Alberta Health Services

Cancer Care

Cancer Surveillance

Leukemia

December 2012

2010 Report on Cancer Statistics in Alberta

Acknowledgements

This report was made possible through Alberta Health Services, Cancer Care, Cancer Surveillance and the many contributions of staff and management across Alberta Health Services as well as external agencies and individuals.

The authors wish to thank individuals working in the following AHS departments and partner agencies for their contributions to this report: Alberta Cancer Registry, Surveillance and Health Status Assessment, Alberta Health and Statistics Canada. Contributions included provision of information, analysis and interpretation, and assistance with consultation sessions and communication of the report.

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Suggested Citation:
Cancer Surveillance: *2010 Report on Cancer Statistics in Alberta.* Edmonton: Cancer Care, Alberta Health Services, 2012.

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Table of Contents

Purpose of the Report

Cancer Surveillance is a specialized team within Alberta Health Services, Cancer Care, that actively contributes to Alberta Health Service's goal of creating the best-performing publicly funded health system in Canada. This is accomplished 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 leukemia 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 31, 2012.

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

Summary

- Approximately **1 in 46** men and **1 in 63** women will develop invasive leukemia within their lifetime.
- In 2010, **2,651** potential years of life were lost due to leukemia.
- As of December 31, 2010, approximately **4,150** Albertans were alive who had previously been diagnosed with leukemia.
- From 1990 to 2010*, **male** and **female incidence rates have remained stable**.
- From 2000 to 2010*, **male** leukemia **mortality rates have decreased** while **female** leukemia **mortality rates have remained stable** over the period 1990 to 2010*.
- In 2010, there were **509** new cases of leukemia in Alberta and **180** deaths due to the disease.
- Approximately **630** cases of leukemia are expected to be diagnosed in 2015.
- The five-year relative survival ratio for leukemia in Alberta is approximately **70%** for those diagnosed between 2008 and 2010.

In 2010, there were 509 new cases of leukemia in Alberta and 180 deaths due to the disease.

The five-year relative survival ratio for leukemia in Alberta is approximately 70% for those diagnosed between 2008 and 2010.

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

Probability of Developing and Dying from Leukemia

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 on the person being leukemia-free prior to the beginning of that age range. It is important to note that the probabilities of developing and 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 of the individual. In addition, someone diagnosed with cancer has a higher probability of developing another cancer in the future.[1]

The probability of developing leukemia increases with age, after an initial peak as a child, and varies by sex (***Table 9-1***). Approximately 1 in 46 males and 1 in 63 females will develop invasive leukemia in their lifetime.

Males have a higher chance of developing leukemia than females. On a population basis the probability of developing leukemia by the end of the age range for a leukemia-free individual at the beginning of the age range are shown in the bottom eight rows of ***Table 9-1***. For instance, a leukemia-free female representative of the general population at age 40 has a 1 in 1,611 chance of developing leukemia by the time she is 50.

The probability of dying from leukemia increases with age and varies by sex (***Table 9-2***). Approximately 1 in 105 males and 1 in 136 females will die of invasive leukemia.

Males have a higher chance of dying from leukemia than females. On a population basis the probability of a cancer-free individual at the beginning of the age range dying from leukemia by the end of the age range are shown in the bottom eight rows of ***Table 9-2***. For example, a cancer-free female representative of the general population at age 40 has a 1 in 6,534 chance of dying from leukemia by the time she is 50.

Table 9-1: **Probability of Developing Leukemia by Age and Sex, Alberta, 2006-2010**

Age Group (Years)	Males	Females
Lifetime Risk (all ages)	1 in 46	1 in 63
0 – 20	1 in 927	1 in 1,231
20 - 30	1 in 2,883	1 in 4,700
30 - 40	1 in 2,971	1 in 2,627
40 - 50	1 in 1,207	1 in 1,611
50 - 60	1 in 412	1 in 699
60 - 70	1 in 200	1 in 313
70 - 80	1 in 124	1 in 181
80+	1 in 91	1 in 144

Data Sources: Alberta Cancer Registry, Alberta Health

Table 9-2: **Probability of Dying from Leukemia by Age and Sex, Alberta, 2006-2010**

Age Group (Years)	Males	Females
Lifetime Risk (all ages)	1 in 105	1 in 136
0 - 20	1 in 5,079	Less than 1 in 10,000
20 - 30	Less than 1 in 10,000	Less than 1 in 10,000
30 - 40	Less than 1 in 10,000	Less than 1 in 10,000
40 - 50	1 in 5,449	1 in 6,534
50 - 60	1 in 2,331	1 in 3,513
60 - 70	1 in 620	1 in 935
70 - 80	1 in 261	1 in 418
80+	1 in 136	1 in 188

