortality with a special emphasis on cigarette smoking. Environ Health Perspect. 1995;103:131-42.

130. Brisson J, Major D, Pelletier E. Évaluation de l'exhaustivité du fichier des tumeurs du Québec. Québec (QC): Institut national de la santé publique du Québec; 2003.

131. Sneyd M, Cox B. The control of melanoma in New Zealand. N Z Med J. 2006;119:U2169.

132. Gandini S, Sera F, Cattaruzza MS, et al. Meta-analysis of risk factors for cutaneous melanoma: II. Sun exposure. Eur J Cancer. 2005;41:45-60.

133. Elwood JM, Jopson J. Melanoma and sun exposure: an overview of published studies. Int J Cancer. 1997;73:198-203.

134. Miller AJ, Mihm MC, Jr. Melanoma. N Engl J Med. 2006;355:51-65.

135. Naldi L, Randi G, Di Landro A, La Vecchia C. Red hHairs, number of nevi, and risk of cutaneous malignant melonoma: results from a case-control study in Italy. Arch Dermatol. 2006;142:935-6.

136. Olsen CM, Carroll HJ, Whiteman DC. Estimating the attributable fraction for melanoma: a meta-analysis of pigmentary characteristics and freckling. Int J Cancer. 2010;127:2430-45.

137. Williams PF, Olsen CM, Hayward NK, Whiteman DC. Melanocortin 1 receptor and risk of cutaneous melanoma: a meta-analysis and estimates of population burden. Int J Cancer. 2011;129:1730-40.

138. Olsen CM, Carroll HJ, Whiteman DC. Familial melanoma: a meta-analysis and estimates of attributable fraction. Cancer Epidemiol Biomarkers Prev. 2010;19:65-73.

139. Gandini S, Sera F, Cattaruzza MS, et al. Meta-analysis of risk factors for cutaneous melanoma: III. Family history, actinic damage and phenotypic factors. Eur J Cancer. 2005;41:2040-59.

140. Law MH, Macgregor S, Hayward NK. Melanoma genetics: recent findings take us beyond well-traveled pathways. J Invest Dermatol. 2012;132:1763-74.

141. Erdmann F, Lortet-Tieulent J, Schüz J, et al. International trends in the incidence of malignant melanoma 1953-2008—are recent generations at higher or lower risk? Int J Cancer. 2013;132:385-400.

142. Shields M, Wilkins K. An update on mammography use in Canada. Health Rep. 2009;20:7-19.

143. Canadian Task Force on Preventive Health Care. Screening for Breast Cancer - Summary of recommendations for clinicians and policy-makers [Internet]. Edmonton (AB): Canadian Task Force on Preventive Health Care; 2014 [cited 2014 Mar 28]. Available from: http://canadiantaskforce.ca/guidelines/2011-breast-cancer/

144. Canadian Association of Radiologists. CAR practice guidelines and technical standards for breast imaging and intervention. Ottawa (ON): Canadian Association of Radiologists; [updated 2012 Sep 29; cited 2014 Mar 28]. Available from: http://www.car.ca/uploads/standards%20guidelines/20131024_en_breast_imaging_practice_guidelines.pdf

145. Zahl PH, Strand BH, Maehlen J. Incidence of breast cancer in Norway and Sweden during introduction of nationwide screening: prospective cohort study. BMJ. 2004;328:921-4.

146. Miller AB, Wall C, Baines CJ, Sun P, To T, Narod SA. Twenty five year follow-up for breast cancer incidence and mortality of the Canadian National Breast Screening Study: randomised screening trial. BMJ. 2014;348:g366.

147. Key TJ, Verkasalo PK, Banks E. Epidemiology of breast cancer. Lancet Oncol. 2001;2:133-40.

148. Ford D, Nault F. Changing Fertility Patterns, 1974 to 1994. Health Reports. 1996;8:39-46.

149. Statistics Canada. Births and total fertility rate, by province and territory (Fertility rate) [Internet]. Ottawa: Statistics Canada [updated 2013 Mar 19; cited 2013 Sept 6]. Available from: http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/hlth85b-eng.htm

150. Nelson HD, Humphrey LL, Nygren P, Teutsch SM, Allan JD. Postmenopausal hormone replacement therapy: scientific review. JAMA. 2002;288:872-81.

151. Cancer Research UK. Breast cancer risk factors [Internet]. London (UK): Cancer Research UK [updated 2013 Dec 17; cited 2013 Dec 19]. Available from: http://www.cancerresearchuk.org/cancer-info/cancerstats/types/breast/riskfactors/

152. Rossouw JE, Anderson GL, Prentice RL, et al. Risks and benefits of estrogen plus progestin in healthy postmenopausal women: principal results from the Women's Health Initiative randomized controlled trial. JAMA. 2002; 288(3):321-33.

