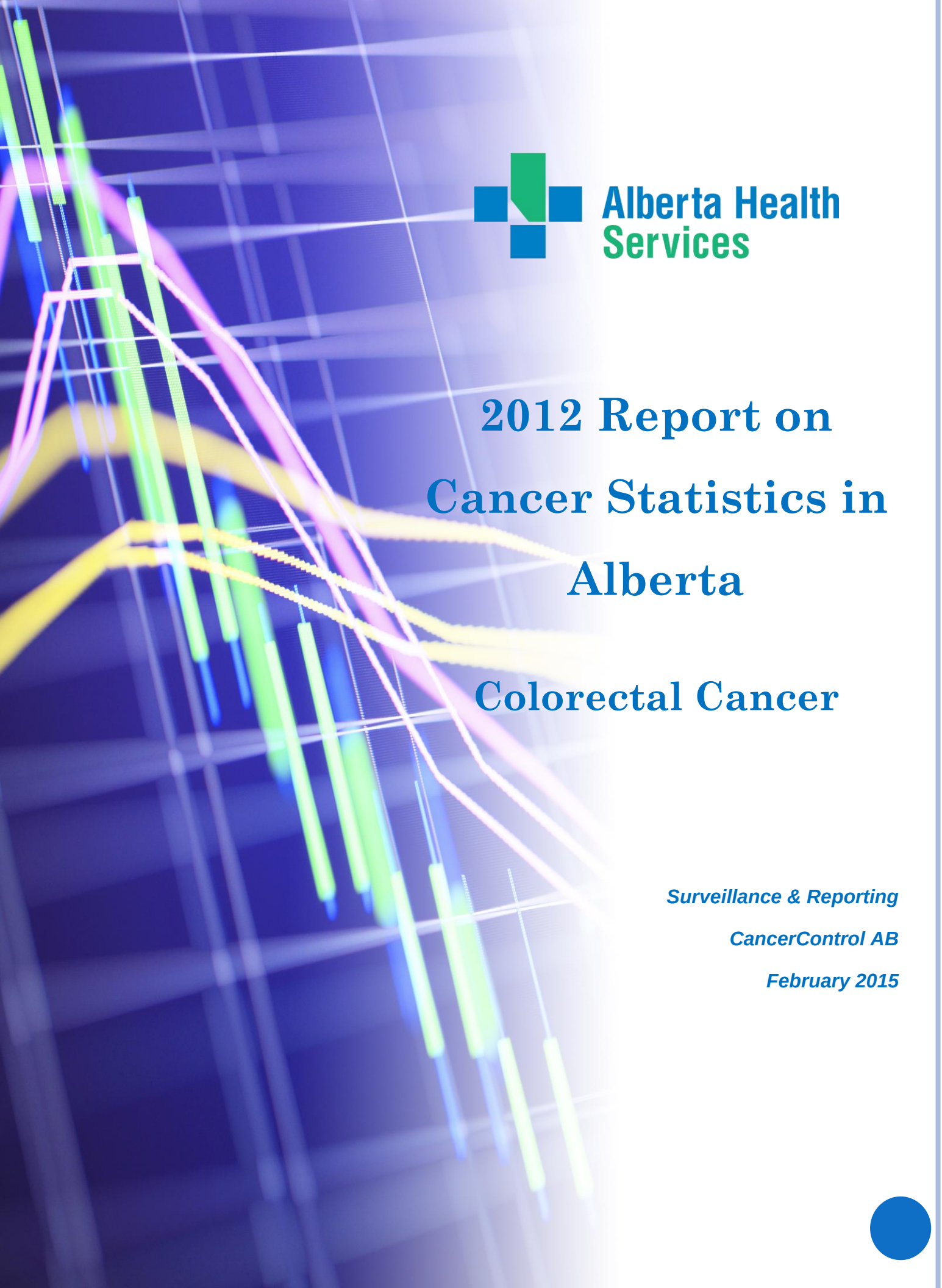

Alberta Health Services

2012 Report on Cancer Statistics in Alberta

Colorectal Cancer

Surveillance & Reporting

CancerControl AB

February 2015

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Purpose of the Report

Surveillance & Reporting, a specialized team within Cancer Measurement Outcomes Research and Evaluation (C-MORE), Alberta Health Services, actively contributes to Changing our Future: Alberta's Cancer Plan to 2030. As well, Surveillance & Reporting keenly contributes to the goal of making Alberta a place where most cancers are prevented, more cancers are cured, and suffering is reduced. This is accomplished in part by conducting cancer ***surveillance*** through the collection, integration, analysis, and dissemination of cancer-related data and information.

The report is designed to provide comprehensive and detailed information regarding cancer in Alberta. It will help support health professionals, researchers, and policy makers in the planning, monitoring, and evaluation of cancer-related health programs and initiatives. It will also be a useful education tool for the general public and media.

Navigating the Report

This document provides information on colorectal cancer (see **Appendix** for cancer definitions) statistics in Alberta. Details about other individual cancer types are available within separate documents. The words highlighted in ***dark blue*** are terms described in detail in the Glossary within the **Appendix** document.

Data Notes

In this document, the term "cancer" refers to ***invasive cancers*** unless otherwise specified. It is important to note that this document contains both actual and estimated data; distinctions are made where applicable. The numbers published in this report should be considered provisional, as a few cases and deaths may be registered in subsequent years. The data in this report reflect the state of the Alberta Cancer Registry as of July 14, 2014.

For detailed descriptions about data sources and how they affect data presented in this report, please see the **Appendix** document.

Summary

- Colorectal cancer is the second most commonly diagnosed cancer in males and the third in females accounting for **1,911** new cases diagnosed in 2012 and **683** deaths in 2012. Approximately **1 in 13** men and **1 in 16** women will develop invasive colorectal cancer within their lifetime. As of December 31, 2012, approximately **14,300** Albertans were alive who had previously been diagnosed with colorectal cancer.

- Over the last 21 years, between 1992 and 2012, both **male and female** colorectal cancer **incidence rates have remained stable** whilst **mortality rates have decreased**. Colorectal cancer incidence and mortality remains consistent across all five Alberta Health Zones. Colorectal cancer rates are low until about age 40, at which point rates begin to increase, with rates for males rising more quickly than for females.

- Approximately **2,500** cases of colorectal cancer are expected to be diagnosed in 2017. Most of the increase in colorectal cancer incidence since 1992 is estimated to be attributable to an aging population (**73%**) and population growth (**60%**).

- Potential years of life lost (PYLL) is the number of years of life lost when a person dies prematurely from any cause, based on their life expectancy. In 2012, **10,065** potential years of life were lost due to colorectal cancer.

- Generally, cancers diagnosed in earlier stages (I & II) will receive less invasive treatment and have better survival. **47%** of colorectal cancer cases were diagnosed in stages I & II from 2010-2012. Survival for patients diagnosed in Stage I and II was above 90% for patients diagnosed in 2009-2012 and decreased to 19% for those diagnosed in stage IV.

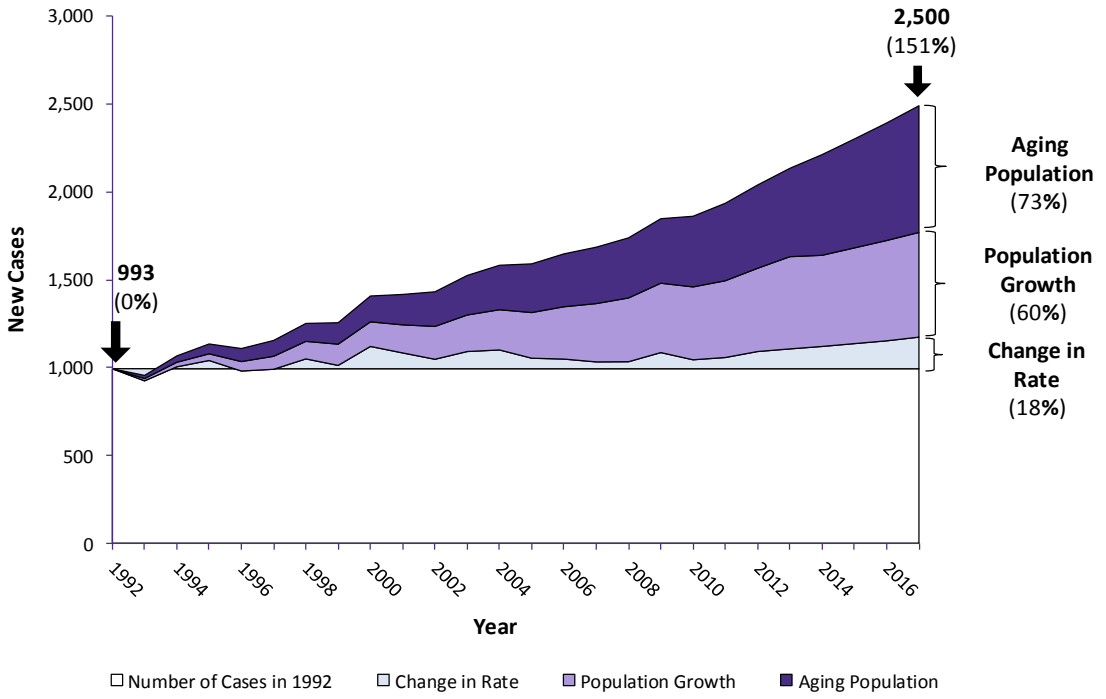
- The five-year relative survival ratio for colorectal cancer in Alberta is approximately **64%** for those diagnosed between 2010 and 2012, an improvement compared to those diagnosed in 1992-1994 (**55%**). This means that those diagnosed in 2010 to 2012 are about 64% as likely to be alive 5 years after their diagnoses as someone who has not been diagnosed with cancer.

* Year range represents the period over which the most recent significant trend was observed.

Demography

Demography changes in Alberta (aging of the population and population growth) contributed more new cases of colorectal cancer in both males and females over the last two decades when compared to the change in the colorectal cancer rate (**Figure 6-1**).

Figure 6-1: Trends in New Cases Colorectal Cancer Attributed to Aging Population, Population Growth and Change in Colorectal Cancer Rate, Both Sexes, Alberta, 1992-2017



Data Source: Alberta Cancer Registry, Alberta Health Services; Alberta Health

The horizontal black line indicating 993 new cases in **Figure 6-1** represents the number of colorectal cancer cases that occurred in 1992. The line at the top of the dark purple-shaded area of the graph represents the number of new cases that actually occurred between 1992 and 2012, projected to 2017. Between these two lines, the three colored areas reflect the increase in colorectal cancer cases due to the impact of rate change, population growth, and aging population.

The light blue shaded area (lower) represents the total number of new colorectal cancer cases that would have occurred each year if the cancer incidence rates alone had changed, but the population had remained the same as in 1992; this will account for approximately 18% of the total increase in new colorectal cancer cases in 2017.

The light purple shaded area (middle) represents the number of new colorectal cancer cases that would have occurred each year if the population alone had grown larger, but the population age distribution had remained the same as in 1992; this will account for approximately 60% of the total increase in new colorectal cancer cases in 2017.

The dark purple shaded area (top) represents the number of new colorectal cancer cases attributed to increases in the older adult population - the 'aging population'; this will account for approximately 73% of the total increase in new colorectal cancer cases in 2017.

The patterns of new colorectal cancer cases are different between males and females. In 1992, there were 427 new cases in females and 566 new cases in males.

In 2017, 1,050 new cases are projected in females, accounting for 145% increase from 1992, where 21% will be due to the change in female colorectal cancer rate, 58% due to the population growth, and 66% due to aging population. Approximately 1,450 new cases are estimated in males, accounting for 155% increase from 1992, where 10% will be due to the change in male colorectal cancer rate, 62% due to the population growth, and 82% due to aging population.

Probability of Developing or Dying from Colorectal Cancer

The ***probability of developing or dying of cancer*** measures the risk of an individual in a given age range developing or dying of cancer, and is conditional upon the person being colorectal cancer-free prior to the beginning of that age range.

It is important to note that the probabilities of developing or dying of cancer represent all of Alberta's population on average and should be interpreted with caution at the individual level as the probabilities will be affected by the risk behaviours and exposures of the individual. In addition, someone diagnosed with cancer has a higher probability of developing another cancer in the future[1].

