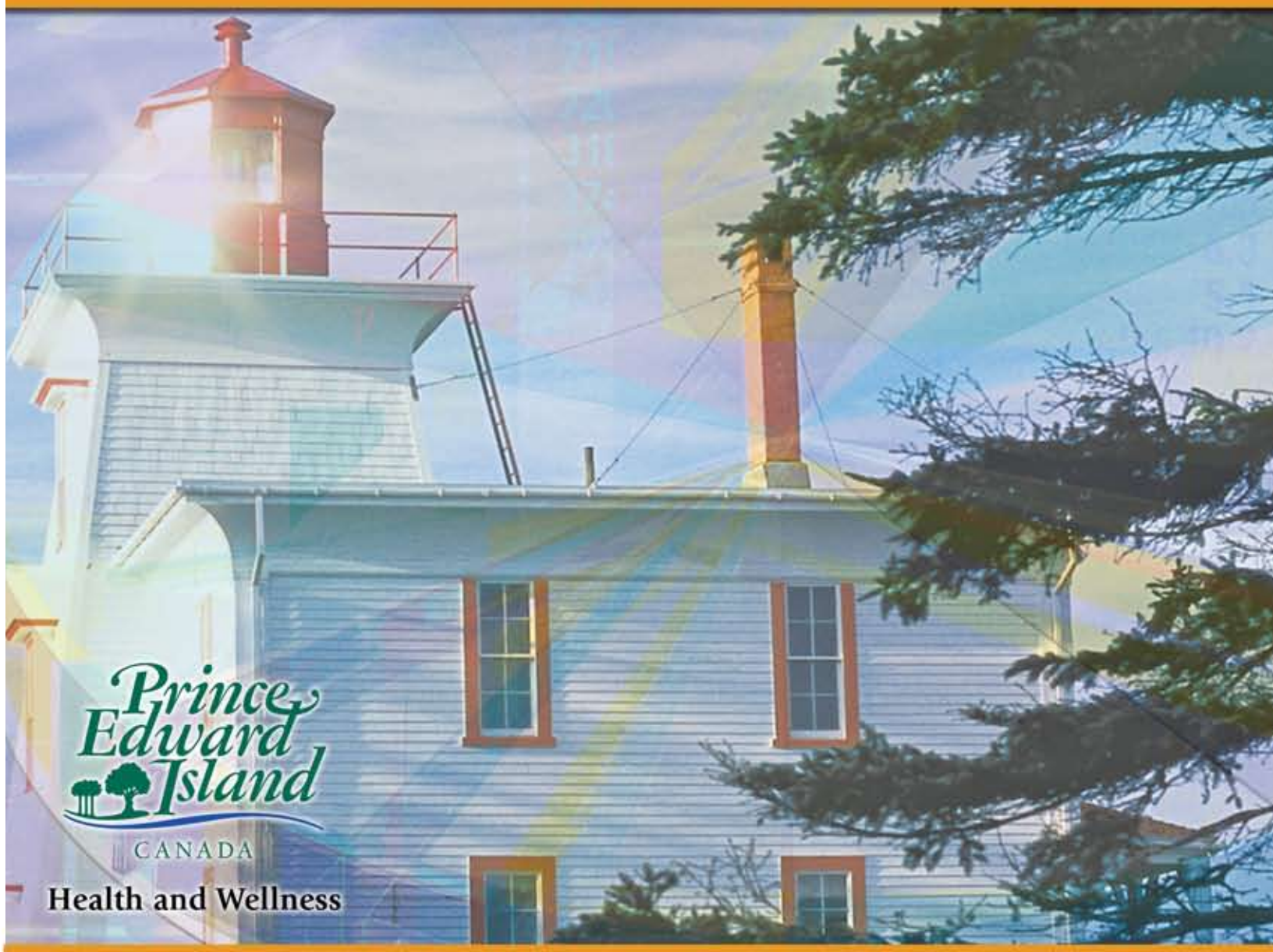
Prince Edward Island Cancer Trends 1980-2009



Prince Edward Island Cancer Trends: 1980 - 2009

Dear Minister Currie:

I have the privilege of providing you *Prince Edward Island Cancer Trends 1980-2009.* This report documents the changing nature of cancer in Islanders.

Respectfully submitted,

Dr. Heather Morrison
Chief Public Health Officer

Prince Edward Island
Cancer Trends
1980-2009

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This book is dedicated to all Islanders who have been touched by cancer.

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FOREWORD

I am pleased to introduce the Prince Edward Island Cancer Trends 1980-2009 Report which is the result of a partnership between the Epidemiology Unit of the Chief Public Health Office, Department of Health and Wellness and those of us working in the PEI Cancer Treatment Centre. The information presented within comes from the PEI Cancer Registry. The registry is of vital importance to all of us because it is the first step in understanding cancer trends in Islanders. Our cancer rates have increased over the past 30 years, but are now slowing and stabilizing. Prince Edward Island is a traditional place. However, as time passes, we notice that we are changing. The most striking change is the age of our population. With increasing age, we have seen an increase in the number of people diagnosed with cancer. We need to prepare for the increase in cancer cases while at the same time doing what we can to prevent new cases. It is noteworthy that many cancers are now amenable to treatment that were not in the 80s. This impacts on the workload and funding of treating cancer.

We have learned much about cancer in PEI, but in addition, we have generated many questions about how we can make the picture of cancer in PEI a much brighter scene for all of us. More work is needed to figure out the hows and whys of our cancer trends including continued analysis of registry data, in depth analysis of rates by age and sex, and evaluation of tumor staging data. This information will help direct our efforts in improving outcomes and is essential to health professionals and government officials for future health care planning. Prevention and early detection are keys to reducing the burden of cancer to Islanders and should be part of everyone's health program.

Dr. Dagny Dryer MD FRCPC

HIGHLIGHTS AND IMPLICATIONS

- In PEI, the number of new cases of cancer continues to rise mostly due to the aging of our population and the increased risk of cancer. There were almost twice as many new cases of cancer diagnosed in 2009 (835 cases) as there were in 1980 (473 cases). While the age-standardized incidence rate has increased over this time period, recent incidence rates have stabilized.

- The number of yearly deaths in PEI due to cancer increased by 30% from 271 deaths in 1992 to 352 deaths in 2009. The increase is mostly attributed to the aging of our population. In addition, the age-standardized mortality rate has increased in women and decreased in men during this time period.

- The ten-year prevalence of cancer is the proportion of Islanders diagnosed from 1999 through 2008 who are still alive on January 1, 2009. The ten-year prevalence for all cancers in PEI is 2.8% indicating that more than 1 in 40 islanders have had a personal cancer experience in the last 10 years.

- Over half of all new cancers and cancer deaths are from lung, colorectal, prostate, and breast cancers.

    - In 2009, Islanders had the highest incidence rate of lung cancer across Canada. Even though Island men have seen a decrease in incidence and mortality rates of lung cancer, women have not seen similar decreases in rates. The decrease of lung cancer in men has been attributed to decreases in smoking rates in men since the 1960's.

    - Cancer of the colon and rectum has a high incidence in PEI and in all of the Atlantic Provinces. The mortality rate for colorectal cancer has been decreasing since 1992. In 2011, PEI introduced a colorectal screening program.

    - Prostate cancer is the most common cancer diagnosed in PEI. Due to the high survival from this cancer, it is also the most prevalent cancer.

    - Breast cancer is the most common cancer in women. Mortality rates have remained stable since 1992; however, the long-term survival in Island women is significantly lower than the Canadian rate.

- For most age groups, survival from cancer has improved since the 1990s. The improved relative survival is attributed to the types of cancers currently diagnosed along with improved diagnosis and treatment. Improved survival results in an increase in the number of people with specific health care needs arising from their cancer experience.

- Currently there is a high burden of cancer in PEI and with the aging population this trend will likely continue. Appropriate planning should be addressed to ensure that all Islanders will have access to cancer services they require.

TABLE OF CONTENTS

1 PEI CANCER DATA

For this report, analyses of new cancer cases from 1980 through 2009 and cancer deaths from 1992 through 2009 from the PEI Cancer Registry will be presented. Full details of the methods can be found in Appendix I.

1.1 Registry data sources

PEI cancer data in the PEI Cancer Registry is compiled from multiple sources by the registry staff including from the PEI Laboratory, medical health records, PEI Vital Statistics, other provincial and territorial cancer registries, physician offices, and Statistics Canada.

1.2 Data quality

The PEI Cancer Registry data has been Certified by the North American Association of Central Cancer Registries (NAACCR) since 1998 with the Registry receiving the highest level (Gold Standard) for the "completeness, accuracy, and timeliness" of the PEI cancer data for 10 of those years, with the achievement of silver standard the other four 4 years.

1.3 Counting cancer cases and deaths

The Surveillance, Epidemiology, and End Result (SEER) cancer groupings primarily based on anatomical site of origin and microscopic cellular structure were used (Appendix II). Included in the PEI cancer data are malignant or invasive cancers and *in situ* bladder cancer. Excluded from this report are basal and squamous cell carcinoma skin cancers.

1.4 Cancer rates in PEI

Many different measurements can be used to describe cancer in a population. The number of cases (count and prevalence) in PEI represents the burden of cancer on society, while the rate of cancer represents the risk of being diagnosed (incidence rate) or dying from a cancer (mortality rate). This report will utilize incidence and mortality rates along with any changes in the rates over the last few decades to describe the risk. Prevalence is the proportion of Islanders alive with a diagnosis of cancer, either a new diagnosis or a pre-existing diagnosis, and is thus a useful measure for health care systems planning. Five-year Relative Survival Ratios (RSR) are a measure of progress in early diagnosis and treatments and are presented for multiple cancers. To examine if rates are increasing or decreasing over time, annual percentage change (APC) for all and for individual cancers were calculated. Specific definitions for these measurements and other terms are available at the end of this document in the Glossary of Terms and Methods (Appendix III).

Age-standardization is used to adjust the effects of differences in age when comparing rates between different populations such as PEI and Canada.

2 INCIDENCE AND MORTALITY

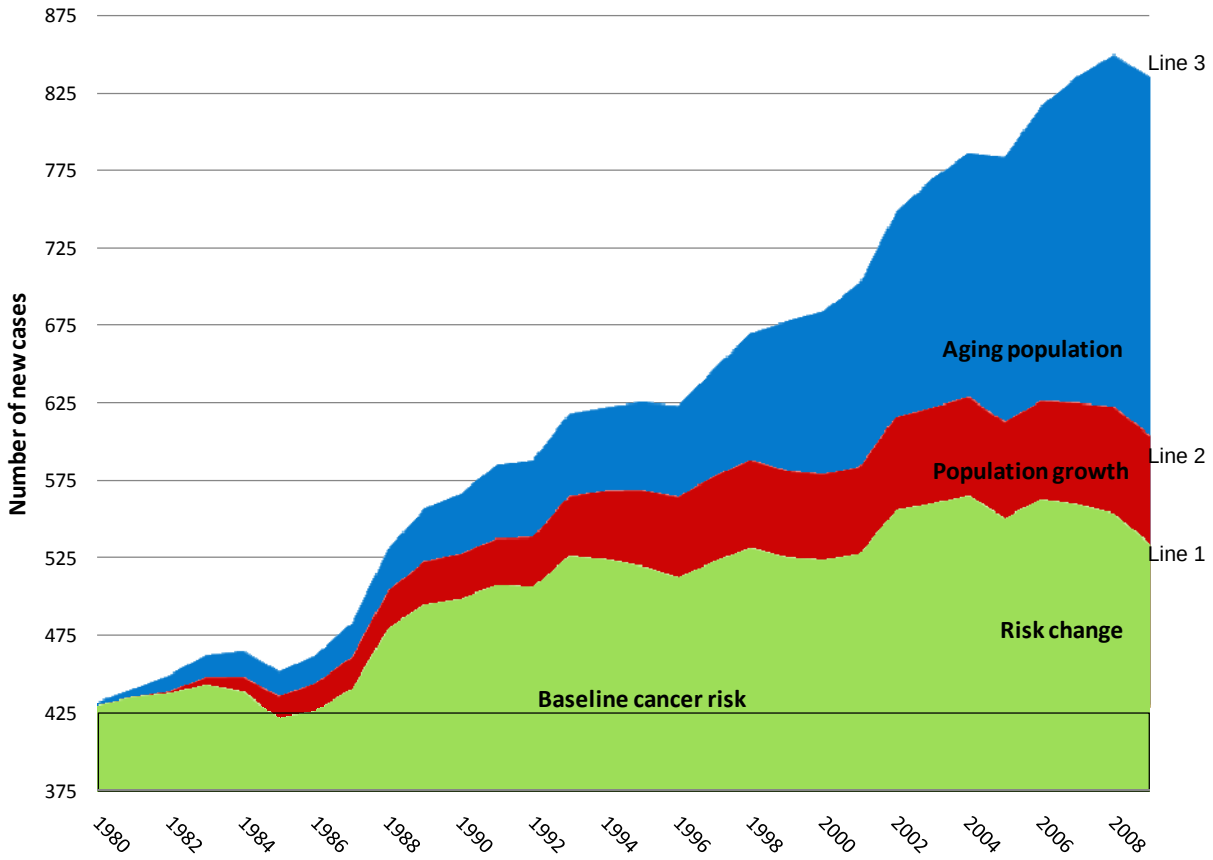
2.1 Increases in new cases and deaths

The social and economic cost of cancer to Islanders and the health care system can be gauged by the numbers of new cancer cases and cancers deaths. The number of new cases of cancer in a population each year is dependent on numerous factors[1] including the age structure of the population, the population size, and the changes in the risk of being diagnosed with cancer. The change in risk is influenced by the improved methods of diagnosing cancer and by changing levels of genetic, environmental, and other factors which modify cancer risk, including tobacco and alcohol use, inactivity, and suboptimal nutrition. In PEI, the number of new cases of cancer continues to rise. There were almost twice as many new cases of cancer diagnosed in 2009 (835 cases) as there were in 1980 (425 cases).

Figure 1 describes the proportion of new cases each year that are attributed to these factors. The black line is the baseline and represents the total number of new cases that would have occurred if the population of PEI had stayed the same age and size as it was in 1980. The top line (line 3) is the total number of new cancer cases that actually occurred each year. The number of cases **between** the baseline and line 1 represents the number of cases attributable to the change in risk of cancer diagnosis. The number of cases **between** line 1 and line 2 represents the number of new cases that are attributed to the increase in population. The number of cases **between** line 2 and line 3 represents those that are attributed the aging of the population.

The largest proportion of new cases has been attributed to our aging population. PEI has a very high concentration of older adults relative to many other provinces of Canada. The median age of Islanders has climbed from 32.4 in 1990 to 37.1 in 2000 and finally up to 42.8 where it was in 2011. This can be compared to the median Canadian age of 40.6 in 2011.[2] The proportion of Islanders 65 years of age and older is 16.3% compared to 14.8% for Canada. The increase in the median age of the population is mainly associated with the aging of the baby boomers and at the same time, a decreasing birth rate.[3]

Figure 1: New cancer cases diagnosed annually* in PEI, 1980-2009

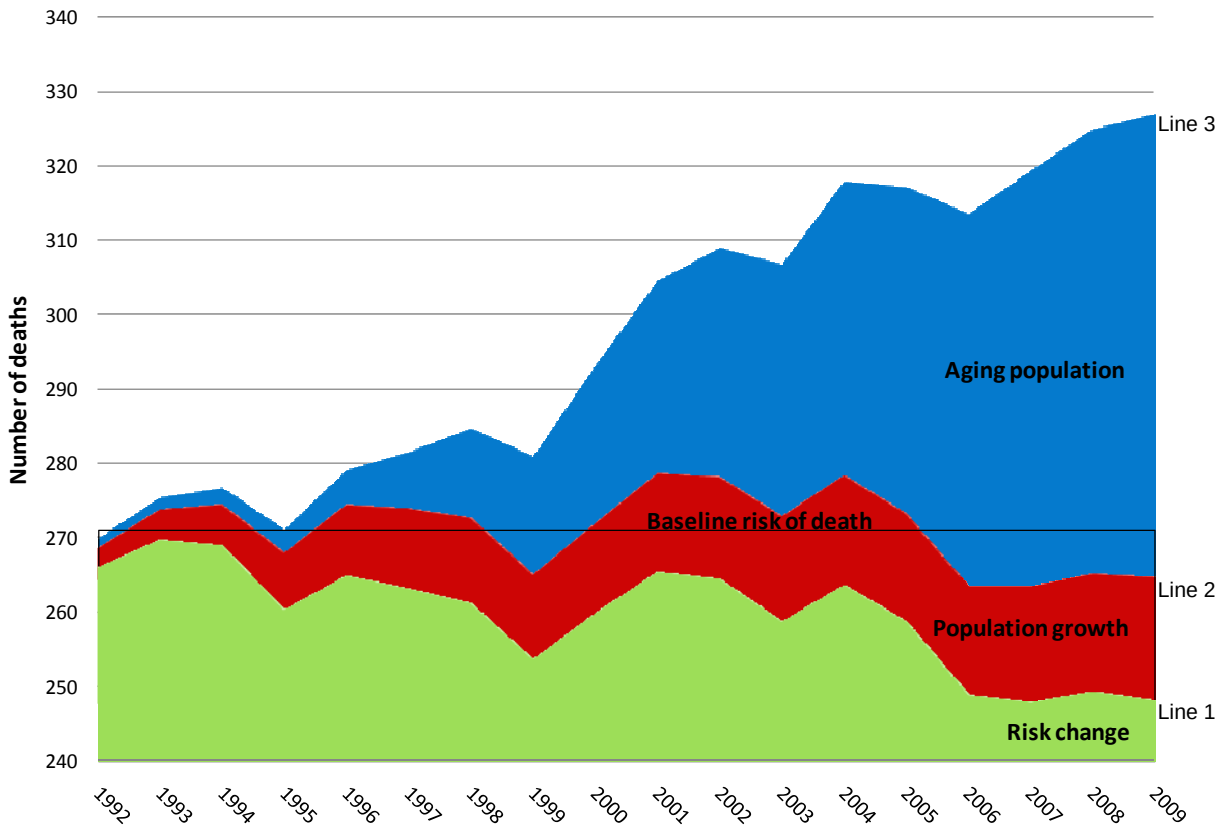


*3 year moving averages

There was a rapid increase in risk of being diagnosed with cancer during the late 1980s. The rate of increase slowed over the next two decades and in the late 2000's, the number of new cases attributed to changes in the risk and new diagnostic methods decreased.

