



2020



Report on Cancer Statistics
in Prince Edward Island:
Cancer Trends: 1982-2016



Health PEI

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



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Prince Edward Island Cancer Trends: 1982-2016

Forward

I am pleased to introduce the Prince Edward Island Cancer Trends 1982-2016 Report which has been produced by members of the PEI Cancer Registry which is a province-wide database containing all cases of cancer diagnosed in PEI residents since 1969. Following the trends of cancer in our Province is important to make sure that we are able to respond to increases in cancers or cancer deaths.

Over the last three decades there has been an increase in the number of cancer cases diagnosed in PEI. This increase is attributed to the increasing size of PEI's population and the increasing age of our population. This information is important to help us plan for the increased resources that will be required to provide for these patients needs. On a positive note, a concerted effort to understand the different cancers and how to prevent, diagnose, and treat them has stopped any increases in the individual's risk of being diagnosed and dying from cancer in PEI.

In this report, the overall trends of cancer in PEI are presented. The number of cancers and cancer deaths as well as how long Islanders survive with cancer are presented for all cancers together and for select cancers.

This report should be used to guide the Province in planning for future healthcare needs, to offer health care providers information on how PEI patients are doing, and to update Islanders about the state of cancer in the PEI population. It is important for us to continue to make improvements in prevention, reductions in risk factors, earlier diagnosis, and better treatments to enhance the health of all Islanders, reducing the consequences cancer has on all of us.

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Highlights and Implications

- In PEI, the number of new cases of cancer continues to rise mostly due to the aging of our population. There were almost twice as many new cases of cancer diagnosed in 2016 (906 cases) as there were in 1982 (457 cases). While the age-standardized incidence rate has increased over this longer time period, incidence rates in the last 10 years have decreased significantly in males and have stabilized in females.
- Although not significantly different, the cancer incidence rates overall and for the most common cancers in PEI males tend to be higher than the incidence rate in Canadian males. Cancer rates in PEI females tend to be similar for females in PEI and Canada.
- The number of yearly deaths in PEI due to cancer increased by 19% from 268 deaths in 1992 to 318 deaths in 2016. The increase is attributed to the aging of our population. The risk of dying from cancer (age-standardized mortality rate) has been significantly decreasing in females and males during this time period.
- The ten-year prevalence of cancer is the proportion of Islanders diagnosed from 2007 through 2016 who are still alive on January 1, 2017. The ten-year prevalence for all cancers in PEI is 2.8% indicating that more than 1 in 36 islanders have had a personal cancer experience in the last 10 years.

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

1. Prostate cancer is the most commonly diagnosed cancer in PEI males. The age-standardized incidence rate has decreased both dramatically and significantly in the last 10 years. This change has been attributed to the reduction in the use of PSA as a screening tool.
2. Breast cancer is the most commonly diagnosed cancer in PEI females with 27% of cancers diagnosed in Island females between 2012 and 2016. The age-standardized incidence rate has not changed significantly since the early 1980s. However, the age-standardized mortality rate has decreased significantly since the early 1990s. Improved survival is a result of prevention, early detection, and improved treatment.
3. Age-standardized lung cancer incidence and mortality rates in PEI males have decreased over the past decades. The age-standardized incidence rate in females has been increasing while the mortality rate has been stable. The difference between males and females has been attributed to decreasing smoking rates in males earlier than females.
4. Colorectal cancer (CRC) is the second most commonly diagnosed cancer in Canada and PEI. Recent reports show the incidence of CRC in North America has been decreasing for the last two decades except those younger than 50 years old. This is true in PEI as well. Mortality has decreased over time in PEI. As the uptake of colorectal screening increases, the rates of colorectal cancer diagnoses and deaths should decrease.

- For most age groups, the length of survival from cancer has improved since the 1990s. The improved relative survival is attributed to the types of cancers currently diagnosed along with improved detection and treatments of cancer. 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 the cancer services they require. Prevention should be encouraged as well as healthy lifestyles to reduce the cancer burden in PEI.



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PEI Cancer Data

For this report, analyses of new cancer cases from 1982 through 2016 and cancer deaths from 1992 through 2016 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. NAACCR has presented the Registry with the Gold or Silver standard award in every year but one since 1998 for the “completeness, accuracy, and timeliness” of PEI cancer data.

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 measures 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. Age-standardization is used to adjust the effects of differences in age when comparing rates between different populations such as PEI and Canada as well as comparing rates between years. Rates are standardized to the Canadian 2011 population.

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 cancer deaths. The number of new cases of cancer in a population each year is dependent on numerous factors¹ 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 2016 (906 cases) as there were in 1982 (457 cases).

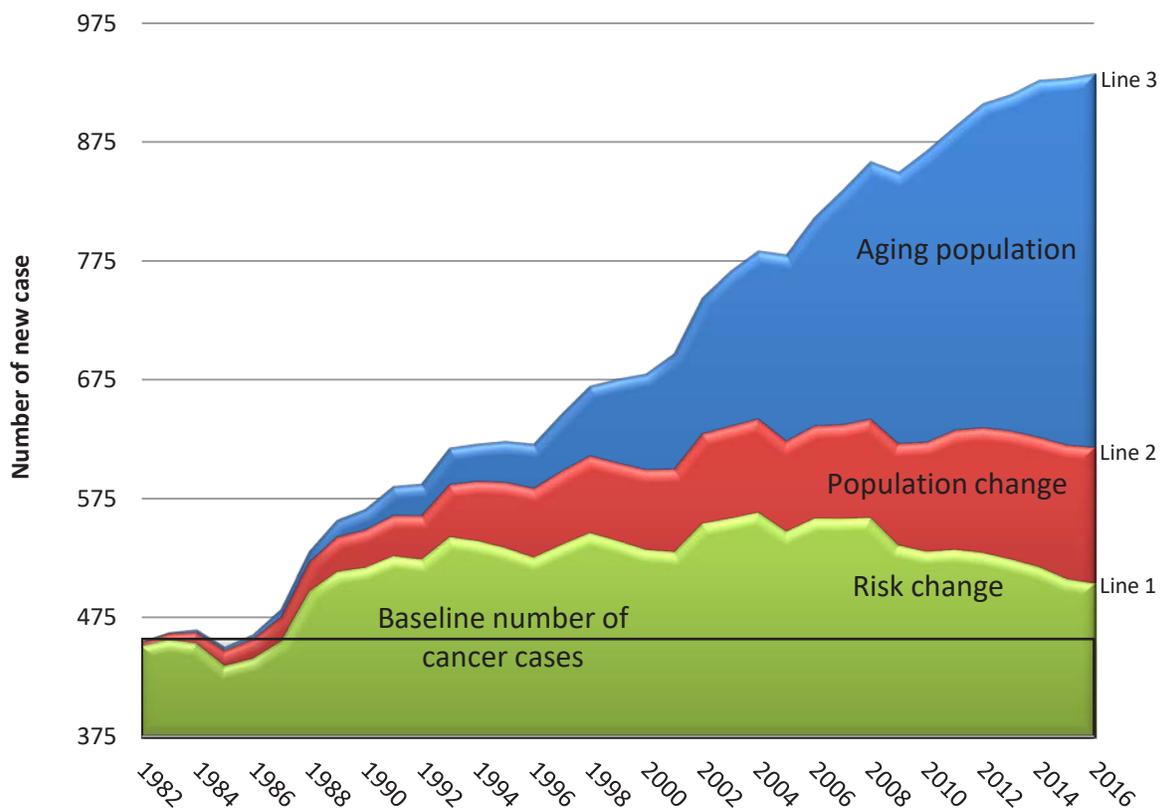
Figure 1 describes the proportion of new cases each year that are attributed to these factors. The black line is the baseline and represents the total number of new cases that would have occurred if the population of PEI had stayed the same age and size as it was in 1982. The top line (line 3) is the 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 to the aging of the population. Figure 2 is similar to figure 1, but instead of describing new cases, it describes deaths due to cancer.



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 34.4 in 1992 to 40.3 in 2006 and again up to 43.9 in 2016. This can be compared to the median Canadian age of 40.8 in 2011.² In 2016, the proportion of Islanders 65 years of age and older was 18.9% compared to 16.4% 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.

There was a rapid increase in risk (figure 1, line 1) 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 cases attributed to the increasing population increased steadily over time (between lines 1 and 2). The largest increase in cases has been overwhelmingly attributed to the aging population in PEI (between lines 2 and 3). As Islanders continue to live to older ages, health services will need to keep adhere to the pace.

Figure 1: New cancer cases diagnosed annually* in PEI, 1982-2016

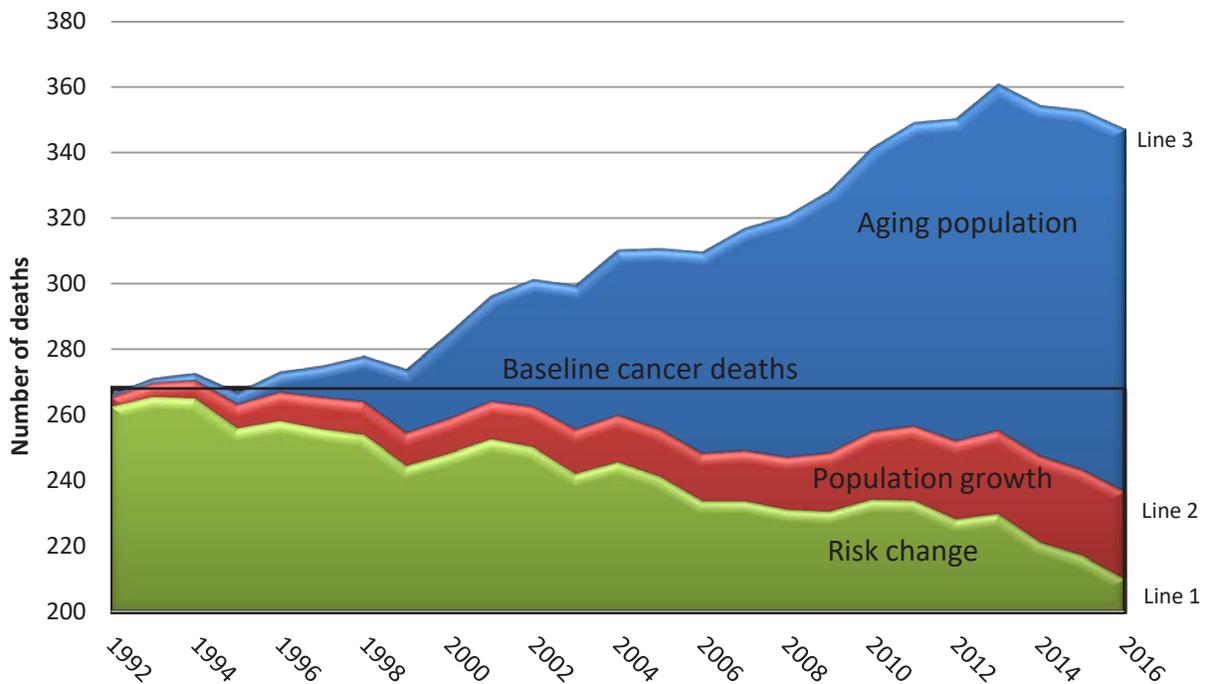


The number of yearly deaths in PEI due to cancer increased by 30% from 268 deaths in 1992 to 347 deaths at the end of the period (figure 2). Similar to the number of new cases in figure 1, the different lines represent the increase or decrease in deaths each year associated with increasing age (line 1), increasing population in PEI (line 2), and the change in risk of death (line 3).

