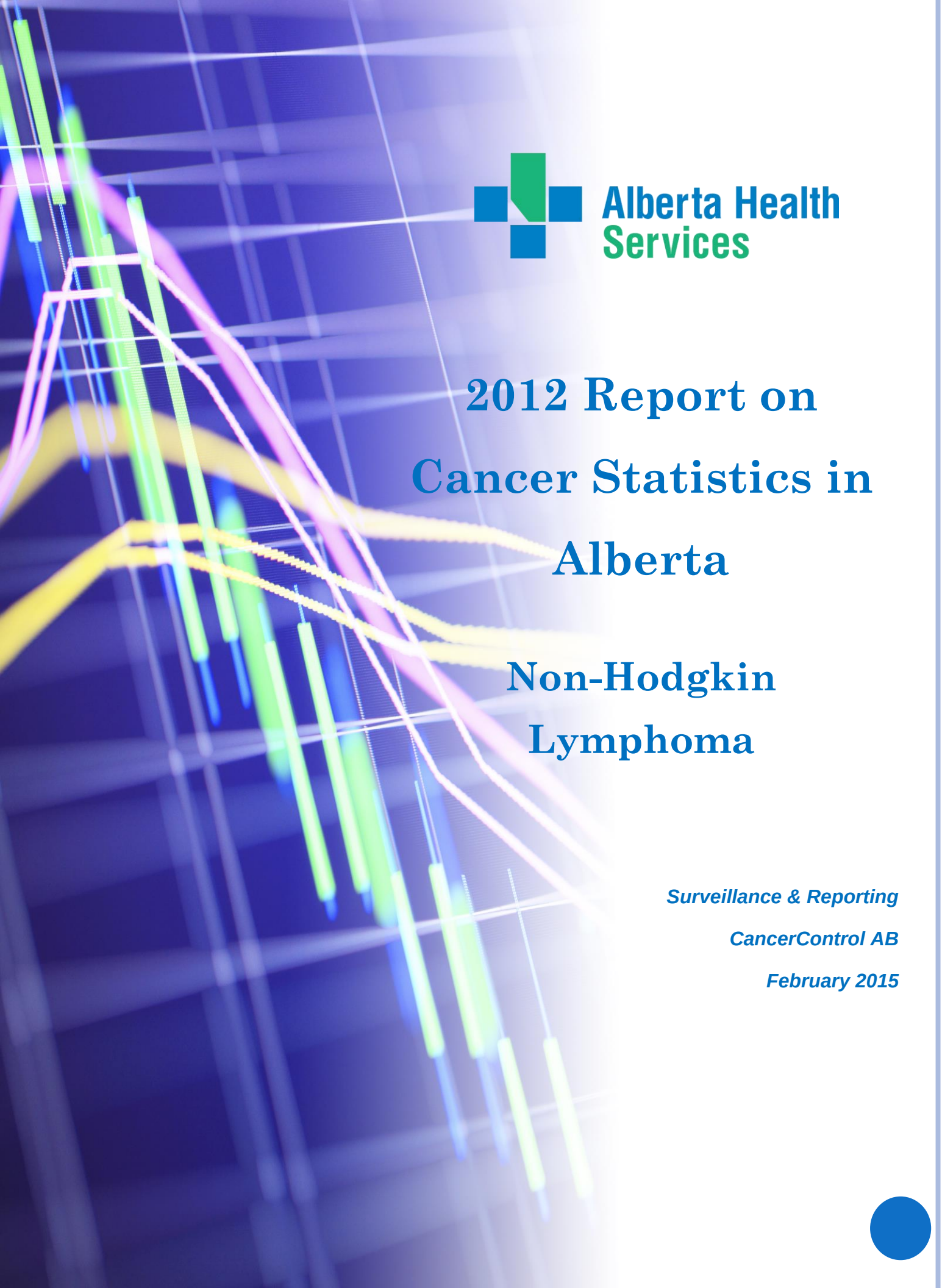

Alberta Health Services

2012 Report on Cancer Statistics in Alberta

Non-Hodgkin Lymphoma

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 non-Hodgkin lymphoma (see **Appendix** for cancer site 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

- The chance of being diagnosed with non-Hodgkin lymphoma in a lifetime is approximately **1 in 39** men and **1 in 46** women. As of December 31, 2012, approximately **5,700** Albertans were alive who had previously been diagnosed with non-Hodgkin lymphoma.

- In 2012, there were **700** new cases of non-Hodgkin lymphoma in Alberta and **213** deaths due to the disease. Over the past 30 years, between 1992 and 2012, the incidence rates have been increasing and mortality rates have been decreasing. Incidence of non-Hodgkin Lymphoma increases rapidly after age 30. Incidence is higher in males than in females. In the future it is estimated that approximately **900** cases of non-Hodgkin lymphoma are expected to be diagnosed in 2017

- Survival for non-Hodgkin Lymphoma is generally good and has improved consistently. The five-year relative survival ratio for non-Hodgkin lymphoma in Alberta was **53%** for those diagnosed 1992-1994 and was **73%** for those diagnosed between 2010 and 2012. This means that those diagnosed in 2010 to 2012 are about **73%** as likely to be alive 5 years after their diagnoses as someone of the same age who has not been diagnosed with cancer.

- 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, **3,101** potential years of life were lost due to non-Hodgkin lymphoma.

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

Probability of Developing or Dying from Non-Hodgkin Lymphoma

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 non-Hodgkin lymphoma 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 8-1: Probability of Developing Non-Hodgkin Lymphoma by Age and Sex, Alberta, 2008-2012

Age Group	Males	Females
Lifetime Risk (all ages)	1 in 39	1 in 46
0 - 20	1 in 3,412	1 in 6,357
20 - 30	1 in 3,045	1 in 6,054
30 - 40	1 in 1,527	1 in 2,320
40 - 50	1 in 584	1 in 895
50 - 60	1 in 343	1 in 454
60 - 70	1 in 159	1 in 219
70 - 80	1 in 103	1 in 132
80+	1 in 84	1 in 97

Data Source: Alberta Cancer Registry, Alberta Health Services

The probability of developing non-Hodgkin lymphoma increases with age (**Table 8-1**). Approximately 1 in 39 males and 1 in 46 females will develop invasive non-Hodgkin lymphoma in their lifetime.