Table 6-1: Probability of Developing Colorectal Cancer by Age and Sex, Alberta, 2008-2012

Age Group	Males	Females
Lifetime Risk (all ages)	1 in 13	1 in 16
0 - 20	Less than 1 in 10,000	Less than 1 in 10,000
20 - 30	1 in 5,831	1 in 4,975
30 - 40	1 in 1,557	1 in 1,597
40 - 50	1 in 447	1 in 474
50 - 60	1 in 117	1 in 166
60 - 70	1 in 50	1 in 82
70 - 80	1 in 32	1 in 48
80+	1 in 24	1 in 28

Data Source: Alberta Cancer Registry, Alberta Health Services

The probability of developing colorectal cancer increases with age (**Table 6-1**). Approximately 1 in 13 males and 1 in 16 females will develop invasive colorectal cancer in their lifetime.

Males have a higher chance of developing colorectal cancer than females. On a population basis, the probability of developing colorectal cancer by the end of the age range for a colorectal cancer-free individual at the beginning of the age range are shown in **Table 6-1**. For instance, a colorectal cancer-free female at age 40 has a 1 in 474 chance of developing colorectal cancer by the time she is 50.

Table 6-2: Probability of Dying from Colorectal Cancer by Age and Sex, Alberta, 2008-2012

Age Group	Males	Females
Lifetime Risk (all ages)	1 in 32	1 in 38
0 - 20	Less than 1 in 10,000	Less than 1 in 10,000
20 - 30	Less than 1 in 10,000	Less than 1 in 10,000
30 - 40	1 in 9,594	1 in 8,882
40 - 50	1 in 1,825	1 in 2,295
50 - 60	1 in 511	1 in 744
60 - 70	1 in 166	1 in 309
70 - 80	1 in 80	1 in 140
80+	1 in 42	1 in 46

Data Source: Alberta Cancer Registry, Alberta Health Services

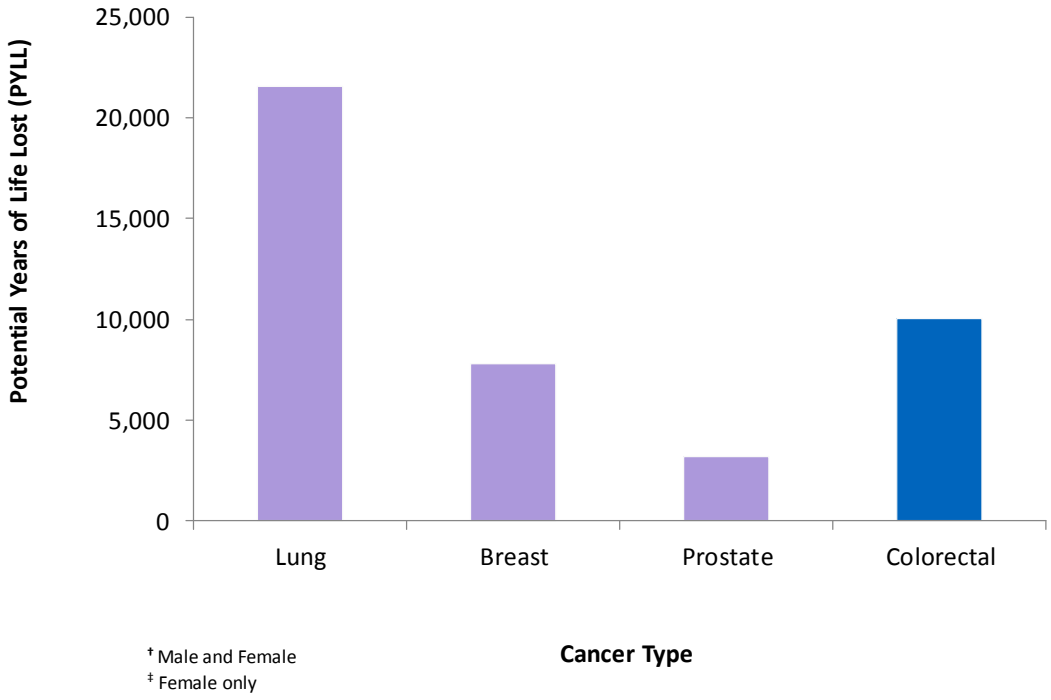
The probability of dying from colorectal cancer varies by age and sex (**Table 6-2**). Approximately 1 in 32 males and 1 in 38 females will die of invasive colorectal cancer.

Males have a higher chance of dying from colorectal cancer than females. On a population basis, the probability of a cancer-free individual at the beginning of the age range dying from colorectal cancer by the end of the age range are shown in **Table 6-2**. For example, a cancer-free female at age 40 has a 1 in 2,295 chance of dying from colorectal cancer by the time she is 50.

Potential Years of Life Lost

One frequently used measure of premature death is ***potential years of life lost (PYLL)***. PYLL due to cancer is an estimate of the number of years that people would have lived had they not died from cancer. PYLL due to cancer has been calculated by multiplying the number of deaths in each age group and the absolute difference between the mid-point age of an age group and the age-specific life expectancy. The age-specific life expectancy is calculated by determining the age to which an individual would have been expected to live had they not died from cancer. PYLL is one way to measure the impact, or burden, of a disease on a population.

Figure 6-2: Potential Years of Life Lost (PYLL) from Colorectal Cancer† Compared with Lung†, Breast‡ and Prostate Cancers, Alberta, 2012



† Male and Female
‡ Female only

Data Source: Alberta Cancer Registry, Alberta Health Services; Statistics Canada

In 2012, **10,065** potential years of life were lost due to colorectal cancer, which constitutes 10.9% of PYLL for all cancers (**Figure 6-2**).

Prevalence

The ***prevalence*** of a disease is defined as the number of people alive who had been previously diagnosed with that disease.

Limited-duration colorectal cancer prevalence represents the number of people alive on a certain day who had previously been diagnosed with colorectal cancer within a specified number of years (e.g. 2, 5, 10, or 20 years) while complete colorectal cancer prevalence represents the proportion of people alive on a certain day who had previously been diagnosed with colorectal cancer, regardless of how long ago the diagnosis was.[2]

In this section of the report, both limited-duration and complete colorectal cancer prevalence are presented; the latter describing the number of people alive as of December 31, 2012 who had ever been diagnosed with colorectal cancer.

Prevalence is a useful indicator of the impact of cancer on individuals, the healthcare system, and the community as a whole. Although many cancer survivors lead healthy and productive lives, the experience can have a strong impact on the physical and emotional well-being of individuals and their families. The cancer experience can also result in the continued use of the healthcare system through rehabilitation or support services, as well as loss of work productivity, which can affect the whole community.

As of December 31, 2012, approximately **14,300** Albertans were alive who had previously been diagnosed with colorectal cancer (**Table 6-3**). In addition, there were **3,000** Albertans alive who had been diagnosed with colorectal cancer within the previous two years. The two year time period is significant because most definitive cancer treatments will occur within two years of diagnosis.

Table 6-3: Limited-Duration and Complete Prevalence for Colorectal Cancer, Both Sexes, Alberta, 2012

Duration	Prevalence (#)
2-Year	3,000
5-Year	6,150
10-Year	9,600
20-Year	12,700
Complete (Ever Diagnosed)	14,300

Data Source: Alberta Cancer Registry, Alberta Health Services

Colorectal Cancer Incidence and Mortality

Introduction

Incidence counts are the number of new cancer cases diagnosed during a specific time period in a specific population. In this section of the report, incidence counts refer to the number of new colorectal cancer diagnoses in Alberta residents in a calendar year. Incidence rates are the number of new cancer cases diagnosed per 100,000 in the population, in a specific time period.

Mortality counts describe the number of deaths attributed to cancer during a specific period of time in a specific population. In this section of the report, mortality refers to the number of deaths due to colorectal cancer in Alberta residents in a calendar year, regardless of date of diagnosis. Mortality rates are the number of deaths per 100,000 in the population, in a specific time period.

In order to compare cancer incidence or cancer mortality over time, or between populations, ***age-standardized incidence rates (ASIRs)*** or ***age-standardized mortality rates (ASMRs)*** are presented. These are weighted averages of ***age-specific rates*** using a standard population. These rates are useful because they are adjusted for differences in age distributions in a population over time, which permit comparisons of cancer incidence or mortality among populations that differ in size, structure, and/or time period. ASIRs and ASMRs give the overall incidence and mortality rates that would have occurred if the population of Alberta had been the same as the standard population. In this report the Canadian 1991 standard population is used.

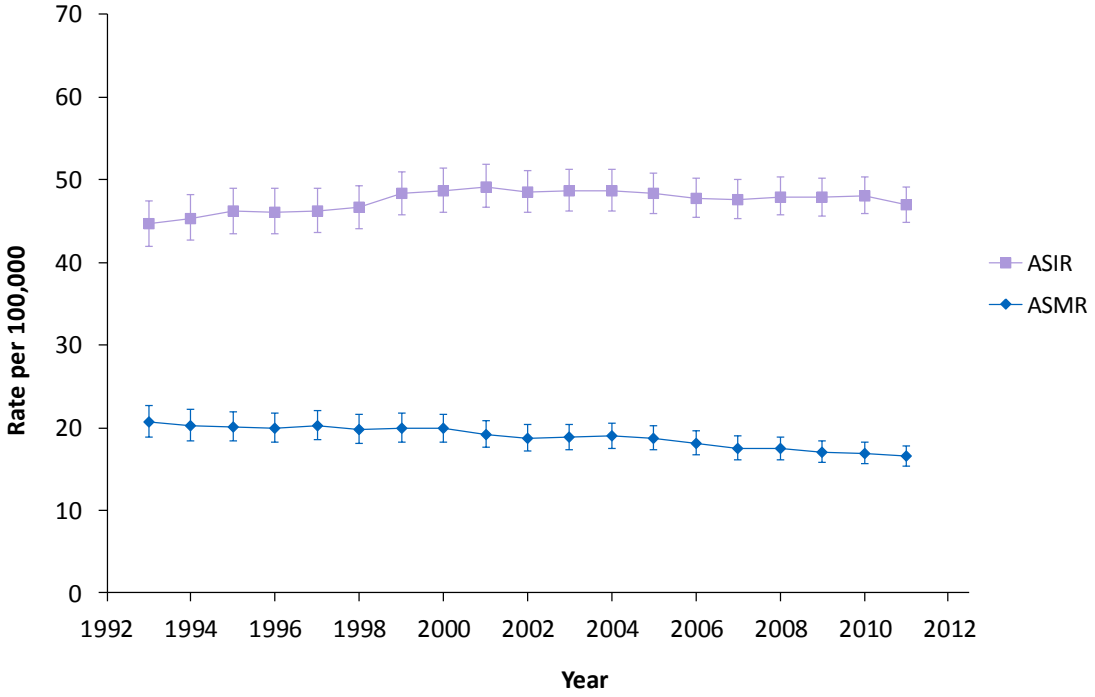
Three-year moving averages are used to smooth out year-to-year fluctuations so that the underlying trend may be more easily observed. They are calculated based on aggregating three years of data. Age-standardized incidence rates (ASIRs) and age-standardized mortality rates (ASMRs) are presented as three-year moving averages; therefore, information can only be presented for 1993-2011. This smoothing of trends is especially important when the number of cancer cases per year is relatively small and where year-to-year variability can be quite large.

Incidence and mortality can be affected by the implementation of public health prevention or screening strategies that either prevent disease or find cancer in its early ***stages*** when treatment is generally more successful. Incidence and mortality are also affected by the development of cancer treatment programs, which may impact chances of survival and research innovations.

The following figures show incidence and mortality trends in Alberta. Separate analyses for both incidence and mortality are shown in subsequent sections. The statistical significance* of the trends was determined by using Joinpoint[3] and is described in the text accompanying each graph. Joinpoint models are based on yearly rates; hence, there may be slight differences in the rates presented in the text (from Joinpoint model) and the graphs (where ASIRs and ASMRs are shown as three-year moving averages).

* Throughout this report, the use of the word significant refers to statistical significance at an alpha level of 0.05 (i.e. 95%CI).