The number of yearly deaths in PEI due to cancer increased by 30% from 271 deaths in 1992 to 352 deaths in 2009 (figure 2). Similar to the number of new cases in figure 1, the different lines represent the increase or decrease in deaths each year associated with increasing age, increasing population in PEI, and the change in risk of death.

Figure 2: Deaths from cancer annually* in PEI, 1992-2009



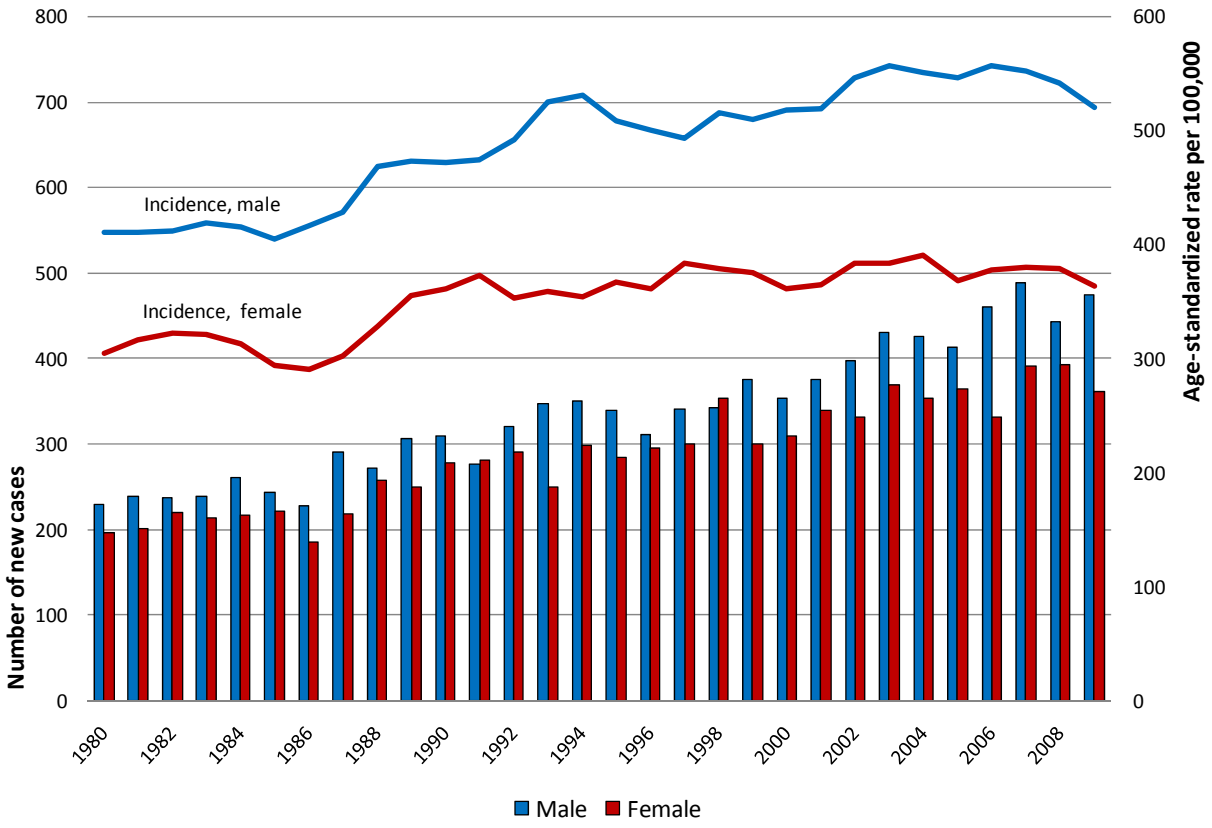
*5-year moving averages

The change in risk includes the risk factors leading to death, improved treatments, and earlier detection. Although the number of deaths due to cancer has been increasing each year in PEI, those deaths attributed to the change in risk have decreased. Similar to the new cases, the increase in the number of cancer deaths is mainly attributed to the aging population. The number of cancer deaths attributed to the population growth has increased slowly until the latter part of the 2000's. The population in PEI has grown rapidly from 135,290 in 2001[4] to 140,205 in 2011.[5]

2.2 Trends in incidence and mortality for all cancers

The rate of cancer has increased in both men and women over the past 30 years (1980-2009) (figure 3). The increase in age-standardized rates has slowed over the past 10 years; however, the number of new cases continues to climb mostly due to the aging of the population (figure 1). In 2009, there were 474 and 361 new cases of cancer in males and females, respectively.

Figure 3: New cases and age-standardized incidence rates* for males and females in PEI, 1980-2009



*3-year moving averages

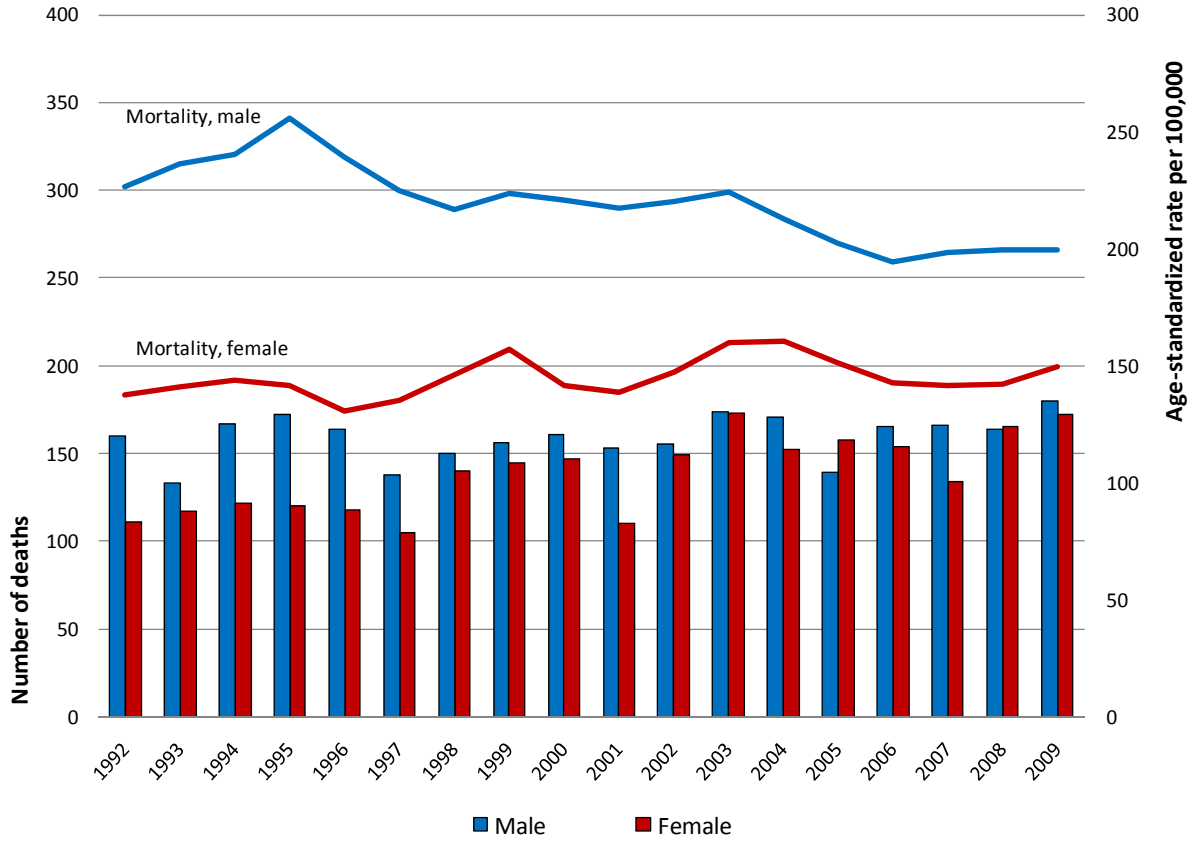
The age-standardized incidence rate in men increased from 403 new cases per 100,000 Islanders in 1980 to 531 per 100,000 in 2009. Although the cancer rate in men has increased significantly by an average of 1.1% every year since 1980, in the last 10 years (2000-2009) the rate of new cases has slowed to only an average 0.4% increase each year.

The age-standardized rate in women was lower than men, but followed a similar pattern. The yearly incidence rate increased an average of 0.8% over the 30 year time period. However, during the last 10 years, the rate has stabilized to an average yearly increase of 0.1%.

Since 1992, the mortality rate from cancer has been decreasing slowly by an average of 0.5% per year. Although the overall age-standardized mortality rate is slowly decreasing, the number of cancer deaths continues to rise mostly due to the increasing age structure of the population (figure 2). In 2009, there were 180 and 172 deaths due to cancer in men and women, respectively (figure 4).

Cancer mortality rates in men have been steadily decreasing and have a significant average yearly decrease of 1.3% each year. Main contributors to this decrease have been reductions in mortality from prostate, lung, stomach and colorectal cancers.

Figure 4: Deaths and age-standardized mortality rates* for males and females in PEI, 1992-2009



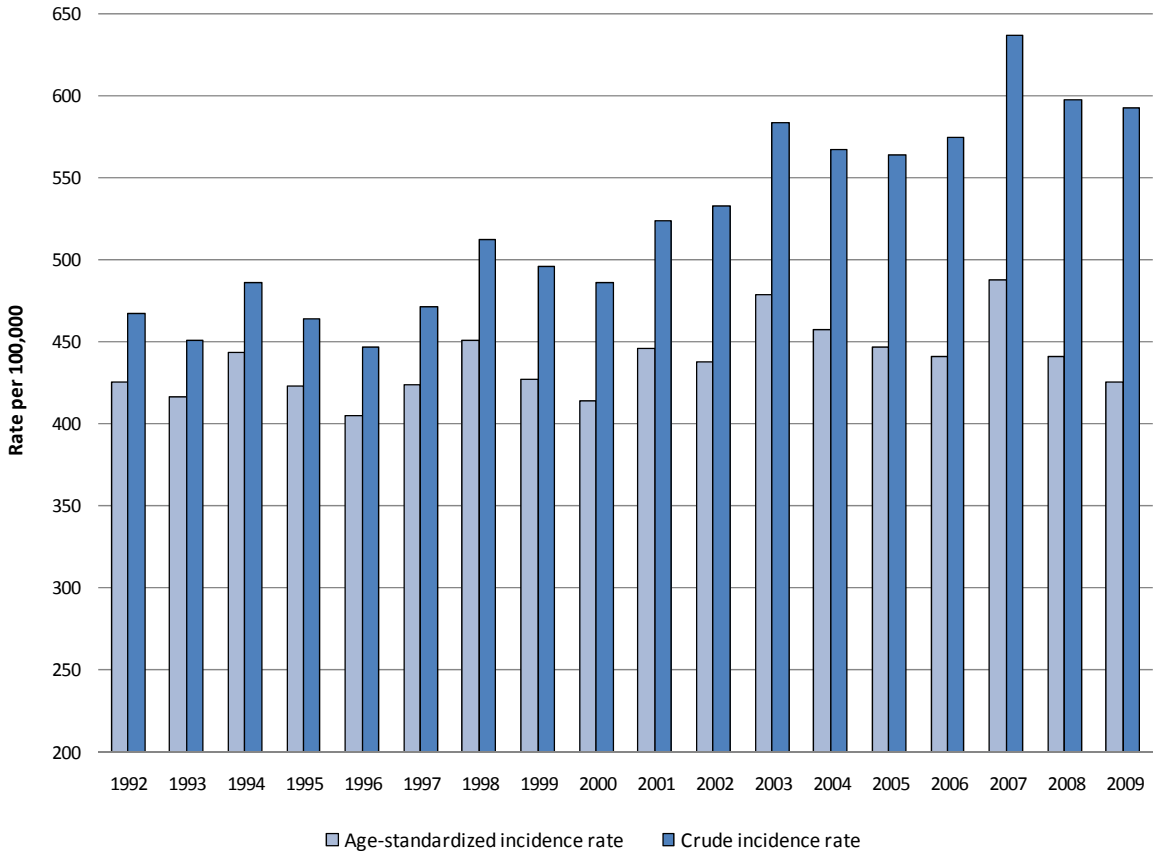
*5-year moving averages

Unfortunately, the mortality rate in women has been trending slowly upward by an average increase of 0.4% per year since 1992. There are multiple cancers that have contributed to the trend in cancer mortality in women including increases in deaths from breast, kidney, bladder, brain, non-Hodgkin lymphoma, and leukemia. Fortunately, the average rate has stabilized in the last 10 years with no change in average yearly mortality rates from year to year.

2.3 Describing the burden and risk of cancer in PEI

The burden of cancer to Islanders and the health care system can be measured by the number of cases of cancer and people living with cancer. If you are an Islander and you wanted to know the risk of being diagnosed with cancer or dying from cancer in PEI, you would want to know the crude incidence or mortality rate. The crude rate is the number of new cases or deaths per 100,000 Islanders. However, if you wanted to know if the risk of being diagnosed with cancer or dying from cancer was different in PEI compared to other provinces or all of Canada, you would want to compare the age-standardized rates. Age-standardized rates are used to describe the rate of cancer in Islanders if our population was a standard population. Provincial and Canadian rates must be age-standardized in order to compare them appropriately.

Figure 5: Comparison between crude and age-standardized incidence rates in PEI, 1992-2009



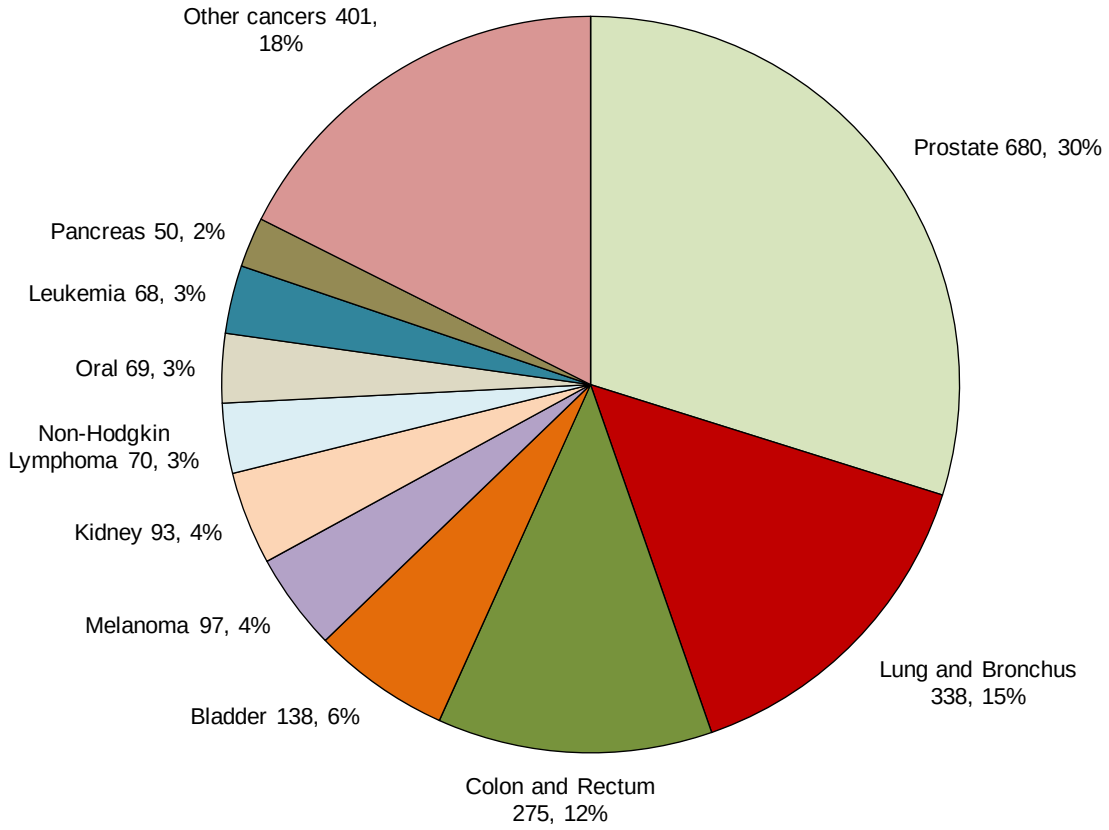
Age-standardized rates should not be used to allocate funds to cancer prevention, screening, and treatment programs for PEI. Because the population of PEI is older than the standard population, the actual or crude incidence rate in PEI is higher than the age-standardized rate (figure 5). Prevention and treatment programs should be based on crude incidence rate and the actual number of cases to be sure that all Islanders have access to the programs they need.

2.4 Most common cancer incidence

Cancer is more common in men than women in PEI. There were 4119 cases of cancer diagnosed during the years 2005-2009 of which 55% were in men and 45% in women. The most common cancers over the past 5 years are prostate, lung, colorectal, and female breast.