153. De P, Neutel CI, Olivotto I, Morrison H. Breast cancer incidence and hormone replacement therapy in Canada. J Natl Cancer Inst. 2010;102(19):1489-95.

154. Boyd NF, Martin LJ, Sun L et al. Body size, mammographic density, and breast cancer risk. Cancer Epidemiol Biomarkers Prev. 2006;15:2086-92.

155. Boyd NF, Martin LJ, Yaffe MJ, Minkin S. Mammographic density and breast cancer risk: current understanding and future prospects. Breast Cancer Res. 2011;13:223.

156. Boyd N, Martin L, Stone J, Little L, Minkin S, Yaffe M. A longitudinal study of the effects of menopause on mammographic features. Cancer Epidemiol Biomarkers Prev. 2002;11(10 Pt 1):1048-53.

157. Huo CW, Chew GL, Britt KL, et al. Mammographic density-a review on the current understanding of its association with breast cancer. Breast Cancer Res Treat. 2014;144:479-502.

158. Bertrand KA, Tamimi RM, Scott CG, et al. Mammographic density and risk of breast cancer by age and tumor characteristics. Breast Cancer Res. 2013;15:R104.

159. Parkin DM, Boyd L, Walker LC. The fraction of cancer attributable to lifestyle and environmental factors in the UK in 2010. Summary and conclusions. Br J Cancer. 2011;105:S77-81.

160. Monninkhof EM, Elias SG, Vlems FA. Physical activity and breast cancer: a systematic review. Epidemiology. 2007;18:137-157.

161. Kobayashi LC, Janssen I, Richardson H, Lai AS, Spinelli JJ, Aronson KJ. A case-control study of lifetime light intensity physical activity and breast cancer risk. Cancer Causes Control. 2014;25(1):133-40.

162. Baan R, Straif K, Grosse Y, et al. WHO International Agency for Research on Cancer Monograph Working Group. Carcinogenicity of alcoholic beverages. Lancet Oncol. 2007; 8:292-3.

163. Cogliano VJ, Baan R, Straif K, et al. Preventable exposures associated with human cancers. J Natl Cancer Inst. 2011;103:1827-39.

164. Reynolds P. Smoking and breast cancer. J Mammary Gland Biol Neoplasia. 2013;18:15-23.

165. Johnson KC, Miller AB, Collishaw NE, et al. Active smoking and secondhand smoke increase breast cancer risk: the report of the Canadian Expert Panel on Tobacco Smoke and Breast Cancer Risk (2009). Tob Control. 2011;20:e2.

166. Walboomers JM, Jacobs MV, Manos MM, et al. Human papillomavirus is a necessary cause of invasive cervical cancer worldwide. J Pathol. 1999;189:12-9.

167. Ferenczy A, Franco E. Persistent human papillomavirus infection and cervical neoplasia. Lancet Oncol. 2002;3:11-6.

168. Deneris A, Bond S. Clinical update: human papillomavirus vaccine. J Midwifery Womens Health. 2006;51:515-8.

169. Moore RA, Ogilvie G, Fornika D, et al. Prevalence and type distribution of human papillomavirus in 5,000 British Columbia women—implications for vaccination. Cancer Causes Control. 2009;20:1387-96.

170. Palefsky JM, Holly EA. Chapter 6: Immunosuppression and co-infection with HIV. J Natl Cancer Inst Monogr. 2003;31:41-46.

171. Parkin DM. Tobacco-attributable cancer burden in the UK in 2010. Br J Cancer. 2011;105:S6-13.

172. Colucci R, Hryniuk W, Savage C. HPV vaccination programs in Canada: are we hitting the mark? In: Cancer Advocacy Coalition of Canada. Report card on cancer in Canada, 2008 [Internet]. Cancer Advocacy Coalition of Canada; 2008 [cited 2013 Sept 6]. Available from: http://www.canceradvocacy.ca/reportcard/2008/index.html

173. Public Health Agency of Canada. Human papillomavirus (HPV) prevention and HPV vaccines: questions and answers [Internet]. Ottawa (ON): Public Health Agency of Canada; 2011 [updated 2011 Mar 31; cited 2013 Sept 6]. Available from: http://www.phac-aspc.gc.ca/std-mts/hpv-vph/hpv-vph-vaccine-eng.php#a3

174. Cogliano V, Grosse Y, Baan R, Straif K, Secretan B, El Ghissassi F. Carcinogenicity of combined oestrogen-progestagen contraceptives and menopausal treatment. Lancet Oncol. 2005;6:552-3.

175. Cust AE, Armstrong BK, Friedenreich CM, Slimani N, Bauman A. Physical activity and endometrial cancer risk: a review of the current evidence, biologic mechanisms and the quality of physical activity assessment methods. Cancer Causes Control. 2007;18: 243-58.