Figure 6-3: Age-Standardized Incidence Rates (ASIRs)[*†] and Mortality Rates (ASMRs)[*†] for Colorectal Cancer, Both Sexes, Alberta, 1992-2012



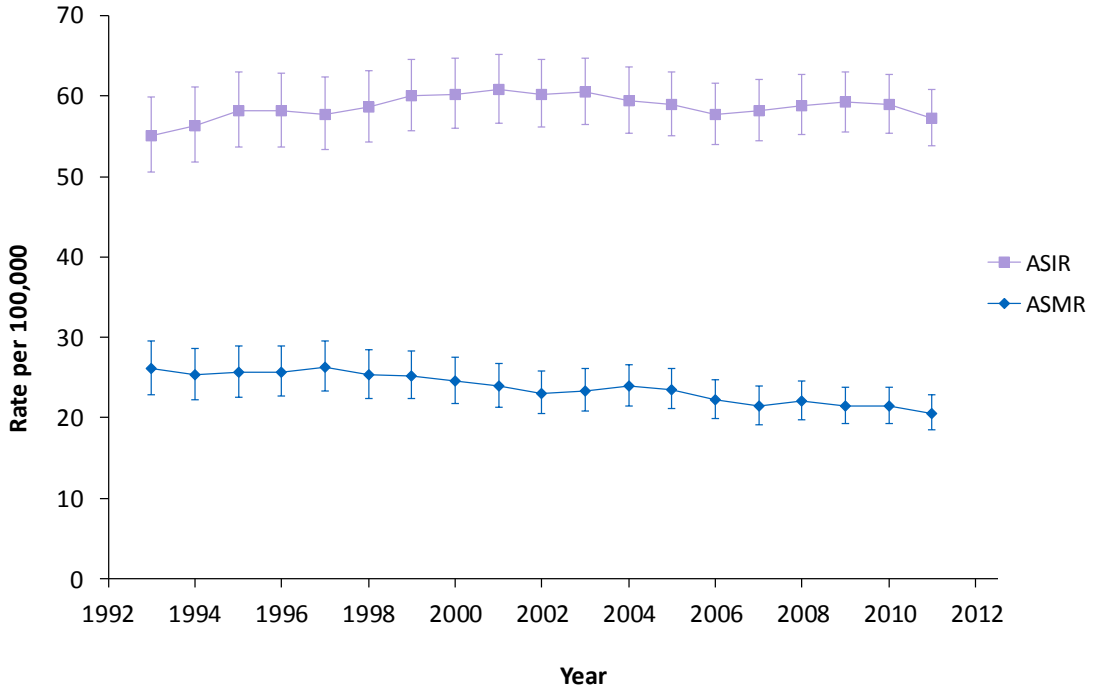
[*] Three-year moving average.
[†] Standardized to 1991 Canadian population.

Data Source: Alberta Cancer Registry, Alberta Health Services; Alberta Health

Colorectal cancer ASIRs increased significantly between 1992 and 2001 by 1.2% annually and remained stable from 2001 to 2012 (**Figure 6-3**). In 2012, the ASIR for colorectal cancer was 45.3 per 100,000 in the population.

Colorectal cancer mortality rates are lower than incidence rates (**Figure 6-3**). ASMRs decreased significantly since 1992 by 1.3% annually between 1992 and 2012. In 2012, the ASMR for colorectal cancer was 16.1 per 100,000 in the population.

Figure 6-4: Age-Standardized Incidence Rates (ASIRs)[*†] and Mortality Rates (ASMRs)[*†] for Colorectal Cancer, Males, Alberta, 1992-2012



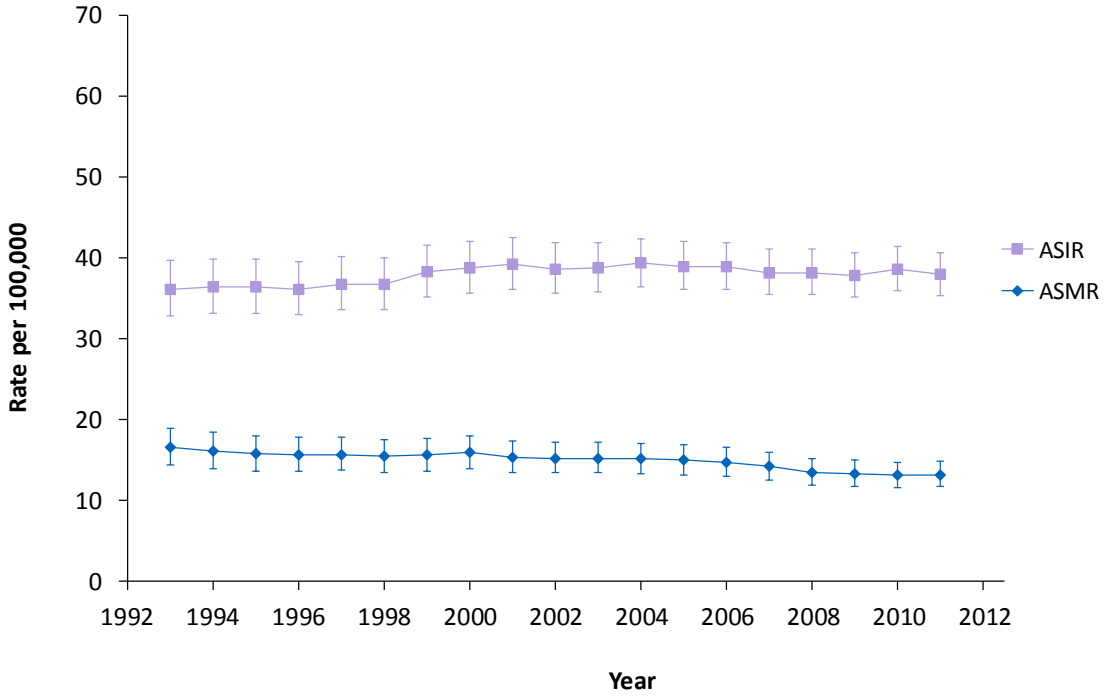
[*] Three-year moving average.
[†] Standardized to 1991 Canadian population.

Data Source: Alberta Cancer Registry, Alberta Health Services; Alberta Health

Male colorectal cancer ASIRs have not changed significantly between 1992 and 2012 (**Figure 6-4**). In 2012, the ASIR for colorectal cancer in males was 55.1 per 100,000 males in the population.

Over the period 1992 to 2012 male colorectal cancer ASMRs decreased significantly by 1.4% annually (**Figure 6-4**). In 2012, the ASMR for colorectal cancer in males was 20.0 per 100,000 males in the population.

Figure 6-5: Age-Standardized Incidence Rates (ASIRs)[*†] and Mortality Rates (ASMRs)[*†] for Colorectal Cancer, Females, Alberta, 1992-2012



[*] Three-year moving average.
[†] Standardized to 1991 Canadian population.

Data Source: Alberta Cancer Registry, Alberta Health Services; Alberta Health

Female colorectal cancer ASIRs has not changed significantly since 1992 (**Figure 6-5**). In 2012, the ASIR for colorectal cancer in females was 36.5 per 100,000 females in the population.

Female colorectal cancer ASMRs decreased significantly since 1992. Between 1992 and 2012, female colorectal cancer ASMRs decreased by 1.3% annually (**Figure 6-5**). In 2012, the ASMR for colorectal cancer in females was 12.7 per 100,000 females in the population.

Colorectal Cancer Incidence

The following six figures (**Figures 6-6** to **6-11**) provide information on colorectal cancer incidence in Alberta. The number of new cancer cases in Alberta is affected not only by changes in the underlying risk of developing colorectal cancer, but also by the changes in the age structure and growth of the population. In order to compare trends over time, age-standardized incidence rates (ASIRs) are provided.

In **Figures 6-6** and **6-7** observed age standardized incidence rates are shown for 1992 to 2011 (three-year moving averages), and ***projected*** rates for 2012 to 2017. Similarly, observed numbers of new colorectal cancer cases are shown for the years 1992 to 2012 and projected numbers for 2013 to 2017.

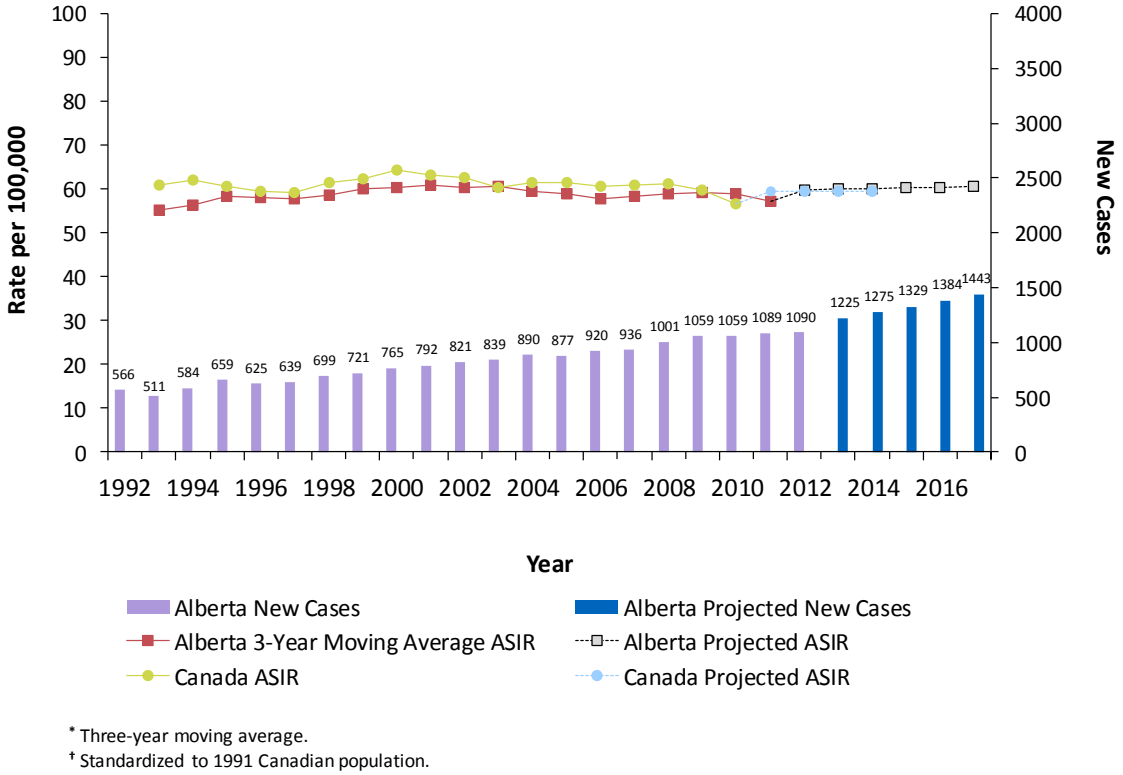
The projected cancer numbers were calculated by applying the estimated age-specific cancer incidence rates to the projected age-specific population figures provided by Alberta Health.[4] These were observed up to 2011 (due to the use of three-year moving averages) and estimated for 2012 to 2017. Caution should be exercised when comparing Canada[5] and Alberta rates as Canadian rates are yearly rates while Alberta rates are three-year moving averages.

The estimated colorectal cancer incidence rates were calculated by extrapolating the historical trends in age-specific rate based on data from 1987 to 2011.

Cancer stage is an important factor in determining treatment and ***prognosis***; generally, the earlier the diagnosis, the better the outcome. The American Joint Committee on Cancer (AJCC) classification defines cancer stage based on the knowledge that cancers of the same anatomic site and histology share similar patterns of growth and similar outcomes. The Alberta Cancer Registry started to record the stage at diagnosis in 2004 using the collaborative staging system which is based on AJCC, 6th Edition.[6]

Figure 6-11 provides information on the proportion of new cases diagnosed at each stage in three cohorts: 2004-2006, 2007-2009 and 2010-2012. Proportional and multiplicative odds models[7] were used to analyze the annual change of cancer stage distribution.