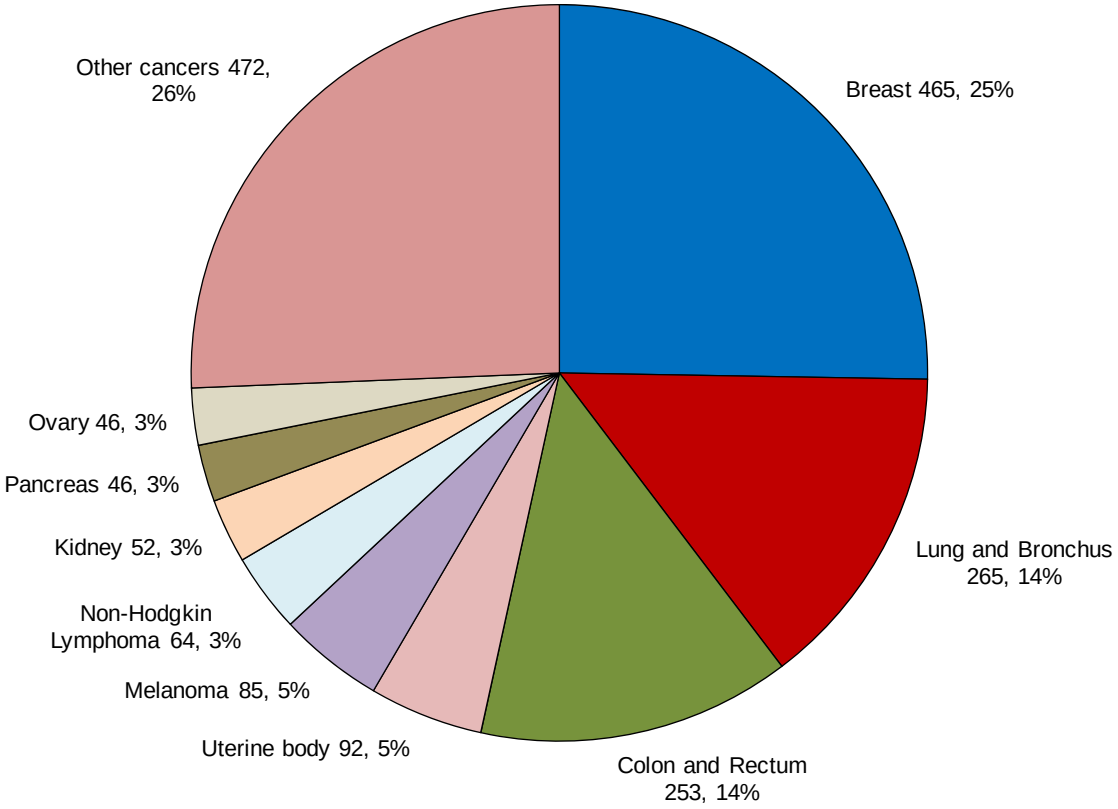
For men, 30% of the cancers were prostate cancer (figure 6a). Lung cancer accounted for 15% while colorectal cancer accounted for 12% of all diagnosed cancers. Together, these three cancers accounted for 57% of all cancers in men. The next most common cancers in Island men were bladder (6%), melanoma (4%), and kidney (4%). The order of the most common cancers in Island men is similar to the most common cancers in Canada except that there is a lower proportion of non-Hodgkin lymphoma (NHL) in PEI.[6] In PEI men, NHL is the 7th most common cancer, while in all Canadian men it is the 5th most common.

Figure 6a: Most common cancer diagnoses, male, PEI, 2005-2009



The most common cancer diagnosed in women in PEI over the last five years is breast (25%), followed by lung (14%) and colorectal (14%) (figure 6b). One major difference in PEI women compared with Canadian women is that thyroid cancer is the 5th most commonly diagnosed cancer in Canadian women at 4% while it is not in the top 10 most commonly diagnosed cancers in PEI (<2%).[6] Melanoma is more commonly diagnosed in women in PEI (5%) than it is in Canada (<3%).

Figure 6b: Most common cancer diagnoses, female, PEI, 2005-2009



2.5 Most common cancer deaths

Cancer deaths in both male and female Islanders (figures 7a and 7b) follow a similar pattern to the Canadian cancer deaths.[7] Lung cancer is by far the leading cause of cancer deaths in both men and women. Lung cancer is followed by colorectal, prostate, and pancreas in men and breast, colorectal, and pancreas in women. The number of male deaths due to NHL has a lower rank in PEI than in Canada, ranking lower than the number of deaths due to cancers of the esophagus, leukemia, and bladder in PEI.

Figure 7a: Most common cancer deaths, male, PEI, 2005-2009

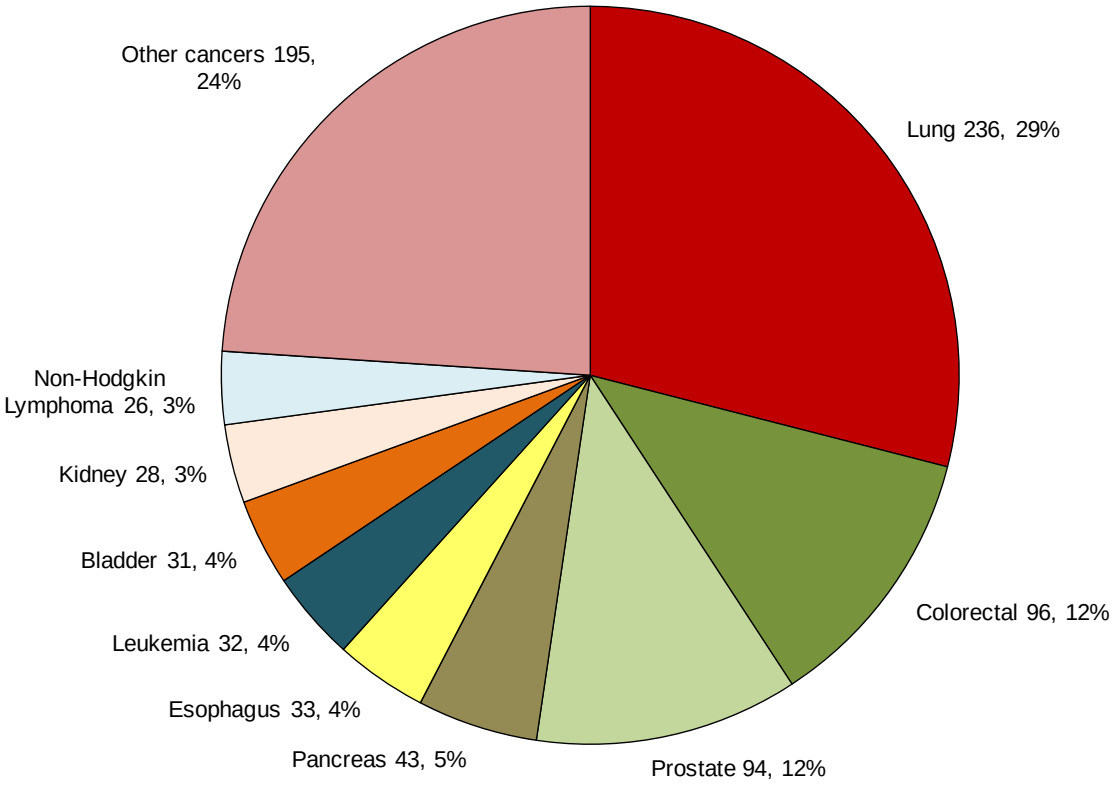
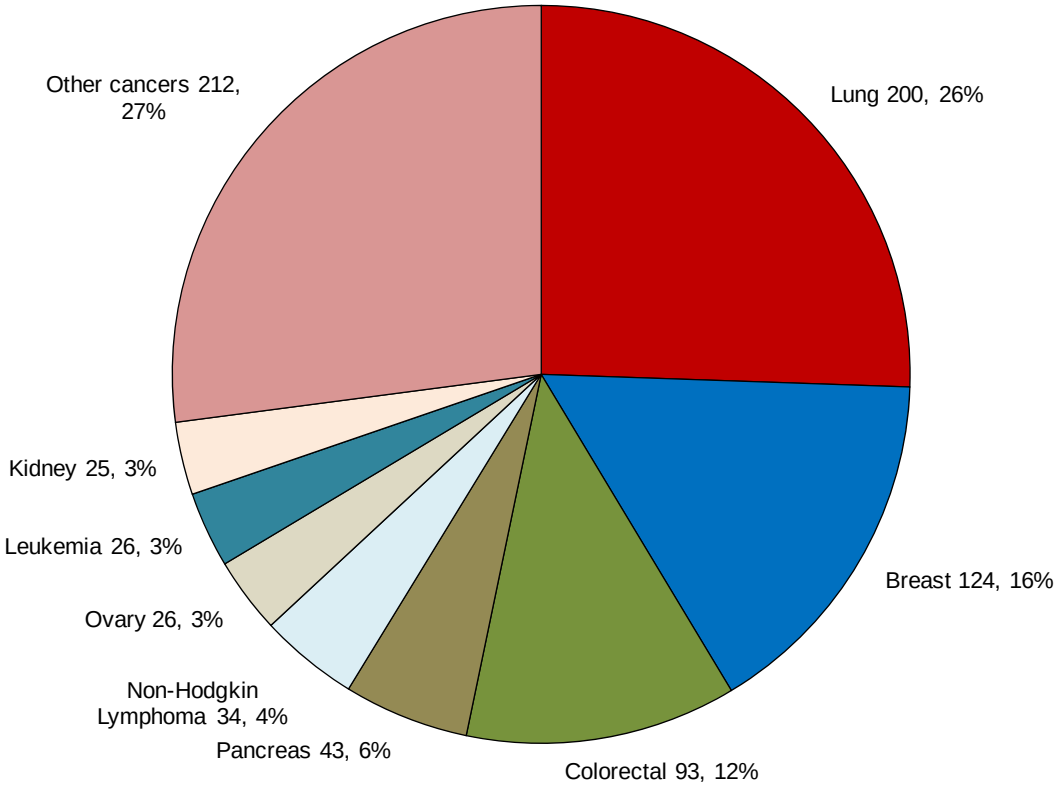


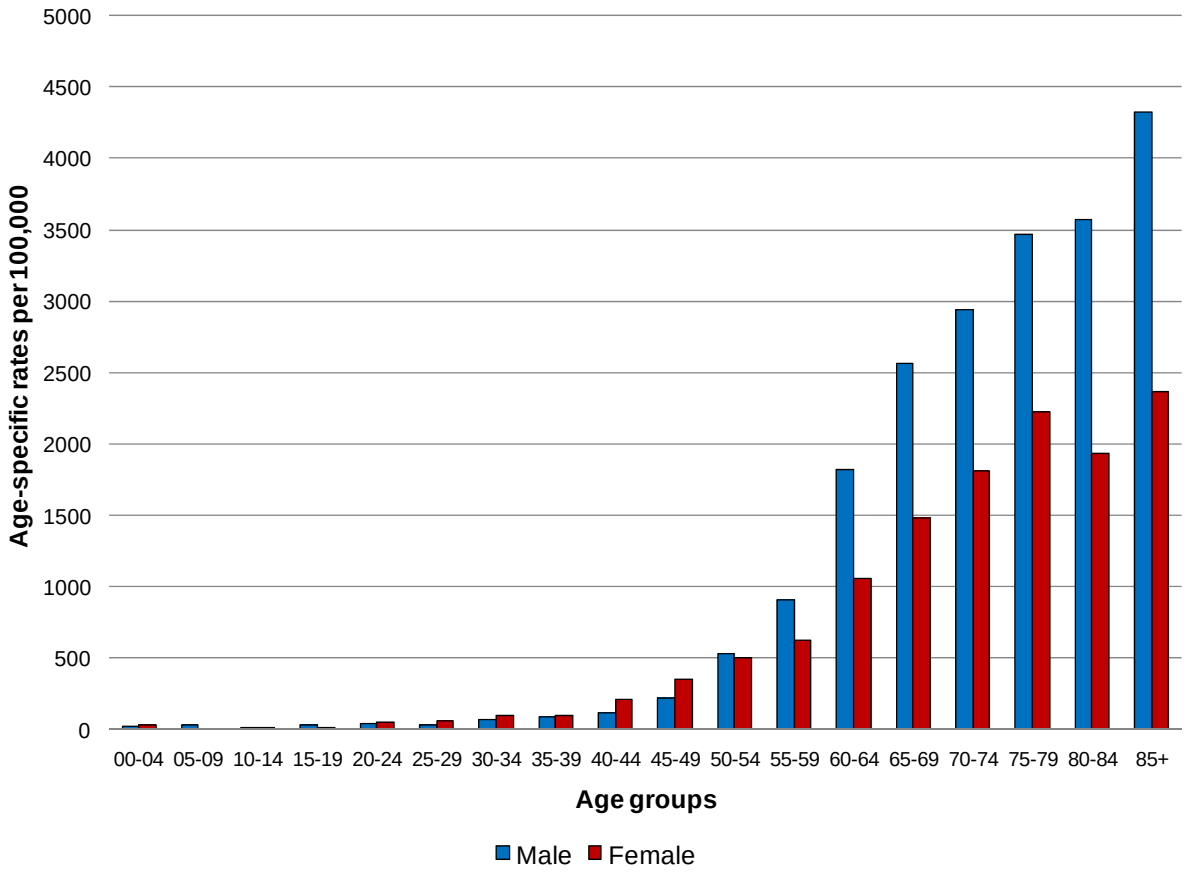
Figure 7b: Most common cancer deaths, female, PEI, 2005-2009



2.6 New cases and deaths by age

The rates of cancer and cancer deaths increase as people age, and PEI has an older population. Although people 50 years of age and older account for 39% of the population on PEI, 91% of all cancers diagnosed and 91% of cancer deaths between 2005 and 2009 occurred in this age group. The median age group for cancer diagnoses is 65-69 years while the median age group for a cancer death is 75-79 years. The median age group for a cancer death in PEI for the years 2005-2009 is higher than the expected median age group for a cancer death in Canada for 2011 which is 70-74 years.[7]

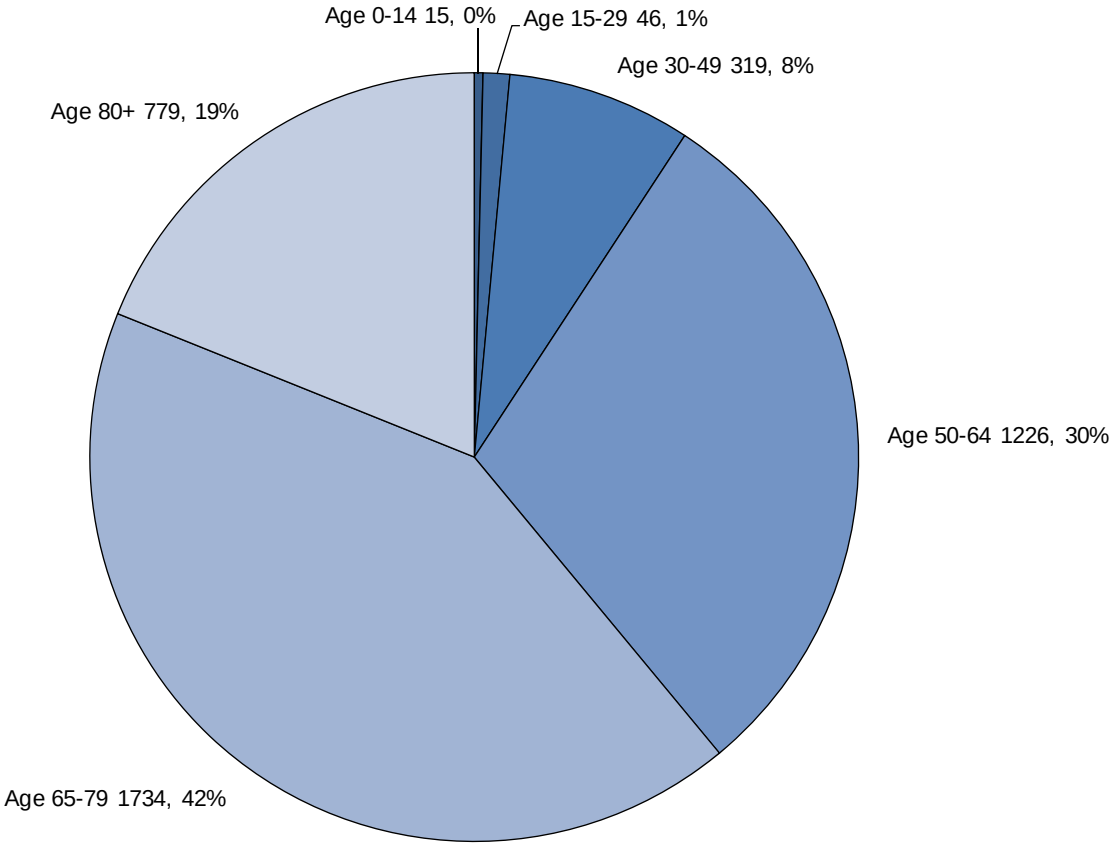
Figure 8: Incidence rates for all cancers by 5-year age groups, PEI, 2005-2009



Women have a higher incidence rate than men until after 50 years of age when the rates switch and men have a higher incidence rate (figure 8). The higher rate in women less than 50 years of age is related to rates associated with cancer in women including breast, cervical, uterine, and ovarian cancers. The rapid increase in male cancers after 50 years old is related to increases of prostate, lung, colorectal, and bladder cancer.