176. Zhang Y, Liu H, Yang S, Zhang J, Qian L, Chen X. Overweight, obesity and endometrial cancer risk: results from a systematic review and meta-analysis. Int J Biol Markers. 2014;29(1):e21-9.

177. Arem H, Irwin ML, Zhou Y, Lu L, Risch H, Yu H. Physical activity and endometrial cancer in a population-based case-control study. Cancer Causes Control. 2011;22:219-26.

178. Voskuil DW, Monninkhof EM, Elias SG, Vlems FA, van Leeuwen FE, Task Force Physical Activity and Cancer. Physical activity and endometrial cancer risk, a systematic review of current evidence. Cancer Epidemiol Biomarkers Prev. 2007;16:639-48.

179. Bray F, dos Santos Silva I, Moller H, Weiderpasse E. Endometrial cancer incidence trends in Europe: underlying determinants and prospects for prevention. Cancer Epidemiol Biomarkers Prev. 2005;14:1132-42.

180. Evans T, Sany O, Pearmain P, Ganesan R, Blann A, Sundar S. Differential trends in the rising incidence of endometrial cancer by type: data from a UK population-based registry from 1994 to 2006. Br J Cancer. 2011;104:1505-10.

181. Fisher WA, Black A. Contraception in Canada: a review of method choices, characteristics, adherence and approaches to counselling. CMAJ. 2007;176:953-61.

182. Dossus L, Allen N, Kaaks R, et al. Reproductive risk factors and endometrial cancer: the European prospective investigation into cancer and nutrition. Int J Cancer. 2010;127:442-51.

183. Tortolero-Luna G, Mitchell MF. The epidemiology of ovarian cancer. J Cell Biochem Suppl. 1995;23:200-7.

184. Kelsey JL, Whittemore AS. Epidemiology and primary prevention of cancers of the breast, endometrium, and ovary: a brief overview. Ann Epidemiol. 1994;4:89-95.

185. Hunn J, Rodriguez GC. Ovarian cancer: etiology, risk factors, and epidemiology. Clin Obstet Gynecol. 2012;55:3-23.

186. Goldman MB, Hatch M. Women and Health. Waltham (MA): Academic Press; 1999.

187. Salehi F, Dunfield L, Phillips KP, Krewski D, Vanderhyden BC. Risk factors for ovarian cancer: an overview with emphasis on hormonal factors. J Toxicol Environ Health B Crit Rev. 2008;11:301-21.

188. Pearce CL, Chung K, Pike MC, Wu AH. Increased ovarian cancer risk associated with menopausal estrogen therapy is reduced by adding a progestin. Cancer. 2009;115:531-9.

189. Beral V, Million Women Study Collaborators, Bull D, Green J, Reeves G. Ovarian cancer and hormone replacement therapy in the Million Women Study. Lancet. 2007;369:1703-10.

190. Levy-Lahad E, Friedman E. Cancer risks among BRCA1 and BRCA2 mutation carriers. Br J Cancer. 2007;96:11-5.

191. Gayther SA, Pharoah PD. The inherited genetics of ovarian and endometrial cancer. Curr Opin Genet Dev. 2010;20:231-8.

192. Granstrom C, Sundquist J, Hemminki K. Population attributable fractions for ovarian cancer in Swedish women by morphological type. Br J Cancer. 2008;98:199-205.

193. Negri E, Pelucchi C, Franceschi S, et al. Family history of cancer and risk of ovarian cancer. Eur J Cancer. 2003;39:505-10.

194. Secretan B, Straif K, Baan R, et al. A review of human carcinogens--Part E: tobacco, areca nut, alcohol, coal smoke, and salted fish. Lancet Oncol. 2009;10:1033-4.

195. Canadian Task Force on the Periodic Health Examination. Periodic health examination, 1991 update 3. Secondary prevention of prostate cancer. CMAJ. 1991;145:413-28.

196. Levy IG, Gibbons L, Collins JP, Perkins DG, Mao Y. Prostate cancer trends in Canada: rising incidence or increased detection? CMAJ. 1993;149:617-24.

197. Canadian Cancer Society's Steering Committee on Cancer Statistics. Canadian Cancer Statistics 2006. Toronto (ON): Canadian Cancer Society; 2006.

198. Kramer BS, Brown ML, Prorok PC, Potosky AL, Gohagan JK. Prostate cancer screening: what we know and what we need to know. Ann Intern Med. 1993;119:914-23.

199. Hayes JH, Barry MJ. Screening for prostate cancer with the prostate-specific antigen test: a review of current evidence. JAMA. 2014;311:1143-9.

200. Evans HS, Møller H. Recent trends in prostate cancer incidence and mortality in southeast England. Eur Urol. 2003;43:337-41.