Figure 6-6: Actual and Projected Number of New Cases and Age-Standardized Incidence Rates (ASIRs)*† for Colorectal Cancer, Males, Alberta, 1992-2017



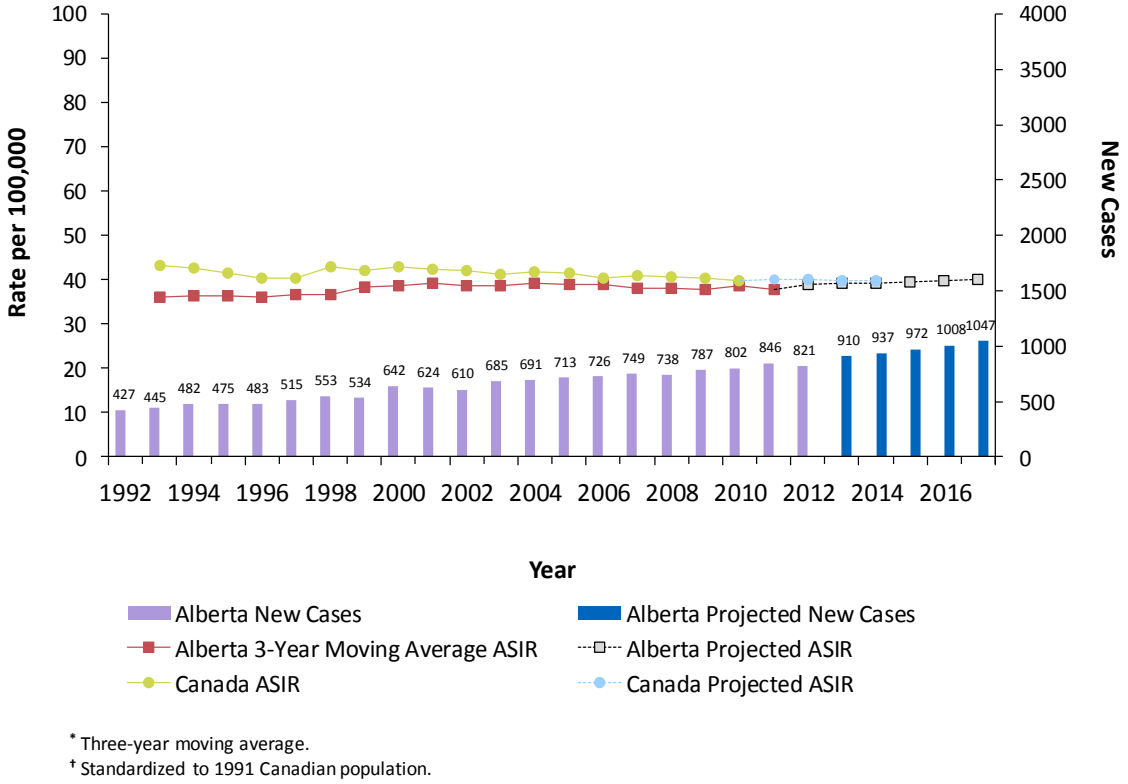
* Three-year moving average.
† Standardized to 1991 Canadian population.

Data Source: Alberta Cancer Registry, Alberta Health Services; Alberta Health; Canadian Cancer Society

In 2012, 1,090 cases of male colorectal cancer were diagnosed in Alberta (**Figure 6-6**). ASIRs for male colorectal cancer in Alberta were generally lower than ASIRs in Canada.

It is estimated that 1,450 cases of colorectal cancer will be diagnosed in males in Alberta in 2017; however, with the Alberta-wide Colorectal Screening Program[8], these rates may change significantly.

Figure 6-7: Actual and Projected Number of New Cases and Age-Standardized Incidence Rates (ASIRs)*† for Colorectal Cancer, Females, Alberta, 1992-2017



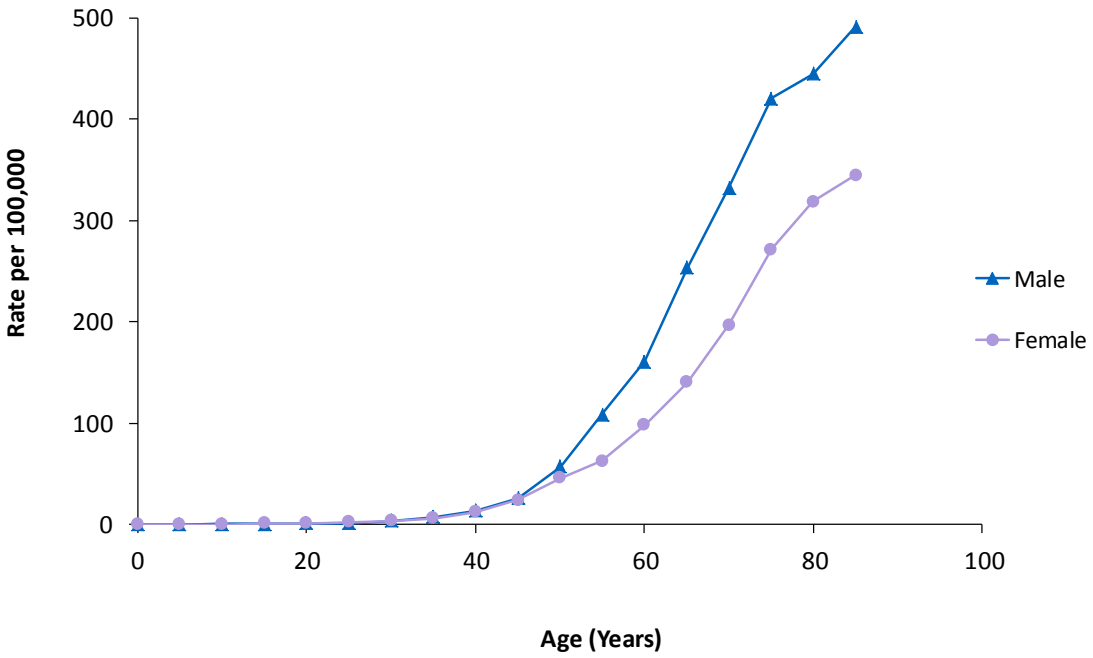
* Three-year moving average.
† Standardized to 1991 Canadian population.

Data Source: Alberta Cancer Registry, Alberta Health Services; Alberta Health; Canadian Cancer Society

In 2012, 821 cases of female colorectal cancer were diagnosed in Alberta (**Figure 6-7**). ASIRs for female colorectal cancer in Alberta were generally lower than ASIRs in Canada.

It is estimated that 1,050 cases of colorectal cancer will be diagnosed in females in Alberta in 2017; however, with the Alberta-wide Colorectal Cancer Screening Program[8], these rates may change significantly.

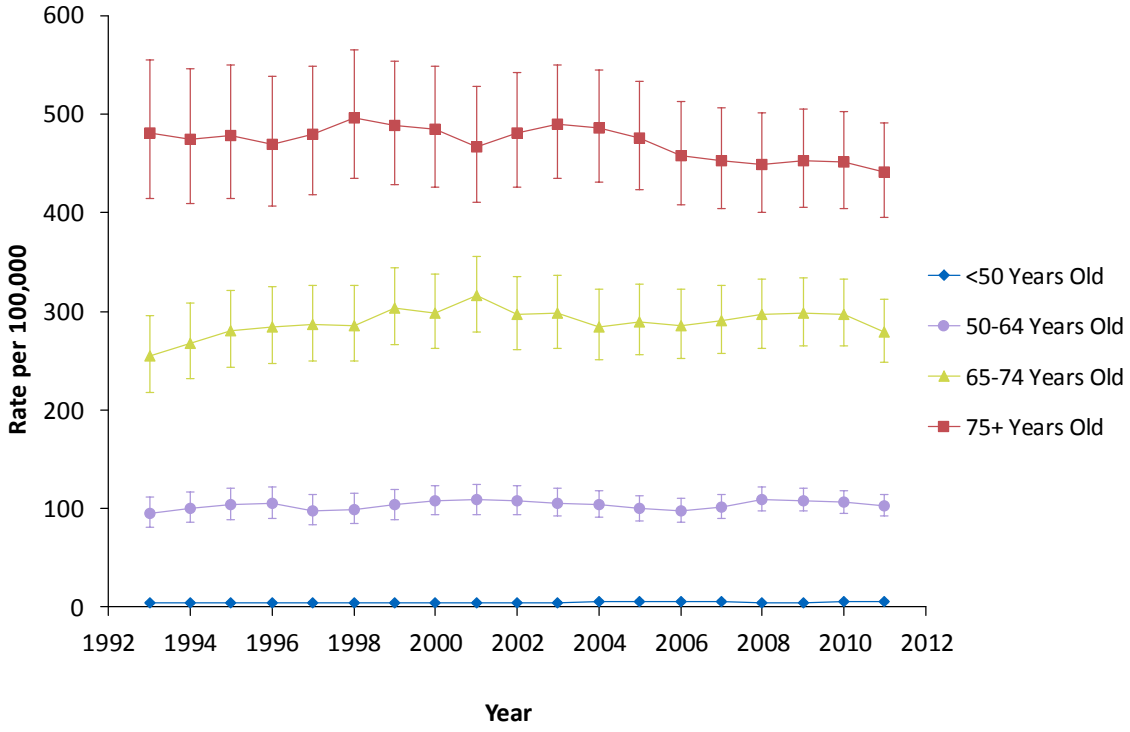
Figure 6-8: Age-Specific Incidence Rates for Colorectal Cancer by Sex, Alberta, 2008-2012



Data Source: Alberta Cancer Registry, Alberta Health Services; Alberta Health

Both males and females have low colorectal cancer rates until about age 40, at which point rates begin to increase (**Figure 6-8**). Males have higher colorectal cancer rates than females after age 45. The highest colorectal cancer incidence rates occur in the older age groups.

Figure 6-9: Age-Standardized Incidence Rates (ASIRs)[*†] for Colorectal Cancer, Ages <50, 50-64, 65-74, and 75+, Males, Alberta, 1992-2012



[*] Three-year moving average.
[†] Standardized to 1991 Canadian population.

Data Source: Alberta Cancer Registry, Alberta Health Services; Alberta Health

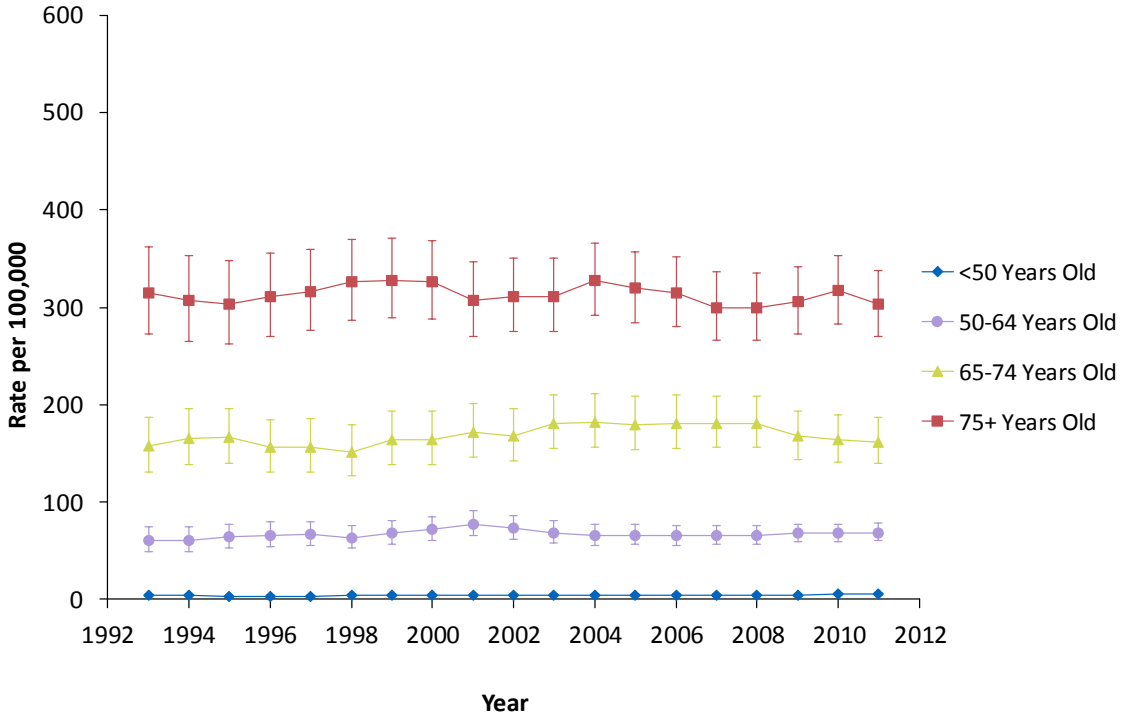
Age-standardized colorectal cancer incidence rates in males differ across age groups (**Figure 6-9**).

Male incidence rates for colorectal cancer in the <50 age group increased significantly between 1992 and 2012 by 1.8% annually.

Colorectal incidence rates for males in the age groups 50-64 and 65-74 years did not significantly change over the period 1992 to 2012.