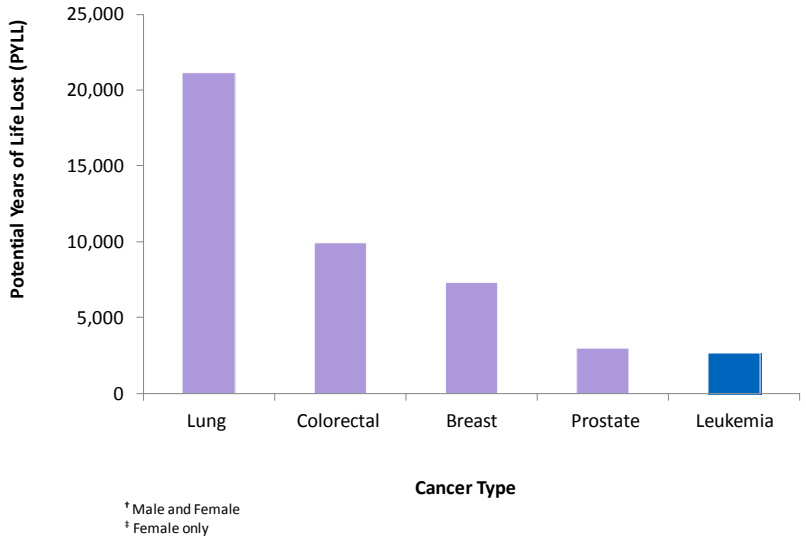
Data Sources: Alberta Cancer Registry, Alberta Health

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.

In 2010, **2,651** potential years of life were lost due to leukemia, which constitutes about 3% of PYLL for all cancers (***Figure 9-1***).

Figure 9-1: **Potential Years of Life Lost (PYLL) from Leukemia† Compared with Lung†, Colorectal†, Breast‡ and Prostate Cancers, Alberta, 2010**



Data Source: Alberta Cancer Registry

Prevalence

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

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

In this section of the report, both limited-duration and complete leukemia prevalence are presented; the latter describing the number of people alive as of December 31, 2010 who had ever been diagnosed with leukemia.

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 that can affect the whole community.

As of December 31, 2010, approximately **4,150** Albertans were alive who had previously been diagnosed with leukemia (***Table 9-3***) out of which approximately **760** Albertans were alive on the same date who had been diagnosed with leukemia in the previous two years, the period during which cases are more likely to receive definitive treatments.

Table 9-3: **Limited-Duration and Complete Prevalence for Leukemia, Both Sexes Combined, Alberta, 2010**

Duration	Prevalence
2-Year	761
5-Year	1,721
10-Year	2,758
20-Year	3,638
Complete	4,174

Data Source: Alberta Cancer Registry

Leukemia Incidence and Mortality

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 leukemia diagnoses in Albertan residents in a calendar year. Incidence rates are the number of new leukemia cases diagnosed per 100,000 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 leukemia in Albertan residents in a calendar year, regardless of date of diagnosis. Mortality rates are the number of deaths per 100,000 population in a specific time period.

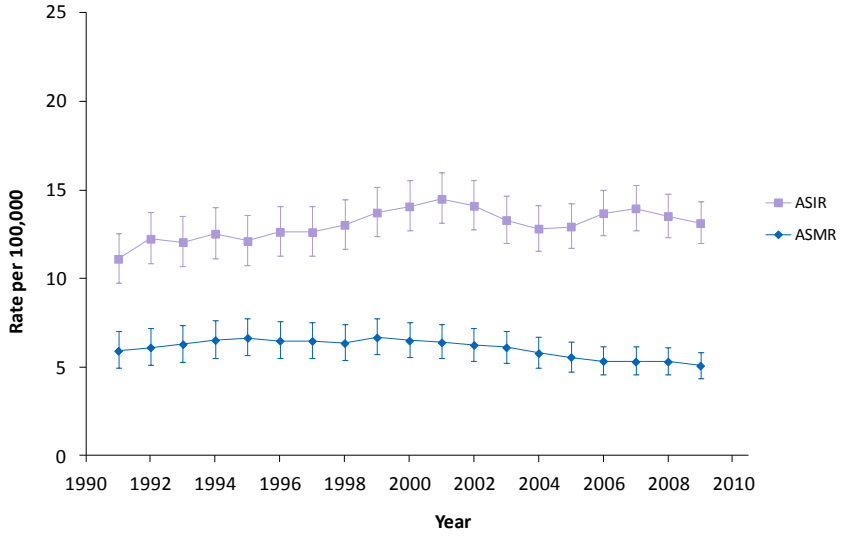
In order to compare cancer incidence or cancer mortality over time or between populations, ***age-standardized incidence rates (ASIRs)*** or ***age-standardized mortality rates (ASMRs)*** are presented. These are weighted averages of ***age-specific rates*** using a standard population to determine the weights. 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 population is used as the standard population.