Males have a higher chance of developing non-Hodgkin lymphoma than females. On a population basis, the probability of developing non-Hodgkin lymphoma by the end of the age range for a non-Hodgkin lymphoma-free individual at the beginning of the age range are shown in **Table 8-1**. For instance, a non-Hodgkin lymphoma-free female at age 50 has a 1 in 454 chance of developing non-Hodgkin lymphoma by the time she is 60.

Table 8-2: Probability of Dying from Non-Hodgkin Lymphoma by Age and Sex, Alberta, 2008-2012

Age Group	Males	Females
Lifetime Risk (all ages)	1 in 100	1 in 118
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	Less than 1 in 10,000	Less than 1 in 10,000
40 - 50	1 in 4,135	1 in 7,799
50 - 60	1 in 1,738	1 in 4,026
60 - 70	1 in 558	1 in 899
70 - 80	1 in 245	1 in 403
80+	1 in 136	1 in 144

Data Source: Alberta Cancer Registry, Alberta Health Services

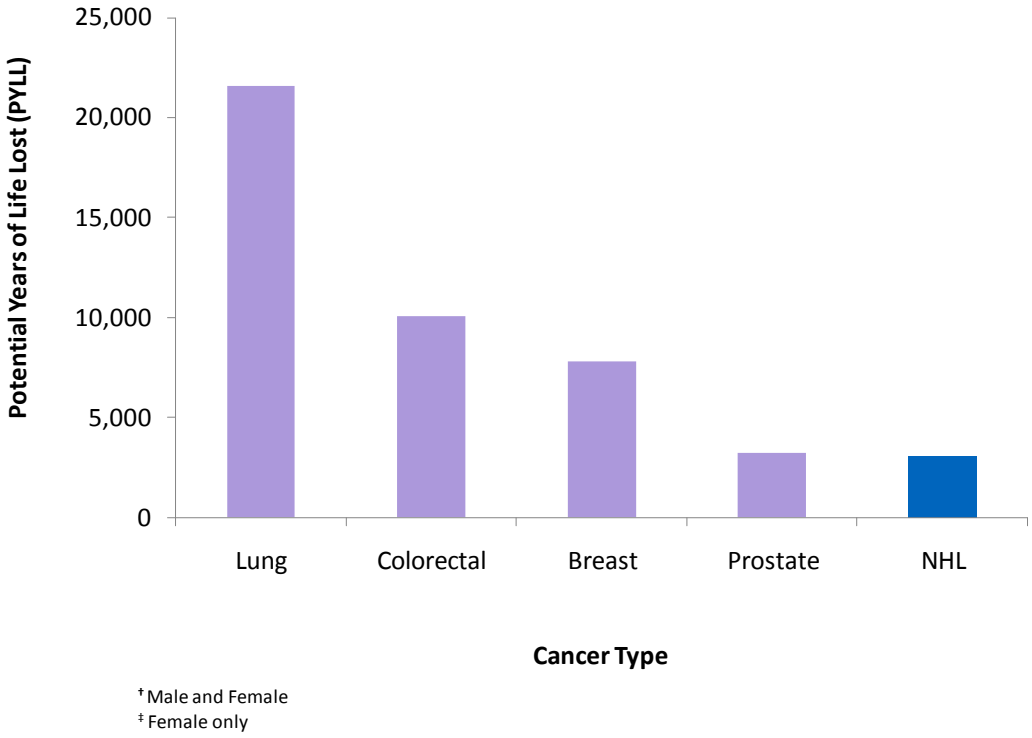
The probability of dying from non-Hodgkin lymphoma varies by age and sex (**Table 8-2**). Approximately 1 in 100 males and 1 in 118 females will die of invasive non-Hodgkin lymphoma.

Males have higher chance of dying from non-Hodgkin lymphoma than females. On a population basis, the probability of a cancer-free individual at the beginning of the age range dying from non-Hodgkin lymphoma by the end of the age range are shown in **Table 8-2**. For example, a cancer-free female at age 50 has a 1 in 4,026 chance of dying from non-Hodgkin lymphoma by the time she is 60.

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 8-1: Potential Years of Life Lost (PYLL) from Non-Hodgkin Lymphoma† Compared with Lung†, Colorectal†, Breast‡ and Prostate Cancers, Alberta, 2012



† Male and Female
‡ Female only

Data Source: Alberta Cancer Registry, Alberta Health Services

In 2012, **3,101** potential years of life were lost due to non-Hodgkin lymphoma, which constitutes 3.4% of PYLL for all cancers (**Figure 8-1**).

Prevalence

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

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

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

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 **5,700** Albertans were alive who had previously been diagnosed with non-Hodgkin lymphoma (**Table 8-3**). In addition, there were **1,100** Albertans alive who had been diagnosed with non-Hodgkin lymphoma 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 8-3: Limited-Duration and Complete Prevalence for Non-Hodgkin lymphoma, Both Sexes, Alberta, 2012

Duration	Prevalence (#)
2-Year	1,100
5-Year	2,400
10-Year	3,900
20-Year	5,100
Complete (Ever Diagnosed)	5,700

Data Source: Alberta Cancer Registry, Alberta Health Services

Non-Hodgkin Lymphoma 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 non-Hodgkin lymphoma 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 non-Hodgkin lymphoma 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.