The incidence rates for males in the age group 75+ years significantly decreased between 1992 and 2012 by 0.5% annually.

Figure 6-10: Age-Standardized Incidence Rates (ASIRs)*† for Colorectal Cancer, Ages <50, 50-64, 65-74, and 75+, Females, Alberta, 1992-2012



* Three-year moving average.
† Standardized to 1991 Canadian population.

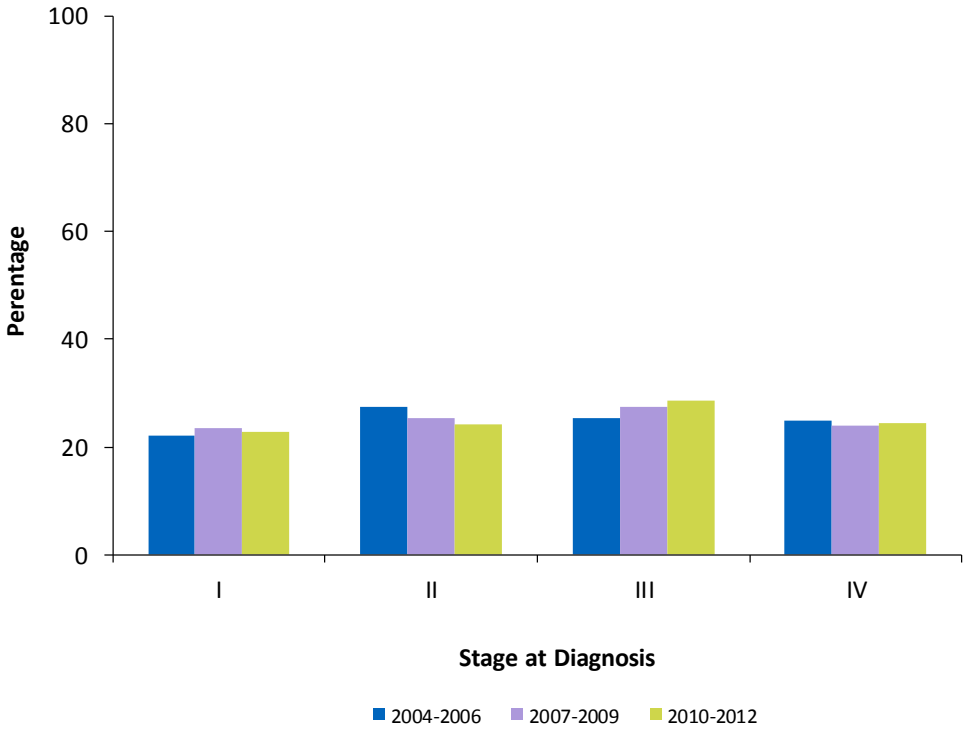
Data Source: Alberta Cancer Registry, Alberta Health Services; Alberta Health

Age-standardized colorectal cancer incidence rates in females differ across age groups (**Figure 6-10**).

Between 1992 and 2012, colorectal cancer incidence rates for females significantly increased in the age group <50 years by 2.0% annually, but did not change significantly in the age groups 50-64 years, 65-74 years, and 75+ years over the same period.

The older the age groups, the higher the colorectal cancer incidence rates (**Figures 6-9 and 6-10**).

Figure 6-11: Relative Distribution of New Cases by Stage at Diagnosis and Cohort for Colorectal Cancer, Both Sexes, Alberta, 2004-2006, 2007-2009, 2010-2012



* Stage at diagnosis based on AJCC 6th Ed.; Stage 0 was combined with Stage I.

The diagnosis of colorectal cancer is evenly distributed across all four stages (**Figure 6-11**). Over the 9 years from 2004 to 2012, the early detection of colorectal cancer has declined. Colorectal cancer is a group of cancers made up of colon, rectosigmoid junction and rectal cancers. While early diagnosis (stage I) of colon cancer improved slightly over this time period, early diagnosis (stage I and II) of rectosigmoid junction and rectal cancers declined significantly.

There has been an increase in opportunistic screening with Fecal Occult Blood test and colonoscopy during this period. However, the increase in screening among people aged 50-74 did not resulted in an overall shift to earlier stages at diagnosis. The colorectal cancer screening participation rate remained low during this period, and for those who were screened, many of them had been screened for the first time. Patients who are screened for the first time are more likely to be diagnosed at a later stage, a phenomenon known as lead-time bias. Individuals who receive screening at regular intervals are generally diagnosed at an earlier stage.

Colorectal Cancer Mortality

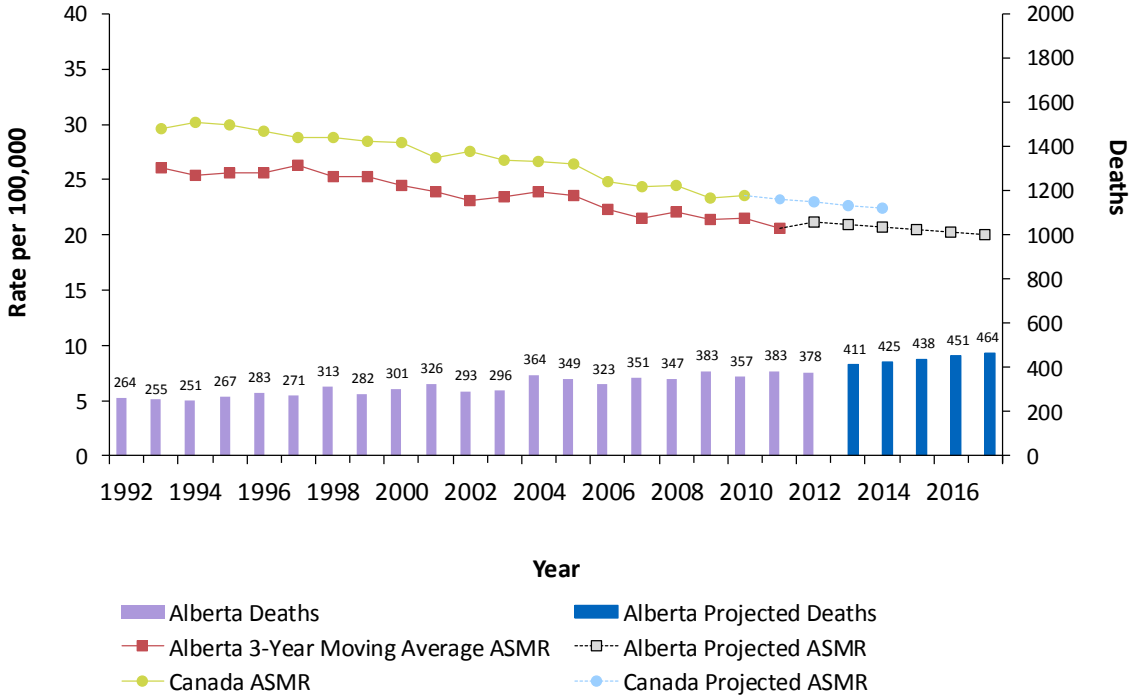
The following five figures (**Figures 6-12** to **6-16**) provide information on colorectal cancer mortality in Alberta. The number of deaths in Alberta is affected not only by changes in the underlying risk of dying from colorectal cancer, but also by the changes in the age structure and growth of the population. In order to compare trends over time, age-standardized mortality rates (ASMRs) are also provided.

In **Figures 6-12** and **6-13** observed age standardized mortality rates are shown for 1992 to 2011 (three-year moving averages), and ***projected*** rates for 2012 to 2017. Similarly, observed numbers of cancer deaths are shown for the years 1992 to 2012 and projected numbers for 2013 to 2017.

The projected numbers of cancer deaths were calculated by applying the estimated age-specific cancer mortality rates to the age-specific population figures provided by Alberta Health.[4] These were observed up to 2011 (due to the use of three-year moving averages) and estimated for 2012 to 2017. Caution should be exercised when comparing Canada[5] and Alberta rates as Canadian rates are yearly rates while Alberta rates are three-year moving averages.

The estimated colorectal cancer mortality rates were calculated by extrapolating the historical trends in age-specific rate based on data from 1987 to 2011.

Figure 6-12: Actual and Projected Number of Deaths and Age-Standardized Mortality Rates (ASMRs)*† for Colorectal Cancer, Males, Alberta, 1992-2017



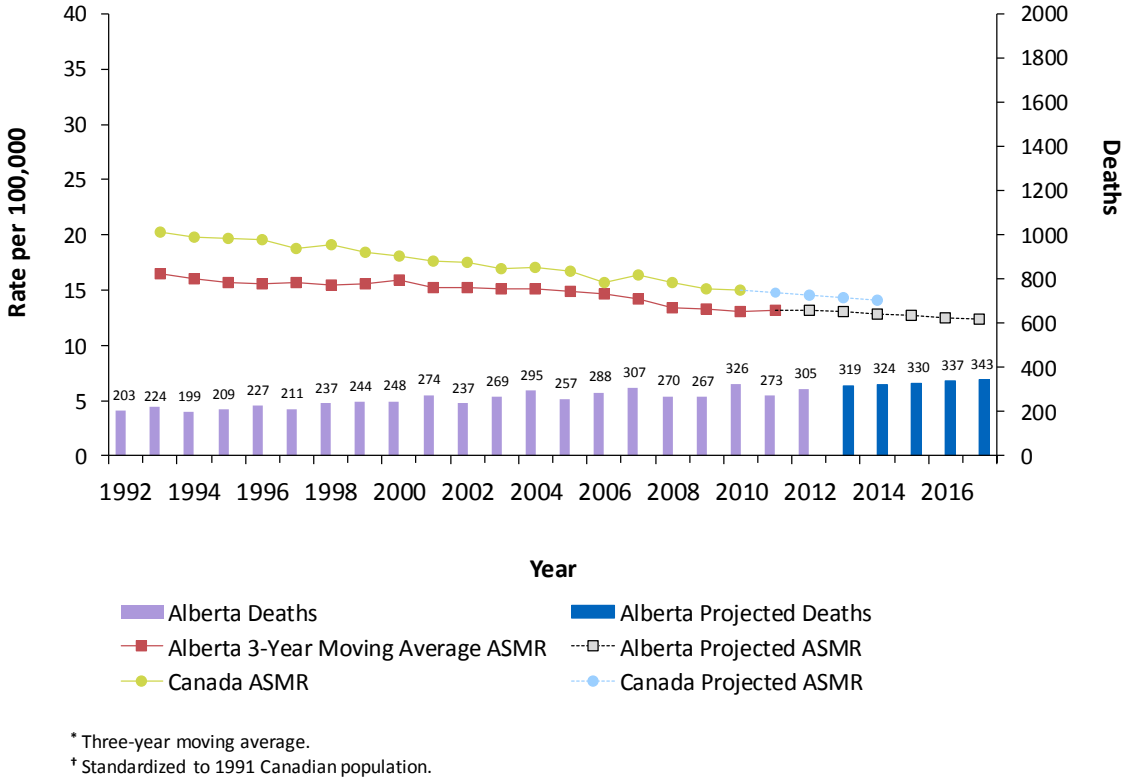
* Three-year moving average.
† Standardized to 1991 Canadian population.

Data Source: Alberta Cancer Registry, Alberta Health Services; Alberta Health; Canadian Cancer Society

In 2012, 378 males died of colorectal cancer in Alberta (**Figure 6-12**). ASMRs for male colorectal cancer in Alberta were lower than ASMRs in Canada.

It is estimated that 460 males will die from colorectal cancer in Alberta in 2017.