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 by age group. Age-standardized incidence rates (ASIRs) and age-standardized mortality rates (ASMRs) are presented as three-year moving averages. This smoothing of trends is especially important when the number of cancer cases per year is relatively small, where year-to-year variability can be quite large.

Incidence and mortality can be affected by a variety of factors; 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, the development of cancer treatment programs that may impact chances of survival and research innovations.

The following figures show incidence and mortality trends for leukemia 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] method 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).

Figure 9-2: **Age-Standardized Incidence Rates (ASIRs)[*†] and Mortality Rates (ASMRs)[*†] and 95% Confidence Intervals (CI) for Leukemia, Both Sexes Combined, Alberta, 1990-2010**



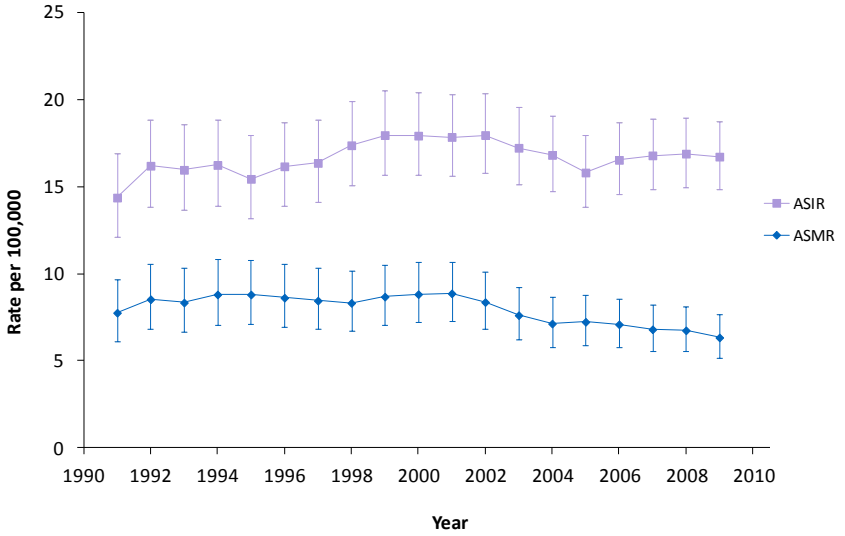
[*] Three-year moving average.
[†] Standardized to 1991 Canadian population.

Data Sources: Alberta Cancer Registry, Alberta Health

Leukemia ASIRs in both sexes combined increased significantly since 1990 (***Figure 9-2***). Between 1990 and 2010, leukemia ASIRs in both sexes combined increased significantly by 0.7% annually. In 2010, the ASIR for leukemia in both sexes combined was 13 per 100,000 population.

Leukemia mortality rates are lower than incidence rates (***Figure 9-2***). Leukemia ASMRs in both sexes combined remained stable between 1990 and 2000, but decreased significantly between 2000 and 2010 by 3.2% annually. In 2010, the ASMR for leukemia in both sexes combined was 4 per 100,000 population.

Figure 9-3: **Age-Standardized Incidence Rates (ASIRs)[*†] and Mortality Rates (ASMRs)[*†] and 95% Confidence Intervals (CI) for Leukemia, Males, Alberta, 1990-2010**



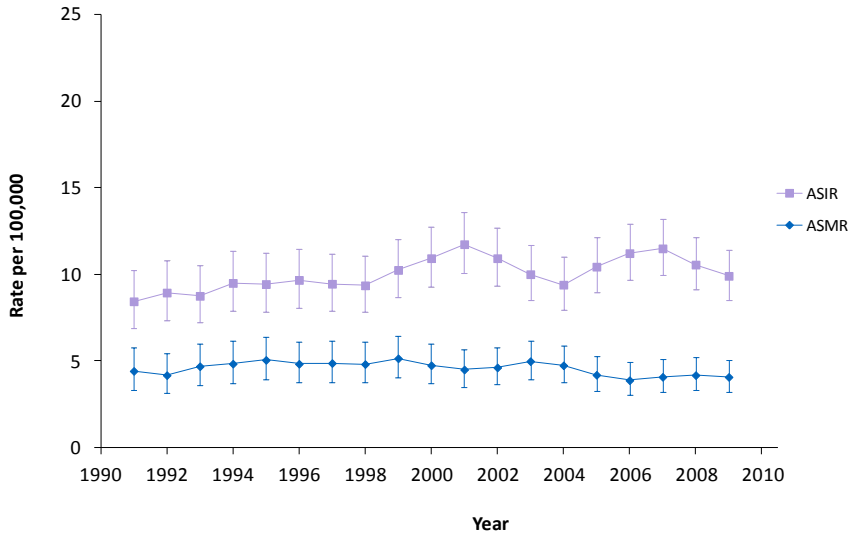
[*] Three-year moving average.
[†] Standardized to 1991 Canadian population.