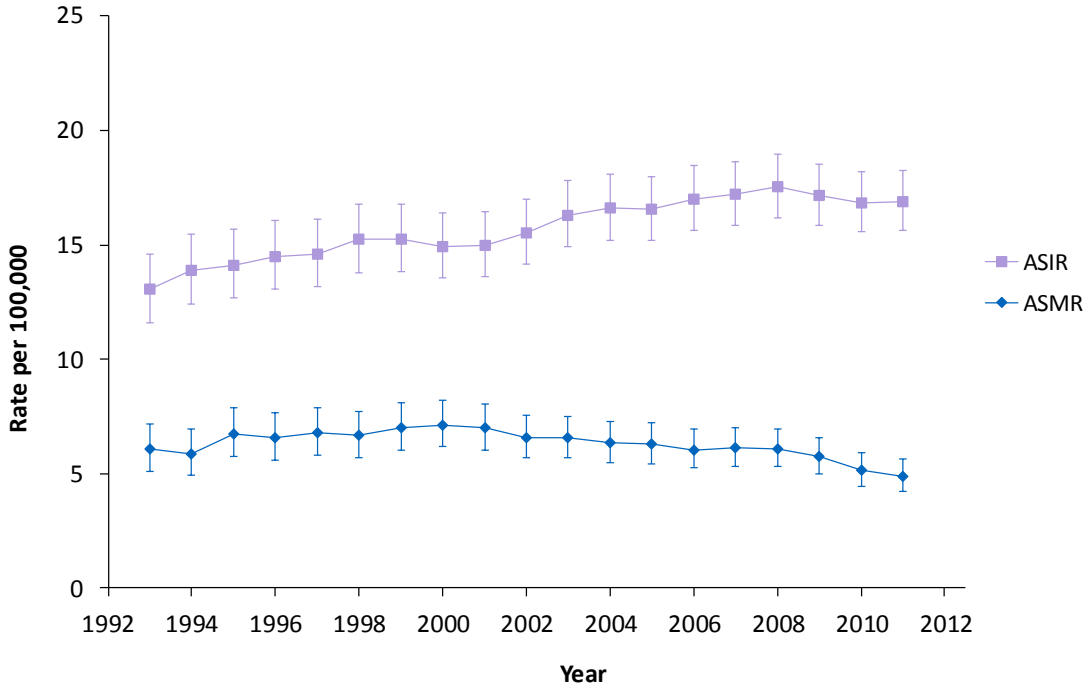
Three-year moving averages are used to smooth out year-to-year fluctuations so that the underlying trend may be more easily observed. They are calculated based on aggregating three years of data. Age-standardized incidence rates (ASIRs) and age-standardized mortality rates (ASMRs) are presented as three-year 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 8-2: Age-Standardized Incidence Rates (ASIRs)[*†] and Mortality Rates (ASMRs)[*†] with 95% Confidence Intervals (CI) for Non-Hodgkin Lymphoma, Both Sexes, Alberta, 1992-2012



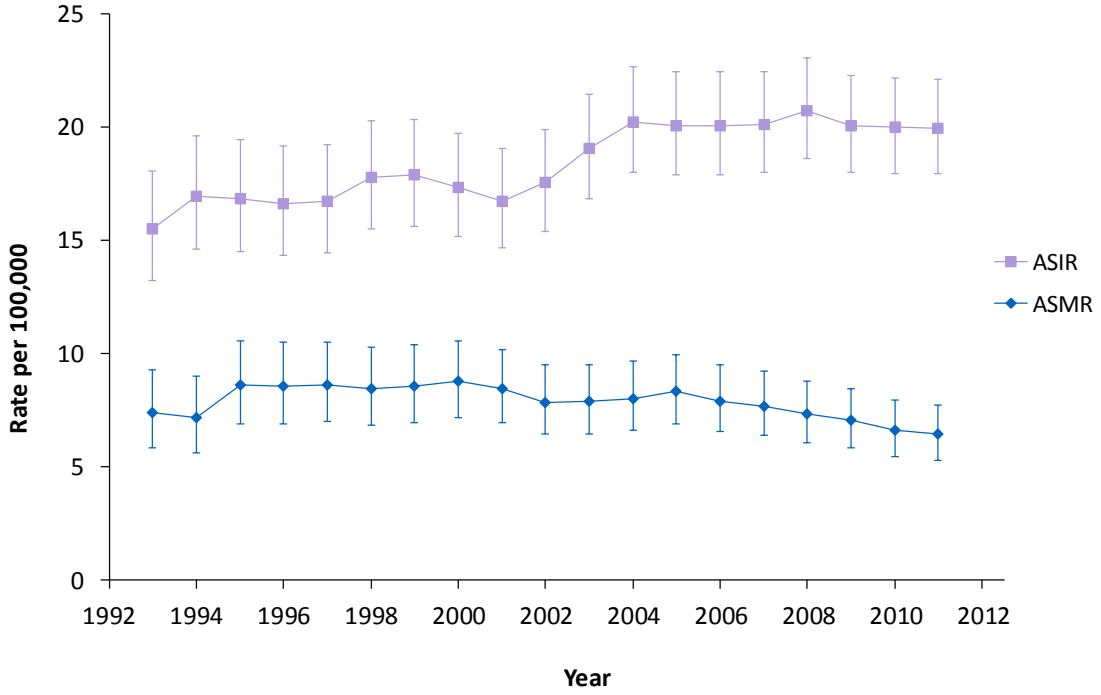
[*] Three-year moving average.
[†] Standardized to 1991 Canadian population.

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

Non-Hodgkin lymphoma ASIRs increased significantly since 1992 (**Figure 8-2**). Between 1992 and 2012, non-Hodgkin lymphoma ASIRs increased by 1.4% annually. In 2012, the ASIR for non-Hodgkin lymphoma was 17.1 per 100,000 in the population.

Non-Hodgkin lymphoma mortality rates are lower than incidence rates (**Figure 8-2**). ASMRs did not change significantly between 1992 and 2000. Between 2000 and 2012, non-Hodgkin lymphoma ASMRs decreased by 3.0% annually. In 2012, the ASMR for non-Hodgkin lymphoma was 5.1 per 100,000 in the population.

Figure 8-3: Age-Standardized Incidence Rates (ASIRs)[*†] and Mortality Rates (ASMRs)[*†] with 95% Confidence Intervals (CI) for Non-Hodgkin Lymphoma, Males, Alberta, 1992-2012



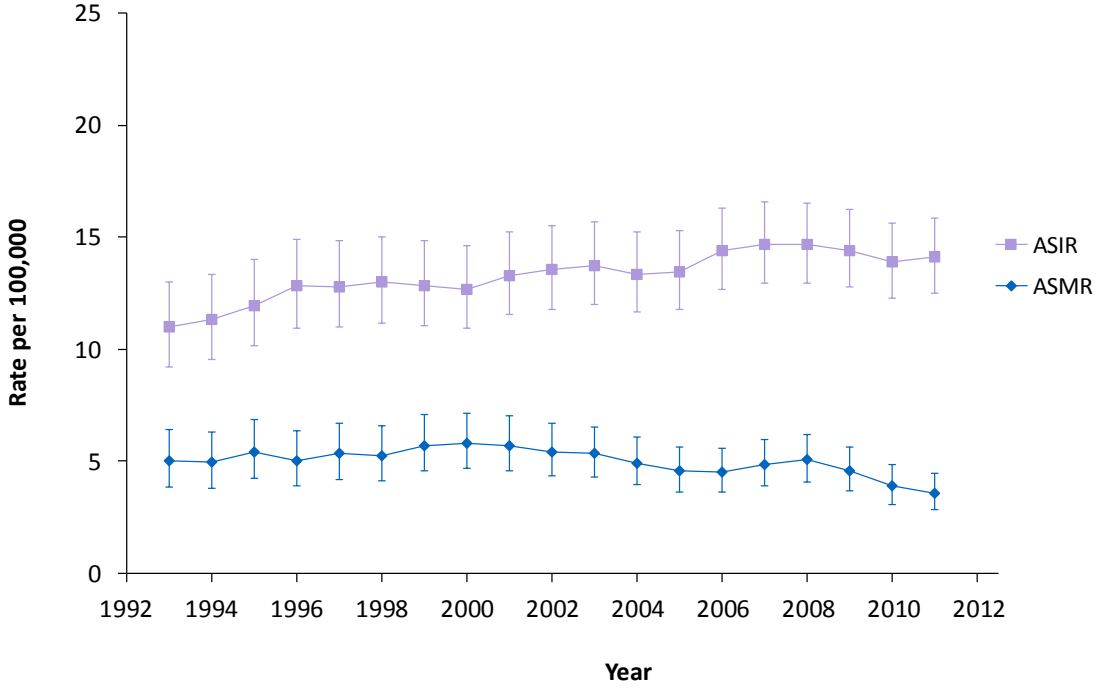
[*] Three-year moving average.
[†] Standardized to 1991 Canadian population.