201. Brawley OW. Trends in prostate cancer in the United States. J Natl Cancer Inst Monogr. 2012;2012:152-6.

202. Kicinski M, Vangronsveld J, Nawrot TS. An epidemiological reappraisal of the familial aggregation of prostate cancer: a meta-analysis. PLoS ONE. 2011;6:e27130.

203. Bruner DW, Moore D, Parlanti A, Dorgan J, Engstrom P. Relative risk of prostate cancer for men with affected relatives: systematic review and meta-analysis. Int J Cancer. 2003;107:797-803.

204. Johns LE, Houlston RS. A systematic review and meta-analysis of familial prostate cancer risk. BJU Int. 2003;91:794.

205. Hemminki K, Czene K. Age specific and attributable risks of familial prostate carcinoma from the family-cancer database. Cancer. 2002;95:1346-53.

206. Ferlay J, Shin HR, Bray F, Forman D, Mathers C, Parkin DM. GLOBOCAN 2008, Cancer Incidence and Mortality Worldwide: IARC CancerBase No. 10. Lyon (FR): International Agency for Research on Cancer; 2010.

207. Parkin DM, Ferlay J, Hamdi-Cherif M, et al. Cancer in Africa: epidemiology and prevention. 1st ed. Lyon (FR): IARC Scientific Publications no.153; 2003.

208. Brawley OW. Prostate cancer epidemiology in the United States. World J Urol. 2012; 30:195-200.

209. Leitzmann MF, Rohrmann S. Risk factors for the onset of prostatic cancer: age, location, and behavioral correlates. Clin Epidemiol. 2012;4:1-11.

210. Chen L, Stacewicz-Sapuntzakis M, Duncan C, et al. Oxidative DNA damage in prostate cancer patients consuming tomato sauce-based entrees as a whole-food intervention. J Natl Cancer Inst. 2001;93:1872-1879.

211. Yan L, Spitznagel EL. Soy consumption and prostate cancer risk in men: a revisit of a meta-analysis. Am J Clin Nutr. 2009;89:1155-63.

212. Gao X, LaValley MP, Tucker KL. Prospective studies of dairy product and calcium intakes and prostate cancer risk: a meta-analysis. J Natl Cancer Inst. 2005;97:1768-77.

213. Gann PH. Risk factors for prostate cancer. Rev Urol. 2002;4 Suppl 5:S3-10.

214. McGlynn KA, Devesa SS, Sigurdson AJ, Brown LM, Tsao L, Tarone RE. Trends in the incidence of testicular germ cell tumors in the United States. Cancer. 2003;97:63-70.

215. Bray F, Richiardi L, Ekbom A, Pukkala E, Cuninkova M, Møller H. Trends in testicular cancer incidence and mortality in 22 European countries: continuing increases in incidence and declines in mortality. Int J Cancer. 2006;118:3099-111.

216. Power DA, Brown RS, Brock CS, Payne HA, Majeed A, Babb P. Trends in testicular carcinoma in England and Wales, 1971-99. BJU Int. 2001;87:361-5.

217. Stone JM, Cruickshank DG, Sandeman TF, Matthews JP. Trebling of the incidence of testicular cancer in Victoria, Australia (1950-1985). Cancer. 1991;68:211-9.

218. Møller H, Fairley L, Coupland V, et al. The future burden of cancer in England: incidence and numbers of new patients in 2020. Br J Cancer. 2007;96(9):1484-8.

219. Pettersson A, Richiardi L, Nordenskjold A, et al. Age at surgery for undescended testis and risk of testicular cancer. N Engl J Med. 2007;356:1835-41.

220. Zhang Y, Graubard BI, Klebanoff MA, et al. Maternal hormone levels among populations at high and low risk of testicular germ cell cancer. Br J Cancer. 2005;92:1787-93.

221. Sharpe RM, Skakkebaek NE. Are oestrogens involved in falling sperm counts and disorders of the male reproductive tract? Lancet. 1993;341:1392-5.

222. Skakkebaek NE, Rajpert-De Meyts E, Jørgensen N, et al. Germ cell cancer and disorders of spermatogenesis: an environmental connection? APMIS. 1998;106:3-12.

223. Hemminki K, Chen B. Familial risks in testicular cancer as aetiological clues. Int J Androl. 2006;29:205-10.

224. Chow WH, Devesa SS. Contemporary epidemiology of renal cell cancer. Cancer J. 2008;14:288-301.

225. Chow WH, Devesa SS, Warren JL, Fraumeni JF Jr. Rising incidence of renal cell cancer in the United States. JAMA. 1999;281:1628-31.

226. Liu S, Semenciw R, Morrison H, Schanzer D, Mao Y. Kidney cancer in Canada: the rapidly increasing incidence of adenocarcinoma in adults and seniors. Can J Public Health. 1997;88:99-104.