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 (line 1). The number of cancer deaths attributed to the population growth has increased slowly over time (between line 1 and 2). Similar to the new cases, the increase in the number of cancer deaths is mainly attributed to the aging population. The population in PEI has grown rapidly from 130,827 in 1992 to 146,969 in 2016.

Figure 2: Deaths from cancer annually* in PEI, 1992-2016



*5 year rolling average

2.2 Trends in incidence and mortality for all cancers

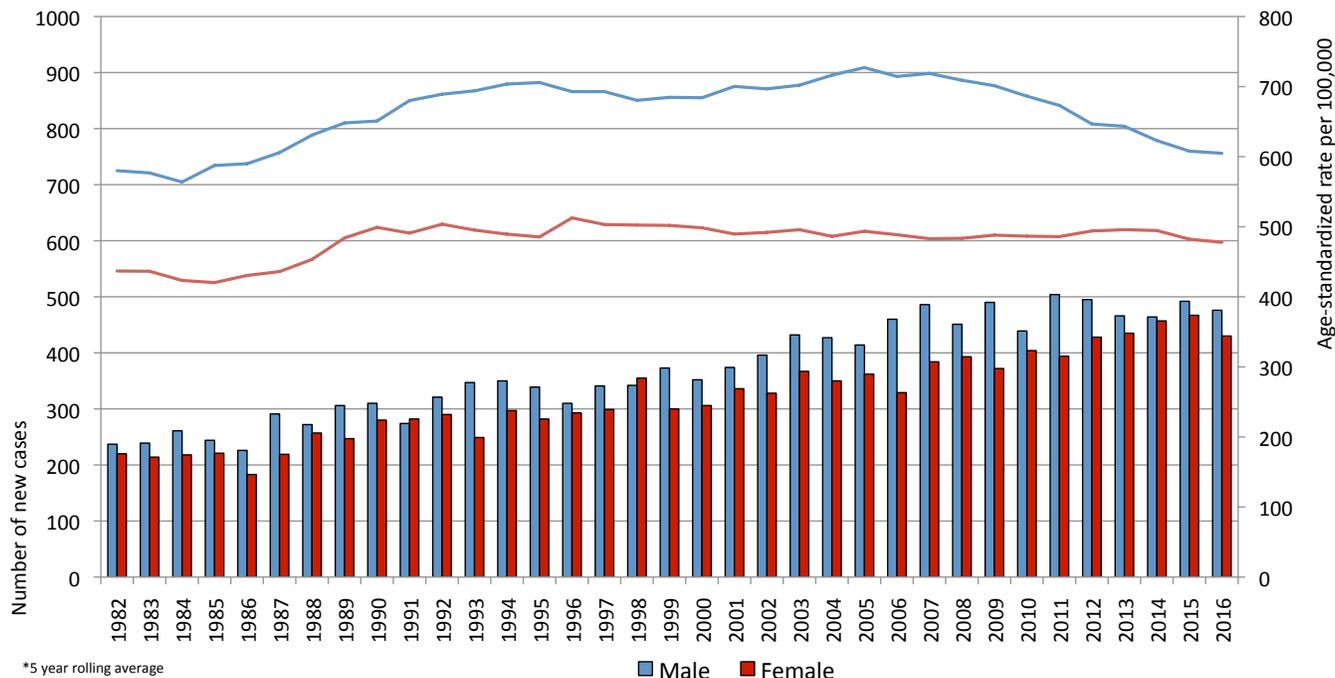
The rate of cancer has increased in both males and females over the past 35 years (1982-2016) (figure 3). The age-standardized rates has been decreasing over the past 10 years; however, the number of new cases continues to climb mostly due to the aging of the population (figure 1). In 2016, there were 476 and 430 new cases of cancer in males and females, respectively.

The age-standardized incidence rate in males increased from 580 new cases per 100,000 Islanders in 1982 to 604 per 100,000 in 2016. Although the cancer rate in males has increased significantly by an average

of 0.9% annually between the years 1982-2007, the rate decreased significantly by 2.5% annually in the last 10 years (2007-2016). The biggest contributor to the decreasing rate is the decline in prostate cancer diagnoses.

The age-standardized rate in females was lower than males. The yearly incidence rate significantly increased an average of 2.2% from 1982 to 1991. After that time, the rate has stabilized to an average yearly decrease of 0.1%.

Figure 3: New cases and age-standardized incidence rates* for males and females in PEI, 1982-2016



*5 year rolling average

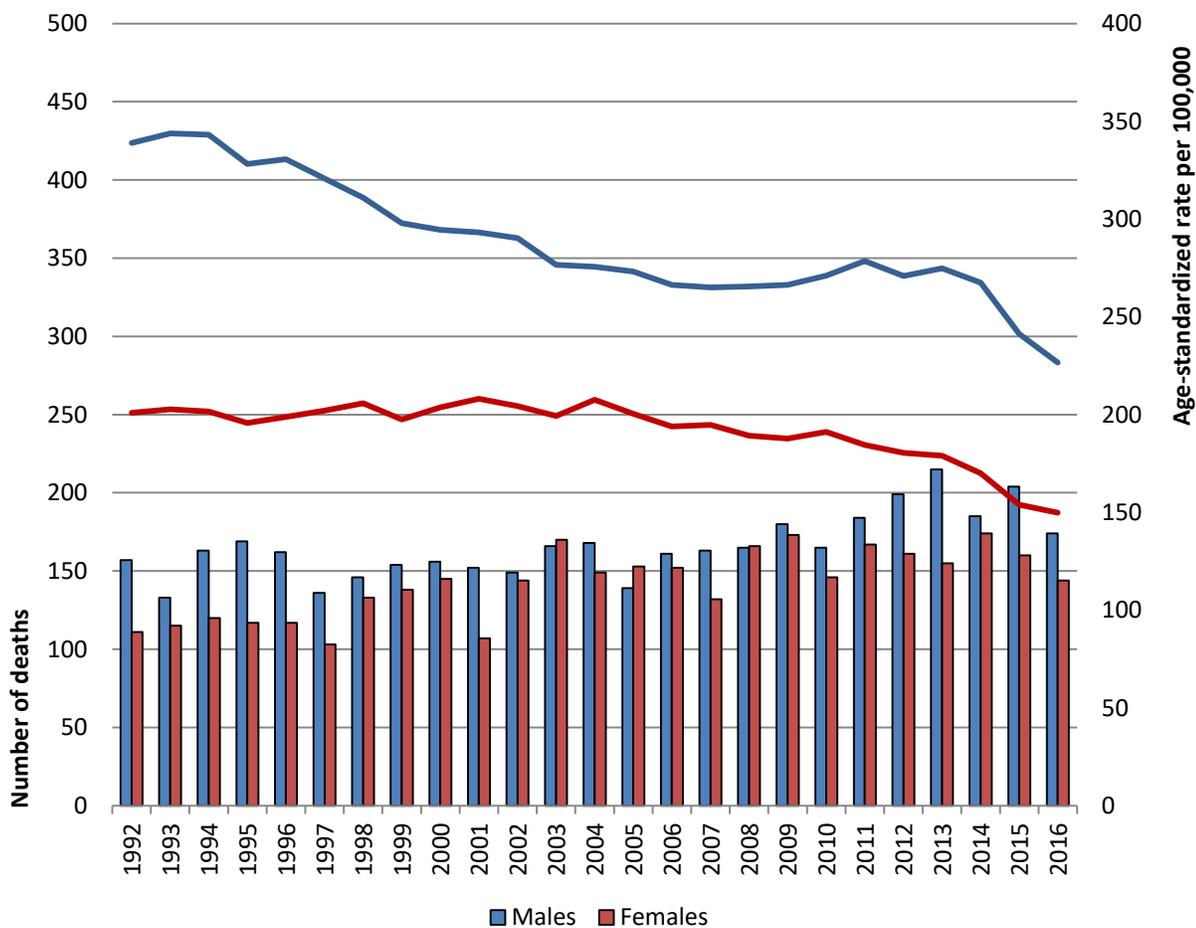
Since 1992, the overall age-standardized mortality rate has been decreasing. However the number of cancer deaths continues to slowly grow mostly due to the increasing age structure of the population (figure 2). In 2016, there were 174 and 144 deaths due to cancer in males and females, respectively (figure 4).

Cancer mortality rates in males have been steadily decreasing and have a significant average yearly

decrease of 1.2% each year. Main contributors to this decrease have been reductions in mortality from prostate, lung, and colorectal cancers.

The mortality rate in females has been significantly decreasing as well by an average of 0.9% per year since 1992. The decreasing cancer mortality rate in females has been influenced by the decreases in deaths due to breast and colorectal cancers.