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

Male non-Hodgkin lymphoma ASIRs significantly increased since 1992 (**Figure 8-3**). Between 1992 and 2012, male non-Hodgkin lymphoma ASIRs increased by 1.5% annually. In 2012, the ASIR for non-Hodgkin lymphoma in males was 20.4 per 100,000 males in the population.

Male non-Hodgkin lymphoma ASMRs decreased significantly between 1992 and 2012 by 1.1% annually (**Figure 8-3**). In 2012, the ASMR for non-Hodgkin lymphoma in males was 6.4 per 100,000 males in the population.

Figure 8-4: Age-Standardized Incidence Rates (ASIRs)[*†] and Mortality Rates (ASMRs)[*†] with 95% Confidence Intervals (CI) for Non-Hodgkin Lymphoma, Females, Alberta, 1992-2012



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

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

Female non-Hodgkin lymphoma ASIRs increased significantly since 1992 (**Figure 8-4**). Between 1992 and 2012, female non-Hodgkin lymphoma ASIRs increased by an average annual increase of 1.1%. In 2012, the ASIR for non-Hodgkin lymphoma in females was 14.4 per 100,000 females in the population.

Female non-Hodgkin lymphoma ASMRs decreased significantly between 1992 and 2012 by an annual average of 1.5% (**Figure 8-4**). In 2012, the ASMR for non-Hodgkin lymphoma in females was 4.0 per 100,000 females in the population.

Non-Hodgkin Lymphoma Incidence

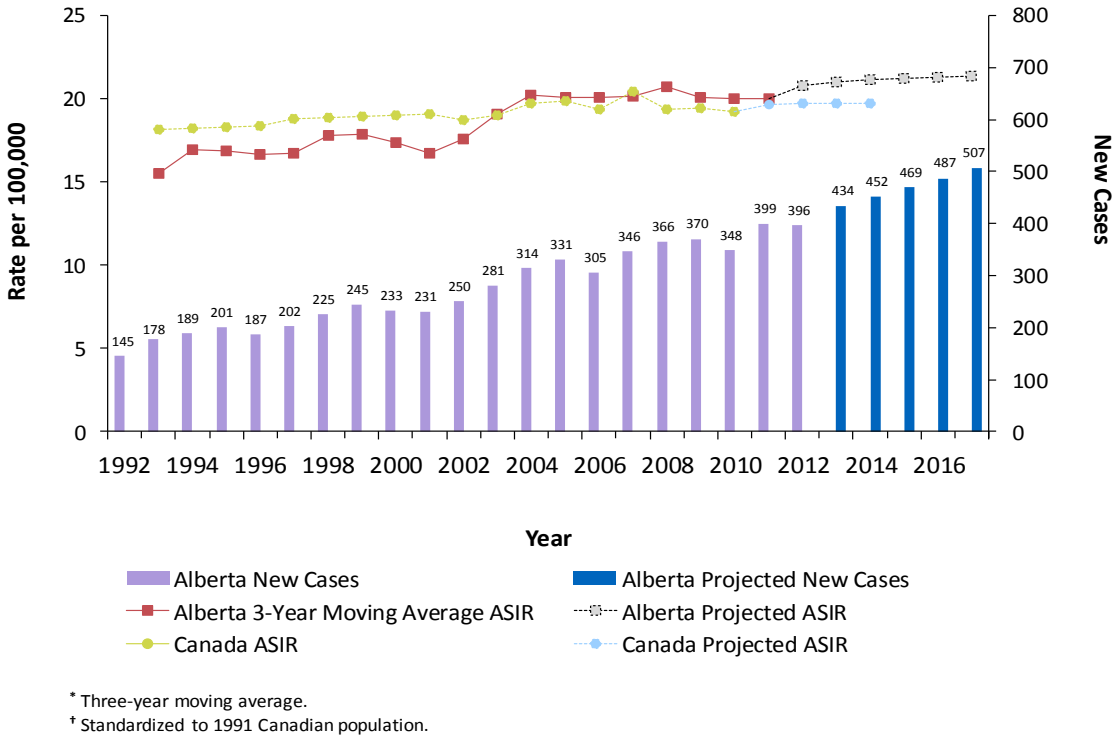
The following three figures (**Figures 8-5** to **8-7**) provide information on non-Hodgkin lymphoma (NHL) incidence in Alberta. The number of new cancer cases in Alberta is affected not only by changes in the underlying risk of developing NHL, but also by the changes in the age structure and growth of the population. In order to compare trends over time, age-standardized incidence rates (ASIRs) are provided.

In **Figures 8-5** and **8-6** observed age standardized incidence rates are shown for 1992 to 2011 (three-year moving averages), ***projected*** rates for 2012 to 2017, and observed numbers of new non-Hodgkin lymphoma 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 non-Hodgkin lymphoma incidence rates were calculated by extrapolating the historical trends in age-specific rate based on data from 1987 to 2011.