227. Mathew A, Devesa SS, Fraumeni JF Jr, Chow WH. Global increases in kidney cancer incidence, 1973-1992. Eur J Cancer Prev. 2002;11:171-8.

228. Levi F, Ferlay J, Galeone C, et al. The changing patterns of kidney cancer incidence and mortality in Europe. BJU Int. 2008;101:949-58.

229. Chow WH, Dong LM, Devesa SS. Epidemiology and risk factors for kidney cancer. Nat Rev Urol. 2010;7:245-57.

230. Simard EP, Ward EM, Siegel R, Jemal A. Cancers with increasing incidence trends in the United States: 1999 through 2008. CA Cancer J Clin. 2012;62:118-28.

231. Patard JJ. Incidental renal tumours. Curr Opin Uro. 2009;19:454-8.

232. Hock LM, Lynch J, Balaji KC. Increasing incidence of all stages of kidney cancer in the last 2 decades in the United States: An analysis of surveillance, epidemiology, and end results program data. J Urol. 2002;167: 57-60.

233. Moore LE, Wilson RT, Campleman SL. Lifestyle factors, exposures, genetic susceptibility, and renal cell cancer risk: a review. Cancer Invest. 2005;23:240-55.

234. Lipworth L, Tarone RE, McLaughlin JK. The epidemiology of renal cell carcinoma. J Urol. 2006;176:2353-8.

235. Hu J, Ugnat AM. Active and passive smoking and risk of renal cell carcinoma in Canada. Eur J Cancer. 2005;41:770-8.

236. Chow WH, Grindley G, Fraumeni JF Jr, Jarvholm B. Obesity, hypertension, and the risk of kidney cancer in men. N Engl J Med. 2000;343:1305-11.

237. Bao C, Yang X, Xu W et al. Diabetes mellitus and incidence and mortality of kidney cancer: A meta-analysis. J Diabetes Complications. 2013;Feb 20.

238. Bonsib SM. Renal cystic diseases and renal neoplasms: a mini-review. Clin J Am Soc Nephrol. 2009;4:1998-2007.

239. Curado FJA, Hernandez PC, Castro RP, et al. New epidemiologic patterns and risk factors in renal cancer. Actas Urol Esp. 2009;33:459-67.

240. Karami S, Lan Q, Rothman N, et al. Occupational trichloroethylene exposure and kidney cancer risk: a meta-analysis. Occup Environ Med. 2012;69:858-67.

241. Lynch CF, Platz CE, Jones MP, Gazzaniga JM. Cancer registry problems in classifying invasive bladder cancer. J Natl Cancer Inst. 1991;83:429-33.

242. Hankey BF, Edwards BK, Ries LA, Percy CL, Shambaugh E. Problems in cancer surveillance: Delineating in situ and invasive bladder cancer. J Natl Cancer Inst. 1991;83:384-5.

243. Schned AR, Andrew AS, Marsit CJ, Zens MS, Kelsey KT, Karagas MR. Survival following the diagnosis of noninvasive bladder cancer: WHO/International Society of Urological Pathology versus WHO Classification systems. J Urol. 2007;178:1200.

244. Brennan P, Bogillot O, Greiser E, et al. The contribution of cigarette smoking to bladder cancer in women (pooled European data). Cancer Causes Control. 2001;12:411-7.

245. Zeegers MP, Tan FE, Dorant E, van den Brandt PA. The impact of characteristics of cigarette smoking on urinary tract cancer risk: a meta-analysis of epidemiological studies. Cancer. 2000;89:630-9.

246. Pashos CL, Botteman MF, Laskin BL, Redaelli A. Bladder cancer: epidemiology, diagnosis, and management. Cancer Pract. 2002;10:311-22.

247. Olfert SM, Felknor SA, Delclos GL. An updated review of the literature: risk factors for bladder cancer with focus on occupational exposures. South Med J. 2006;99:1256-63.

248. Letašiová S, Medve'ová A, Šovèíková A. Bladder cancer, a review of the environmental risk factors. Environ Health. 2012;11 Suppl 1:S11.

249. Kirkali Z, Chan T, Manoharan M, et al. Bladder cancer: epidemiology, staging and grading, and diagnosis. Urology. 2005;66:4-34.

250. Siemiatycki J, Dewar R, Nadon L, Gérin M. Occupational risk factors for bladder cancer: results from a case-control study in Montreal, Quebec, Canada. Am J Epidemiol. 1994;140: 1061-80.

251. Gaertner RR, Trpeski L, Johnson KC. A case-control study of occupational risk factors for bladder cancer in Canada. Cancer Causes Control. 2004;15:1007-19.