Figure 6-13: Actual and Projected Number of Deaths and Age-Standardized Mortality Rates (ASMRs)*† for Colorectal Cancer, Females, Alberta, 1992-2017



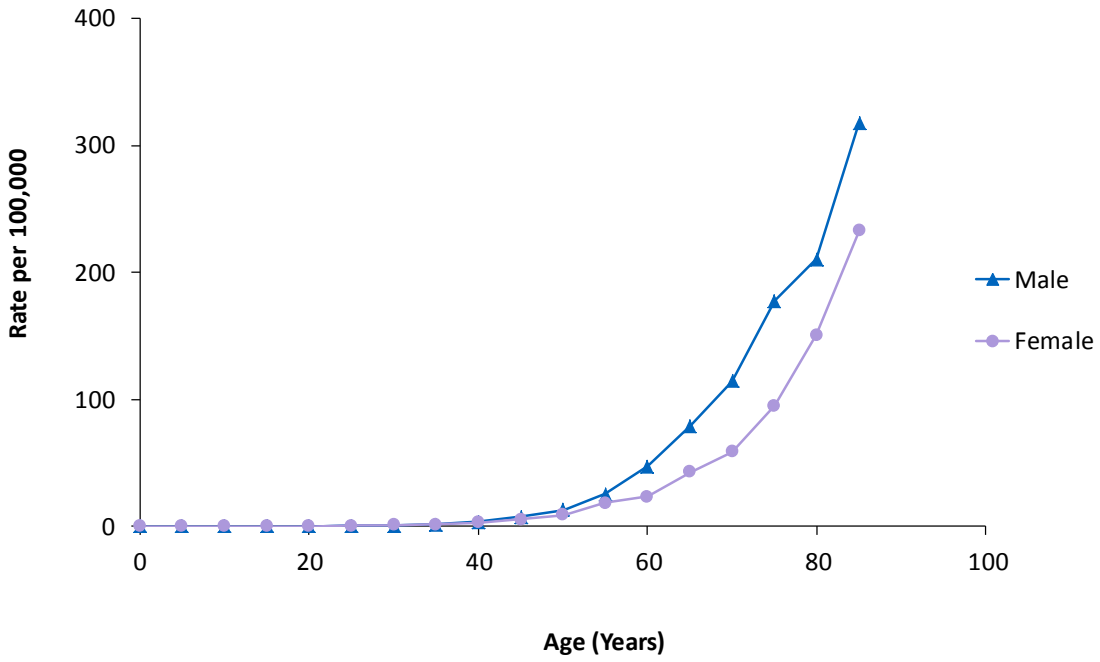
* Three-year moving average.
† Standardized to 1991 Canadian population.

Data Source: Alberta Cancer Registry, Alberta Health Services; Alberta Health; Canadian Cancer Society

In 2012, 305 females died of colorectal cancer in Alberta (**Figure 6-13**). ASMRs for female colorectal cancer in Alberta were lower than ASMRs in Canada.

It is estimated that 340 females will die from colorectal cancer in Alberta in 2017.

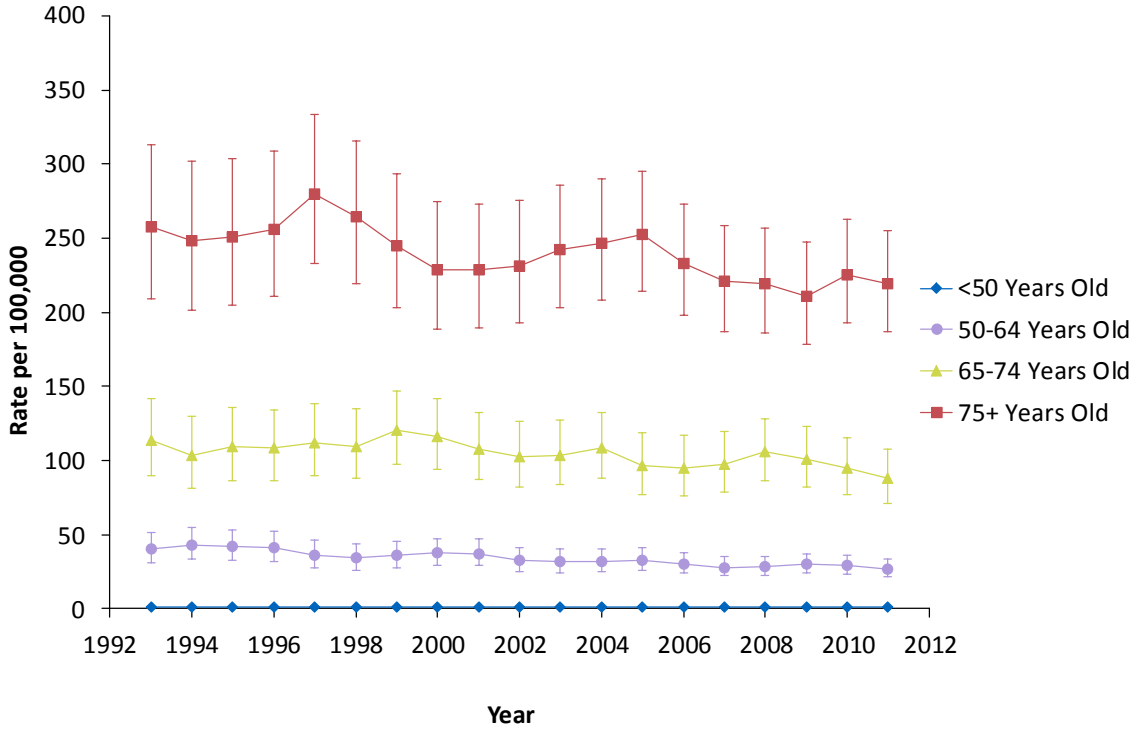
Figure 6-14: Age-Specific Mortality Rates for Colorectal Cancer by Sex, Alberta, 2008-2012



Data Source: Alberta Cancer Registry, Alberta Health Services; Alberta Health

Male and female colorectal cancer mortality rates remain low until approximately age 40, but begin rising thereafter. Males have higher mortality rates than women after age 45 (**Figure 6-14**). The highest colorectal cancer mortality rates occur in the older age groups.

Figure 6-15: Age-Standardized Mortality Rates (ASMRs)*† for Colorectal Cancer, Ages <50, 50-64, 65-74, and 75+, Males, Alberta, 1992-2012



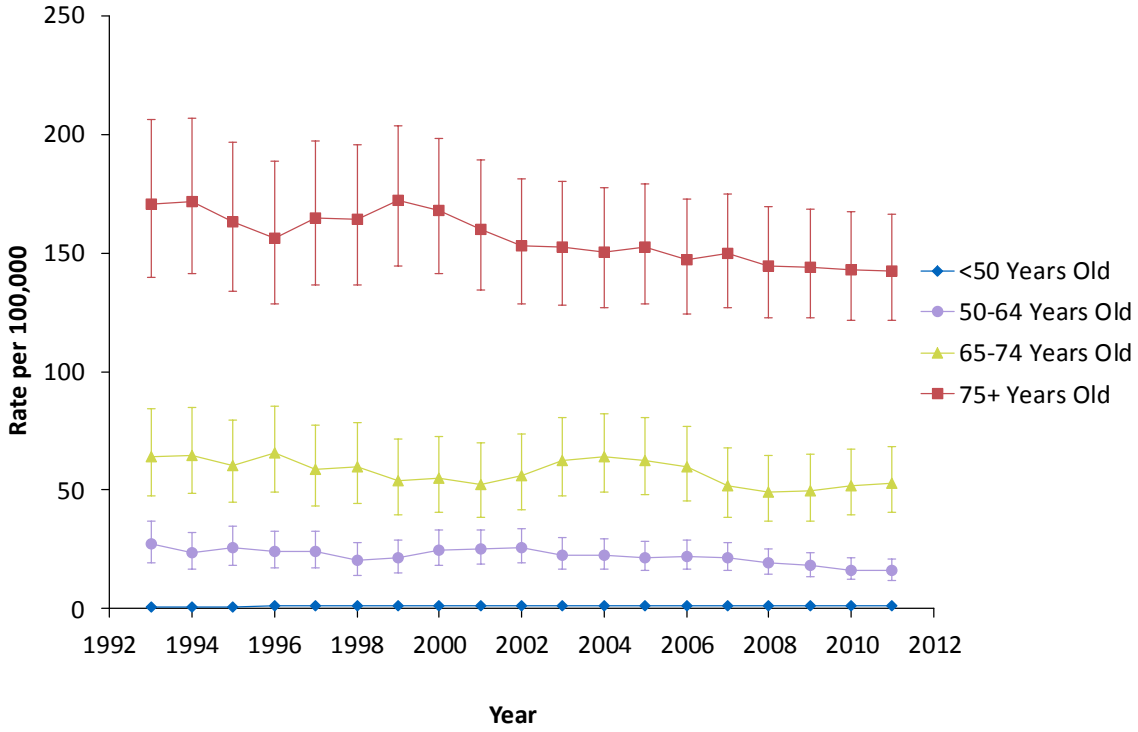
* Three-year moving average.
† Standardized to 1991 Canadian population.

Data Source: Alberta Cancer Registry, Alberta Health Services; Alberta Health

Age-standardized colorectal cancer mortality rates in males vary over time and with age (**Figure 6-15**).

Between 1992 and 2012, male mortality rates for colorectal cancer did not significantly change in the <50 age group, but significantly decreased in the 50-64, 65-74, and 75+ age groups by 2.4%, 1.3%, and 1.0% annually, respectively.

Figure 6-16: Age-Standardized Mortality Rates (ASMRs)*† for Colorectal Cancer, Ages <50, 50-64, 65-74, and 75+, Females, Alberta, 1992-2012



* Three-year moving average.
† Standardized to 1991 Canadian population.

Data Source: Alberta Cancer Registry, Alberta Health Services; Alberta Health

Age-standardized colorectal cancer mortality rates in females vary over time and with age (**Figure 6-16**).

Between 1992 and 2012, female mortality rates for colorectal cancer did not significantly change in the <50 age group, but significantly decreased in the 50-64, 65-74, and 75+ age groups by 2.5%, 1.2%, and 1.1% annually, respectively.

Colorectal Cancer Survival

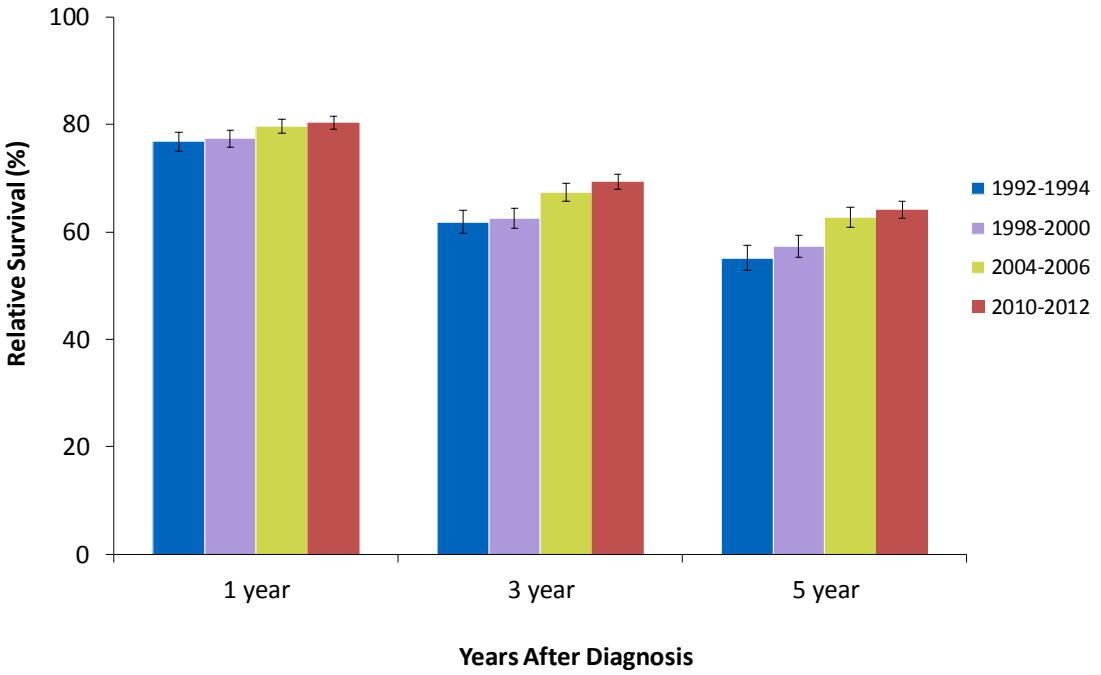
Cancer survival ratios indicate the proportion of people who will be alive at a given time after they have been diagnosed with cancer. Survival is an important outcome measure and is used for evaluating the effectiveness of cancer control programs.

Survival depends on several factors including the cancer type (most importantly site, stage, and morphology at diagnosis), sex, age at diagnosis, health status, and available treatments for that cancer. While ***relative survival ratios*** (RSRs) give a general expectation of survival over the whole province, these ratios may not apply to individual cases. Individual survival outcomes depend on the stage at diagnosis, treatment, and other individual circumstances.