Figure 4: Deaths and age-standardized mortality rates* for males and females in PEI, 1992-2016



*5 year rolling average

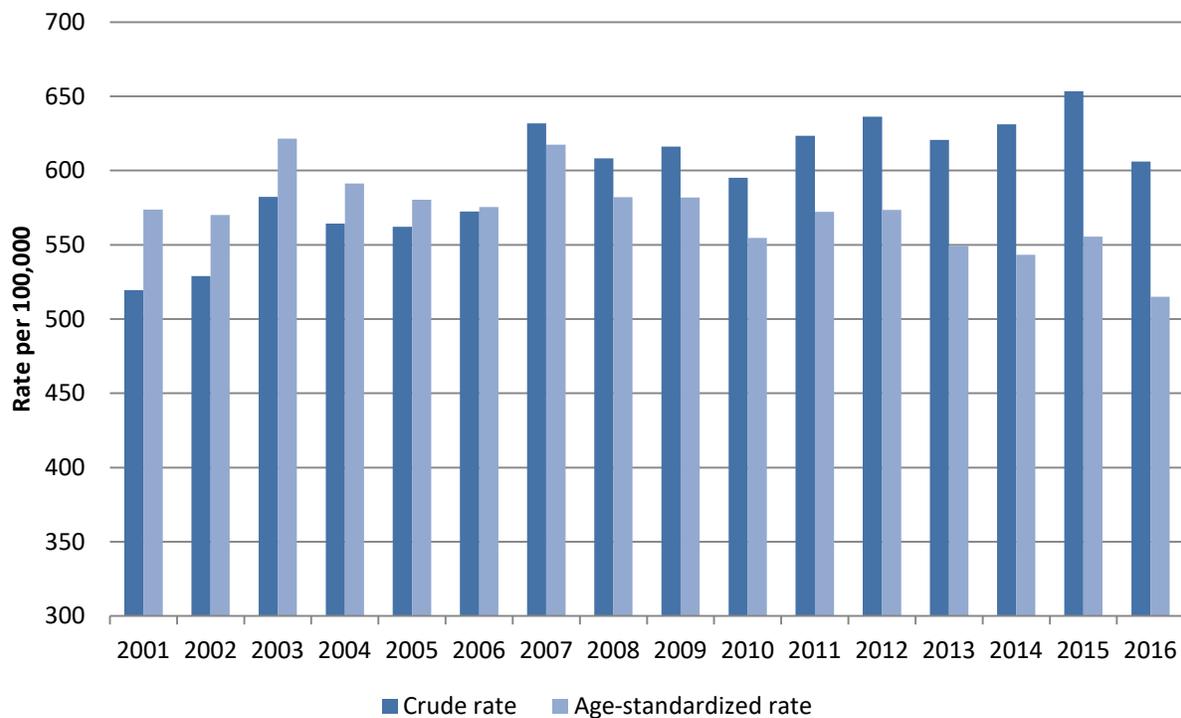
2.3 The burden and risk of cancer in PEI

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.

Age-standardized rates should not be used to allocate funds to cancer prevention, screening, and treatment programs for PEI. Figure 5 displays both the crude (actual rate) and the rate age-standardized to the population of Canada in 2011. 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 and care they need.

Figure 5: Comparison between crude and age-standardized incidence rates in PEI, 2001-2016



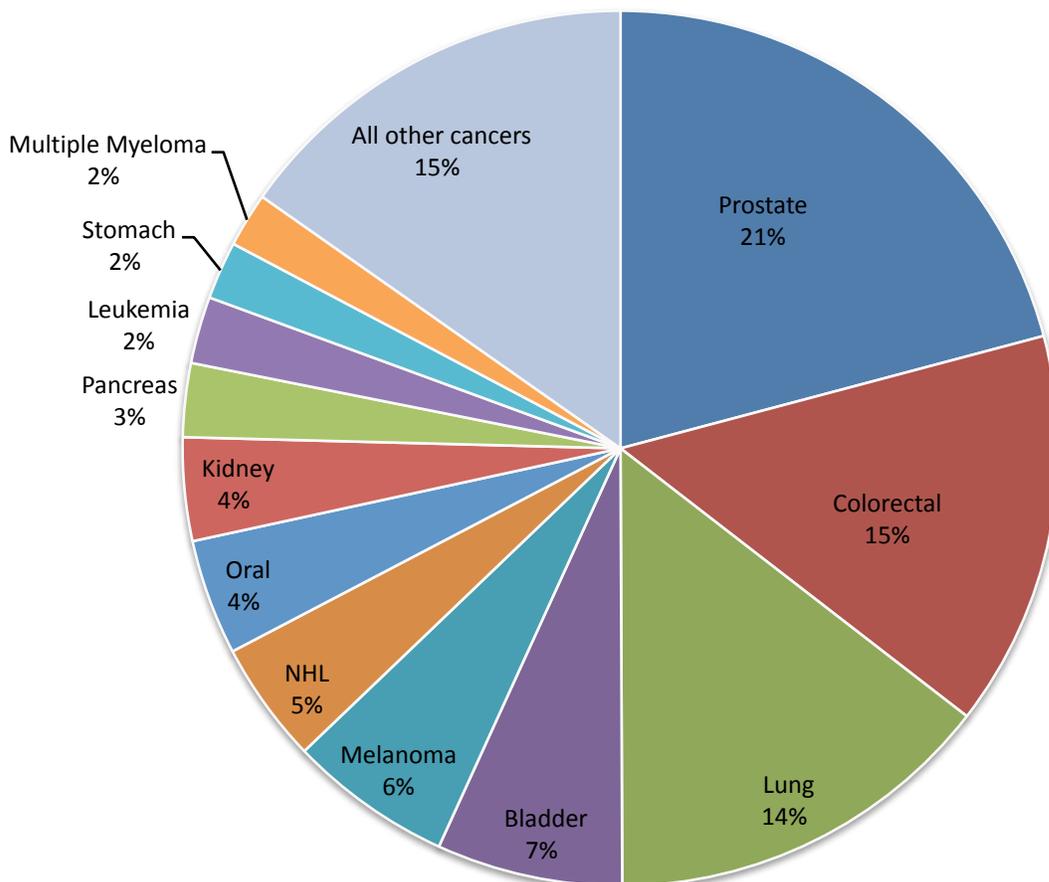
2.4 Most common cancer incidence

Cancer is more common in males than females in PEI. There were 4604 cases of cancer diagnosed during the years 2012-2016 of which 52% were in males and 48% in females. The most common cancers over the past 5 years are lung, colorectal, female breast, and prostate.

For males, 21% of the cancers were prostate cancer (figure 6). Colorectal cancer accounted for 15% while lung cancer accounted for 14% of all diagnosed cancers. Together, these three cancers accounted for 50% of

all cancers in males. The next most common cancers in PEI males were bladder (7%), melanoma (6%), and non-Hodgkin lymphoma (NHL) (5%). The order of the most common cancers in males is similar to the most common cancers in Canada except that there is a higher proportion of melanoma in PEI. In PEI men, melanoma is the 5th most common cancer, while in all Canadian males it is the 7th most common.

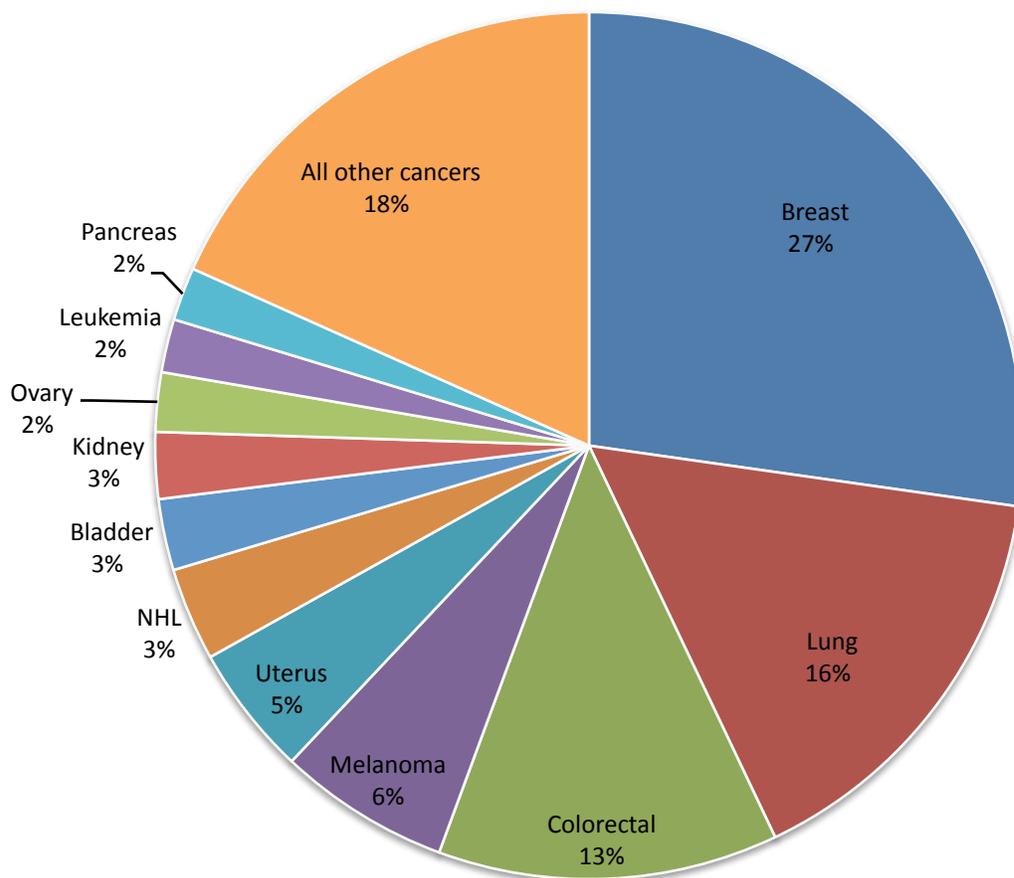
Figure 6: Most common cancer diagnoses, males, PEI, 2012-2016



The most common cancer diagnosed in females in PEI over the last five years is breast (27%), followed by lung (16%) and colorectal (13%) (figure 7). One major difference in PEI females compared with Canadian females is that thyroid cancer is the 5th most commonly

diagnosed cancer in Canadian females at 4% while it is not in the top 10 most commonly diagnosed cancers in PEI (<2%).³ Melanoma is the 4th most commonly diagnosed in females in PEI (6%) compared to 7th in Canada (3%).

Figure 7: Most common cancer diagnoses, females, PEI, 2012-2016



2.5 Most common cancer deaths

Cancer deaths in both male and female Islanders (figures 8 and 9) follow a similar pattern to the Canadian cancer deaths.⁴

Lung cancer is by far the leading cause of cancer deaths in both males and females. Lung cancer is followed by colorectal, prostate, and pancreas in males and breast, colorectal, and pancreas in females.