252. Villanueva CM, Fernández F, Malats N, Grimalt JO, Kogevinas M. Meta-analysis of studies on individual consumption of chlorinated drinking water and bladder cancer. J Epidemiol Community Health. 2003;57:166-73.

253. Villanueva CM, Cantor KP, King WD et al. Total and specific fluid consumption as determinants of bladder cancer risk. Int J Cancer. 2006;118:2040-7.

254. Canadian Cancer Society's Steering Committee. Canadian cancer statistics 2009. Toronto: Canadian Cancer Society; 2009.

255. Preston-Martin S, Munir R, Chakrabarti I. Nervous system. In: Cancer epidemiology and prevention, 3rd ed. Schottenfeld D, Fraumeni JF, editors. New York (NY): Oxford University Press; 2006. p. 1173-95.

256. Hemminki K, Tretli S, Olsen JH, et al. Familial risks in nervous system tumours: joint Nordic study. Br J Cancer. 2010;102: 1786-90.

257. Kilfoy BA, Zheng T, Holford TR, et al. International patterns and trends in thyroid cancer incidence, 1973-2002. Cancer Causes Control. 2009;20:525-31.

258. Davies L, Welch HG. Increasing incidence of thyroid cancer in the United States, 1973-2002. JAMA. 2006;295:2164-7.

259. Enewold L, Zhu K, Ron E, et al. Rising thyroid cancer incidence in the United States by demographic and tumor characteristics, 1980-2005. Cancer Epidemiol Biomarkers Prev. 2009;18:784-91.

260. Kent WD, Hall SF, Isotalo PA, Houlden RL, George RL, Groome PA. Increased incidence of differentiated thyroid carcinoma and detection of subclinical disease. CMAJ. 2007;177:1357-61.

261. Cancer Care Ontario. Thyroid cancer incidence increasing in Ontario [Internet]. Toronto (ON): Cancer Care Ontario; 2010 [updated 2010 Mar 2; cited 2013 Oct 30]. Available from: https://www.cancercare.on.ca/cancerfacts/

262. Ron E, Schneider AB. Thyroid Cancer. In: Schottenfeld D, Fraumeni JF Jr, editors. Cancer epidemiology and prevention, 3rd ed. New York (NY): Oxford University Press; 2006. p. 975-94.

263. Haq M, Harmer C. Thyroid cancer: an overview. Nucl Med Commun. 2004;25:861-7.

264. Zabel EW, Alexander BH, Mongin SJ, et al. Thyroid cancer and employment as a radiologic technologist. Int J Cancer. 2006;119:1940-5.

265. Ron E, Lubin JH, Shore RE, et al. Thyroid cancer after exposure to external radiation: a pooled analysis of seven studies. Radiat Res. 1995;141:259-77.

266. Peterson E, De P, Nuttall R. BMI, diet and female reproductive factors as risks for thyroid cancer: a systematic review. PLoS ONE. 2012;7:e29177.

267. Tsang RW, Hodgson DC, Crump M. Hodgkin's lymphoma. Curr Probl Cancer. 2006;30:107-58.

268. Andersson J. Epstein-Barr virus and Hodgkin's lymphoma. Herpes. 2006;13:12-6.

269. International Agency for Research on Cancer. Epstein-barr virus and Kaposi's sarcoma herpesvirus/human herpesvirus 8. IARC monographs on the evaluation of carcinogenic risks to humans, Vol. 70. Lyon, France, International Agency for Research on Cancer; 1997.

270. Grulich AE, van Leeuwen MT, Falster MO, Vajdic CM. Incidence of cancers in people with HIV/AIDS compared with immunosuppressed transplant recipients: a meta-analysis. Lancet. 2007;370:59-67.

271. Goldin LR, Pfeiffer RM, Gridley G, et al. Familial aggregation of Hodgkin lymphoma and related tumors. Cancer. 2004;100:1902-8.

272. Sergentanis TN, Kanavidis P, Michelakos T, Petridou ET. Cigarette smoking and risk of lymphoma in adults: a comprehensive meta-analysis on Hodgkin and non-Hodgkin disease. Eur J Cancer Prev. 2013;22:131-50.

273. Kamper-Jørgensen M, Rostgaard K, Glaser SL, et al. Cigarette smoking and risk of Hodgkin lymphoma and its subtypes: a pooled analysis from the International Lymphoma Epidemiology Consortium (InterLymph). Ann Oncol. 2013;24:2245-55.

274. Chang ET, Zheng T, Weir EG, et al. Childhood social environment and Hodgkin's lymphoma: new findings from a population-based case-control study. Cancer Epidemiol Biomarkers Prev. 2004;13:1361-70.