Data Sources: Alberta Cancer Registry, Alberta Health

Male leukemia ASIRs have not increased significantly since 1990 (***Figure 9-3***). In 2010, the ASIR for leukemia in males was 17 per 100,000 male population.

Male leukemia mortality rates are lower than incidence rates (***Figure 9-3***). Male leukemia AMSRs remained stable between 1990 and 2000. Over the period 2000 to 2010, male leukemia ASMRs decreased significantly by 3.9% annually. In 2010, the ASMR for leukemia in males was 5 per 100,000 male population.

Figure 9-4: **Age-Standardized Incidence Rates (ASIRs)[*†] and Mortality Rates (ASMRs)[*†] and 95% Confidence Intervals (CI) for Leukemia, Females, Alberta, 1990-2010**



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

Data Sources: Alberta Cancer Registry, Alberta Health

Female leukemia ASIRs have not increased significantly since 1990 (***Figure 9-4***). In 2010, the ASIR for leukemia in females was 9 per 100,000 female population.

Female leukemia mortality rates are lower than incidence rates (***Figure 9-4***). Female leukemia ASMRs have not changed significantly since 1990. In 2010, the ASMR for leukemia in females was 4 per 100,000 female population.

Leukemia Incidence

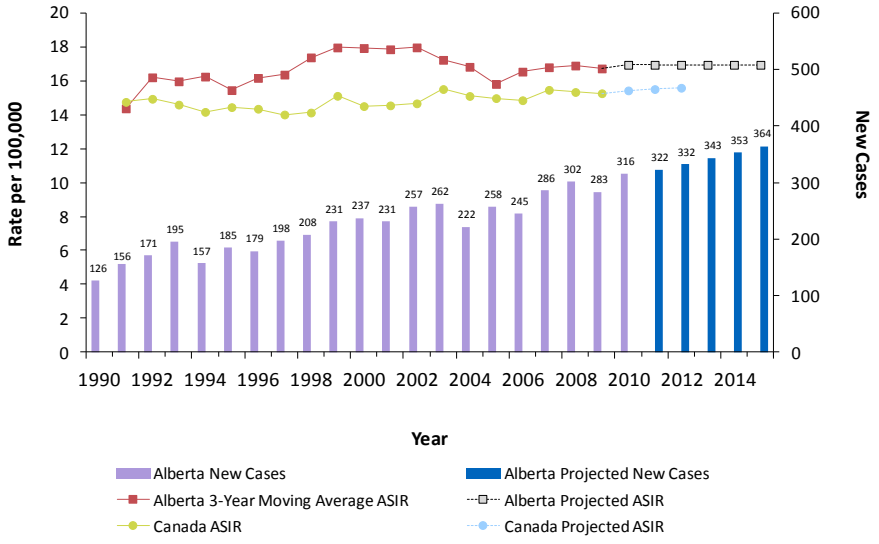
The following three figures (***Figures 9-5*** **to** ***9-7***) provide information on leukemia incidence in Alberta. The number of new cancer cases in Alberta is affected not only by changes in the incidence rates, but also by the changes in the age structure and growth of the population. In order to compare trends over time, age-standardized incidence rates (ASIRs) are also provided.

In ***Figures 9-5*** and ***9-6*** observed age standardized incidence rates are shown for 1990-2009, and ***projected*** rates for 2010 -2015, and observed numbers of new leukemia cases are shown for the years 1990-2010 and projected numbers for 2011-2015

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 2009 and estimated for 2010-2015. 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 leukemia incidence rates were calculated by extrapolating the historical trends in age-specific rate based on data for 1985-2009.