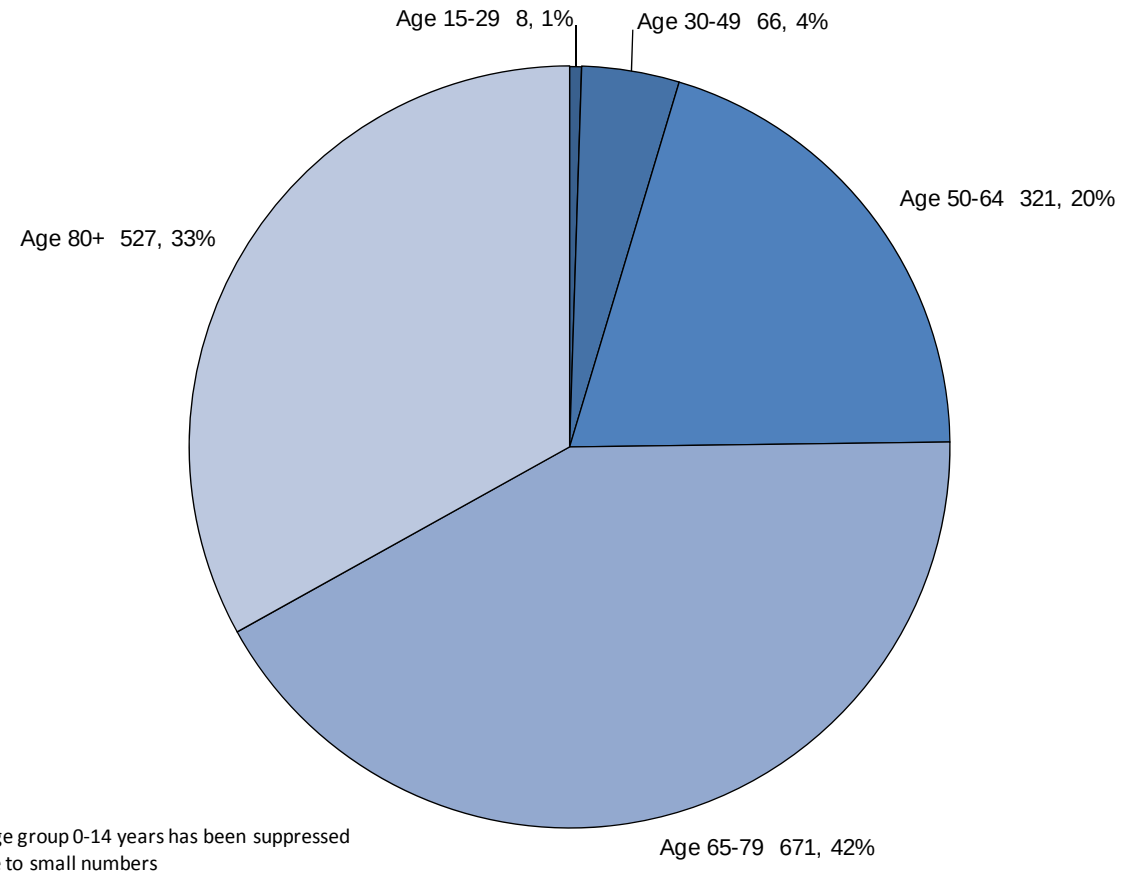
The proportion of new cases of cancer in children and young adults combined (0-29 years old) is less than 2% of all cancers diagnosed in PEI (figure 9a). The proportion of cancer in older adults (65+) is 61% of all cancers diagnosed in PEI.

Figure 9a: Cancer cases by age group, PEI, 2005-2009



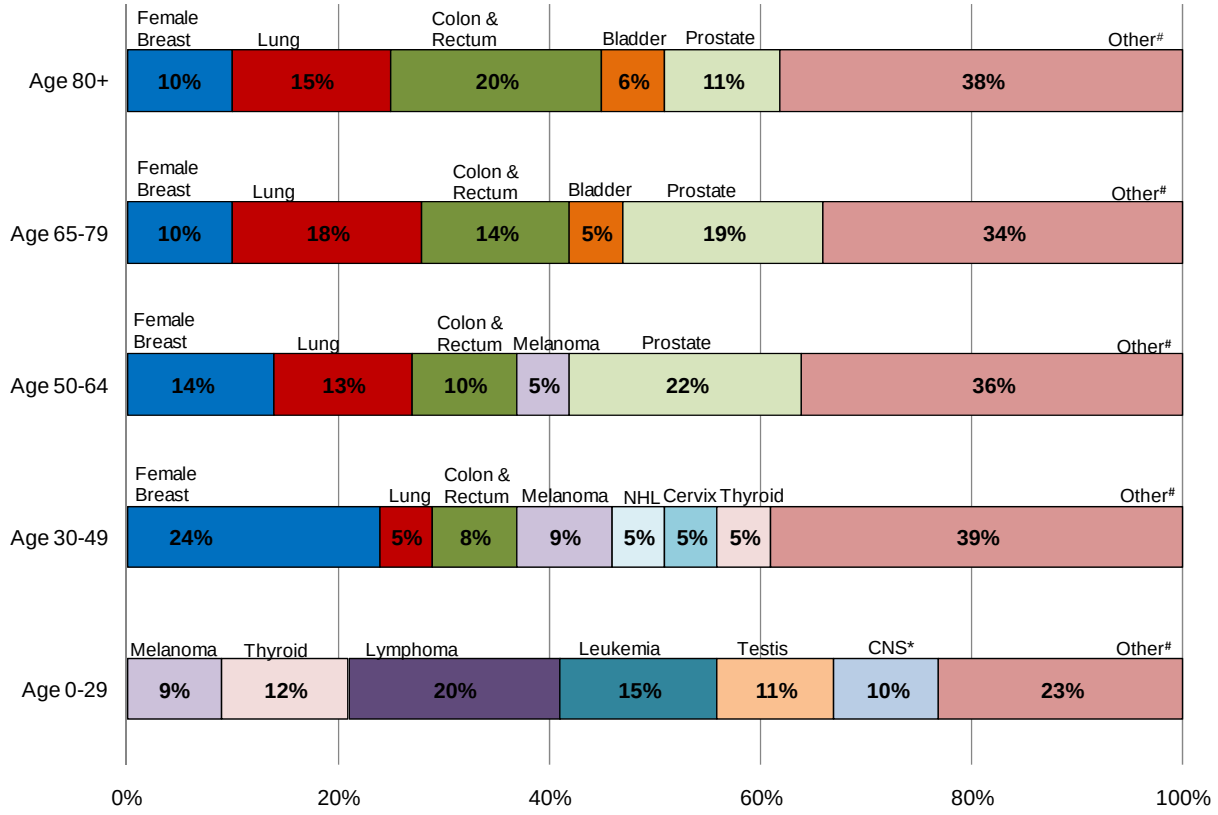
The proportion of cancer deaths in children and young adults combined (0-29 years old) is less than 1% of all cancers diagnosed in PEI (figure 9b). The proportion of cancer deaths in older adults (65+) is 75% of all cancers diagnosed in PEI.

Figure 9b: Cancer deaths by age group, PEI, 2005-2009



To identify which types of cancer are the most common by age group, data from 2000-2009 were combined (figure 10). For the youngest age group, lymphoma (both NHL and Hodgkin lymphoma) is the most common. The most common cancer in children (0-14 years old) is leukemia while the most common cancer in young adults (15-29 years old) is thyroid. However, testicular cancer is a cancer in males only; thus, it actually has the highest incidence rate for this 15-29 years old male age group.

Figure 10: Most common cancer diagnoses by age groups, PEI, 2000-2009



*CNS consists of both brain and central nervous system
#Other cancers are the total of all other cancers not identified in each age group

As people grow older, the most common cancer types change. By 30-49 years of age, breast cancer in women becomes the most common cancer. Melanoma, thyroid, and lymphoma (non-Hodgkin lymphoma) continue to be common cancers, but colorectal and lung are increasingly becoming common cancers.

When Islanders are in their 50s and early 60s, prostate, breast, lung, colorectal, and melanoma are the most common cancers. When they are 65 years and older, the most common cancers are lung, prostate, colorectal, breast, and bladder.

2.7 Cancer incidence rates by province, 2009

Statistics Canada collects cancer registry data from all of the provinces and territories.[8] However, the data presented do not include the territories due to small numbers of cases and Quebec because their data was not available at the time of the report. Variation in age-standardized rates between provinces (figures 11 a-d) can be attributed to multiple factors.[7] A variety of known and unknown risk factors will impact incidence rates for each province, and across Canada there is variation both in screening programs offered and in access to diagnostic methods.

For the year 2009, the age-standardized incidence rate of cancer in Prince Edward Island relative to other reporting provinces was low for women but high for men. In general, cancer incidence rates are highest in the Atlantic Provinces. The high cancer incidence rate for Island men is reflective of the fact that Island men have the highest rate of prostate and lung cancer in Canada. The incidence rate for colorectal in men was intermediate; however, the rate of colorectal cancer in Island women was the second highest across Canada. Additionally, the rate for lung cancer in Island women was the highest in the country. The rate of breast cancer in Island women was lower than most provinces. Although these figures show the rates and ranks for the most common cancers for the provinces for the year 2009, the yearly PEI rates and ranks for recent years vary, in large part due to the small population size in PEI. For example, the rate of all cancers in women in PEI between 2000 and 2009 varied from a high of 403 in 100,000 in 2003 to a low of 328 in 100,000 in 2009.

Figure 11 a: All cancer incidence rates by province, male and female, 2009

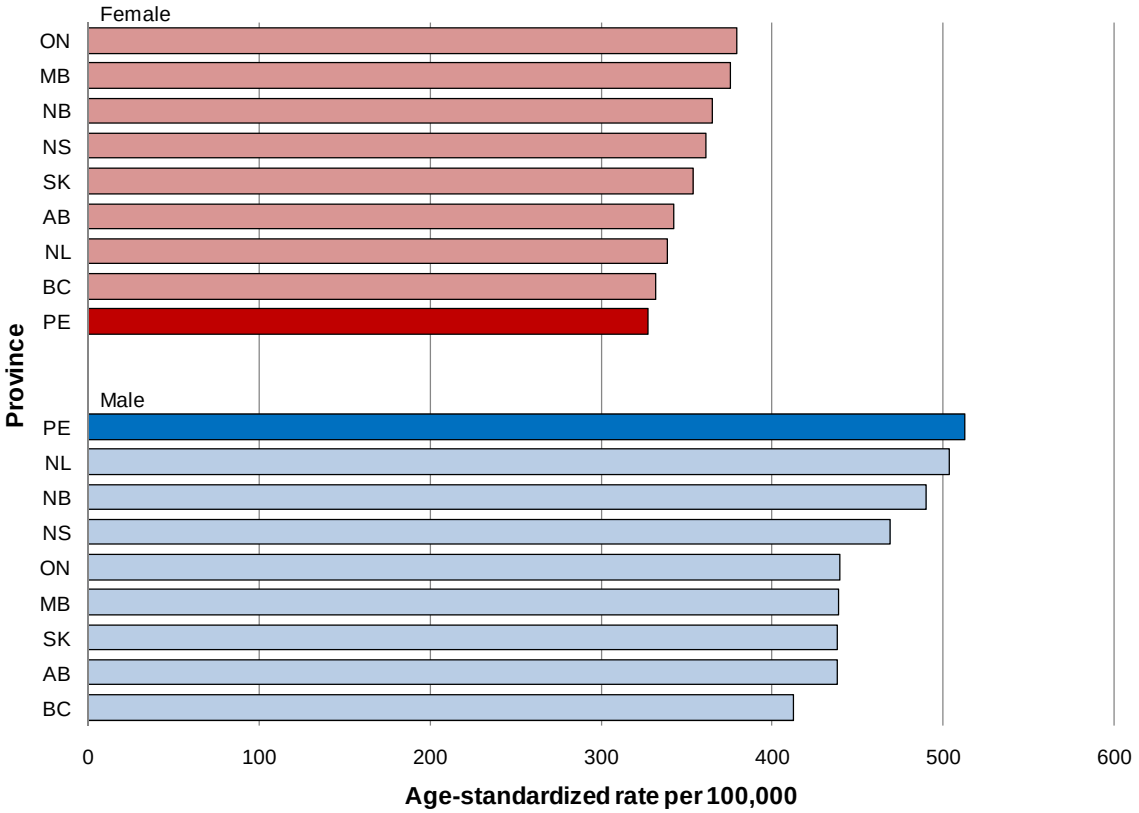


Figure 11b: Female breast and prostate cancer incidence rates by province, 2009

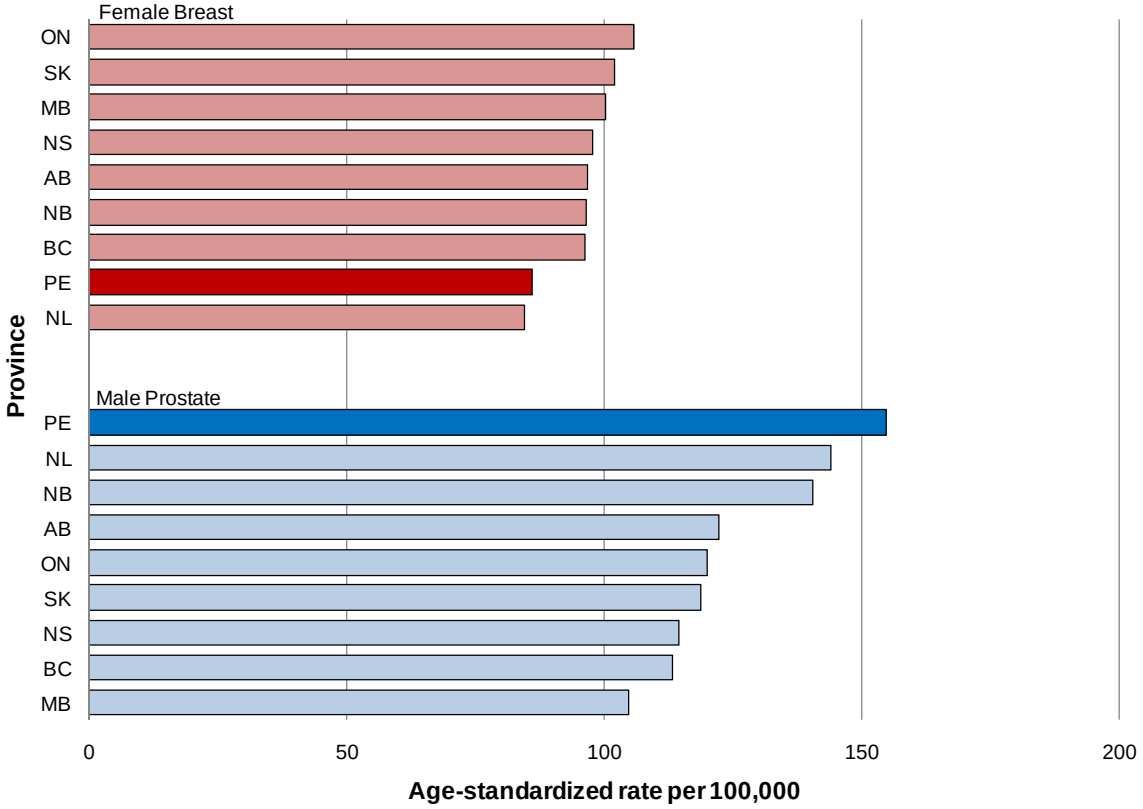


Figure 11c: Colorectal cancer incidence rates by province, male and female, 2009

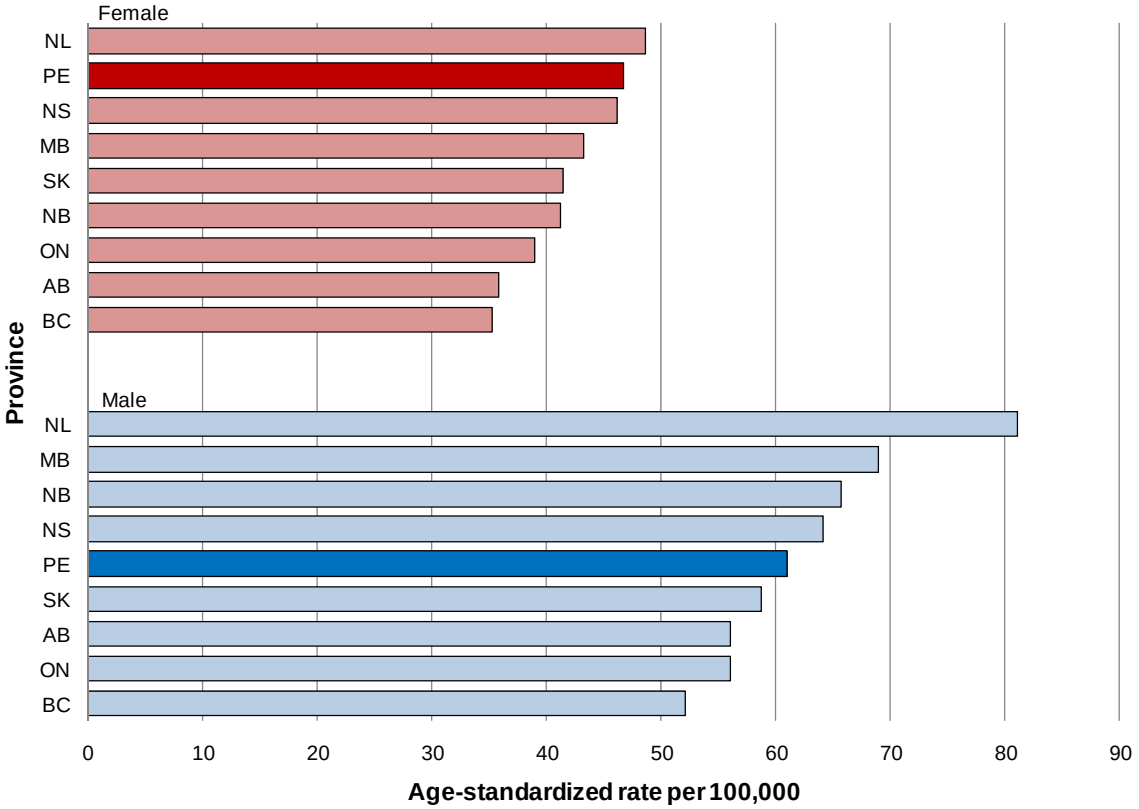
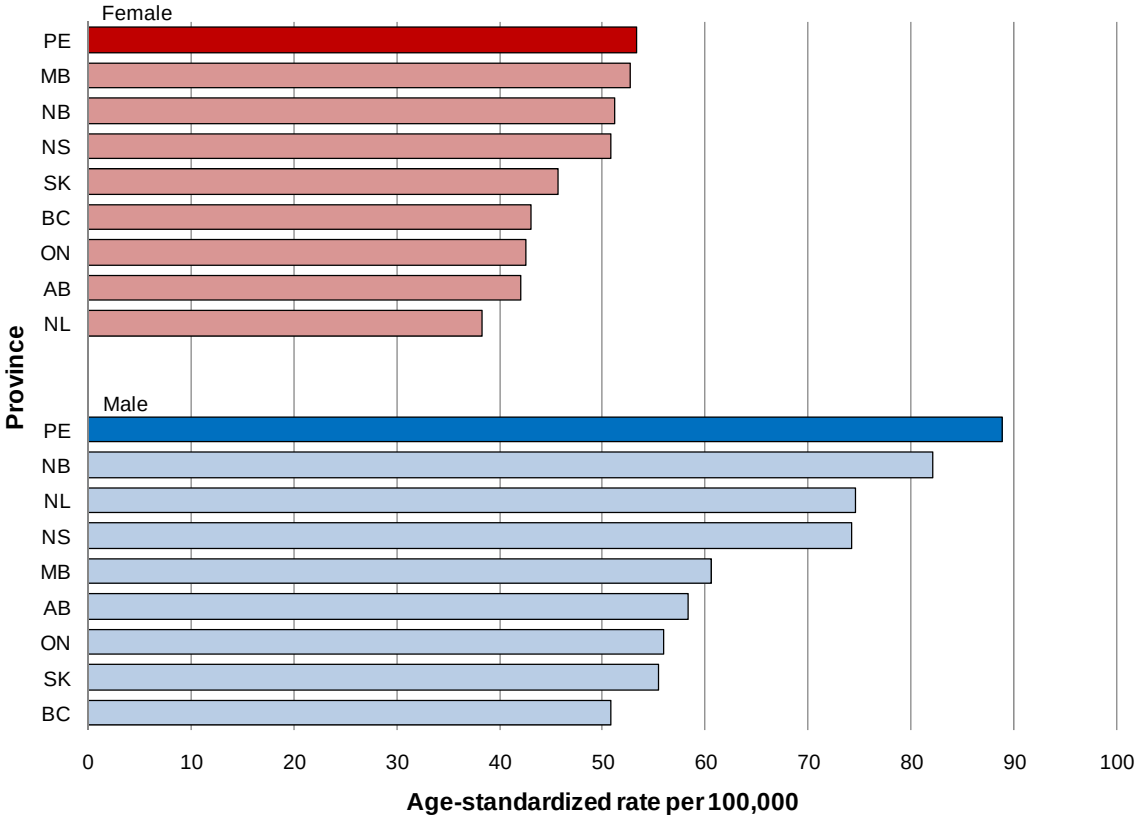


Figure 11d: Lung cancer incidence rates by province, male and female, 2009



3 PREVALENCE

3.1 Prevalence of the most common cancers in PEI

The ten-year prevalence of cancer is the proportion of Islanders diagnosed from 1999 through 2008 who are still alive on January 1, 2009. The level of prevalence is determined by the rate of new cases of cancer diagnosed in the 10-year period and the rate of survival for these Islanders. Cancer prevalence is an important measurement of the burden of cancer to Islanders and the health care system.