Figure 8-5: Actual and Projected Number of New Cases and Age-Standardized Incidence Rates (ASIRs)*† for Non-Hodgkin Lymphoma, Males, Alberta, 1992-2017



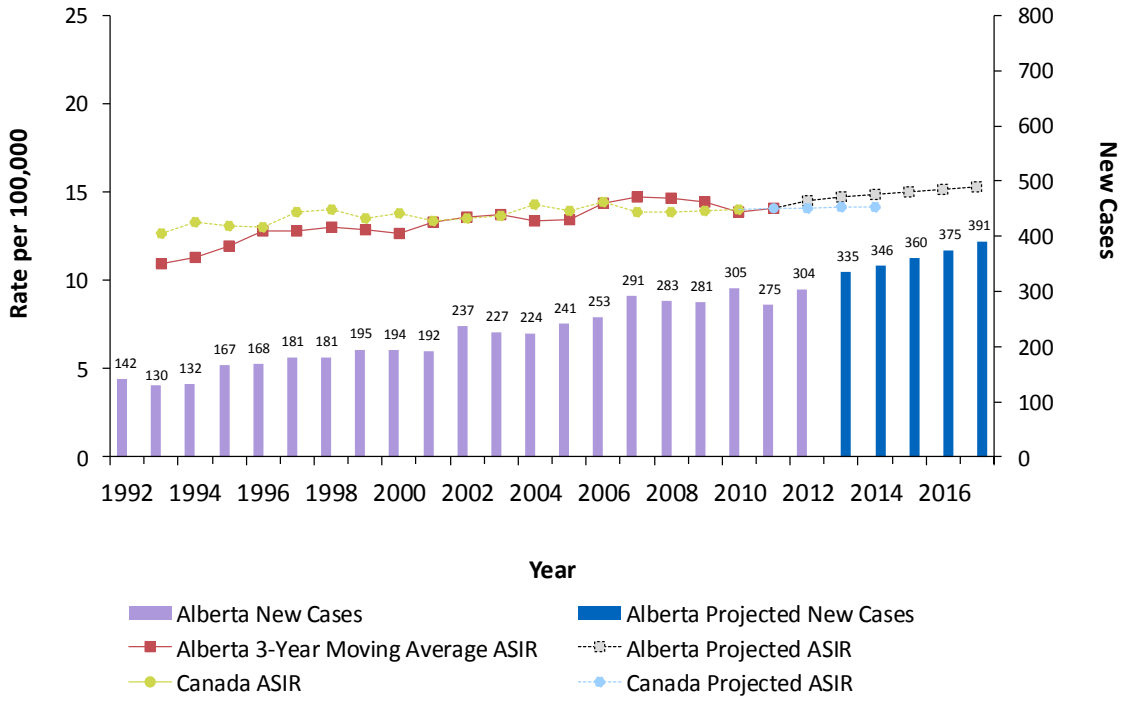
* Three-year moving average.
† Standardized to 1991 Canadian population.

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

In 2012, 396 cases of male non-Hodgkin lymphoma were diagnosed (**Figure 8-5**). ASIRs for male non-Hodgkin lymphoma in Alberta were generally lower than ASIRs in Canada between 1992 and 2002, but were generally higher than ASIRs in Canada over the period 2003 to 2011.

It is estimated that 510 cases of non-Hodgkin lymphoma will be diagnosed in males in Alberta in 2017.

Figure 8-6: Actual and Projected Number of New Cases and Age-Standardized Incidence Rates (ASIRs)[*†] for Non-Hodgkin Lymphoma Cancer, Females, Alberta, 1992-2017



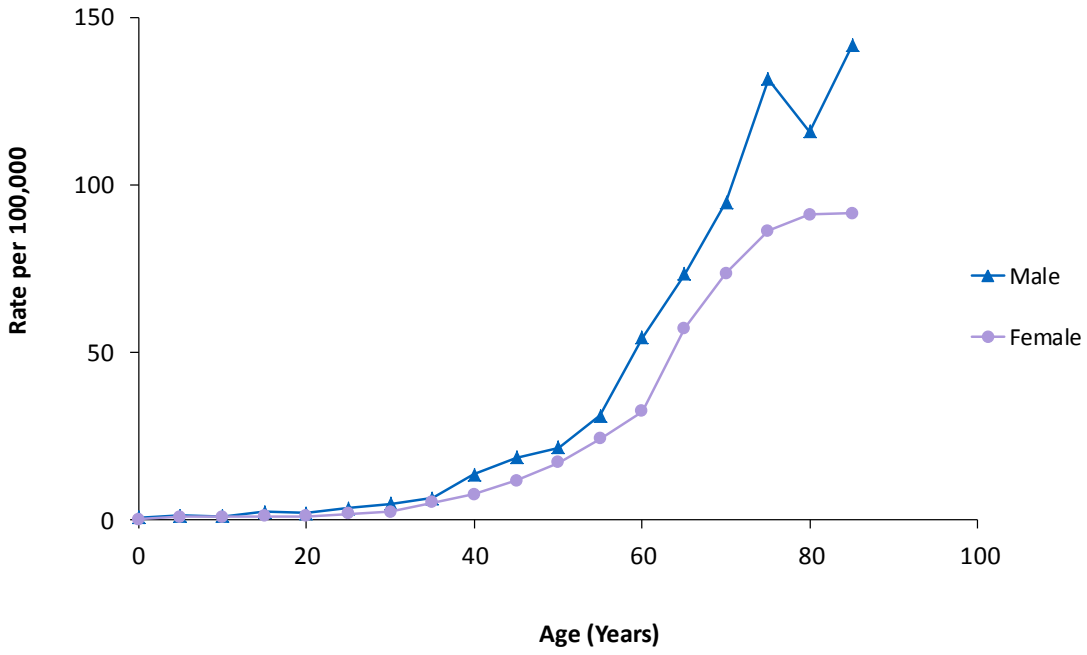
[*] Three-year moving average.
[†] Standardized to 1991 Canadian population.

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

In 2012, 304 cases of female non-Hodgkin lymphoma were diagnosed (**Figure 8-6**). Overall, ASIRs for female non-Hodgkin lymphoma in Alberta were generally lower than ASIRs in Canada over the period of 1992 to 2005.

It is estimated that 390 cases of non-Hodgkin lymphoma will be diagnosed in females in Alberta in 2017.

Figure 8-7: Age-Specific Incidence Rates for Non-Hodgkin Lymphoma by Sex, Alberta, 2008-2012



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

Incidence rates of non-Hodgkin lymphoma change with age in males and females (**Figure 8-7**). Age-specific incidence rates for non-Hodgkin lymphoma in both sexes increase rapidly after age 30. Female age-specific incidence rates are similar to males up to age 35 and are lower than male rates after age 35.