Figure 8: Most common cancer deaths, males, PEI, 2012-2016

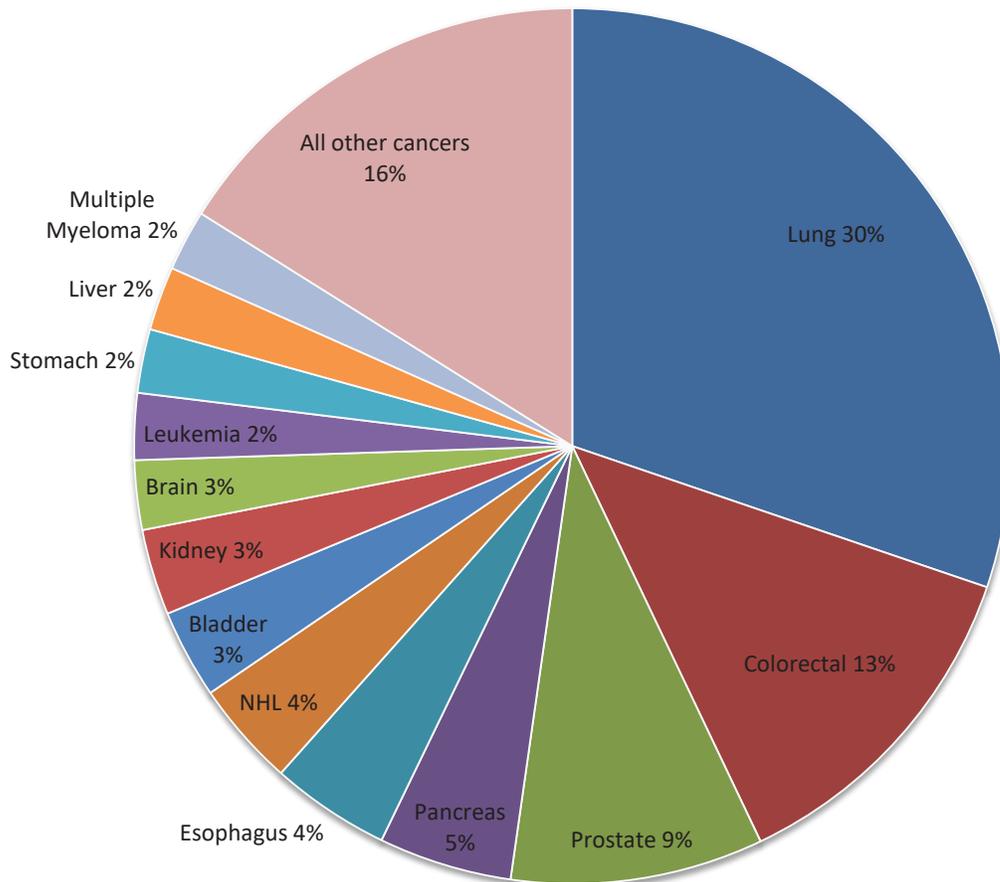
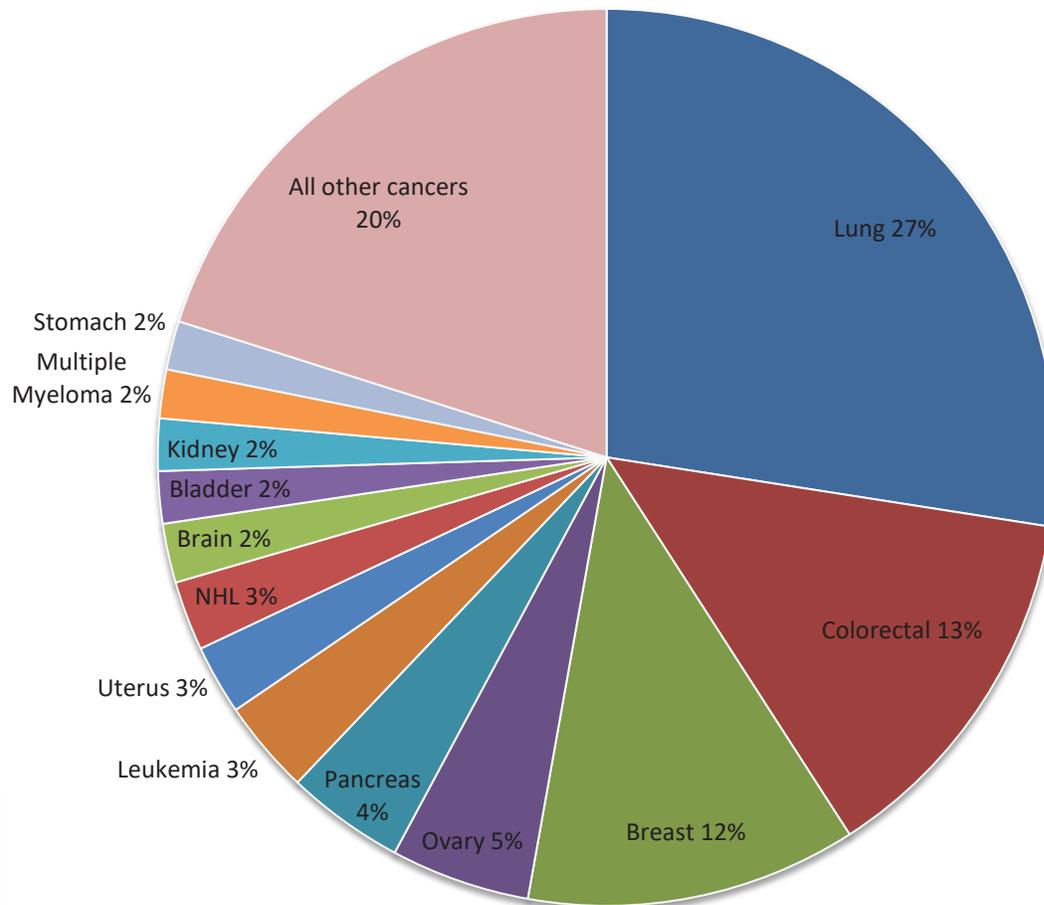


Figure 9: Most common cancer deaths, females, PEI, 2012-2016

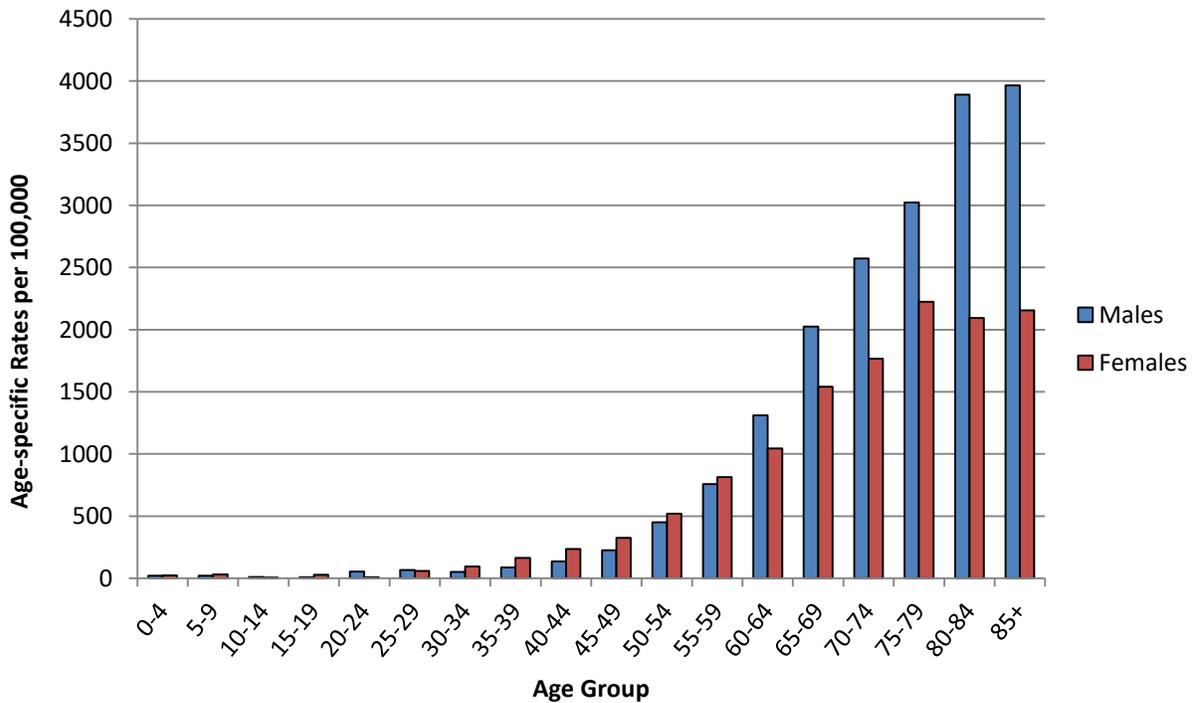


2.6 New cases and deaths by age

The rates of cancer and cancer deaths increase as people age (figure 10), and PEI has an older population. Although people 50 years of age and older account for 40% of the population in PEI, 92% of all cancers diagnosed and 97% of cancer deaths between 2012 and 2016 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 70-74 years for both PEI and Canada.^{5,6}

Females have a higher incidence rate than males until after 60 years of age when the rates switch and males have a higher incidence rate (figure 8). The higher rate in females less than 60 years of age is related to rates associated with cancer in females including breast, and uterine cancers. The rapid increase in male cancers after 60 years old is related to increases of prostate, colorectal, and non-Hodgkin's lymphoma.