Table 1: Ten-year prevalence, most common cancers, PEI, January 1, 2009

	Both sexes		Male		Female	
	%	Count	%	Count	%	Count
All cancers	2.77	3,894	3.07	2,103	2.49	1,791
Colon and rectum	0.35	485	0.35	242	0.34	243
Lung	0.12	164	0.12	80	0.12	84
Prostate			1.42	974		
Breast					0.95	679

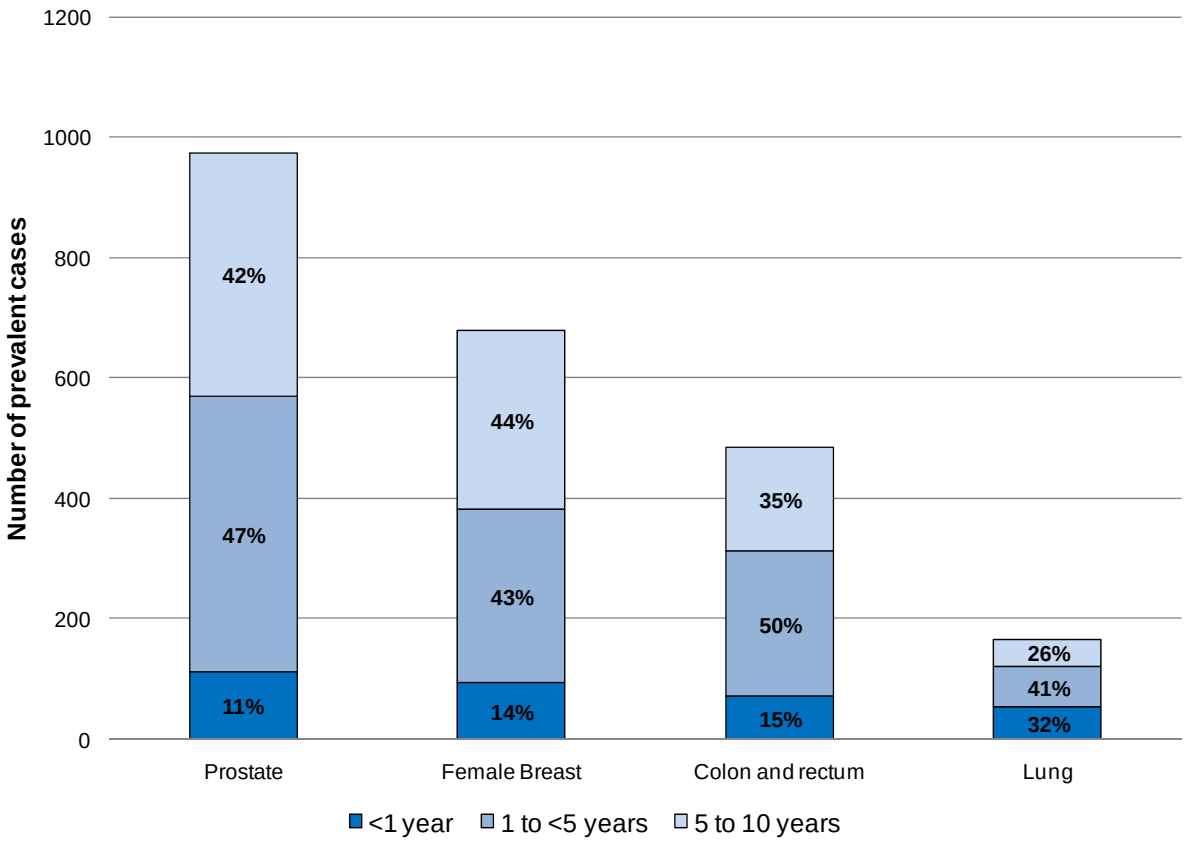
January 1, 2009, 10-Year Limited Duration Prevalence.
Populations were estimated by averaging 2008 and 2009 populations.

The ten-year prevalence for all cancers in PEI is 2.77% indicating that more than 1 in 40 Islanders are living with a diagnosis of cancer in the 10-year period. The prevalence is higher in men (3.07%) than in women (2.49%) reflecting the higher incidence of cancer in men than women. In particular, the high incidence and survival of prostate cancer in Island men contributes to the higher prevalence of cancer in men. In the past 10 years, 1 in every 70 men in PEI has been diagnosed with prostate cancer. Given the high incidence of breast cancer in Island women, it is the most prevalent cancer for this group. In the past 10 years, 1 in every 105 women in PEI has been diagnosed with breast cancer. Equal numbers of men and women are living with colorectal cancer and lung cancer. Even though lung cancer is the second most common cancer diagnosed in PEI, the prevalence is low due to poor survival.

3.2 Prevalence of the most common cancers by time since diagnosis

The number of people living with cancer can be divided by the time since their diagnoses. Care for the cancer patient consists of a progression of active treatment, continuous follow-up for recurrences and treatment of recurrences, and possibly end-of-life care. In addition to medical care, psychological and rehabilitative care may be necessary. For the most part, the first year encompasses the time after diagnosis and the start of treatment. Years 2 through 5 are the intermediate years in which cancer treatments continue and follow-up care is high. After 5 years, the greater part of care adjusts to the needs of a survivor.

Figure 12: Prevalence of most common cancers by time since diagnosis, PEI, January 1, 2009



Prevalence during the first 5 years post-diagnosis is higher than the second 5 years (figure 12). The proportion of lung cancer prevalence in the first year is higher than the proportion of the prevalent cases in prostate, female breast, and colorectal cancers. Its high proportion in the first year is a result of the poor survival in lung cancer patients.

4 SURVIVAL

4.1 Five-year relative survival for all cancers and most common cancers

Relative survival ratio (RSR) is a measure of disease severity and thus prognosis (table 2). It indicates the probability of an average person with a particular cancer surviving to a certain time after diagnosis compared to the average person without cancer. It is based on a large group of people and is only an average estimate. As an example, the five-year relative survival for an average women with breast cancer is 85% indicating that a women diagnosed with cancer has on average an 85% likelihood of surviving 5 years compared to women without breast cancer on PEI. Relative survival measured for particular cancers can be used to identify which cancers are in need of further improvements in prognosis. Relative survival measured over time can be used to measure improvements in cancer screening, diagnosis, and treatment.

Table 2: Interpretation of relative survival ratios in cancer research[9]

Prognosis	5-year relative survival ratio
Excellent	≥ 85%
Good	70-84%
Fair	30-69%
Poor	<30%

The 5-year RSR for men and women (≥15 years of age) combined was 61% for all cancers diagnosed in 2004-2008. Compared to Islanders without cancer, the probability of surviving 5 years after diagnosis is reduced by almost 40%. Figure 13 describes the difference in 5-year RSR for the most common cancers in PEI men and women. The 5-year RSR for all cancers combined in men was 64% for 2004-2008. The highest relative survivals for the most common cancers were seen in prostate (98%), melanoma (81%), and bladder (76%) cancers, while the lowest survival was seen in lung (11%) and pancreatic (8%) cancers. Women had a 5-year RSR of 59% for all cancers diagnosed in the same period. For the most common cancers, the rates were highest for melanoma (93%), breast (85%), and uterine (82%) cancers. The lowest rates in women were for lung (20%) and pancreatic (4%) cancers.

Figure 13: The 5-year relative survival ratios for the most common cancers, male and female, PEI, 2004-2008

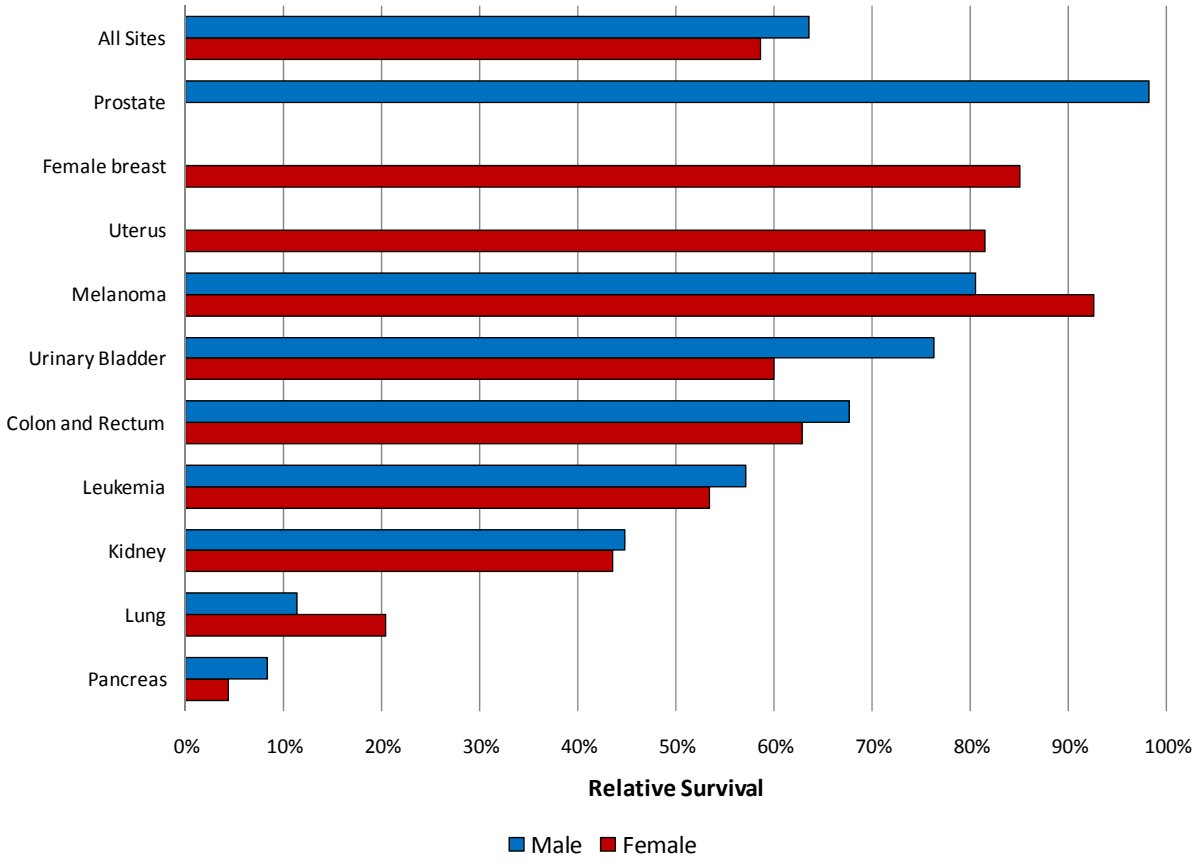
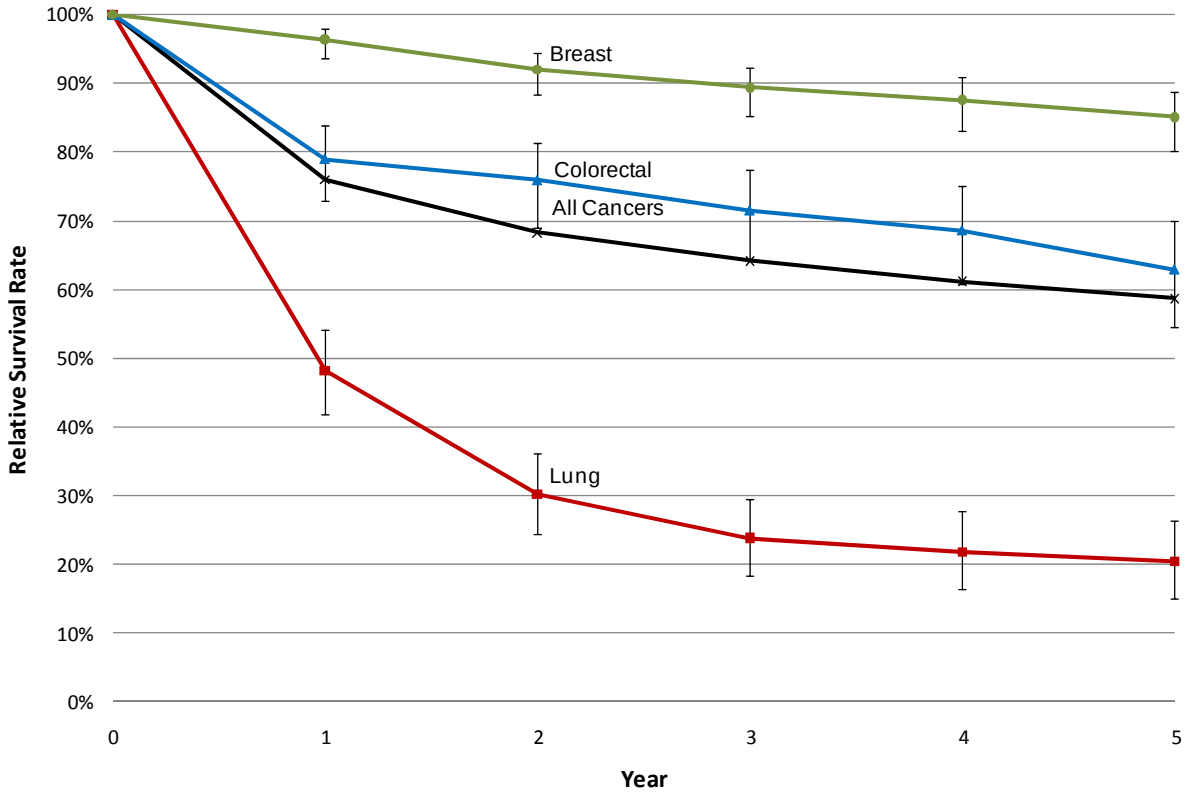


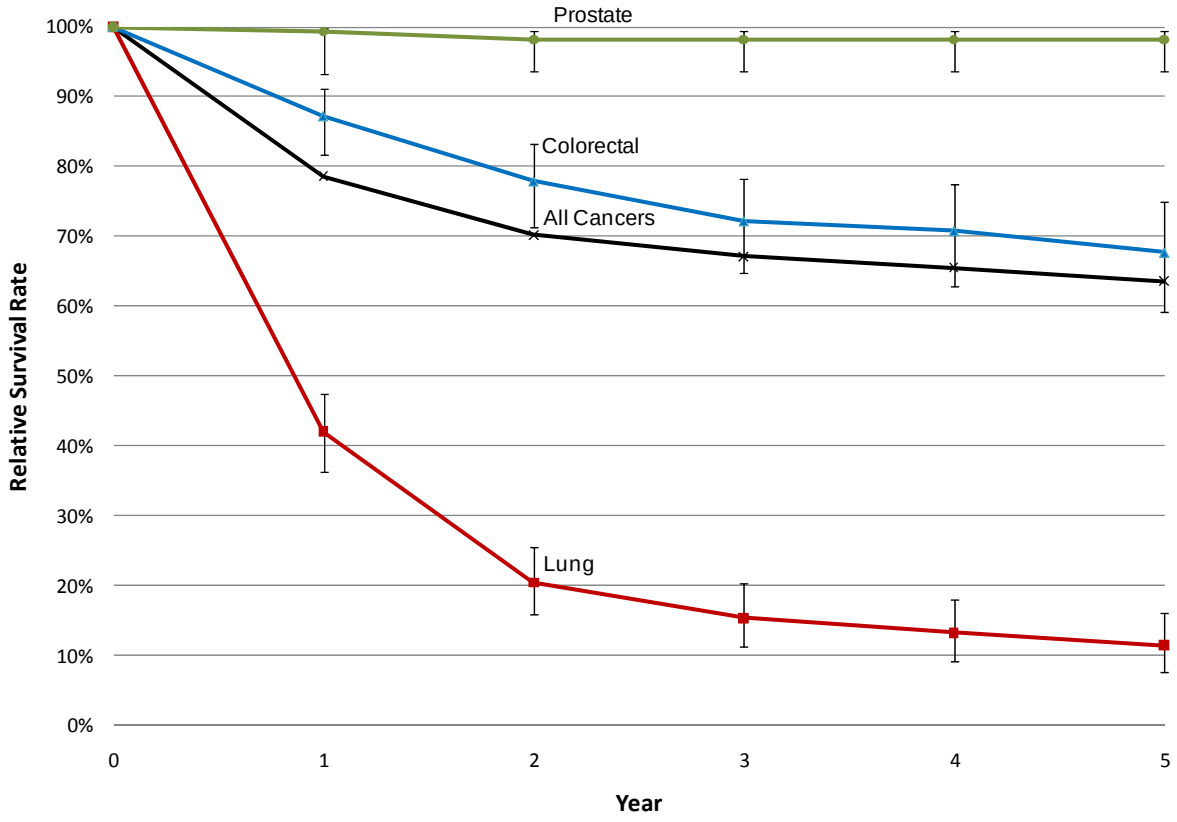
Figure 14a illustrates the change in RSR in women for the most common cancers each year after diagnosis. For most cancers in women, there are steep declines in survival 1 year after diagnosis, after which the relative survival declines more slowly. This indicates the risk of dying is higher in the first year and slowing in the following 4 years. However, breast cancer has more of a linear decline in survival indicating the risk of dying does not diminish after the first year.