Non-Hodgkin Lymphoma Mortality

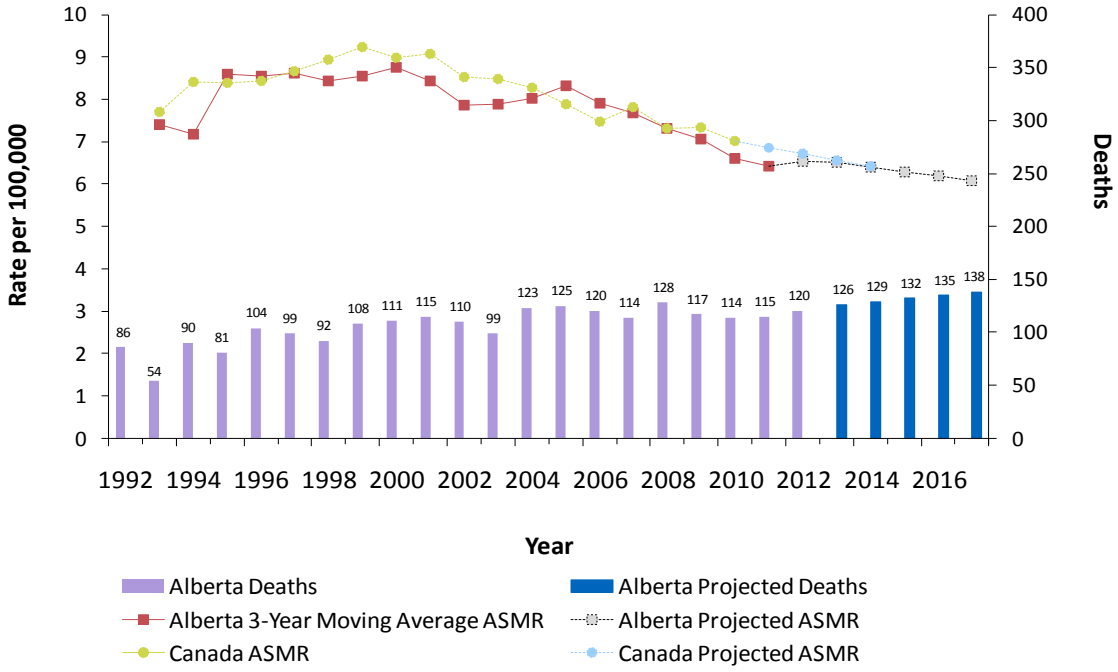
The following three figures (**Figures 8-8** to **8-10**) provide information on non-Hodgkin lymphoma (NHL) mortality in Alberta. The number of deaths in Alberta is affected not only by changes in the underlying risk of dying from NHL, but also by the changes in the age structure and growth of the population.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

In **Figures 8-8** and **8-9** observed age standardized mortality rates are shown for 1992 to 2011 (three-year moving averages), ***projected*** rates for 2012 to 2017. Similarly, observed numbers of non-Hodgkin lymphoma 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 non-Hodgkin lymphoma mortality rates were calculated by extrapolating the historical trends in age-specific rate based on data from 1987 to 2011.

Figure 8-8: Actual and Projected Number of Deaths and Age-Standardized Mortality Rates (ASMRs)*† for Non-Hodgkin Lymphoma, Males, Alberta, 1992-2017



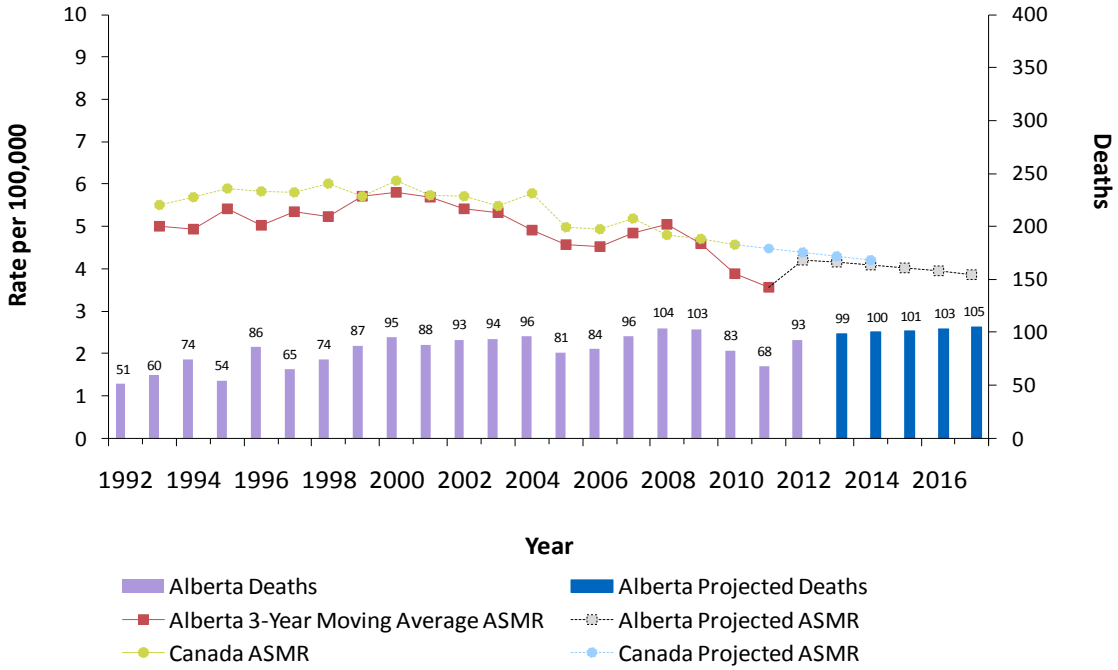
* Three-year moving average.
† Standardized to 1991 Canadian population.

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

In 2012, 120 males died of non-Hodgkin lymphoma (**Figure 8-8**). Overall, ASMRs for male non-Hodgkin lymphoma in Alberta were generally lower than ASMRs in Canada over the period of 1992 to 2004.

It is estimated that 140 males will die from non-Hodgkin lymphoma in Alberta in 2017.