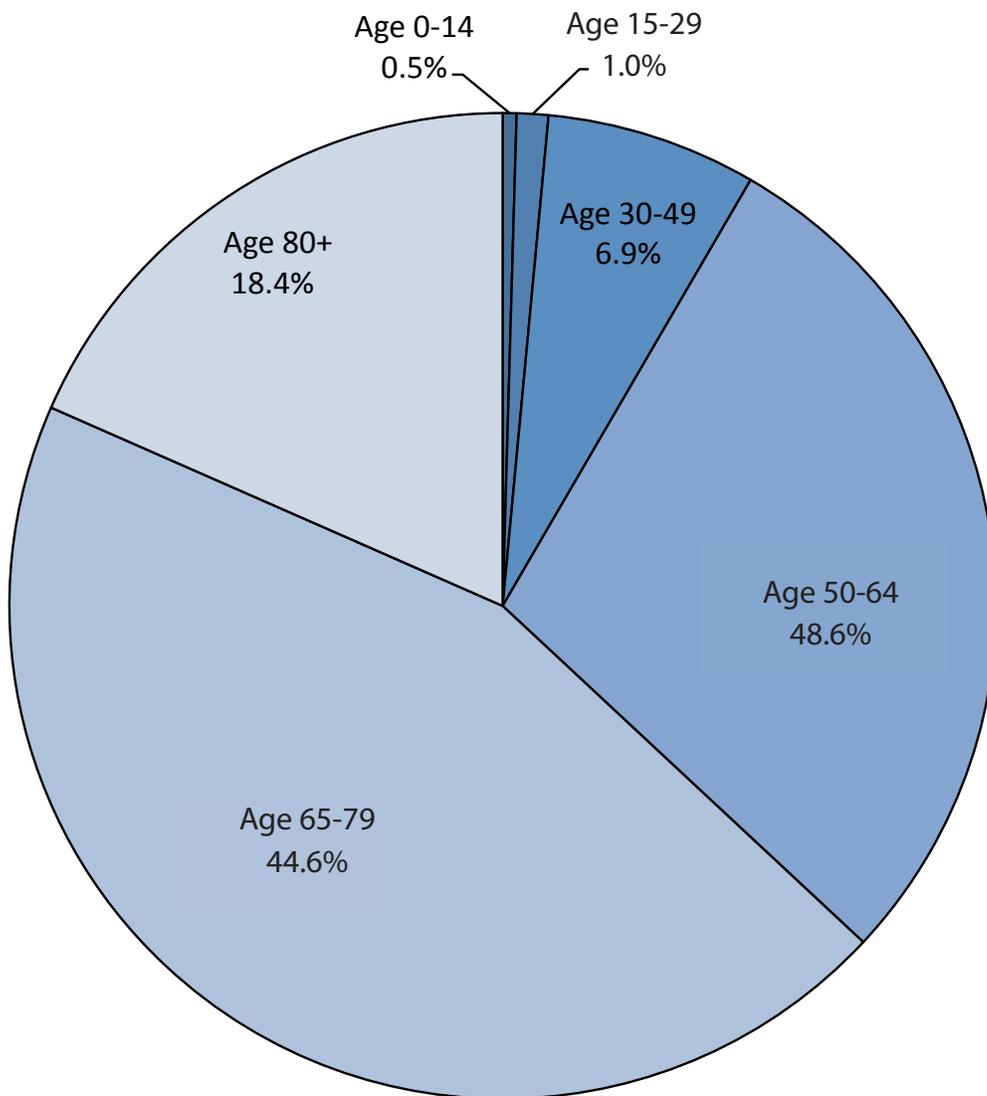
Figure 10: Incidence rates for all cancers by 5-year age groups and sex, PEI, 2012-2016



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 11). The proportion

of cancer in older adults (65+) is 63% of all cancers diagnosed in PEI.

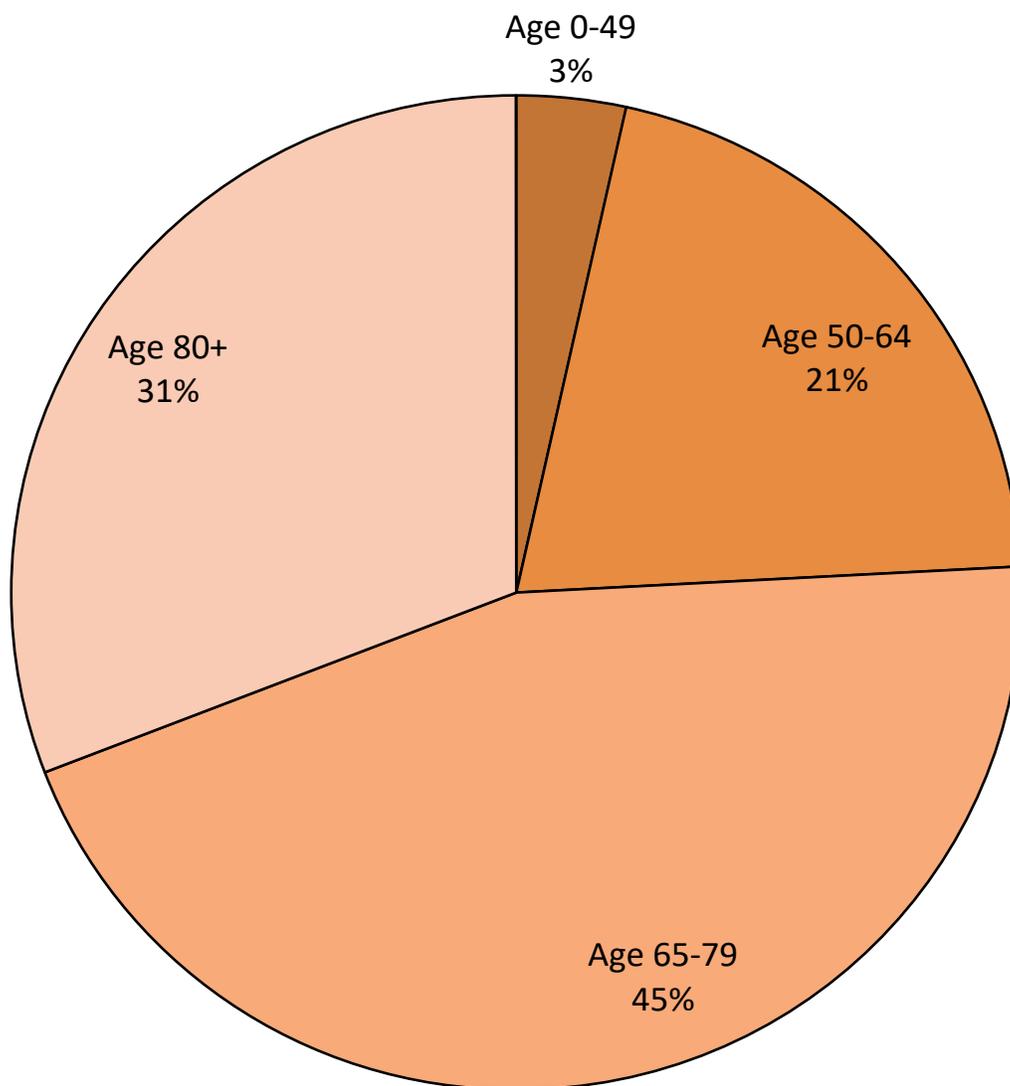
Figure 11: Cancer cases by age group, PEI, 2012-2016



The proportion of cancer deaths in children and young adults combined (0-29 years old) is less than 0.5% of all cancers deaths in PEI (figure 12). The proportion of

cancer deaths in older adults (65+) is 76% of all cancers diagnosed in PEI.

Figure 12: Cancer deaths by age group, PEI, 2012-2016



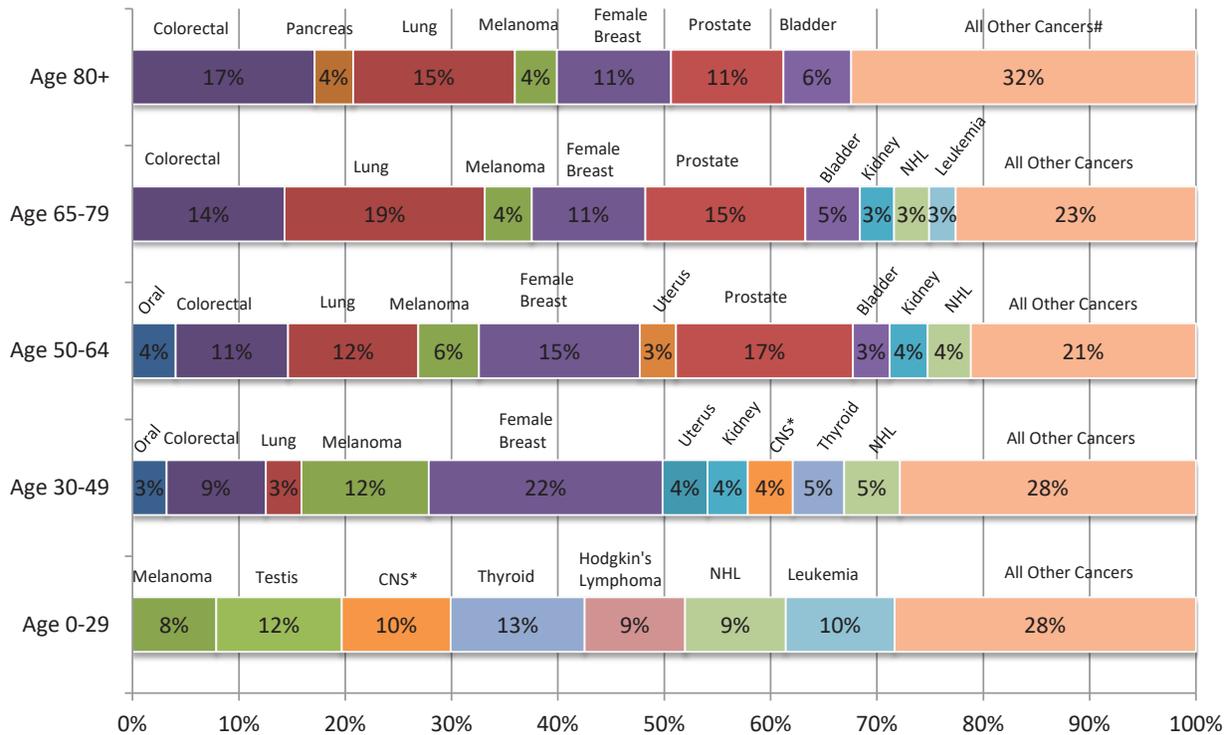
To identify which types of cancer are the most common by age group, data from 2007-2016 were combined (figure 13). For the youngest age group (0-29), lymphoma (both NHL and Hodgkin lymphoma) is the most common. Dividing this age group into two smaller groups, the most common cancer in children (0-14 years old) is leukemia while the most common cancers in young adults (15-29 years old) are lymphoma, testis, and thyroid.