Figure 14a: Yearly relative survival ratios for the most common cancers with 95% confidence intervals, female, PEI, 2004-2008.



Figures 14b illustrates the change in RSR in men for the most common cancers each year after diagnosis. The RSR in PEI men follow a similar pattern as the women with a rapid drop in survival in the first year after diagnosis and then a slower decline in survival after the first year. One exception is prostate cancer which has a very high survival for all years after diagnosis.

Figure 14b: Yearly relative survival ratios for the most common cancers with 95% confidence intervals, male, PEI, 2004-2008.



Age-standardized relative survival is calculated to compare RSR between two populations. Recent PEI age-standardized RSR have been investigated for patients diagnosed with cancer between 2004 and 2006.[10] The 5-year age-standardized RSR in PEI was 59.4% which was significantly lower than the Canadian rate of 61.7%. The age-standardized 5-year RSR was 62.6% in PEI men and 61.6% in Canadian men. Unfortunately, this same rate was considerably lower in PEI women at 55.3% compared to 61.1% in Canadian women. This different relative survival in Island men and women is significant and partly reflects the different types of cancers in men and women, particularly the very high incidence and survival of prostate cancer patients.

Reduced survival in Islanders may be influenced by significantly lower survival in young adults and very old adults compared to their Canadian counterparts. Islanders diagnosed between 45-74 years of age have a similar age-standardized 5-year RSR as Canadians. However, if diagnosed between 15-44 years of age, the age-standardized 5-year RSR is significantly lower at 73.6% in PEI and 81.2% in Canadians. If diagnosed between 75-99 years of age, the relative survivals are 42.0% in Islanders and 49.0% in Canadians. However, in recent years, survival in the 15-44 year old age group is improving although caution should be exercised as the small number of patients in this group can lead to rapid changes in statistics.

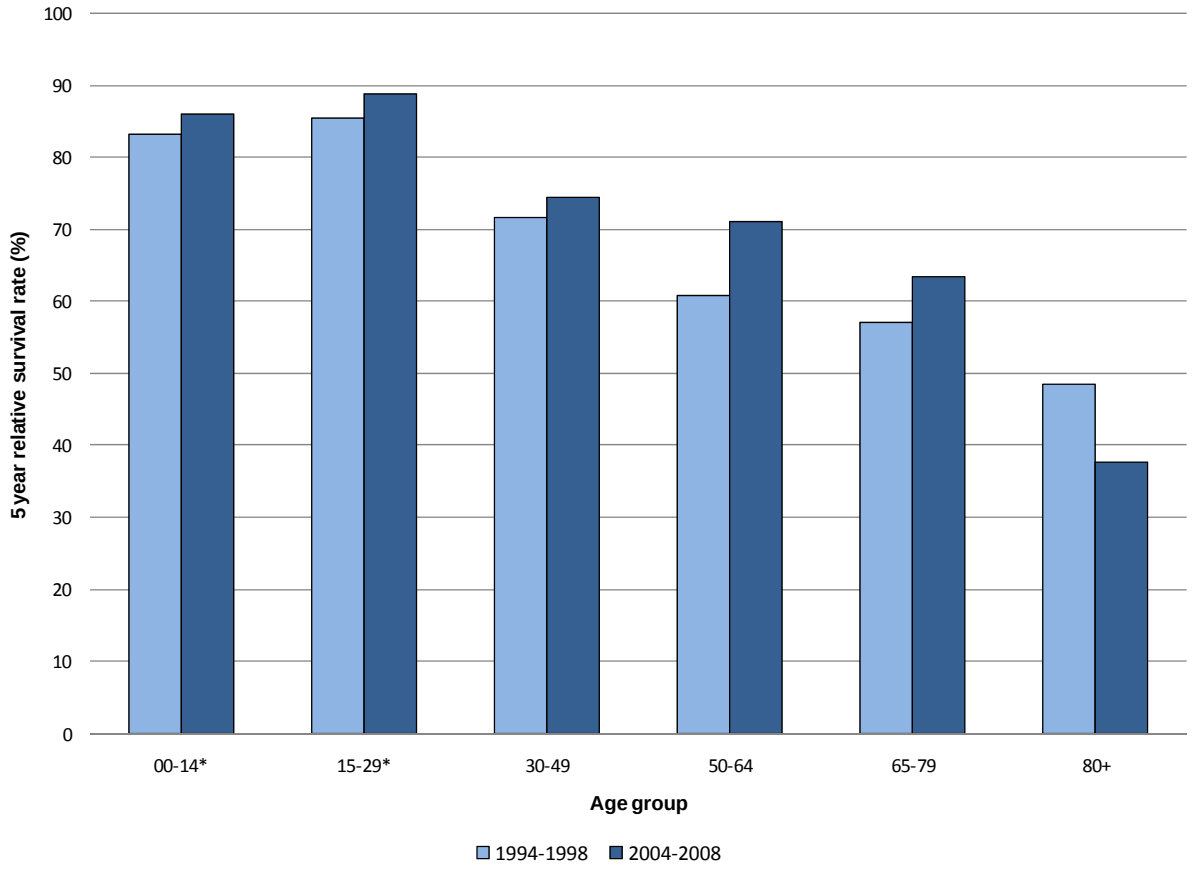
Changes in the relative survival as the years since diagnosis pass is determined by the biology of the cancer type and the ability to treat the cancer. It can be used to identify priority areas in the time continuum from treatment in the immediate period to follow-up care and recurrences. Relative survival for Islanders is very similar to that of Canada for 1 year RSR and 3-year RSR. At 5 and 10-year age-standardized RSR for all cancers, PEI has significantly lower rates than Canada. The 10-year RSR for all cancers was 51.9% in PEI compared to 57.6% in Canada. Lower relative survivals are seen in colorectal cancer in which PEI has a 5 and 10-year age-standardized RSR of 62.1% and 54.4%, respectively, while RSR for Canada were 64.0% and 61.2%, respectively. This pattern is similar for breast cancer in women with 5 and 10-year age-standardized RSR of 82.8% and 73.3%, respectively for PEI and 87.3% and 81.7%, respectively in Canada.

Relative survivals are impacted by multiple different factors, included are the mix of types and stages of cancer, cancer screening programs, and treatment and follow-up care.[10] The stages of cancer for breast, lung, colorectal, and prostate cancers have been collected since 2005. The goal of screening programs is to identify cancers at earlier stages to increase survival times and ultimately reduce mortality rates. Currently, PEI has organized screening programs for colorectal and breast cancers. In 2009-2010, Islanders had a lower rate of colorectal screening than Canada[11]; however, improvements in this rate may occur because the colorectal screening program went Island-wide in 2011. Treatment patterns and guidelines have only been evaluated recently by Canadian Partnership Against Cancer in their System Performance Report.[12]

4.2 Five-year relative survival for different age groups

The 5-year relative survival has improved from the years 1994-1998 to the years 2004-2008 for all except the oldest age group (80+) (figure 15). The highest survival is seen in the age groups 0-14 and15-29. Higher survivals in these age groups are likely due to the different types of cancer seen in the younger age groups relative to the older age groups. Common cancers in this group have a high survival including melanoma, thyroid, Hodgkin lymphoma, and testicular cancers. The lowest survival occurs in the oldest group (80+ years of age). In addition, this group had reduced survival in recent times partly due to an increase in lung cancer incidence.

Figure 15: 5-Year Relative Survival Ratio for All Cancers, by Age Group, PEI, 1994-1998 and 2004-2008



*observed survival

5 INCIDENCE AND MORTALITY TRENDS

5.1 Trends in age-standardized incidence and mortality rates for specific cancers

Table 3 summarizes the trends in age-standardized incidence and mortality rates for overall and specific cancers. Annual percentage change (APC) demonstrates the statistical assessment of the trend. Selected cancers are detailed in the upcoming section and referrals to increasing and decreasing average percents each year are from table 3.

Table 3: Annual percent change in age-standardized incidence and mortality rates, common cancers, PEI

	Incidence						Mortality					
	Males			Females			Males			Females		
Cancer	**Period**	**APC**		**Period**	**APC**		**Period**	**APC**		**Period**	**APC**	
All cancers	1980-2009	1.1*	↑	1980-2009	0.8*	↑	1992-2009	-1.3*	↓	1992-2009	0.4	↑
Prostate	1980-1994	8.2*	↑				1992-2009	-2.3*	↓			
	1994-2009	0.2	↑									
Female breast				1980-2009	0.5	↑				1992-2009	0.1	↑
Lung	1980-2009	-0.4	↓	1980-1990	15.7*	↑	1992-2009	-2.4*	↓	1992-2009	0	
				1990-2009	0.1	↑						
Colon and rectum	1980-2009	0.5	↑	1980-2009	0.1	↑	1992-2009	-1.7*	↓	1992-2009	-1	↓
Bladder	1980-2009	1	↑	1980-2009	1	↑	1992-2009	5.5*	↑			
Uterus				1980-2009	0							
Melanoma	1980-2009	4.4*	↑	1980-2009	3.6*	↑						
Kidney	1980-2009	2.0*	↑	1980-2009	2.5*	↑	1992-2009	-1.3	↓	1992-2009	9.3*	↑
Non-Hodgkin lymphoma							1992-2009	-3	↓	1992-2009	1.5	↑
Pancreas	1980-2009	-1	↓	1980-2009	-0.8	↓	1992-2009	-1.3	↓			
Leukemia	1980-2009	1.8*	↑	1980-2009	-0.8	↓	1992-2009	2.1	↑	1992-2009	3.1	↑
Oral	1980-2009	-2.7*	↓	1980-2009	0.4	↑	1992-2009	-0.3	↓			
Ovary				1980-2009	-2.2*	↓				1992-2009	-1	↓
Stomach	1980-2009	-3.0*	↓				1992-2009	-4.4*	↓			
Brain	1980-2009	1.6	↑	1980-2009	0.5	↑				1992-2009	3.8	↑
Thyroid				1980-2009	1.6	↑						
Cervix				1980-2009	-2.2*	↓						

* APC is significantly different from 0 ($P<0.05$)
Missing data is due to either too few cases or highly erratic data

5.2 Incidence and mortality trends for the most common cancers, PEI

Prostate Cancer

Prostate Cancer is the most common cancer in PEI and Canada[6] with 30% of cancers diagnosed in Island men between 2005-2009 being prostate cancer (figure 6a). The age-standardized incidence of prostate cancer increased rapidly from 1980 peaking in 1994 with 201 new cases per 100,000 men (figure 16a). This peak was likely due to the introduction of PSA (prostate-specific antigen) screening available in 1991. A rapid increase of newly diagnosed cases followed by a rapid decrease in new cases is often seen after a new screening test has been introduced.[13] The rate increased again peaking in 2001 with 213 cases per 100,000 possibly due to the increased media coverage associated with the diagnosis of prostate cancer in the Federal Minister of Health.[14] Since then, the rate has stabilized to 155 new cases per 100,000 men in 2009. After 1992, the rate of mortality has been decreasing by an average of 2.3% each year likely from early detection and improved treatments (figure 17a). In 2009, PEI had the highest age-standardized incidence of prostate cancer in Canada (figure 11b).

The overall benefit for the use of PSA as a screening tool is still under debate.[15] Since introduction of the test, there has been a decrease in the prostate cancer mortality rate. Although there has been a decreasing mortality rate, there may be overdiagnosis, overtreatment, and reduced quality of life due to tumors that may not have been a problem in a patient's lifetime.

Female Breast

Breast cancer is the most commonly diagnosed cancer in women with 25% of cancers diagnosed in Island women between 2005 and 2009 (figure 6b). In 2009, the age-standardized incidence of breast cancer in Island women was 92 cases in 100,000 women. The overall incidence rate of breast cancer has increased very slowly with only an average of 0.5% each year. There was a small peak in the late 1980s and another one in 1998 (figure 16b). The first peak was likely due to the availability of mammography in PEI in 1987 and the second peak was likely due to the initiation of an organized breast cancer screening program for all women in PEI in 1998. There was another increase in the early 2000s followed by a decrease which may have been associated with new information regarding the increased risk from the use of Hormone Replacement Therapy (HRT).[16]

PEI had the second lowest reported incidence rate in Canada (figure 11b); nevertheless, it had the lowest 5-year relative survival for cases diagnosed between 2004 and 2006 compared to all other provinces. Long-term survival in PEI lags behind the Canadian rate. As mentioned previously, the 10-year relative survival was significantly lower for those same patients at 73.3% compared to 81.7% in Canada.[10]

The age-standardized mortality rate for breast cancer in women has increased only slightly to 23 deaths in 100,000 women (figure 17b) in 2009. At the same time, breast cancer mortality rates in Canadian women have been decreasing since the late 1980s. The Canadian rates were higher than PEI rates in the early 1990s but have decreased to lower than PEI rates by 2006.[7]

Lung cancer

In 2009, Islanders had the highest incidence rate of lung cancer across Canada (figure 11d). However, Island men and women have different patterns of age-standardized incidence and mortality rates for lung cancer. Men have a very slowly decreasing rate of lung cancer since 1980 (figure 16a). In 2009, the incidence rate for lung cancer in men was 90 new cases per 100,000 men. The lung cancer mortality rate has been dropping steadily since 1992 by an average of 2.4% reduction each year (figure 17a). The mortality rate in 1992 was 80 lung cancer deaths in 100,000 men while in 2009 the rate was 45 deaths in 100,000 men.

The incidence rate for lung cancer in Island women increased rapidly from 1980 to 1990 with an average increase of 16% each year. This increase is significant and represents an incidence rate that increased from 16 new cases per 100,000 women in 1980 to a peak of 61 new cases per 100,000 in 1990 (figure 16b). Since that time, the incidence rate has stabilized. The rate was 54 new cases per 100,000 in 2009. Although there has been a significant decrease in the mortality rate for lung cancer in Island men, no such decrease has been seen in lung cancer in women. The mortality rate has remained stable since 1992 (figure 17b). While the age-standardized lung cancer incidence rate remains higher in men than women, the age-standardized mortality rate in women was approximately equivalent to mortality rates in men with 43 lung cancer deaths in 100,000 women in 2009. The Canadian Cancer Society reports one main reason Canadian women have not had significant reductions in lung cancer incidence and mortality rates compared with Canadian men is that the rate of smoking in men began to decrease in the mid 1960s while the rate of smoking in women began to decrease much later in the mid 1980s.[17]

Colon and rectum

Cancer of the colon and rectum has a high incidence in PEI and in all of the Atlantic provinces relative to the rest of Canada (figure 11c). The incidence rate has increased slowly by 0.5% per year since 1980 in men while the mortality rate has significantly decreased by an average of 1.7% each year since 1992 (figures 16a and 17a). For PEI men in 2009, the incidence and mortality rates were 63 per 100,000 men and 25 per 100,000 men, respectively.

The incidence rate has remained stable since 1980 in Island women while the mortality rate has been decreasing by an average of 1% per year (figures 16b and 17b). The mortality rate had a small increase in the early 2000s and has been falling since that time. For PEI women in 2009, the incidence and mortality rates were 49 per 100,000 women and 14 per 100,000 women, respectively.

In 2009 and 2010, the PEI government introduced Phase I and Phase II of a pilot colorectal screening program based on the Fecal Occult Blood Test (FOBT). In 2011, the screening program was expanded Island-wide for all Islanders 50 to 75 years of age. PEI residents continue to have lower rates of FOBT and colonoscopy/sigmoidoscopy compared to their Canadian counterparts. The occurrence of either the FOBT or colonoscopy/sigmoidoscopy in 50-74 year olds was 35% and 25% respectively in PEI and 41% and 31% respectively in Canada.[11] As the uptake of colorectal screening increases, the rates of colorectal cancer diagnoses and deaths should decrease as a result of removal of precancerous polyps and treatment of early stage cancer treatment.