Figure 8-9: Actual and Projected Number of Deaths and Age-Standardized Mortality Rates (ASMRs)*† for Non-Hodgkin Lymphoma, Females, Alberta, 1992-2017



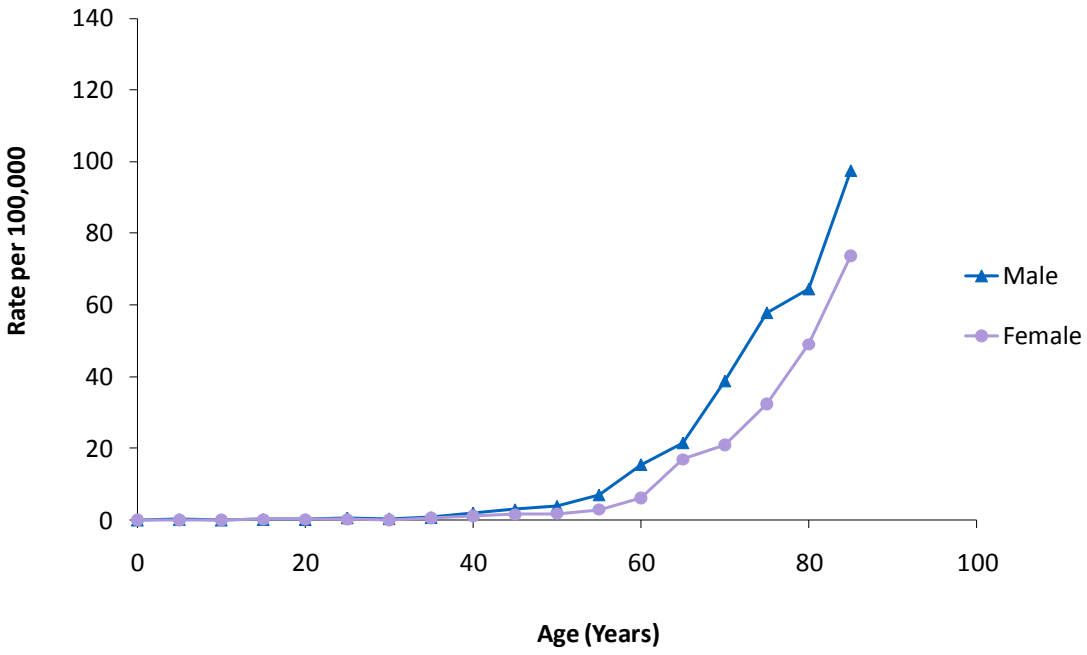
* Three-year moving average.
† Standardized to 1991 Canadian population.

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

In 2012, 93 females died of non-Hodgkin lymphoma in Alberta (**Figure 8-9**). ASMRs for female non-Hodgkin lymphoma in Alberta were generally lower than ASMRs in Canada.

It is estimated that 110 females will die from non-Hodgkin lymphoma in Alberta in 2017.

Figure 8-10: Age-Specific Mortality Rates for Non-Hodgkin Lymphoma by Sex, Alberta, 2008-2012



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

Male and female non-Hodgkin lymphoma mortality rates differ by age and sex (**Figure 8-10**). Age-specific mortality rates for non-Hodgkin lymphoma in both sexes increase after about age 40. Female mortality rates are lower compared to males after age 40. The highest non-Hodgkin lymphoma mortality rates occur in the older age groups.

Non-Hodgkin Lymphoma 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.

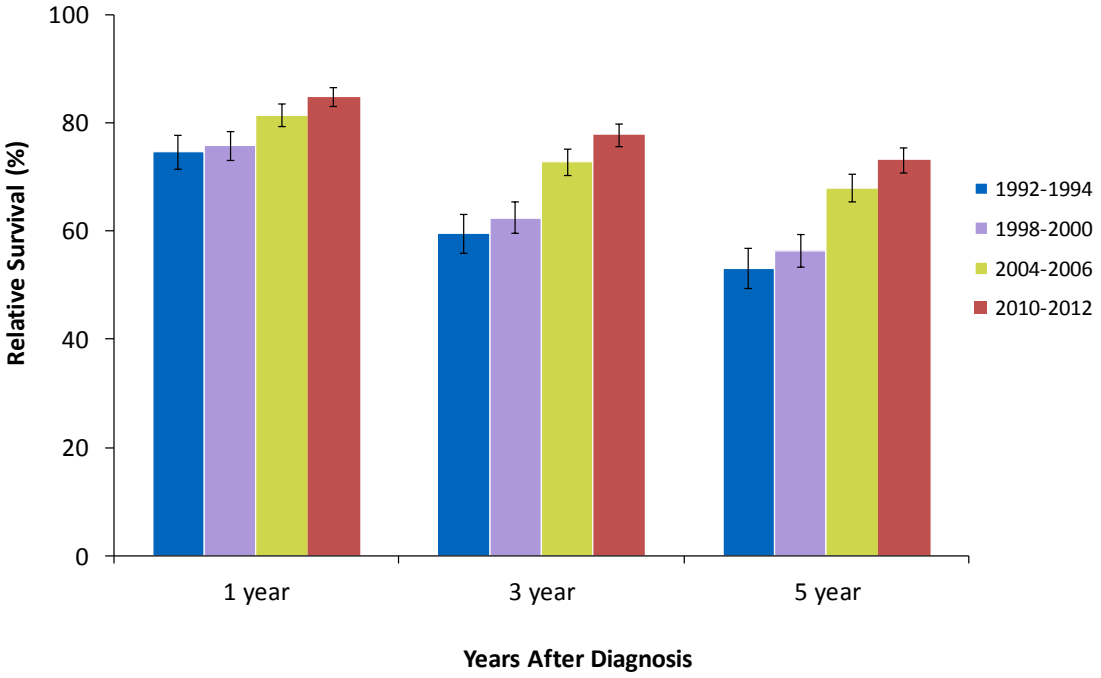
Survival depends on several factors including the cancer type (most importantly site, stage, and morphology at diagnosis), sex, age at diagnosis, health status, and available treatments for that cancer. While ***relative survival ratios*** (RSRs) give a general expectation of survival over the whole 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.[6] 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***[6] 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***[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 8-11: Age-Standardized One, Three and Five-Year Relative Survival Ratios with 95% Confidence Intervals (CI) for Non-Hodgkin Lymphoma, Both Sexes, Alberta, 1992-1994^, 1998-2000^ and 2004-2006^, 2010-2012*