Figure 9-5: **Actual and Projected Number of New Cases and Age-Standardized Incidence Rates (ASIRs)*† for Leukemia, Males, Alberta, 1990-2015**



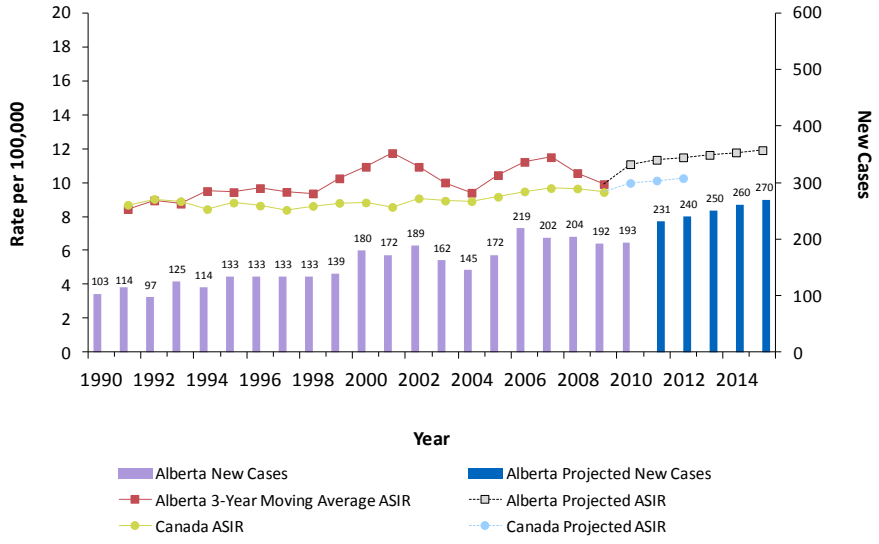
* Three-year moving average.
† Standardized to 1991 Canadian population.

Data Sources: Alberta Cancer Registry, Alberta Health, Canadian Cancer Society

In 2010, 316 cases of male leukemia were diagnosed in Alberta (***Figure 9-5***). Alberta ASIRs for male leukemia were generally higher than those in Canada.

Approximately 360 cases of male leukemia will be diagnosed in Alberta in 2015.

Figure 9-6: **Actual and Projected Number of New Cases and Age-Standardized Incidence Rates (ASIRs)*† for Leukemia, Females, Alberta, 1990-2015**



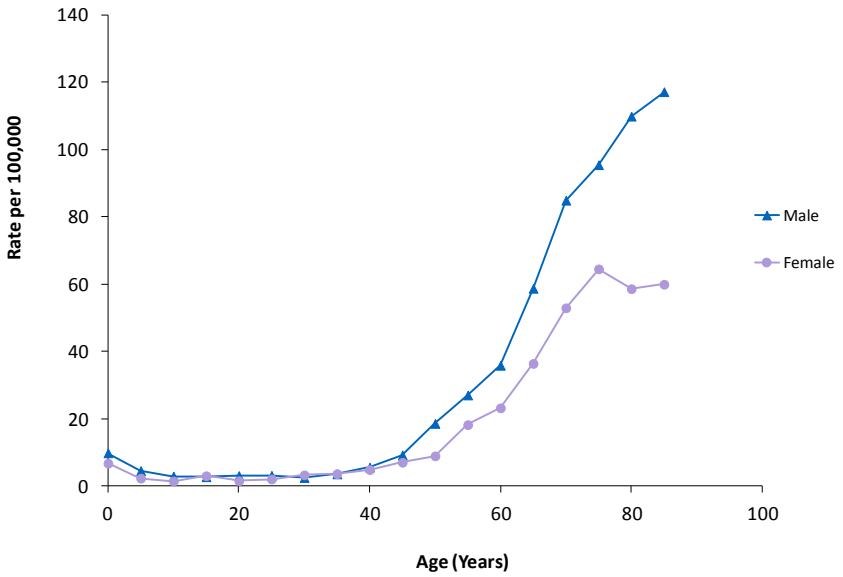
* Three-year moving average.
† Standardized to 1991 Canadian population.

Data Sources: Alberta Cancer Registry, Alberta Health, Canadian Cancer Society

In 2010, 193 cases of female leukemia were diagnosed in Alberta (***Figure 9-6***). Alberta ASIRs for female leukemia were generally higher than those in Canada.

Approximately 270 cases of female leukemia will be diagnosed in Alberta in 2015.

Figure 9-7: **Age-Specific Incidence Rates for Leukemia by Sex, Alberta, 2006-2010**



Data Sources: Alberta Cancer Registry, Alberta Health

Incidence rates of leukemia change with age in males and females (***Figure 9-7***). Age-specific incidence rates for leukemia are somewhat elevated in those under 15 years of age then remain low in both males and females until the age of 40. Female rates are similar to male rates until about the age of 45, after which females have lower incidence rates.