As people grow older, the most common cancer types change. By 30-49 years of age, breast cancer in females becomes the most common cancer. Melanoma, thyroid,

and lymphoma (non-Hodgkin lymphoma) continue to be common cancers, but colorectal is increasingly becoming a common cancer in this age group. Because colorectal cancer is more common in older adults, delays in younger adult patients seeking care or delays in testing by physicians may result in a later stage at diagnosis.⁷

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

Figure 13: Most common cancer diagnoses by age groups, PEI, 2007-2016



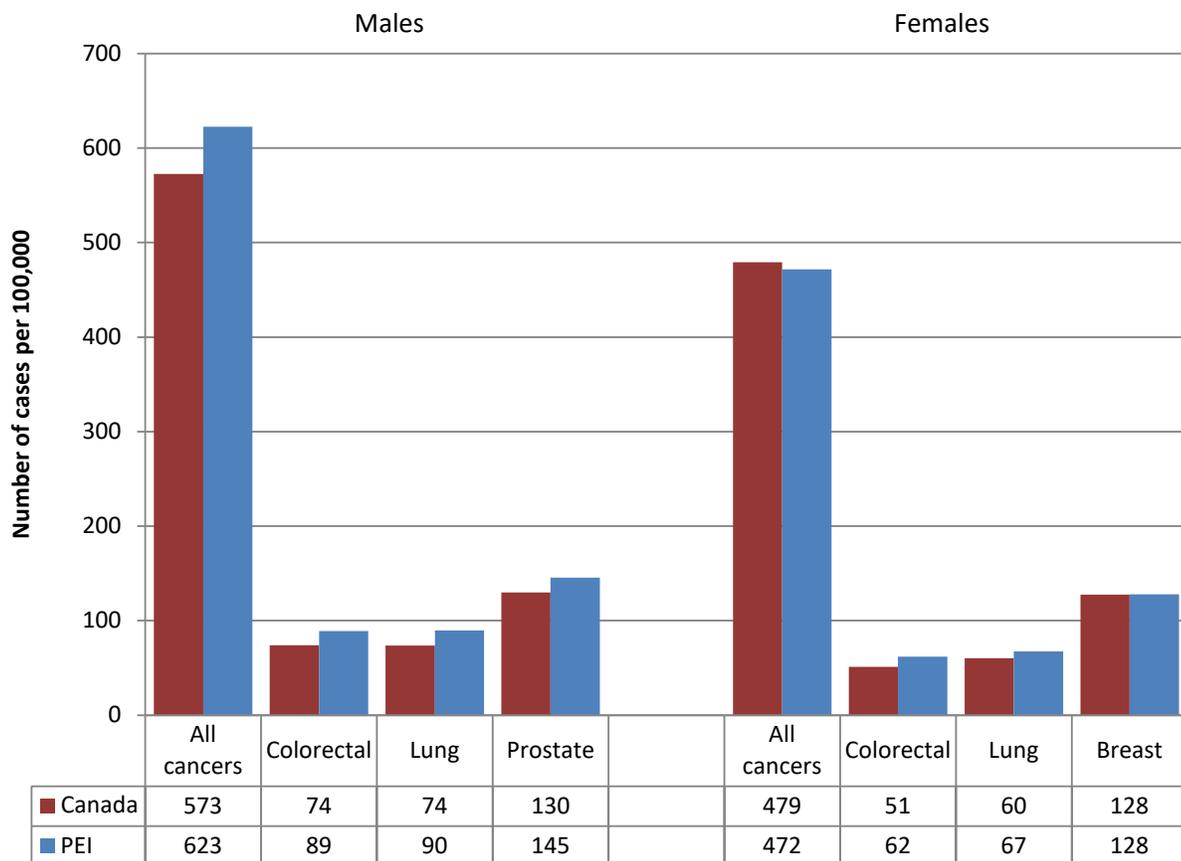
*Central Nervous System (CNS) consists of both brain and central nervous system
 #Other cancers are the total of all other cancers not identified in each age group

2.7 PEI cancer incidence rates compared to Canadian rates

Statistics Canada collects cancer registry data from all of the provinces and territories.⁵ 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 can be attributed to multiple factors such as differences in the prevalence of risk factors and uptake of screening testing within a province.⁴ 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.

Because of the variation from year to year, the last five years of available data (2010-2015) were averaged to show the differences between incidence rates in Canada and in PEI.⁵ Although not significantly different for each of the five years, the cancer rates in PEI males tend to be higher than the incidence rate in Canadian males. This is true for the most common cancers in males. The overall cancer incidence rate and those of the most common cancers in females tend to be similar for females in PEI and Canada. However, lung cancer in PEI females has recently increased and is significantly higher in the years 2014 and 2015 (data not shown) compared to the Canadian rates for those two years.⁵

Figure 14: Average age-standardized incidence rates for cancers in Canada and PEI, by sex, 2011-2015



Prevalence

3.1 Prevalence of the most common cancers in PEI

The ten-year prevalence of cancer is the proportion of Islanders diagnosed from 2007 through 2016 who are still alive on January 1, 2017. 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.

The ten-year prevalence for all cancers in PEI is 2.78% indicating that more than 1 in 36 Islanders are living with a diagnosis of cancer in the 10-year period. The prevalence is higher in males (2.92%) than in females (2.64%) reflecting the higher incidence of cancer in

males than females. In particular, the high incidence and survival of prostate cancer in Island males contributes to the higher prevalence of cancer in males. In the past 10 years, 1 in every 77 males in PEI has been diagnosed with prostate cancer. Given the high incidence of breast cancer in Island females, it is the most prevalent cancer for this group. In the past 10 years, 1 in every 83 females in PEI has been diagnosed with breast cancer. More females are living with lung cancer than males. In the past three years, more females (240) than males (207) have been diagnosed with lung cancer on PEI, accounting for this higher prevalence. In addition, the survival for lung cancer is higher in females than in males.

Table 1: Ten-year prevalence, most common cancers, PEI, January 1, 2017

	Both sexes		Male		Female	
	%	count	%	count	%	count
All cancers	2.78	4191	2.92	2153	2.64	2038
Colon and rectum	0.42	639	0.48	352	0.37	287
Lung	0.17	263	0.14	103	0.21	160
Prostate			1.30	958		
Breast					1.12	862

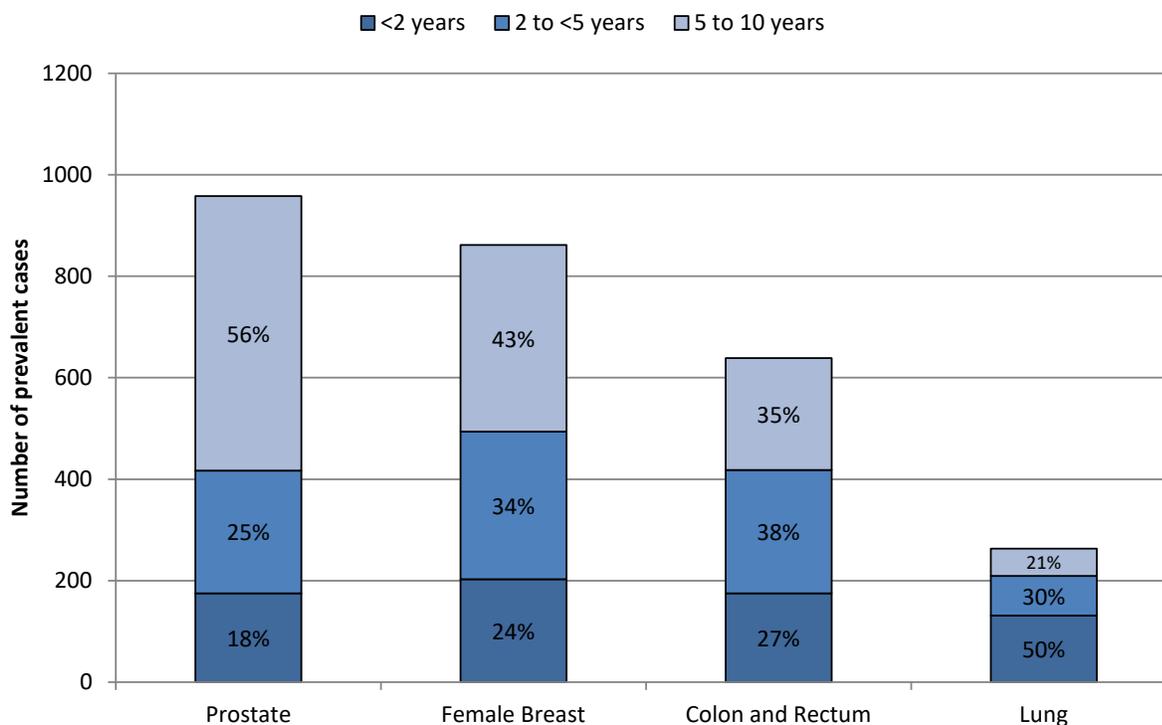
January 1, 2017, 10-year limited duration prevalence
Populations were estimated by averaging 2016 and 2017 populations

3.2 Prevalence of the most common cancers by time since diagnosis

The number of people living with cancer can be partitioned into the times 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 two years encompasses the time after diagnosis, treatment, and treatment recovery. Years 2 through 5 are the intermediate years in which follow-up care is high. After 5 years, the greater part of care adjusts to the needs of a survivor with monitoring.³

Prevalence during the first 5 years post-diagnosis is higher than the second 5 years (figure 15) except for prostate cancer. In recent years, the incidence of prostate cancer has declined resulting in a lower proportion of prostate patients in the period <5 years since diagnosis. The proportion of lung cancer prevalence in the first two years 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.

Figure 15: Prevalence of most common cancers by time since diagnosis on January 1, 2017, PEI



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 is often referred to as net survival. 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 female with breast cancer is 89% indicating that a woman

diagnosed with cancer has on average an 89% likelihood of surviving 5 years compared to females 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 research⁸

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



The 5-year RSR for males and females (≥ 15 years of age) combined was 62% for all cancers diagnosed in 2012-2016. Compared to Islanders without cancer, the probability of surviving 5 years after diagnosis is reduced by almost 38%. Figure 16 describes the difference in 5-year RSR for the most common cancers in PEI males and females. The 5-year RSR for all cancers combined in males was 59% for 2012-2016. The highest relative survivals for the most common cancers were seen in

prostate (93%), melanoma (83%), and bladder (73%) cancers, while the lowest survival was seen in lung (8%) and pancreatic (10%) cancers. Females had a 5-year RSR of 65% for all cancers diagnosed in the same period. For the most common cancers, the survival rates were highest for melanoma (94%), breast (89%), and uterine (84%) cancers. The lowest rates in females were for lung (21%) and pancreatic (12%) cancers.