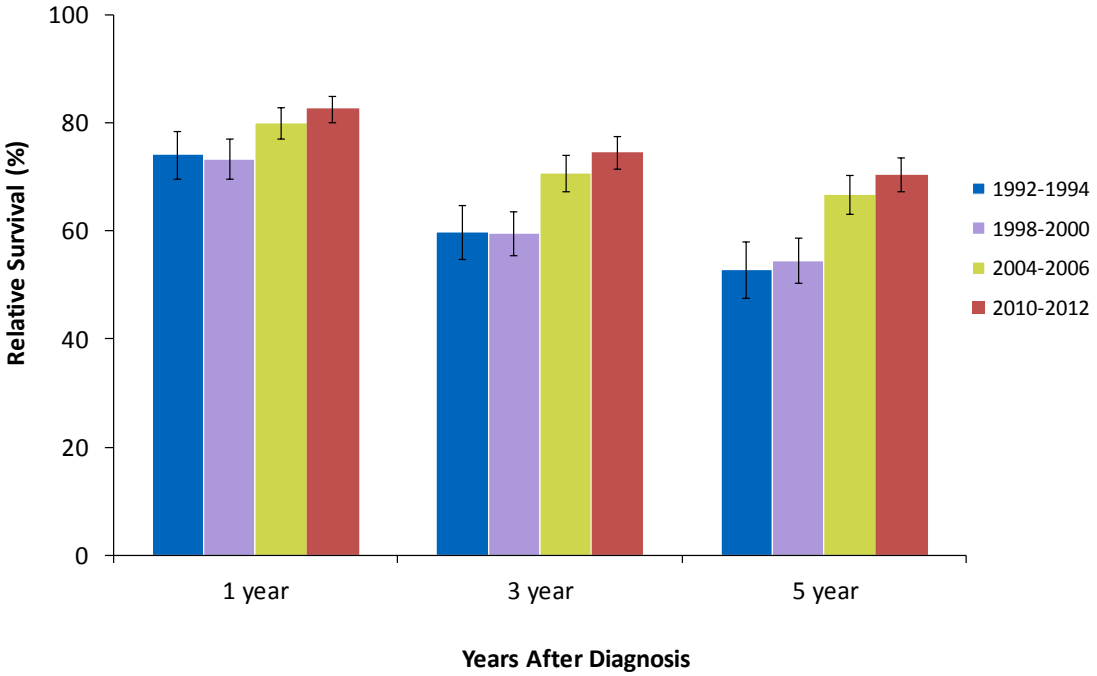
^ Ratios calculated by cohort method, where complete follow-up data are available.
* Ratios calculated by period method, where complete follow-up data are not available.

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

The five-year relative survival ratio for individuals diagnosed with non-Hodgkin lymphoma in the period of 2010 to 2012 is estimated to be 73%.

The five-year relative survival ratio for individuals diagnosed with non-Hodgkin lymphoma in Alberta has improved from 2010 to 2012 compared to those diagnosed in the 1992 to 1994 cohort years (**Figure 8-11**).

Figure 8-12: Age-Standardized One, Three and Five-Year Relative Survival Ratios with 95% Confidence Intervals (CI) for Non-Hodgkin Lymphoma, Males, Alberta, 1992-1994^, 1998-2000^ and 2004-2006^, 2010-2012* †



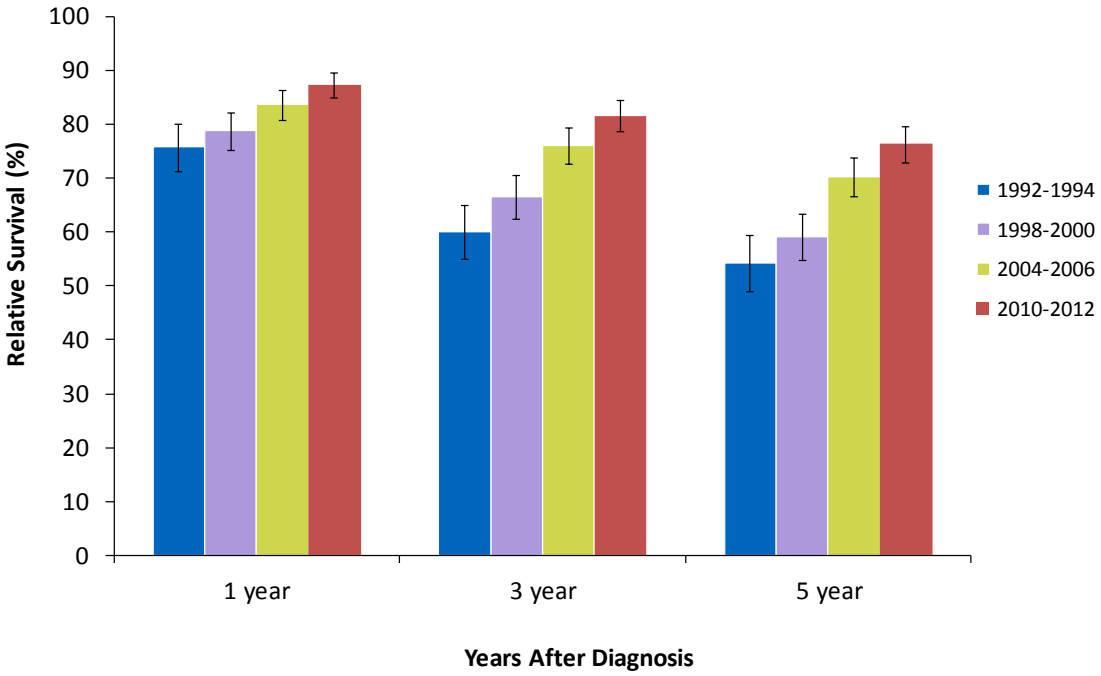
^ Ratios calculated by cohort method, where complete follow-up data are available.
† * Ratios calculated by period method, where complete follow-up data are not available.

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

The five-year relative survival ratio for males diagnosed with non-Hodgkin lymphoma in the period of 2010 to 2012 is estimated to be 70%.

The five-year relative survival ratio for males diagnosed with non-Hodgkin lymphoma in Alberta has improved from 2010 to 2012 compared to those diagnosed in the 1992 to 1994 cohort years (**Figure 8-12**).

Figure 8-13: Age-Standardized One, Three and Five-Year Relative Survival Ratios with 95% Confidence Intervals (CI) for Non-Hodgkin Lymphoma, 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 non-Hodgkin lymphoma in the period of 2010 to 2012 is estimated to be 76%.

The five-year relative survival ratio for females diagnosed with non-Hodgkin lymphoma in Alberta has improved from 2010 to 2012 compared to those diagnosed in the 1992 to 1994 cohort years (**Figure 8-13**).

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

References

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