275. Cancer Care Ontario. Cancer Fact: Hodgkin lymphoma incidence highest in young adults and elderly. Cancer Care Ontario; 2006 [updated 2009 Oct 21; cited 2013 Sept 6]. Available from: https://www.cancercare.on.ca/cancerfacts/

276. Wang SS, Slager SL, Brennan P, et al. Family history of hematopoietic malignancies and risk of non-Hodgkin lymphoma (NHL): a pooled analysis of 10 211 cases and 11 905 controls from the International Lymphoma Epidemiology Consortium (InterLymph). Blood. 2007;109:3479-99.

277. Crump C, Sundquist K, Sieh W, Winkleby MA, Sundquist J. Perinatal and family risk factors for non-Hodgkin lymphoma in early life: a Swedish National Cohort Study. J Natl Cancer Inst. 2012;104:923-30.

278. Grulich AE, Vajdic CM, Cozen W. Altered immunity as a risk factor for non-Hodgkin lymphoma. Cancer Epidemiol Biomarkers Prev. 2007;16:405-8.

279. Matsuo K, Kusano A, Sugumar A, Nakamura S, Tajima K, Mueller NE. Effect of hepatitis C virus infection on the risk of non-Hodgkin's lymphoma: a meta-analysis of epidemiological studies. Cancer Sci. 2004;95:745-52.

280. Dal ML, Franceschi S. Hepatitis C virus and risk of lymphoma and other lymphoid neoplasms: a meta-analysis of epidemiologic studies. Cancer Epidemiol Biomarkers Prev. 2006;15:2078-85.

281. Anderson LA, Engels EA. Hepatitis C virus infection and non-Hodgkin lymphoma: interesting association or causal relationship? Int J Cancer. 2008;122:10-2.

282. Clarke CA, Glaser SL, Dorfman RF, Bracci PM, Eberle E, Holly EA. Expert review of non-Hodgkin's lymphomas in a population-based cancer registry: reliability of diagnosis and subtype classifications. Cancer Epidemiol Biomarkers Prev. 2004;13(1):138-43.

283. Groves FD, Linet MS, Travis LB, Devesa SS. Cancer surveillance series: non-Hodgkin's lymphoma incidence by histologic subtype in the United States from 1978 through 1995. J Natl Cancer Inst. 2000;92:1240-51.

284. Turesson I, Velez R, Kristinsson SY, Landgren O. Patterns of multiple myeloma during the past 5 decades: stable incidence rates for all age groups in the population but rapidly changing age distribution in the clinic. Mayo Clin Proc. 2010;85:225-30.

285. Renshaw C, Ketley N, Møller H, Davies EA. Trends in the incidence and survival of multiple myeloma in South East England 1985-2004. BMC Cancer. 2010;10:74.

286. Levi F, Te VC, Randimbison L, La Vecchia C. Incidence of multiple myeloma in Olmsted County, Minnesota. Cancer. 2005;104:442.

287. Alexander DD, Mink PJ, Adami HO, et al. Multiple myeloma: a review of the epidemiologic literature. Int J Cancer. 2007;120 Suppl 12:40-61.

288. Kristinsson SY, Goldin LR, Björkholm M, Koshiol J, Turesson I, Landgren O. Genetic and immune-related factors in the pathogenesis of lymphoproliferative and plasma cell malignancies. Haematologica. 2009;94:1581-9.

289. Kyle RA, Therneau TM, Rajkumar SV, et al. A long-term study of prognosis in monoclonal gammopathy of undetermined significance. N Engl J Med. 2002;346:564-9.

290. Larsson SC, Wolk A. Body mass index and risk of multiple myeloma: A meta-analysis. Int J Cancer. 2007;121:2512-6.

291. Wallin A, Larson SC. Body mass index and risk of multiple myeloma: a meta-analysis of prospective studies. Eur J Cancer. 2011;47:1606-15.

292. Shiels MS, Cole SR, Kirk GD, Poole C. A meta-analysis of the incidence of non-AIDS cancers in HIV-infected individuals. J Acquir Immune Defic Syndr. 2009;52:611-22.

293. National Cancer Institute. SEER Stat Fact Sheets: Leukemia [Internet]. Bethesda (MD): National Cancer Institute; 2013 [updated 2013 Apr 1; cited 2013 Dec 19]. Available from: http://seer.cancer.gov/statfacts/html/leuks.html

294. Deschler B, Lubbert M. Acute myeloid leukemia: epidemiology and etiology. Cancer. 2006;107:2099-107.

295. International Agency for Research on Cancer. Classification of tumours. Pathology and genetics. Tumors of haematopoietic and lymphoid tissues. Lyon: IARC Press; 2001.

296. Kasim K, Levallois P, Abdous B, Auger P, Johnson KC, Canadian Cancer Registries Epidemiology Research Group. Environmental tobacco smoke and risk of adult leukemia. Epidemiology. 2005;16:672-80.