Figure 16: The 5-year relative survival ratios for the most common cancers, males and females, PEI, 2012-2016

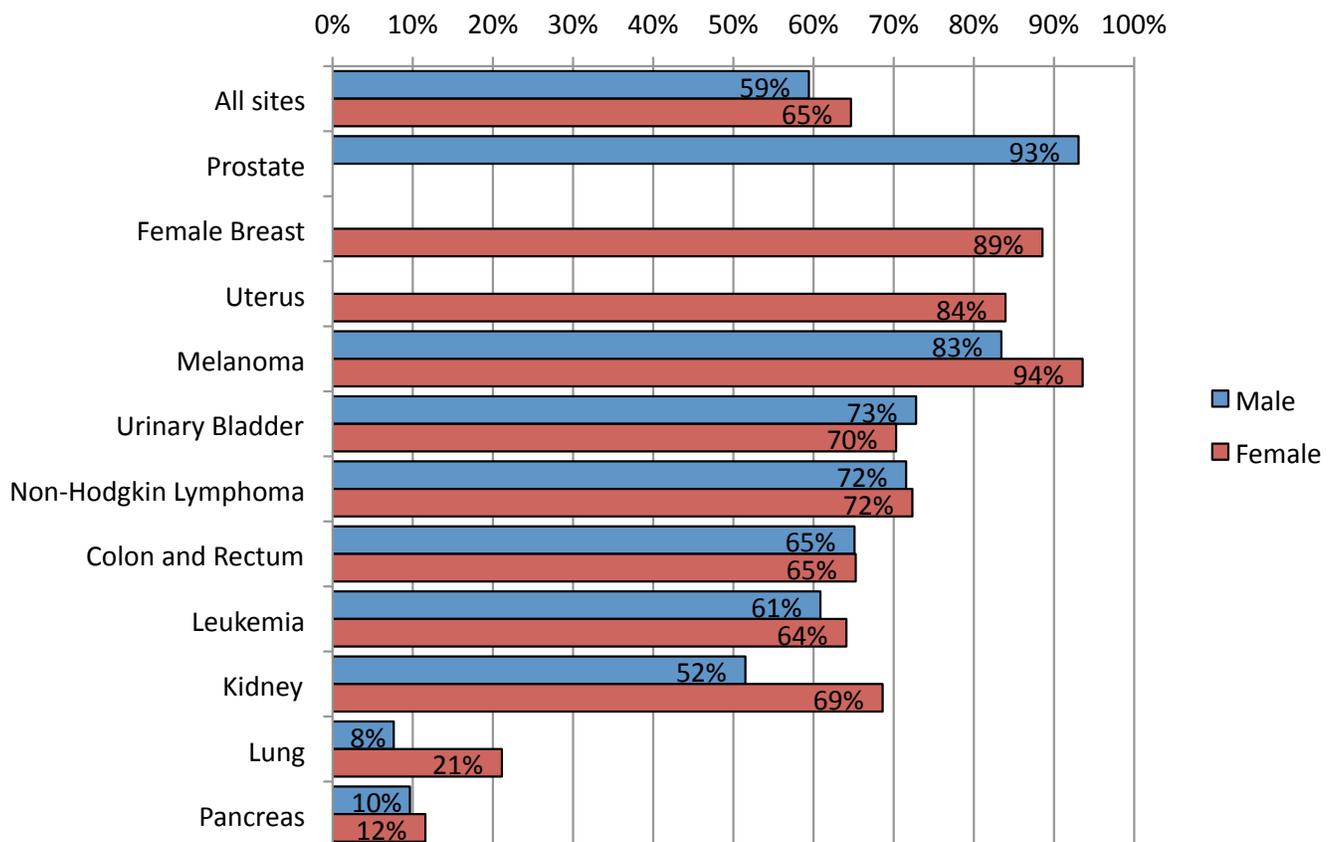


Figure 17 illustrates the change in RSR in females for the most common cancers each year after diagnosis. For most cancers in females, there are steep declines in survival 1 year after diagnosis, after which the relative survival declines more slowly. This indicates the risk

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 17: Yearly relative survival ratios for the most common cancers, females, PEI, 2012-2016

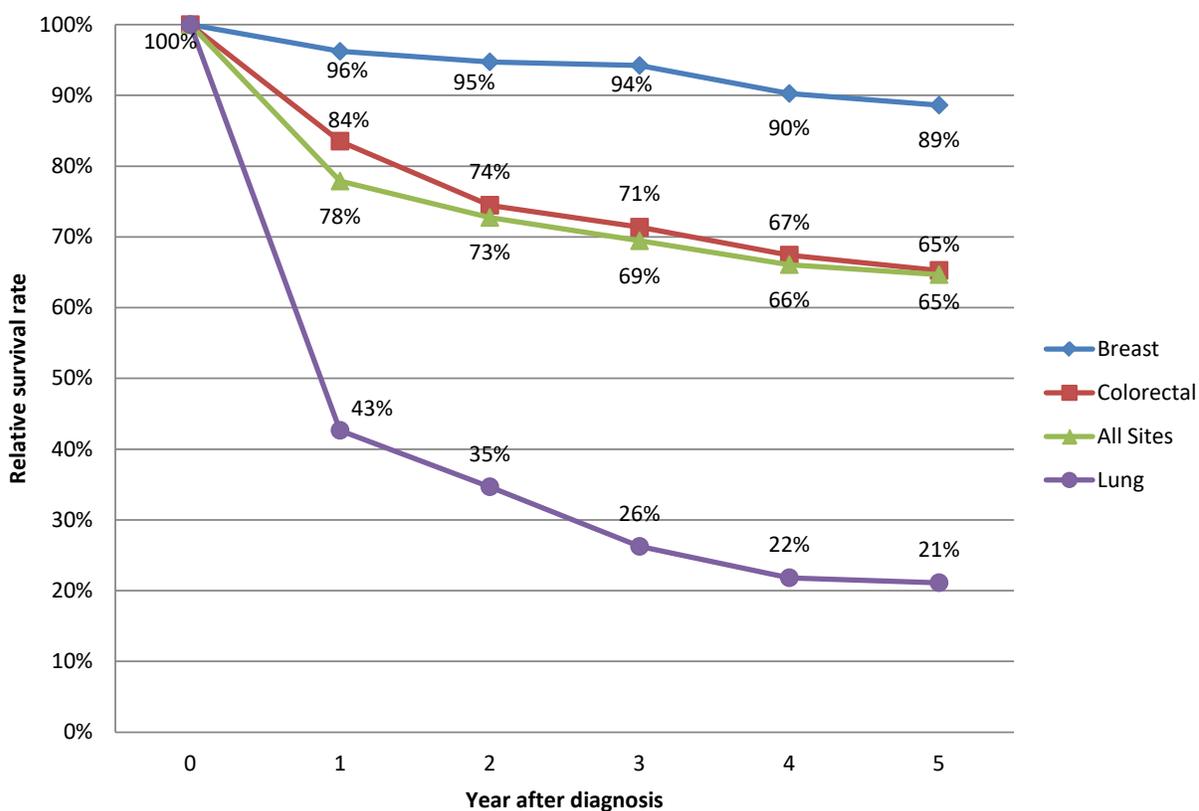
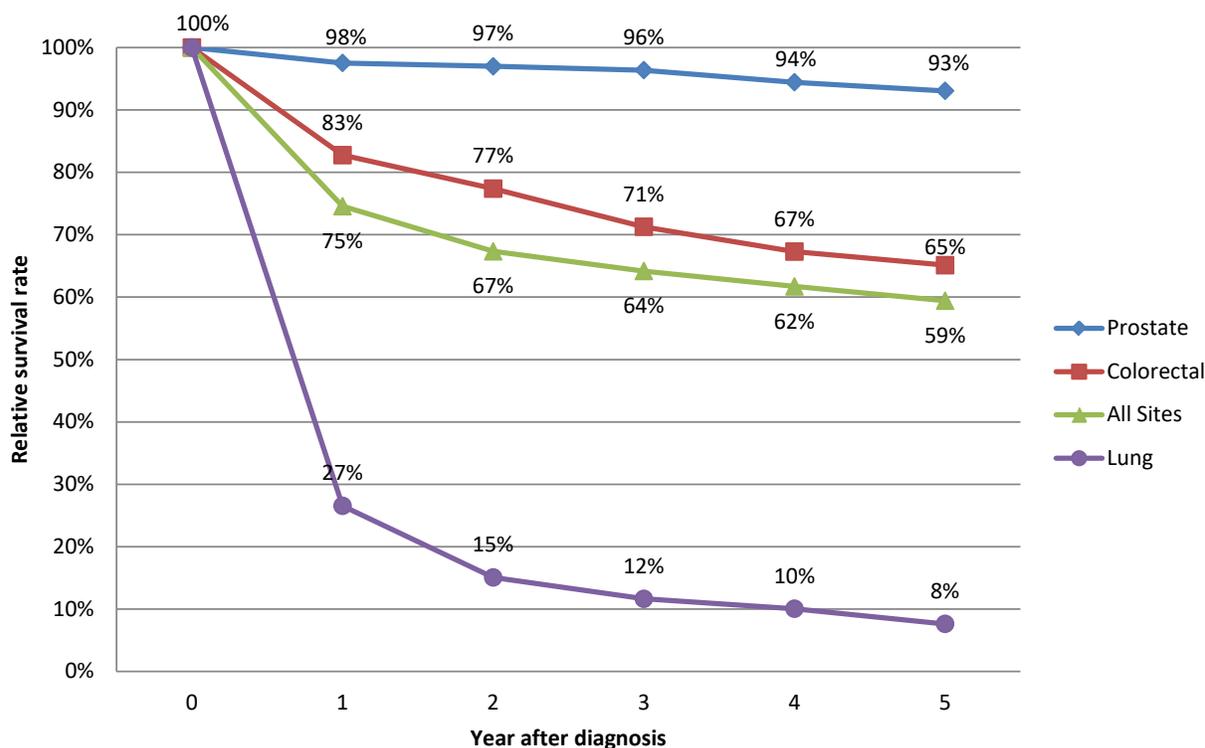


Figure 18 illustrates the change in RSR in males for the most common cancers each year after diagnosis. The RSR in PEI males follow a similar pattern as the females with a rapid drop in survival in the first year after diagnosis and then a slower decline in survival after the first year. One exception is prostate cancer which has a high 5-year RSR. Prostate cancer survival in PEI has a linear decline indicating the risk of dying does not diminish after the first year.