Figure 16a: Incidence trends for the most common cancers, male, PEI, 1980-2009

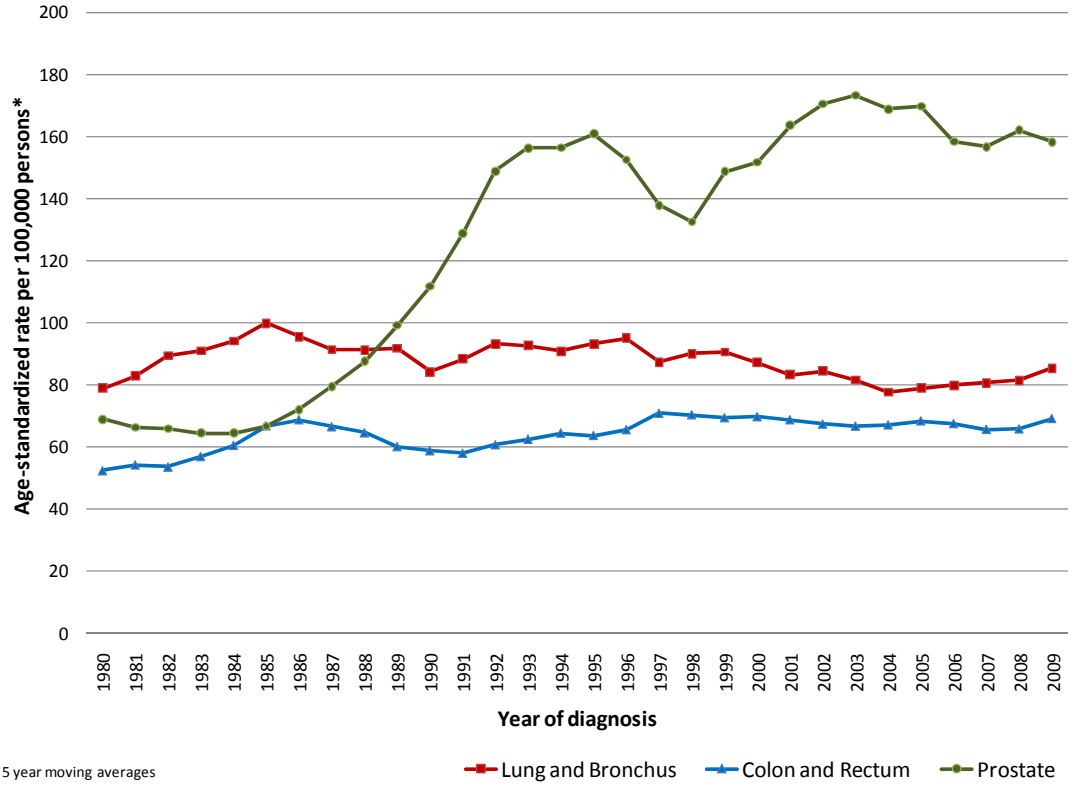


Figure 16b: Incidence trends for the most common cancers, female, PEI, 1980-2009

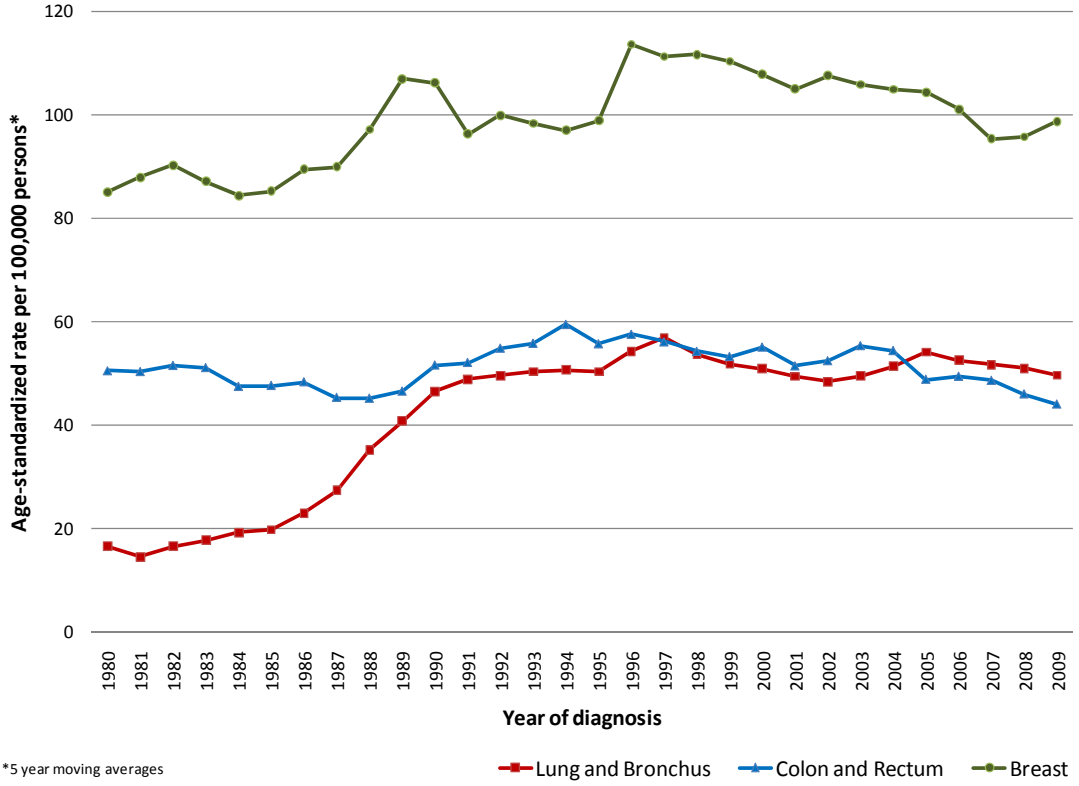


Figure 17a: Mortality trends for most common cancers, male, PEI, 1992-2009

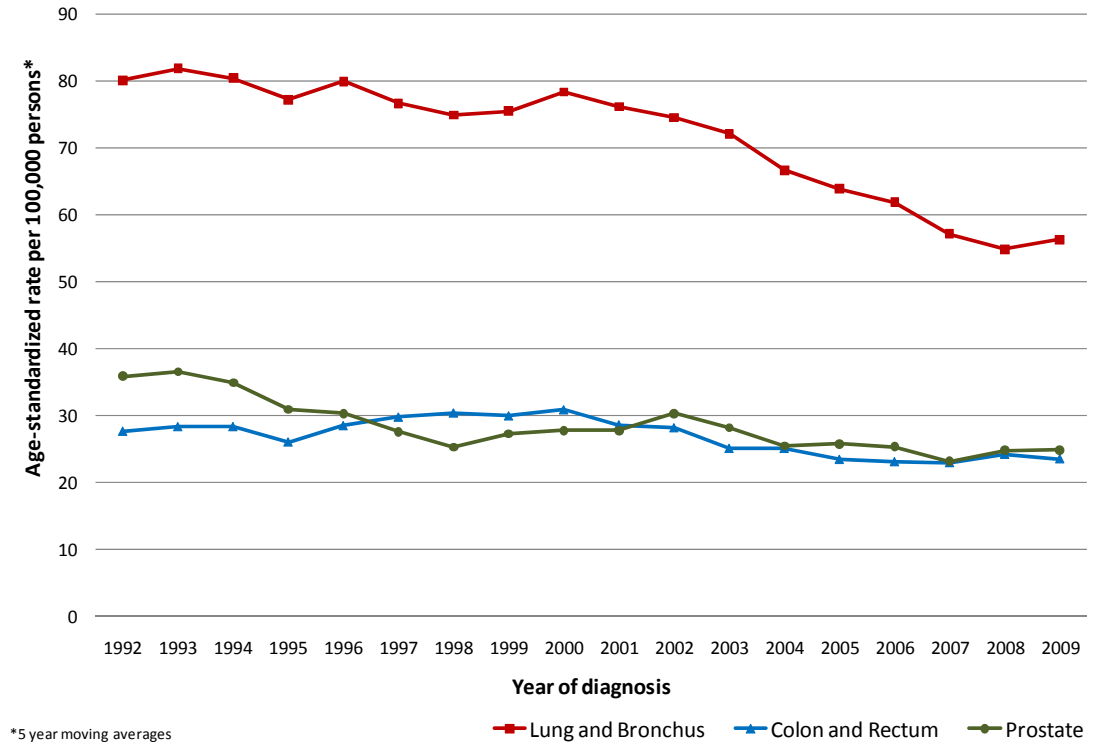
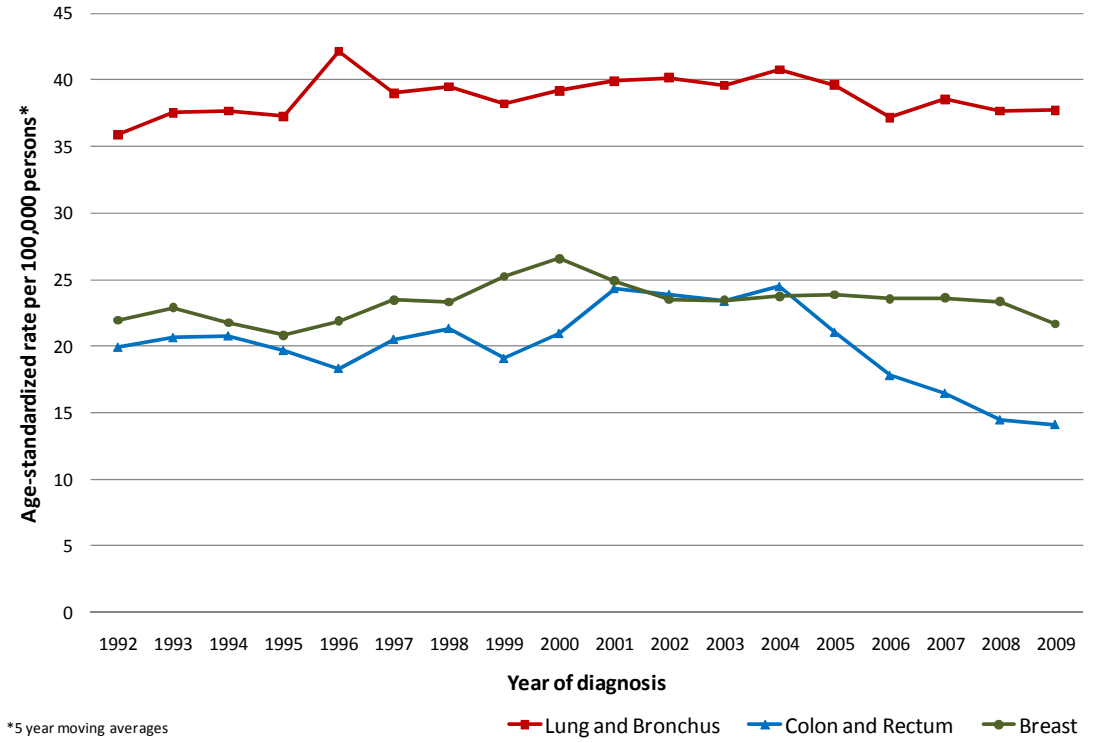


Figure 17b: Mortality trends for most common cancers, female, PEI, 1992-2009



5.3 Incidence and mortality trends for other cancers, PEI

Bladder
Although cancer of the bladder has been increasing at only an average of 1% per year for both men and women, the mortality rate in both men and women has been significantly increasing, on average 6.8% yearly in PEI between 1992 and 2009. The incidence rates in PEI were generally lower than Canada in the 1990s, but have increased to generally higher levels in the 2000s.[6] Reasons for the increasing incidence and mortality rates of bladder cancer in PEI are unknown.

Melanoma
Melanoma skin cancer is the most rapidly increasing cancer in PEI. Over the last 30 years the age-standardized rate has tripled from 7 cases per 100,000 to 21.5 cases per 100,000. The yearly average increase in rate in men was 4.4% and in women was 3.6% (figures 18a and b). Increased exposure to ultraviolet radiation including sunlight and tanning beds is the most common risk factor for melanoma. In 2011, the PEI Department of Health and Wellness published *Guidelines for Tanning Salon Owners and Operators*. One aim of the document is to reduce the exposure of harmful rays for very vulnerable people including those under 18 years of age and those with very light skin type. In 2012, PEI Department of Health and Wellness will be introducing tanning bed regulations that prohibit those less than 18 years of age to use a tanning bed.

Kidney
Cancer of the kidney has significantly increased in Islanders since 1980. The average yearly increase for incidence was 2.0% in men and 2.5% in women (figures 18a and b). The Canadian Cancer Statistics reported that PEI had the highest kidney cancer incidence in 2008 for both men and women.[7] The age-standardized incidence rate in men increased from a yearly average of 12.8 cases in 100,000 in the 1980s to a yearly average of 18.3 cases in 100,000 in the 2000s while the rate in women increased from a yearly average of 5.0 in 100,000 between 1992 and 1999 to a yearly average of 8.5 in 100,000 in the 2000s. The mortality rate in women has increased significantly since 1992. Some of the risk factors for kidney cancer are smoking, obesity, end-stage kidney disease, and hypertension.[18] Although smoking rates have been decreasing, the rates of obesity and hypertension remain well above Canadian averages and hypertension rates in PEI are continuing to increase.[11]

Pancreas
Although not significant, the age-standardized rates for pancreatic cancer in both men and women have been declining slowly since 1980. There have also been associated small reductions in the pancreatic cancer mortality rate. Although pancreatic cancer is less commonly diagnosed in PEI, the incidence rate is still ranked 5th among cancer in PEI and the 5-year relative survival for this disease is very poor at less than 7%. Risk factors include tobacco use, obesity, diabetes, genetic predisposition and occupational chemical exposure.

Leukemia
Leukemia age-standardized rates in males have been rising by an average of 1.8% per year since 1980 while at the same time the rate in women has been declining slowly at 0.8% per year. Although the mortality rate in PEI due to leukemia has been rising since 1992, the Canadian mortality rate has been decreasing.

Oral cavity and pharynx

The incidence of cancers of the oral cavity and pharynx have significantly decreased in men since 1980 (figure 18a). On average, the age-standardized incidence rate decreased 2.7% each year from a yearly average of 25 cases in 100,000 men in the 1980s to 13 cases in 100,000 men in 2000s. At the same time the age-standardized rate has changed very little in Island women, increasing an average of 0.4% each year from a yearly average of 5.4 cases in 100,000 women in the 1980s to 5.9 cases in 100,000 women in 2000s. The decrease in the incidence rate in men has been attributed to the decrease in tobacco use.[19]

Ovary

Over the last 30 years, the age-standardized incidence rate has significantly decreased by an average yearly decrease of 2.2% (figure 18b). Additionally, there has been a small decrease in average yearly mortality rate of 1% since 1992. The age-standardized incidence rate decreased from a yearly average of 13.1 cases in 100,000 women in the 1980s to a yearly average of 8.7 cases in 100,000 women in 2000s. The use of oral contraceptives has been shown to be a protective factor[20] and the widespread use of them likely contributes to the overall decrease in incidence. There is some evidence that the use of HRT is associated with an increase risk of ovarian cancer.[21]

Stomach

Although stomach cancer accounts for only 1% of all cancers in PEI, the incidence and mortality from stomach cancer in males has decreased significantly by an average of 3.0% each year in new cases and 4.4% in deaths in men. The age-standardized incidence rate decreased from a yearly average of 16.6 cases in 100,000 men in the 1980s to a yearly average of 8.3 cases in 100,000 men in 2000s while the mortality rate decreased from a yearly average of 8.4 in 100,000 between 1992 and 1999 to yearly average of 5.4 in 100,000 in the 2000s. Rates in women also declined during this time, but were not as dramatic as in the men.

Not surprisingly, many risk factors for stomach cancer are based on diet and the presence of *Helicobacter pylori*. A family history of stomach cancer and smoking are also risk factors. The decreasing rates in stomach cancers in men may be associated with the reduction of smoking over the years and the awareness and treatment of *H. pylori.*[22]

Brain

Although not significantly higher, incidence and mortality rates for brain cancer have been increasing in PEI. The age-standardized incidence rate increased from a yearly average of 6.2 cases in 100,000 men in the 1980s to a yearly average of 7.4 cases in 100,000 men in 2000s while the mortality rate increased from a yearly average of 2.8 in 100,000 between 1992 and 1999 to a yearly average of 4.6 in 100,000 in the 2000s. In women, the age-standardized incidence rate increased from a yearly average of 3.9 cases in 100,000 in the 1980s to a yearly average of 5.7 cases in 100,000 in 2000s while the mortality rate increased from a yearly average of 3.3 in 100,000 between 1992 and 1999 to a yearly average of 5.3 in 100,000 in the 2000s. Known risk factors for brain cancer are radiation exposure and inherited conditions.