Relative survival ratios are estimated by comparing the survival of cancer patients with that expected in the general population of Albertans of the same age, sex, and in the same calendar year.[9] In this section of the report, RSRs are standardized by the age structure in the standard population (i.e. all persons who were diagnosed with that cancer in Canada between 1992 and 2001) to permit RSRs to be compared over time, independent of differences in age distribution of cancer cases.

RSRs are estimated by the ***cohort method***[9] when complete follow-up data (e.g., at least five years of follow-up to estimate the five-year rate) after diagnosis are available. For recently diagnosed cases whose complete follow-up data are not available, the up-to-date estimates are computed using the ***period method***[10]. However, comparison between cohort and period RSRs should be interpreted with caution because of the two different methods used to derive the respective ratios.
The relative survival ratio is usually expressed as a percentage (%) and the closer the value is to 100%, the more similar the survival pattern is to the general population.

Figure 6-17: Age-Standardized One, Three and Five-Year Relative Survival Ratios for Colorectal Cancer, Both Sexes, Alberta, 1992-1994^, 1998-2000^ and 2004-2006^, 2010-2012*†



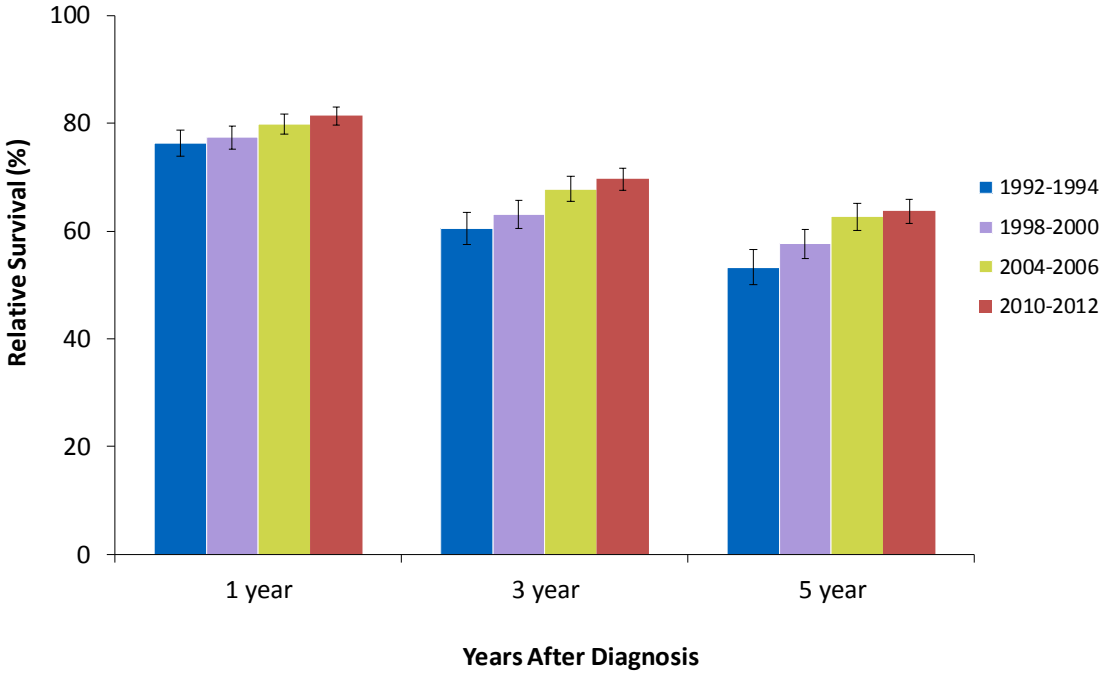
^ Ratios calculated by cohort method, where complete follow-up data are available.
†* Ratios calculated by period method, where complete follow-up data are not available.

Data Source: Alberta Cancer Registry, Alberta Health Services; Statistics Canada

The five-year relative survival ratio for individuals diagnosed with colorectal cancer in the period 2010-2012 is estimated to be 64%.

The five-year relative survival ratio for individuals diagnosed with colorectal cancer in Alberta has improved in 2010-2012 compared to those diagnosed in the 1992-1994 cohort years (**Figure 6-17**).

Figure 6-18: Age-Standardized One, Three and Five-Year Relative Survival Ratios for Colorectal Cancer, Males, Alberta, 1992-1994^, 1998-2000^ and 2004-2006^, 2010-2012*



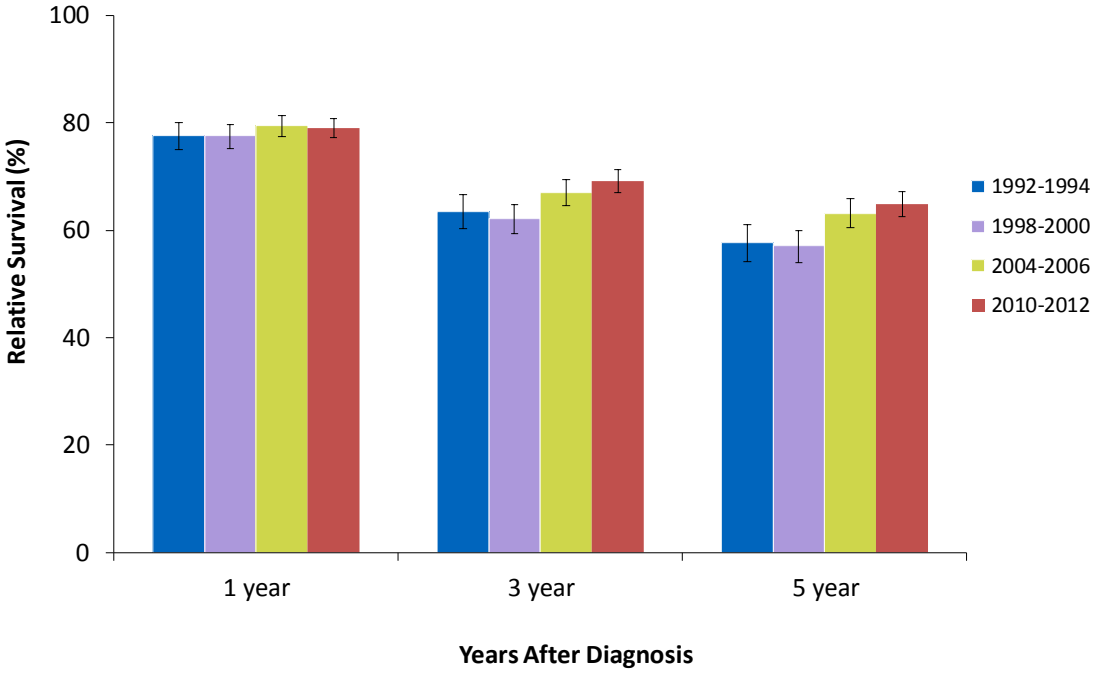
^ Ratios calculated by cohort method, where complete follow-up data are available.
* Ratios calculated by period method, where complete follow-up data are not available.

Data Source: Alberta Cancer Registry, Alberta Health Services; Statistics Canada

The five-year relative survival ratio for males diagnosed with colorectal cancer in the period 2010-2012 is estimated to be 64%.

The five-year relative survival ratio for males diagnosed with colorectal cancer in Alberta has improved in 2010-2012 compared to those diagnosed in the 1992-1994 cohort years (**Figure 6-18**).

Figure 6-19: Age-Standardized One, Three and Five-Year Relative Survival Ratios for Colorectal Cancer, Females, Alberta, 1992-1994^, 1998-2000^ and 2004-2006^, 2010-2012*



^ Ratios calculated by cohort method, where complete follow-up data are available.
* Ratios calculated by period method, where complete follow-up data are not available.

Data Source: Alberta Cancer Registry, Alberta Health Services; Statistics Canada

The five-year relative survival ratio for females diagnosed with colorectal cancer in the period 2010-2012 is estimated to be 65%.

The five-year relative survival ratio for females diagnosed with colorectal cancer in Alberta has improved in 2010-2012 compared to those diagnosed in the 1992-1994 cohort years (**Figure 6-19**).

Table 6-4: Crude One-, Two- and Three-Year Relative Survival Ratios[†] (%) for Colorectal Cancer by Stage and Sex, Alberta, 2009-2012.

Stage[‡]	Number of Cases		One-year Survival Rate (95% CI)		Two-year Survival Rate (95% CI)		Three-year Survival Rate (95% CI)	
	Male	Female	Male	Female	Male	Female	Male	Female
I	**667**	**507**	98 (96, 100)	98 (96, 99)	98 (95, 100)	97 (94, 99)	98 (95, 100)	97 (94, 100)
II	**804**	**613**	95 (93, 97)	95 (93, 97)	95 (92, 97)	93 (90, 96)	94 (90, 96)	93 (89, 96)
III	**990**	**730**	94 (92, 96)	92 (89, 94)	89 (87, 91)	86 (83, 89)	83 (80, 86)	81 (77, 84)
IV	**821**	**615**	48 (45, 52)	44 (40, 48)	30 (27, 33)	27 (24, 31)	19 (17, 22)	19 (16, 23)

[†] Ratios calculated by period method, where complete follow-up data are not available
* Inclusion criteria: First-primary invasive cancer and age 15 to 99 years at diagnosis.
ǂ The staging method changed in 2010 (from AJCC 6 to AJCC 7), so caution should be used when comparing to data from previous reports.

Data Source: Alberta Cancer Registry, Alberta Health Services; Statistics Canada

Cancer ***stage*** (extent or severity of cancer) at diagnosis affects survival. Those diagnosed at an earlier stage have better survival than those diagnosed at a later stage.

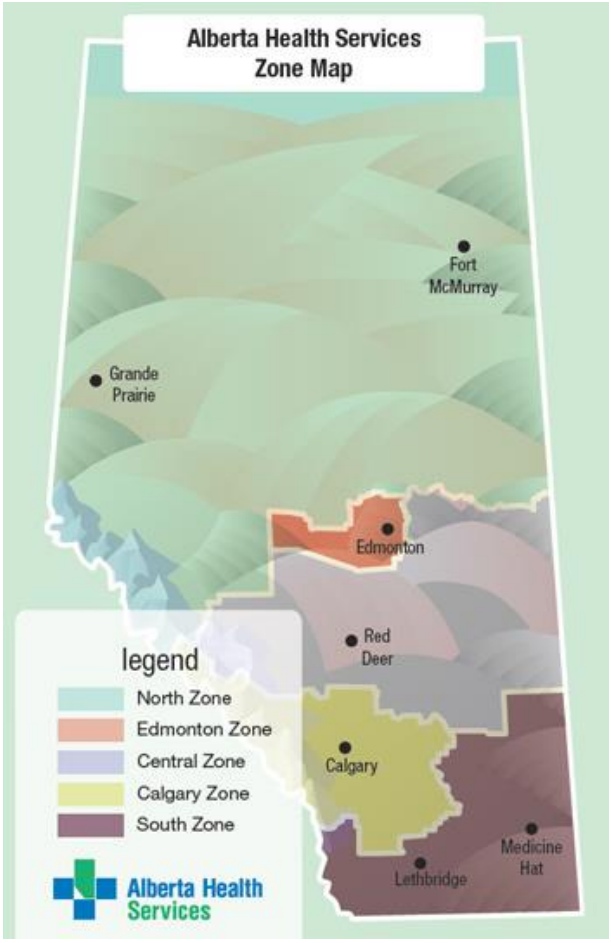
Most colorectal cancer cases in Alberta from 2009-2012 were diagnosed at the later stages (III & IV). The estimated relative survival ratios, compared to the earlier stages (I & II), are lower, particularly in stage IV. Survival ratios are lower among females than males at all stages of diagnosis (**Table 6-4**).