Leukemia Mortality

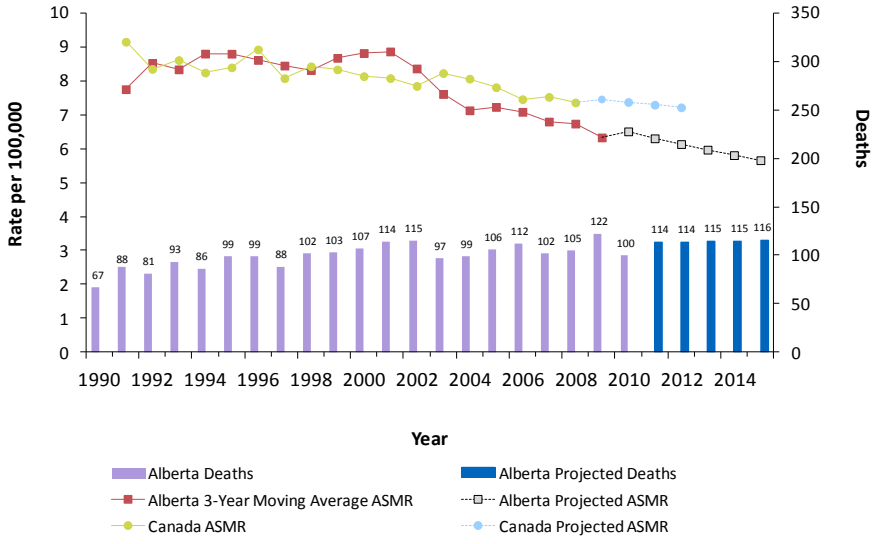
The following three figures (***Figures 9-8*** **to** ***9-10***) provide information on leukemia mortality in Alberta. The number of deaths in Alberta is affected not only by changes in the mortality rates, but also by the changes in the age structure and growth of the population. In order to compare trends over time, age-standardized mortality rates (ASMRs) are also provided.

In ***Figures 9-8*** and ***9-9*** observed age standardized mortality rates are shown for 1990-2009, and ***projected*** rates for 2010 -2015, and observed numbers of cancer deaths are shown for the years 1990-2010 and projected numbers for 2011-2015.

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 2009 and estimated for 2010-2015. 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 leukemia mortality rates were calculated by extrapolating the historical trends in age-specific rate based on data in 1985-2009.

Figure 9-8: **Actual and Projected Number of Deaths and Age-Standardized Mortality Rates (ASMRs)*† for Leukemia, Males, Alberta, 1990-2015**



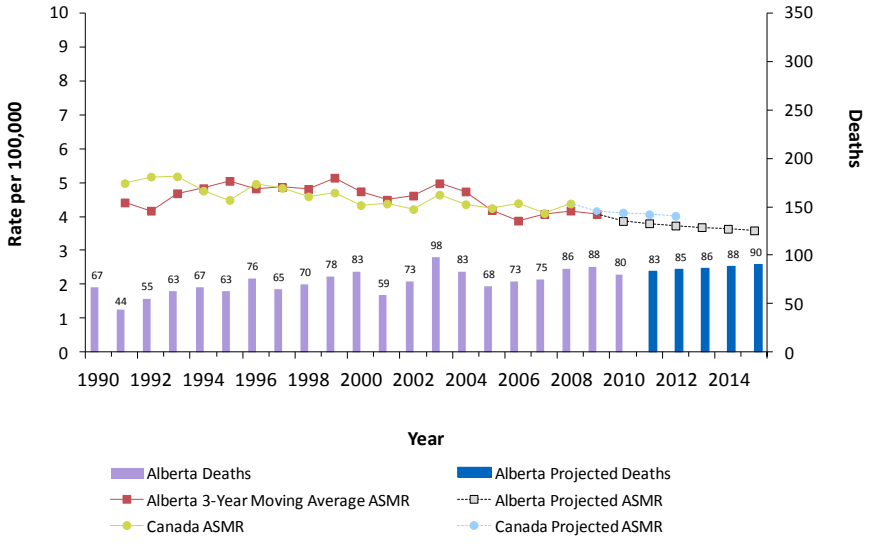
* Three-year moving average.
† Standardized to 1991 Canadian population.

Data Sources: Alberta Cancer Registry, Alberta Health, Canadian Cancer Society

In 2010, 100 males died of leukemia in Alberta (***Figure 9-8***). Alberta ASMRs for male leukemia were similar to those in Canada.

Approximately 120 males are expected to die from leukemia in Alberta in 2015.