Cervical

The cervical cancer incidence rate has been in decline since the 1980s with an average yearly decrease of 2.2% from 1980 until 2009. The decreasing rate is likely due to cervical cancer screening using the Papnicolaou (Pap) test. In 2001, the Province established a Pap screening clinic in the Charlottetown region with traveling clinics across the Island. The age-standardized proportion of women between 18 and 69 years of age who reported in 2008 that they had had a Pap test in the last three years was 83%.[12] However, there is currently no organized Provincial Pap Screening Program. In 2007, a human papilloma virus (HPV) vaccine was introduced to girls in grade 6. The uptake of this vaccine in 2008-2009 school year was 81%. Because this vaccine covers 70% of HPV strains that cause cervical cancer, the expected rate of cervical cancer should continue to decline.[23]

Figure 18a: Incidence trends for selected rapidly changing cancers, male, PEI, 1980-2009

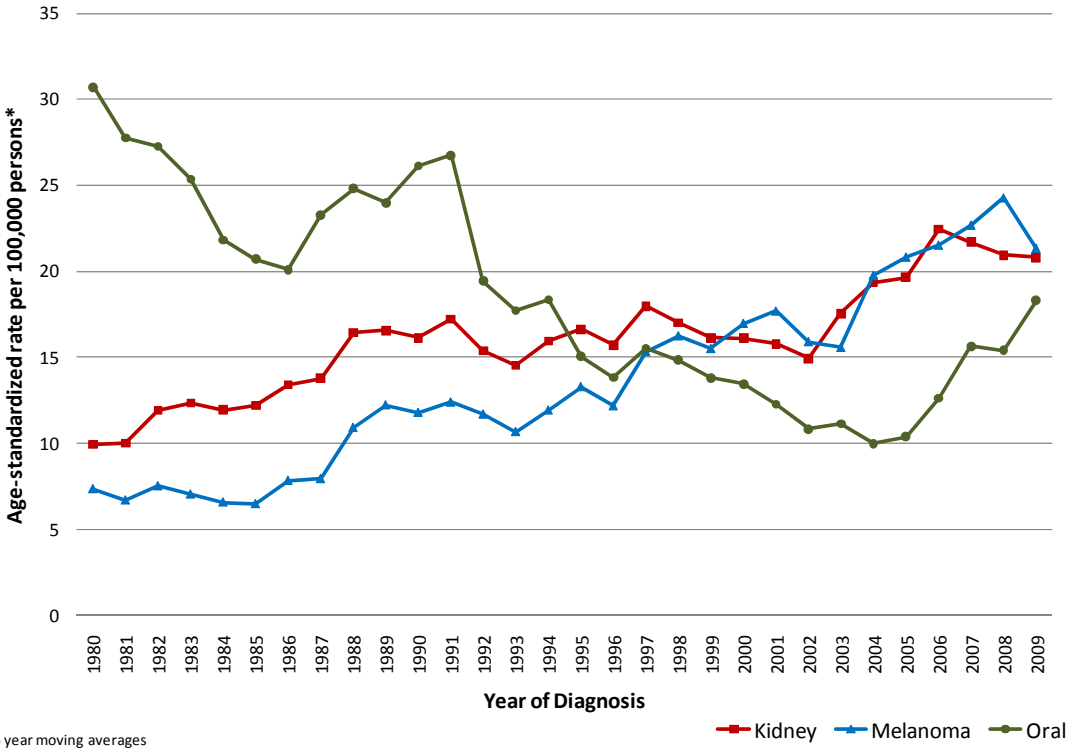
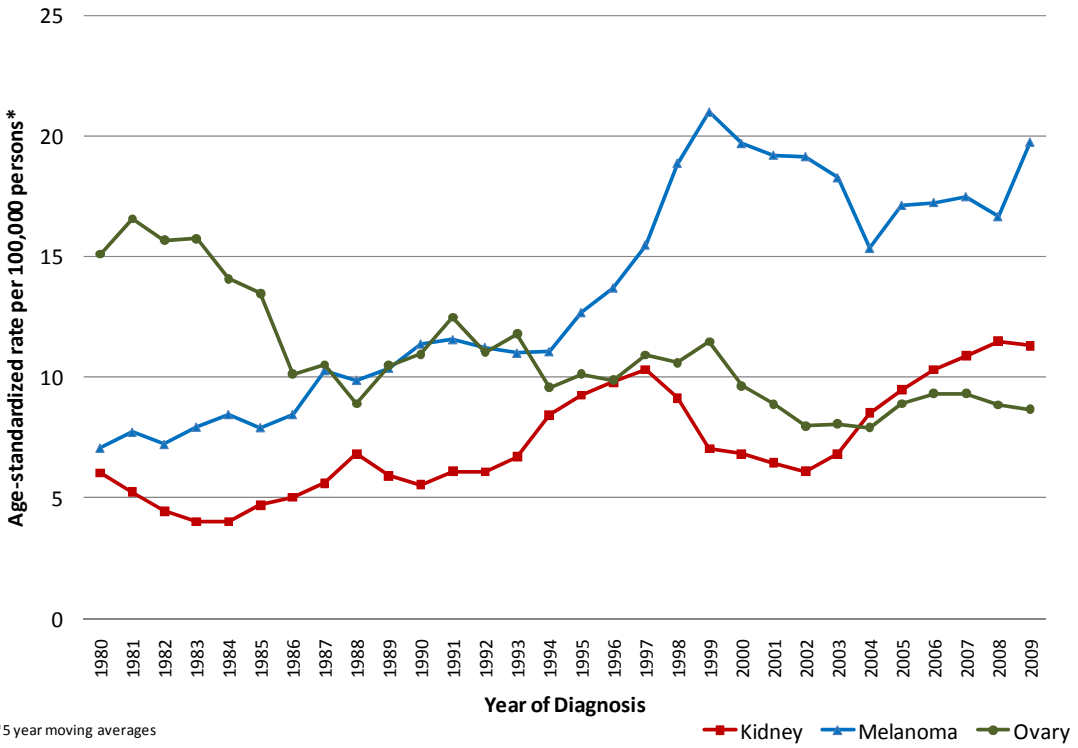


Figure 18b: Incidence trends for selected rapidly changing cancers, female, PEI, 1980-2009



APPENDICES

Appendix I: Methods

Registry data sources

For this report, analysis of new cancer cases from 1980 through 2009 and cancer deaths from 1992 through 2009 from the PEI Cancer Registry are presented. PEI cancer data in the PEI Cancer Registry is compiled from multiple sources by the Registrar.

- Prince Edward Island Provincial Health Care

As cancer is a notifiable disease in PEI, all new cases of cancer are registered with the PEI Cancer Registry which will be referred to as the "Registry" in this report.[24] Although the registry data is collected for all residents of PEI, the registry itself is located at the PEI Cancer Treatment Centre at the Queen Elizabeth Hospital in Charlottetown. The data is collected from PEI Cancer Treatment Centre charts, laboratory reports, pathology reports, cytology reports, autopsy reports, notification from the Discharge Abstract Database, notification from out of province cancer registries, and death certificates, additional information required to complete the cancer registry abstracting process is gathered from physician offices and health records.

- Prince Edward Island Vital Statistics

Quarterly reports are received by the Registry from the Provincial Vital Statistics. All people who had any type of cancer reported on their death certificate are included in the quarterly report. The Registry will include cancer as the "Cause of Death" (COD) for only those people with cancer as the COD on their death certificate. Information from the quarterly report is matched to the associated patient record in the Registry and information is added to the Registry if not present already. Information in the quarterly report includes date of death, province of death, underlying COD if it is cancer, and death registration number.

- Statistics Canada

National Death Clearance, which contains COD, date of death, underlying COD, province of death, and death registration number, is sent yearly to the Registry. This information is used to verify the Provincial Vital Statistics and to identify other cancer patient deaths that occurred in other provinces and is available for deaths from 1992 through 2008 currently. Mortality prior to 1992 was not death cleared by Statistics Canada and will not be presented in this report.

The number of people in the population is needed to calculate rates for incidence, mortality, and prevalence. Population counts by sex and 5-year age groups are provided by Statistics Canada and are from the 2006 Census. The census is done every five years by Statistics Canada, and mid-year population estimates are produced for the intercensal years. 1991 Canadian Standard Population in 5-year age groups (18 groups) is used for age-standardized rates.

Survival rates are calculated using the expected survival (life table in 5-year age groups) of Islanders that are provided by Statistics Canada. The data have the same yearly expected survival from years 1992 through 1998 and the same yearly expected survival from years 1999 through 2009.

Data quality
The Registry works with the Canadian Cancer Registry who provides data quality reports to the provincial registries. The Registry is also a member of the North American Association of Central Cancer Registries (NAACCR). NAACCR's mission is to enhance the quality and the use of cancer surveillance data in North America.[25] NAACR has presented the Registry with the Gold or Silver standard award since 1998 for the "completeness, accuracy, and timeliness" of the PEI cancer data.

Counting cancer cases and deaths
All new cases are counted as incident cases of cancer in the Registry; this may include different cancers in the same primary site previously diagnosed with a cancer. The PEI Registry follows the National Cancer Institute, Surveillance Epidemiology and End Results (SEER) Program Multiple Primary Rules which were adopted as the Canadian Standard for cases diagnosed beginning in 2007. These rules are quite complex and site specific and may allow counting multiple cancers in the same primary site such as breast or colon in the same person and are unlike the International Association of Cancer Registries (IARC) rules which counts multiple tumors in the same primary site only once.[26] The SEER cancer groupings primarily based on anatomical site of origin and microscopic cellular structure were used (Appendix II). Included in the PEI cancer data are malignant or invasive cancers and *in situ* bladder cancer. Excluded from this report are basal and squamous cell carcinoma skin cancers.

The number of new cases of cancer changes each year. To determine the source of this change, the total number of cases each year were partitioned into three segments: those attributed to the increase in population size, those attributed to the aging population, and those attributed to the changing risk and improved detection since 1980.[1] Graphing the increasing number of cases over the year offers an estimate of the proportion of cases which can be attributed to these three sources. Three-year moving averages were used to smooth the lines for the incidence figure. The number of cancer deaths was partitioned similarly to three segments: those attributed to the increase in population size, those attributed to the aging population, and those attributed to the changing risk, earlier detection, and improved treatment since 1992. Five-year moving averages were used to smooth the lines from the mortality figure.

The number and proportion of all cancers were reported by cancer type and by age group of the patient. Because the population of PEI is small there is considerable variation in the number of cases of cancer from year to year. To stabilize the variation over years, 2005-2009 or 2000-2009 data were used to calculate counts for specific cancers and for specific age groupings.

Cancer rates in PEI
Many different measurements can be used to describe cancer in a population. The number of cases in PEI represents the burden of cancer on society, while the rate of cancer represents the risk of being diagnosed or dying from a cancer. This report will utilize incidence and mortality rates along with any changes in the rates over the last few decades to describe the risk. Five-year survival rates are a measure of progress in early diagnosis and improved treatments and are presented for multiple cancers. Specific definitions for these measurements and other terms are available at the end of this document in the Glossary of Terms and Methods (Appendix III).

Age standardization is used to adjust the effects of differences in age when comparing incidence rates between different populations such as PEI and Canada. The incidence and mortality graphs in this report include estimates for the most recent years, and the PEI rates are three year or five-year moving averages. A five-year moving average for a specific year is the

mean of the data from the two years prior to that year, the specific year, and two years after that year. Moving averages are used to smooth the line created by looking at a rate over time to make trends over time more apparent. Changes in rates and comparisons of PEI and Canadian rates were considered statistically significant if $P<0.05$.

All statistics were performed using SEER*Stat software (Surveillance Research Program, National Cancer Institute SEER*Stat software.[27] The SEER*Stat statistical software is available free from the web provided by the National Cancer Institute. The program is meant to be an easy-to-use program to generate standardized cancer statistics for multiple users of Cancer Registry data. Data preparation was performed using the associated SEER*Prep program.

- Incidence and Mortality

The crude incidence rate is the number of new cases of cancer per 100,000 Islanders. The incidence rate is a measure of the risk of being diagnosed with cancer and can be specified by the risk for a specific type of cancer, by the risk in males or females, or the risk by age group. Incidence rate in a specific age group of the population is calculated by dividing the number of cases diagnosed in that age group by the number of people in that age group in PEI. The age groups used in this report are: 0-14 years, 15-29 years, 30-49 years, 50-64 years, 65-79 years and 80+ years at time of diagnosis. In certain analyses, 0-14 and 15-29 year age groups were combined to form 0-29 year age group.

Crude rates can be converted to age-standardized rates using the standard population (1991 Canadian population). As PEI has an older population than the standard population, the age-standardized rates are usually lower than the crude rates and thus are not a good measurement of cancer burden in PEI.

Age-standardized incidence rates from 2009 data from all provinces except Quebec were compared to give a perspective of the risk of cancer in PEI.[8]

Mortality rate is the rate of deaths and is calculated by dividing the number of deaths by the number of people in that age group in PEI. Similar to crude incidence rates, crude mortality rates can be age-standardized to the standard population (1991 Canadian population).

Annual rates are expressed as the number of cancer deaths per 100,000 people per year.

- Prevalence of cancer

Prevalence is the proportion of Islanders alive with a diagnosis of cancer, either a new diagnosis or a pre-existing diagnosis, and is thus a useful measure for health care systems planning. A limited duration of 10 years for the prevalence of the most common cancers are presented and represent the proportion of Islanders that were diagnosed with a cancer in the period from January 1, 1999 through December 31, 2008 who were still alive on January 1, 2009. A person was counted in the prevalence if their diagnosis was within the time range and they were still alive and living on the Island even if they were considered cancer-free. Only people from the Registry that were not identified by death certificate or autopsy only were included. The prevalence of the most common cancers and the proportion of the 10-year survival by time since diagnoses were calculated. Person-based prevalence counts the number of people with cancer rather than the number of tumors; thus, it underestimates the burden of cancer because some people have more than one cancer.

- Five-year relative survival ratio

One method to measure cancer survival is the five-year relative survival ratio which measures the likelihood of a person with cancer being alive five years after diagnosis compared to a person who does not have cancer. A five-year period (2004-2008) for people 15 years and older was used for the analysis. For cases diagnosed during the years 2004-2008, the period method was used to give the most up-to-date relative survival information available.[28,29] The actuarial method was used to develop the life table and the Ederer II method to calculated expected survival.[30] Excluded from the analyses were people identified with cancer by death certificate only or autopsy only, and people that were alive during the time period, but did not have a survival time.

Five-year relative survivals were calculated for specific cancers for men and women. Relative survivals were also calculated by age group and compared with RSR for all cancers diagnosed between 1994 and 1998. The RSR for cancers diagnosed in the earlier period were calculated using the cohort method.[31]

To appreciate how PEI RSR compare to Canadian relative survivals, age-standardized RSR for PEI and Canada for patients diagnosed between 2004-2006 were provided by the Cancer Survival and Prevalence Analytic Network (C-SPAN), an initiative of the Canadian Partnership Against Cancer, in collaboration with CancerCare Manitoba.[10]

- Annual percent change (APC)

The yearly change in age-standardized incidence and mortality rates over a fixed period of time is the annual percent change. The APC assumes that the rate of change is constant from year to year and is calculated using a log-linear regression model in the Joinpoint software.[32] If a single APC does not characterize the trend, Joinpoint is capable of identifying changes in the trend and estimating APC for each time period of the trend.

Yearly age-standardized rates and standard errors from 1980 through 2009 for incidence and from 1992 through 2009 for mortality were used to calculate APC for multiple cancers for men and women separately. Significant APCs are those statistically different from 0% at $P<0.05$.

Appendix II: Description of Cancer Sites

SITE:	DESCRIPTION:	ICDO-3 CODES for site or histology* (Incidence)	ICD-10 (Mortality)
ALL SITES	all primary sites of malignant neoplasms; exclude non-melanoma skin cancer	C00-C80, exclude C44 (M805-811)	C00-C80, exclude C44
ORAL	oral cavity and pharynx	C00-C14	C00-C14
ESOPHAGUS	esophagus	C15	C15
STOMACH	stomach including fundus, body, pylorus	C16	C16
COLON/ RECTUM	colon, rectum, rectosigmoid junction	C18-C20, C26.0	C18-C20, C26.0
LIVER	liver	C22.0	C22.0, C22.2-C22.7
PANCREAS	pancreas including ducts, Islets of Langerhans	C25	C25
LUNG	bronchus, lung	C34	C34
MELANOMA	malignant melanoma (skin and other sites)	M872-M879	C43
BREAST	female breast	C50	C50
CERVIX	cervix, including cervical stump	C53	C53
UTERUS	uterus including endometrium, myometrium, fundus, body	C54, C55	C54, C55
OVARY	ovary	C56	C56
PROSTATE	prostate gland	C61	C61
TESTIS	testis	C62	C62
BLADDER	urinary bladder	C67	C67
KIDNEY	Kidney and renal pelvis	C64.9, C65.9	C64-C65
BRAIN	central nervous system including meninges, brain, spinal cord, cranial nerves (includes benign and malig.)	C70-C72	C70-C72
THYROID	thyroid	C73.9	C73
HODGKIN LYMPHOMA	nodal and extranodal	*9650-9667	C81

SITE:	DESCRIPTION:	ICDO-3 CODES for site or histology* (Incidence)	ICD-10 (Mortality)
N-H LYMPHOMA	Non-Hodgkin Lymphoma: lymphomas other than Hodgkin	*9590-9596,9670-9719, 9727-9729, (9823,9827 if not C42.0,C42.1,C42.4)	C82-C85, C96.3
MULTIPLE MYELOMA	Multiple myeloma	*9731, 9732, 9734	C90.0, C90.2
LEUKEMIA	lymphoid, myeloid, monocytic, other leukemias	*9733,9742,9800,9801,9805, 9820,9826,9831-9837,9840, 9860,9861,9863,9866,9867, 9870-9876,9891,9895-9897, 9910,9920,9930,9931,9940, 9945,9946,9948,9963,9964 (9823,9827 if C420,421,424)	C91-C95, C90.1

Appendix III: Glossary of Terms and Methods

AGE
The age of the patient at the time of diagnosis in years.

DATE OF DIAGNOSIS
Diagnosis can be confirmed at the time of a pathology report, radiology report, surgical report, clinical determination, or on the death certificate. The date of diagnosis is the date of the *earliest* confirmatory report following the sequence specified by the Canadian Cancer Registry rules.

CANCER INCIDENCE
The number of new cases of invasive cancer diagnosed per year. Metastatic and carcinoma-in-situ cancers are excluded. Benign tumours are only included for the central nervous system. Non-melanoma skin cancers are excluded, since they are usually treated simply and successfully without requiring hospitalization, and they are therefore difficult to register completely.

AGE-STANDARDIZED INCIDENCE RATE
The numerator is new cancer cases, weighted by the age structure of a standard population (1991 Canadian population) by 5-year intervals. The denominator is the population estimates produced each year by Statistics Canada. The age-standardized rate is expressed as the number of new cancer cases per 100,000 population per year.

CANCER MORTALITY
The number of deaths due to cancer, based on the cause of death as reported on the death certificate.

AGE-STANDARDIZED MORTALITY RATE
The numerator is cancer deaths, weighted by the age structure of a standard population (1991 Canadian population) by 5-year intervals. The age-standardized rate is expressed as the number of cancer deaths per 100,000 population per year.

SMOOTHING OF GRAPHS
Incidence and mortality rates for PEI are 5-year or 3-year moving averages to smooth out annual fluctuations, since small numbers of cases can cause large fluctuations in rates. This was not used for Canadian rates shown on the graphs, since the large number of cases produces more stable rates.

FIVE-YEAR RELATIVE SURVIVAL RATIO
The survival of cancer patients over the first 5 years after diagnosis, adjusted for causes of death other than cancer. Survival rates measure prognosis, and are influenced by the ability to cure the disease, as well as the stage of the cancer at the time of diagnosis. Five-year survival rates are interpreted as:

1. excellent prognosis (5-year survival 85% or greater)
2. good prognosis (5-year survival 70% - 84%)
3. fair prognosis (5-year survival 30% - 69%)
4. poor prognosis (5-year survival less than 30%)

PREVALENCE

The ten-year prevalence of cancer is the proportion of Islanders diagnosed in the last 10 years who are alive today. Prevalence is determined by the rate of new cases of cancer and the survival rate. It is a measure of the burden of cancer on Islanders and the health care system.

ANNUAL PERCENTAGE CHANGE (APC)

APC assesses the trend or rate of change of incidence or mortality rate over time. It is an estimate of average percent increase or decrease of a rate each year over multiple years.

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