Geographic Variation

The geographic variation section illustrates how the observed rates in each health zone compare with the provincial average. It also compares each zone to the rest of Alberta (excluding the zone of interest). The age standardized incidence and mortality rates for each zone and the respective "rest of Alberta" groupings are presented with their corresponding 95% ***confidence intervals***[11]. The overall age standardized incidence and mortality rates for all of Alberta are presented with their corresponding 95% confidence intervals as horizontal lines on each graph. Any observed differences in rates may be due to several factors such as regional differences in:

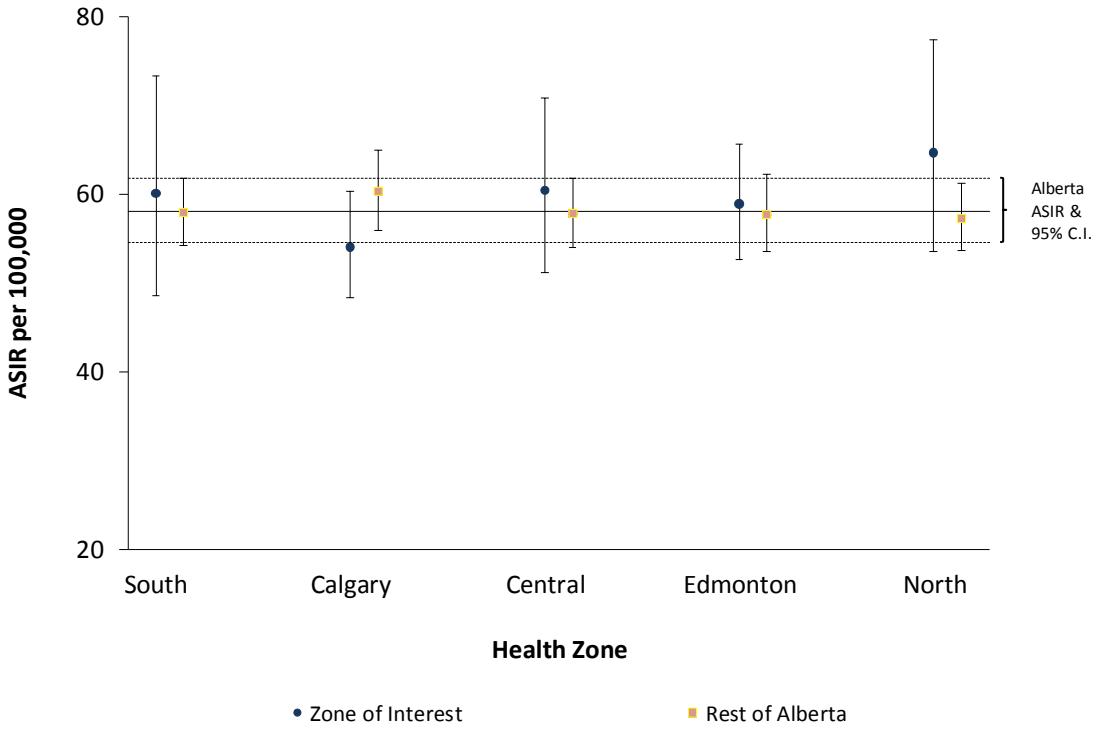
- individual risk factors
- prevention efforts
- cancer screening
- diagnostic activity
- access to cancer care[12].

Figure 6-20: Five Health Zones in Alberta, 2012



Source: Alberta Health Services

Figure 6-21: Age-Standardized Incidence Rates (ASIRs)† with 95% Confidence Intervals (CI) by Zone for Colorectal Cancer, Males, Alberta, 2008-2012

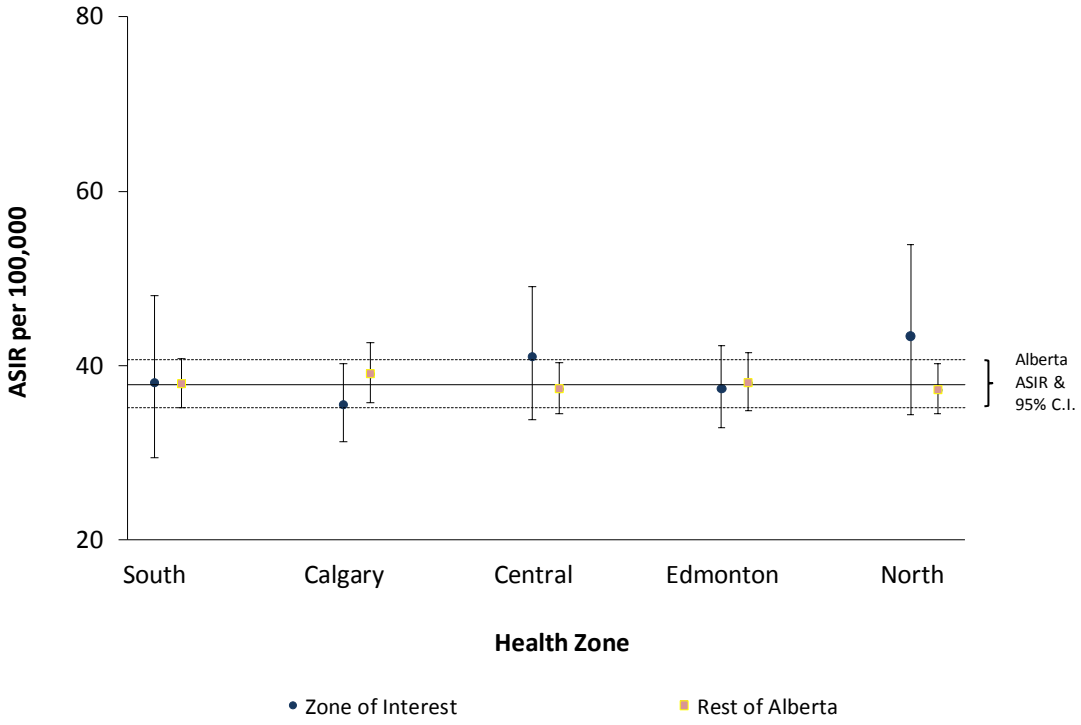


† Standardized to 1991 Canadian population for age-specific rates in 2008-2012.

Data Source: Alberta Cancer Registry, Alberta Health Services; Alberta Health

There is no evidence that male colorectal cancer ASIRs in the zones are higher or lower than the provincial average or the "rest of Alberta" (excluding the zone of interest) (**Figure 6-21**).

Figure 6-22: Age-Standardized Incidence Rates (ASIRs)† with 95% Confidence Intervals (CI) by Zone for Colorectal Cancer, Females, Alberta, 2008-2012

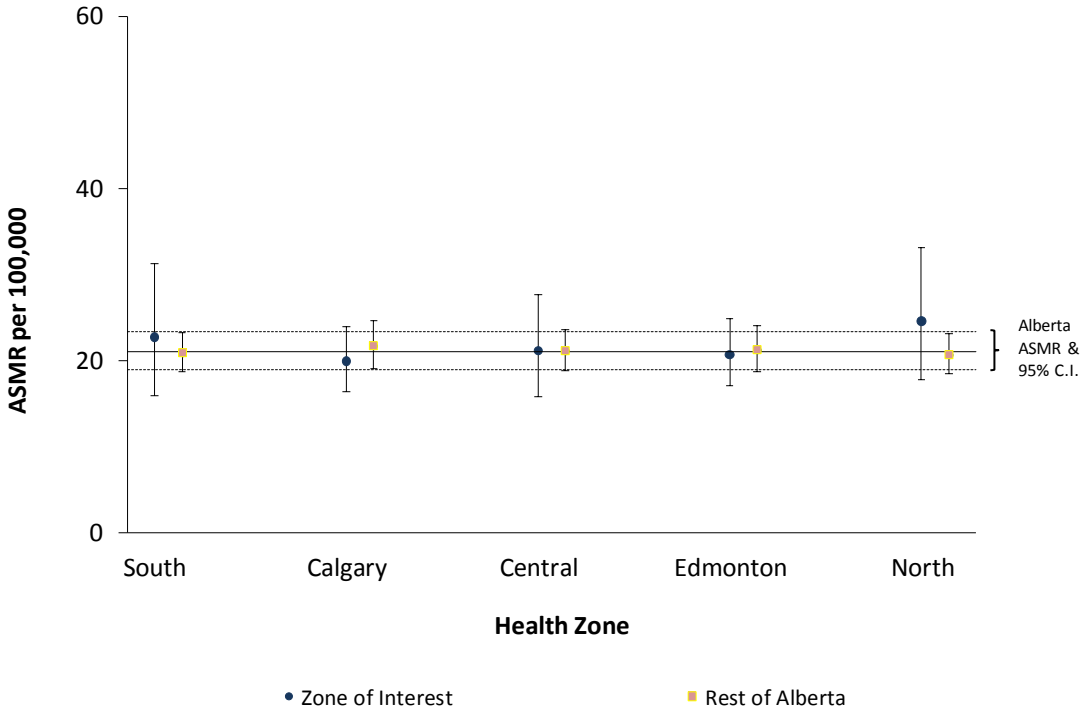


† Standardized to 1991 Canadian population for age-specific rates in 2008-2012.

Data Source: Alberta Cancer Registry, Alberta Health Services; Alberta Health

There is no evidence that female colorectal cancer ASIRs in the zones are higher or lower than the provincial average or the "rest of Alberta" (excluding the zone of interest) (**Figure 6-22**).

Figure 6-23: Age-Standardized Mortality Rates (ASMRs)† with 95% Confidence Intervals (CI) by Zone for Colorectal Cancer, Males, Alberta, 2008-2012

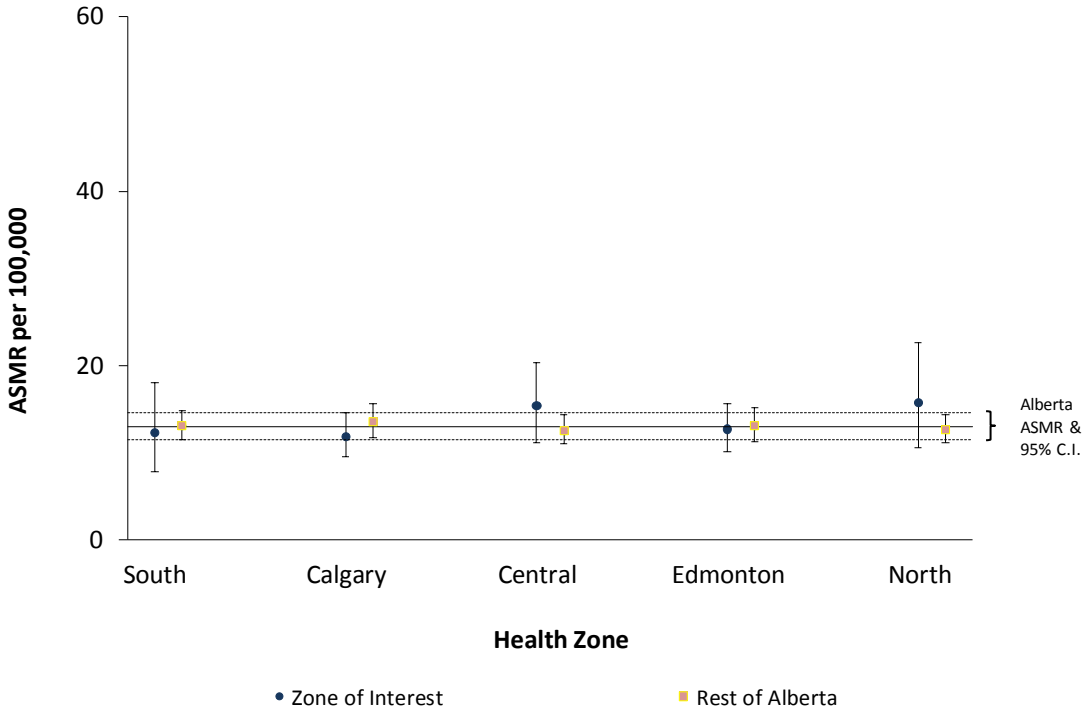


† Standardized to 1991 Canadian population for age-specific rates in 2008-2012.

Data Source: Alberta Cancer Registry, Alberta Health Services; Alberta Health

There is no evidence that male colorectal cancer ASMRs in the zones are higher or lower than the provincial average or the "rest of Alberta" (excluding the zone of interest) (**Figure 6-23**).

Figure 6-24: Age-Standardized Mortality Rates (ASMRs)† with 95% Confidence Intervals (CI) by Zone for Colorectal Cancer, Females, Alberta, 2008-2012



† Standardized to 1991 Canadian population for age-specific rates in 2008-2012.

Data Source: Alberta Cancer Registry, Alberta Health Services; Alberta Health

There is no evidence that female colorectal cancer ASMRs in the zones are higher or lower than the provincial average or the "rest of Alberta" (excluding the zone of interest) (**Figure 6-24**).

Further Information

Further information is available on a separate document, the **Appendix**:

Appendix 1: Glossary of Terms
Appendix 2: Cancer Definitions
Appendix 3: Data Notes

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