Figure 9-9: **Actual and Projected Number of Deaths and Age-Standardized Mortality Rates (ASMRs)*† for Leukemia, Females, Alberta, 1990-2015**



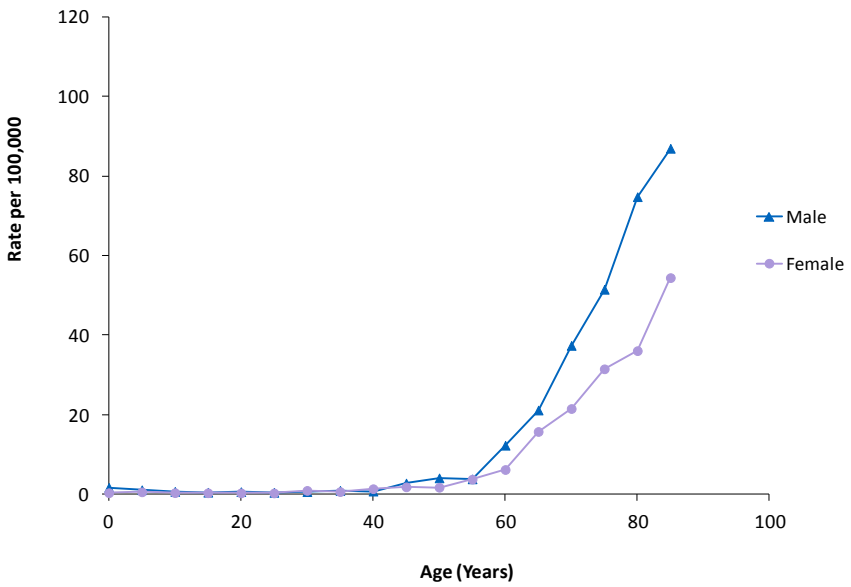
* Three-year moving average.
† Standardized to 1991 Canadian population.

Data Sources: Alberta Cancer Registry, Alberta Health, Canadian Cancer Society

In 2010, 80 females died of leukemia in Alberta (***Figure 9-9***). Alberta ASMRs for female leukemia cancer were similar to those in Canada.

Approximately 90 females are expected to die from leukemia in Alberta in 2015.

Figure 9-10: Age-Specific Mortality Rates for Leukemia by Sex, Alberta, 2006-2010



Data Sources: Alberta Cancer Registry, Alberta Health

Male and female leukemia mortality rates differ by age and sex (***Figure 9-10***). Age-specific mortality rates for leukemia are low in both males and females until about the age of 40 when they begin to increase. Female rates are lower than male rates after 45 years of age. The highest leukemia mortality rates occur in the older age groups.

Leukemia Survival

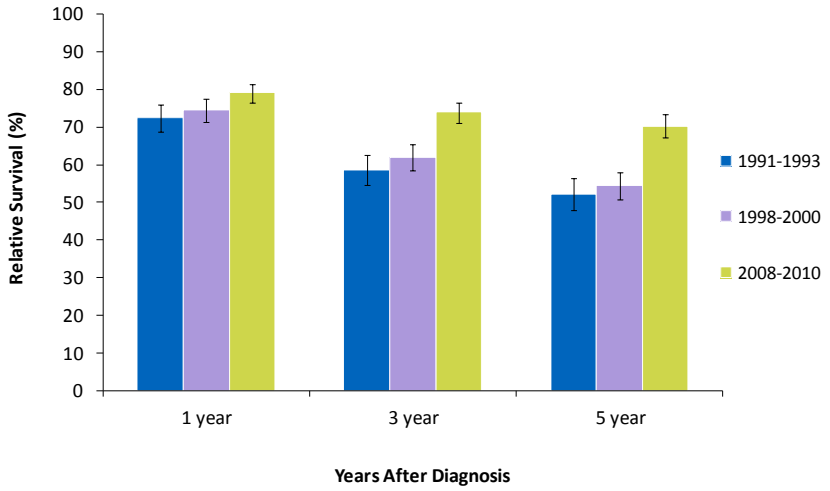
Cancer survival ratios indicate the proportion of people who will be alive at a given time after they have been diagnosed with cancer. Survival is an important outcome measure and is used for evaluating the effectiveness of cancer control programs. Survival depends on several factors including the cancer type (most importantly site, morphology and stage 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. In this section of the report, RSRs are standardized by the age structure in the standard cancer patient 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***[6] when complete follow-up data (e.g., at least five years of follow-up to estimate 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***.[7] 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 9-11: **Age-Standardized One, Three and Five-Year Relative Survival Ratios and 95% Confidence Intervals (CI) for Leukemia, Both Sexes Combined, Alberta, 1991-1993*, 1998-2000* and 2008-2010†**