297. Gessain A, Cassar O. Epidemiological Aspects and World Distribution of HTLV-1 Infection. Front Microbiol. 2012;3:388.

298. International Agency for Research on Cancer. Human immunodeficiency viruses and human T-cell lymphotropic viruses. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Vol. 67. Lyon (FR): IARC Press; 1996.

299. Altieri A, Castro F, Bermejo JL, Hemminki K. Number of siblings and the risk of lymphoma, leukemia, and myeloma by histopathology. Cancer Epidemiol Biomarkers Prev. 2006;15:1281-6.

300. Slager SL, Caporaso NE, de Sanjose S, Goldin LR. Genetic susceptibility to chronic lymphocytic leukemia. Semin Hematol. 2013;50:296-302.

301. Goldin LR, Caporaso NE. Family studies in chronic lymphocytic leukaemia and other lymphoproliferative tumours. Br J Haematol. 2007;139:774-9.

302. Crowther-Swanepoel D, Houlston RS. Genetic variation and risk of chronic lymphocytic leukaemia. Semin Cancer Biol. 2010;20:363-9.

303. Ito T. Stem cell maintenance and disease progression in chronic myeloid leukemia. Int J Hematol. 2013;98:641-7.

304. Liu-Dumlao T, Kantarjian H, Thomas DA, O'Brien S, Ravandi F. Philadelphia-positive acute lymphoblastic leukemia: current treatment options. Curr Oncol Rep. 2012;14:387-94.

305. Hoffbrand AV, Moss PAH, Pettit JE. Essential haematology, 5th ed. Oxford: Blackwell Publishing Ltd.; 2006.

306. Taylor GM, Birch JM. The hereditary basis of human leukemia. In: Henderson ES, Lister TA, Greaves MJ, editors Leukemia, 6th ed. Philadelphia: WB Saunders; 1996. p. 210-45.

307. Lichtman MA. Obesity and the risk for a hematological malignancy: leukemia, lymphoma, or myeloma. Oncologist. 2010;15:1083-101.

308. Larsson SC, Wolk A. Overweight and obesity and incidence of leukemia: a meta-analysis of cohort studies. Int J Cancer. 2008;122:1418-21.

309. Pan SY, Johnson KC, Ugnat AM, Wen SW, Mao Y. Association of obesity and cancer risk in Canada. Am J Epidemiol. 2004;159:259-68.

310. Kasim K, Johnson KC, Levallois P, Abdous B, Auger P, Canadian Cancer Registries Epidemiology Research Group. Recreational physical activity and the risk of adult leukemia in Canada. Cancer Causes Control. 2009;20:1377-86.

311. Marrett LD, Ellison LF, Dryer D. Canadian cancer statistics at a glance: mesothelioma. CMAJ. 2008;178:677-8.

312. American Cancer Society. Global Cancer Facts and Figures, 2nd Edition. Atlanta (GA): America Cancer Society; 2011 [cited 2013 Oct 30]. Available from: http://www.cancer.org/acs/groups/content/@epidemiologysurveilance/documents/document/acspc-027766.pdf

313. International Agency for Research on Cancer. International Rules for Multiple Primary Cancers (ICD-O Third Edition) [Internet]. Lyon (FR): International Agency for Research on Cancer; 2004 [cited 2013 Oct 30]. Available from: http://www.iacr.com.fr/MPrules_july2004.pdf

314. Quon H, Loblaw A, Nam R. Dramatic increase in prostate cancer cases by 2021. BJU Int. 2011;108:1734-8.

Abbreviations

AIDS	acquired immunodeficiency syndrome
ALL	acute lymphocytic leukemia
AML	acute myeloid leukemia
APC	age-period-cohort (model)
ASIR	age-standardized incidence rate
BMI	body mass index
CCR	Canadian Cancer Registry
CI	confidence interval
CLL	chronic lymphocytic leukemia
CML	chronic myeloid leukemia
CNS	central nervous system
DCO	death certificate only
DNA	deoxyribonucleic acid
EBV	Epstein-Barr virus
GERD	gastroesophageal reflux disease
HBV	hepatitis B virus
HCV	hepatitis C virus
HIV	human immunodeficiency virus
HL	Hodgkin lymphoma
HPV	human papilloma virus
HTLV-1	human T-cell lymphotropic virus type 1
IARC	International Agency for Research on Cancer
ICD-9	International Classification of Diseases, Ninth Revision
ICD-O-3	International Classification of Diseases for Oncology, Third Edition
MCMC	Markov chain Monte Carlo
MGUS	monoclonal gammopathy of undetermined significance
MM	multiple myeloma
NCIRS	National Cancer Incidence Reporting System
NHL	non-Hodgkin lymphoma
PSA	prostate-specific antigen (assay)
TC	Territories combined
UK	United Kingdom
US	United States

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