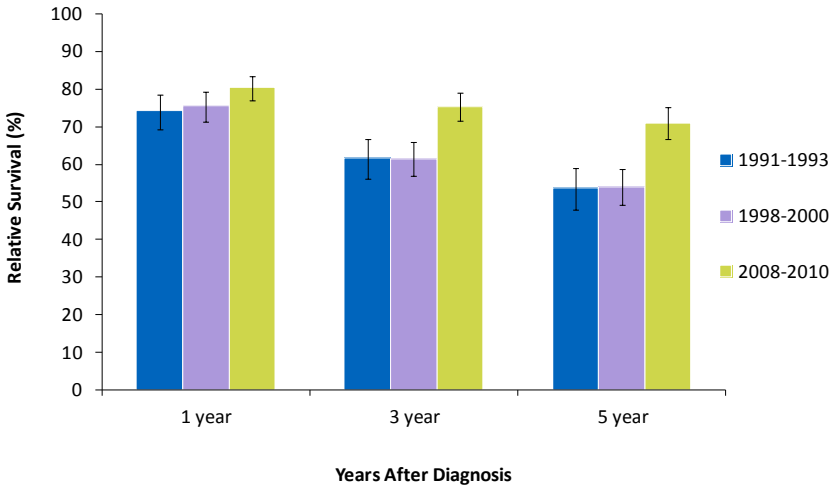
* Ratios calculated by cohort method, where complete follow-up data are available.
† Ratios calculated by period method, where complete follow-up data are not available.

Data Sources: Alberta Cancer Registry, Statistics Canada

The five-year relative survival ratio for individuals diagnosed with leukemia in the period 2008-2010 is an estimated 70% indicating that out of individuals diagnosed with this cancer between 2008 and 2010, around 70% are as likely to be alive five years after diagnosis as individuals from the general population of the same age.

The five-year relative survival ratio for individuals diagnosed with leukemia in Alberta has improved in 2008-2010 compared to those diagnosed in 1991-1993 (***Figure 9-11***).

Figure 9-12: **Age-Standardized One, Three and Five-Year Relative Survival Ratios and 95% Confidence Intervals (CI) for Leukemia, Males, Alberta, 1991-1993*, 1998-2000* and 2008-2010†**



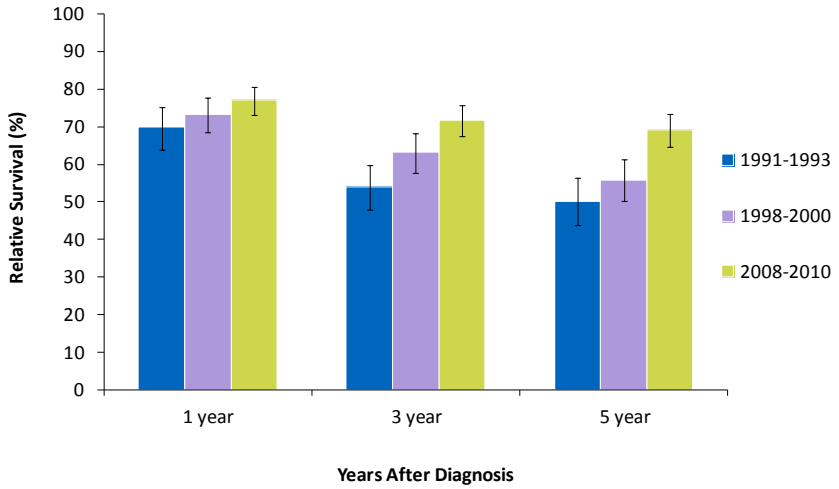
* Ratios calculated by cohort method, where complete follow-up data are available.
† Ratios calculated by period method, where complete follow-up data are not available.

Data Sources: Alberta Cancer Registry, Statistics Canada

The five-year relative survival ratio for males diagnosed with leukemia in the period 2008-2010 is an estimated 71% indicating that out of males diagnosed with this cancer between 2008 and 2010, around 71% are as likely to be alive five years after diagnosis as males from the general population of the same age.

The five-year relative survival ratio for males diagnosed with leukemia in Alberta has improved in 2008-2010 compared to those diagnosed in 1991-1993 (***Figure 9-12***).

Figure 9-13: **Age-Standardized One, Three and Five-Year Relative Survival Ratios and 95% Confidence Intervals (CI) for Leukemia, Females, Alberta, 1991-1993*, 1998-2000* and 2008-2010†**



* 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 Sources: Alberta Cancer Registry, Statistics Canada

The five-year relative survival ratio for females diagnosed with leukemia in the period 2008-2010 is an estimated 69% indicating that out of females diagnosed with this cancer between 2008 and 2010, around 69% are as likely to be alive five years after diagnosis as females from the general population of the same age.

The five-year relative survival ratio for females diagnosed with leukemia in Alberta has improved in 2008-2010 compared to those diagnosed in 1991-1993 (***Figure 9-13***).

Further Information

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

Appendix 1: Glossary

Appendix 2: Cancer Definitions

Appendix 3: Data Notes

References

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