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.⁹ 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. The colorectal screening program is investing in increasing participation in PEI. Screening programs and treatment indicators are continually evaluated by Canadian Partnership Against Cancer in their System Performance Reports.¹⁰

Figure 18: Yearly relative survival ratios for the most common cancers, males, PEI, 2012-2016

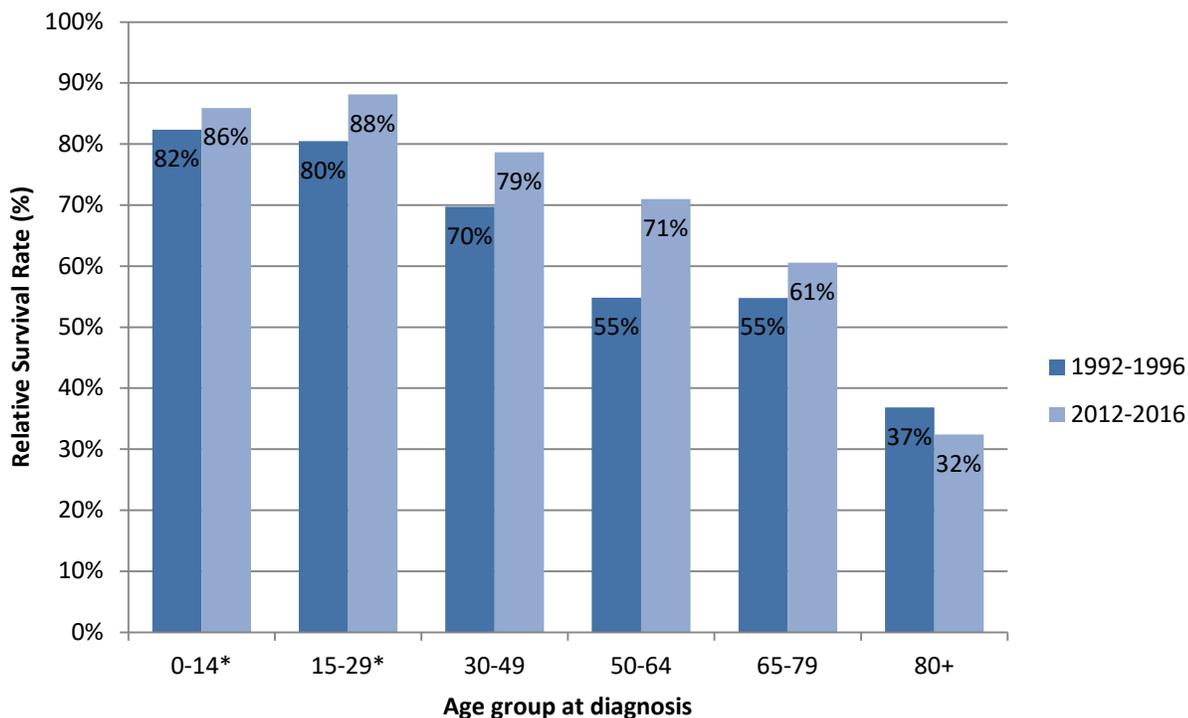


4.2 Five-year relative survival for different age groups

The 5-year relative survival has improved from the years 1992-1996 to the years 2012-2016 for all except the oldest age group (80+) (figure 19). The highest survival is seen in the age groups 0-14 and 15-29. 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 due to a larger proportion in lung, colorectal, and pancreas cancers.

Figure 19: 5-Year Relative Survival Ratio for All Cancers, by Age Group, PEI, 1992-1996 and 2012-2016



*observed survival is used instead of RSR as there are few mortalities seen in these age groups.

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) is the average percent change in rate between each year over a time period and is a statistical assessment of the trend. Many

trends can be described by one APC in the period. Other cancer trends may be more complicated and described using multiple APC's over multiple periods.

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

Cancer	Incidence				Mortality					
	Males		Females		Males		Females			
	Period	APC	Period	APC	Period	APC	Period	APC		
All cancers	1982-2007	0.9	↑	1982-1991	2.2	↑	1992-2016	-1.2	↓	
	2007-2016	-2.5	↓	1991-2016	-0.1	↓				
Colorectal	1982-2016	0.1	↑	1982-1996	1.7	↑	1992-2016	-1.4	↓	
				1996-2016	-2	↓	1992-2016	-2.1	↓	
Lung	1982-2016	-1.2	↓	1982-1990	18	↑	1992-2016	-1.8	↓	
				1990-2016	0.2	↑	1992-2016	-0.4	↓	
Bladder	1982-2016	0.7	↑	1982-2016	0.7	↑	1992-2016	1.4	↑	
Melanoma	1982-2016	4.4	↑	1982-2016	3.5	↑	1992-2016	1.2	↑	
NHL [#]	1982-2016	1.4	↑	1982-2016	0.7	↑	1992-2016	-0.9	↓	
Kidney	1982-2016	1	↑	1982-2016	1.8	↑	1992-2016	-2	↓	
Leukemia	1982-2005	1.8	↑	1982-2016	-0.3	↓	1992-2016	0.2	↑	
	2005-2016	-5.7	↓				1992-2016	2.1	↑	
Pancreas	1982-2016	-0.8	↓	1982-2016	-1.3	↓	1992-2016	-1.1	↓	
Oral*	1982-2004	-4.3	↓	1982-2016	0.2	↑	1992-2016	-2.2	↓	
	2004-2016	5.5	↑							
Stomach	1982-2016	-2.4	↓				1992-2016	-3.1	↓	
Multiple Myeloma	1982-2016	1.6	↑	1982-2016	-0.8	↓	1992-2016	-0.5	↓	
Brain	1982-2016	0.6	↑	1982-2016	-0.3	↓	1992-2016	3.5	↑	
Thyroid				1982-2016	2.1	↑				
Breast				1982-2016	0.1	↑		1992-2016	-2.1	↓
Uterus				1982-2016	-0.3	↓		1992-2016	-1	↓
Ovary				1982-2016	-1.3	↓		1992-2016	-0.2	↓
Cervix				1982-1984	-38.5	↓				
				1984-2016	-1.1	↓				
Prostate*	1982-2007	3	↑				1992-2016	-3.2	↓	
	2007-2016	-9.5	↓							

[#]Non-Hodgkin Lymphoma

* for simplification, average APC for mortality was presented rather than multiple periods

Missing data is due to either too few cases or highly erratic data (gray) or sex specific cancer (green)

Bold indicates significantly different (P<0.05) from 0

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

Detailed statistics on breast cancer, colorectal cancer, and lung cancer in PEI can be found in recent reports found at <https://www.princeedwardisland.ca/en/information/health-pe/cancer-research-and-surveillance>.

Female Breast

Breast cancer is the most commonly diagnosed cancer in females with 27% of cancers diagnosed in Island females between 2012 and 2016 (figure 7). For the years of 2014-2016, the average annual age-standardized incidence of breast cancer in Island females was 128 cases in 100,000 females. The overall incidence rate of breast cancer has not changed significantly since 1982 (table 3). There were a few peaks in the last 30 years (figure 21). 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 females in PEI in 1998. There was also a peak in 2010 when the screening program changed from analog mammography to digital mammography allowing for a large increase in the number of screening females. For the years 2014-2016, PEI did not have a significantly different incidence rate than Canada.⁵ On average, just over 110 females are diagnosed each year with breast cancer in PEI

The age-standardized mortality rate for breast cancer in females has significantly decreased by 2.1% each year since 1992 (table 3). At the same time, breast cancer mortality rates in Canadian females have been decreasing. The PEI rates were similar to Canadian rates in the early 2000s but have diverged recently with PEI rates more rapidly decreasing than Canadian rates.¹⁶

Prostate

Approximately 21% of all cancers diagnosed in males during the period 2012-2016 were prostate cancers (figure 6). This has been changing over the years, since prostate cancer was the most common cancer in PEI and Canada¹¹ with 30% of cancers diagnosed in Island males between 2005-2009 being prostate cancer.¹² The age-standardized incidence of prostate cancer increased rapidly from 1982 peaking in 1994 with 275 new cases per 100,000 males (figure 20). 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 258 cases per 100,000 possibly due to changing the way prostates were biopsied.¹⁴ After this increase, the rate stabilized but then rapidly decreased recently with an average percent decrease of 9.5% each year (table 3). After 1992, the rate of mortality has been significantly decreasing by an average of 3.2% each year likely from early detection and improved treatments (figure 22).

The overall benefit for the use of PSA as a screening tool is still under debate.^{14,15} 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 over diagnosis, overtreatment, and reduced quality of life due to tumors that may not have been a problem in a patient's lifetime.

Lung

Island males and females have different patterns of age-standardized incidence and mortality rates for lung cancer. The age-standardized incidence in males has decreased significantly by 1.2% per year since 1982 (figure 20). In 2016, the age-standardized incidence rate for lung cancer in males was 86 new cases per 100,000 males. Although not significant, the age-standardized lung cancer mortality rate has been decreasing steadily since 1992 by an average of 1.8% each year (figure 22). The mortality rate in 1992 was 108 lung cancer deaths in 100,000 males while in 2016 the rate was 60 deaths in 100,000 males.

The incidence rate for lung cancer in Island females increased rapidly from 1982 to 1990 with an average increase of 18% each year. This increase is significant and represents an incidence rate that increased from 22 new cases per 100,000 females in 1982 to a peak of 81 new cases per 100,000 in 1990 (figure 21). Since that time, the incidence rate has stabilized. The rate was 75 new cases per 100,000 in 2016.

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 females. The mortality rate has remained stable since 1992 (figure 23). The age-standardized mortality rate in females was 35 lung cancer deaths in 100,000 females in 2016. The Canadian Cancer Society reports one main reason Canadian females have not had significant reductions in lung cancer incidence and mortality rates compared with Canadian males is that the rate of smoking in males began to decrease in the mid 1960s while the rate of smoking in females began to decrease much later in the mid 1980s.¹⁷

Colon and Rectum

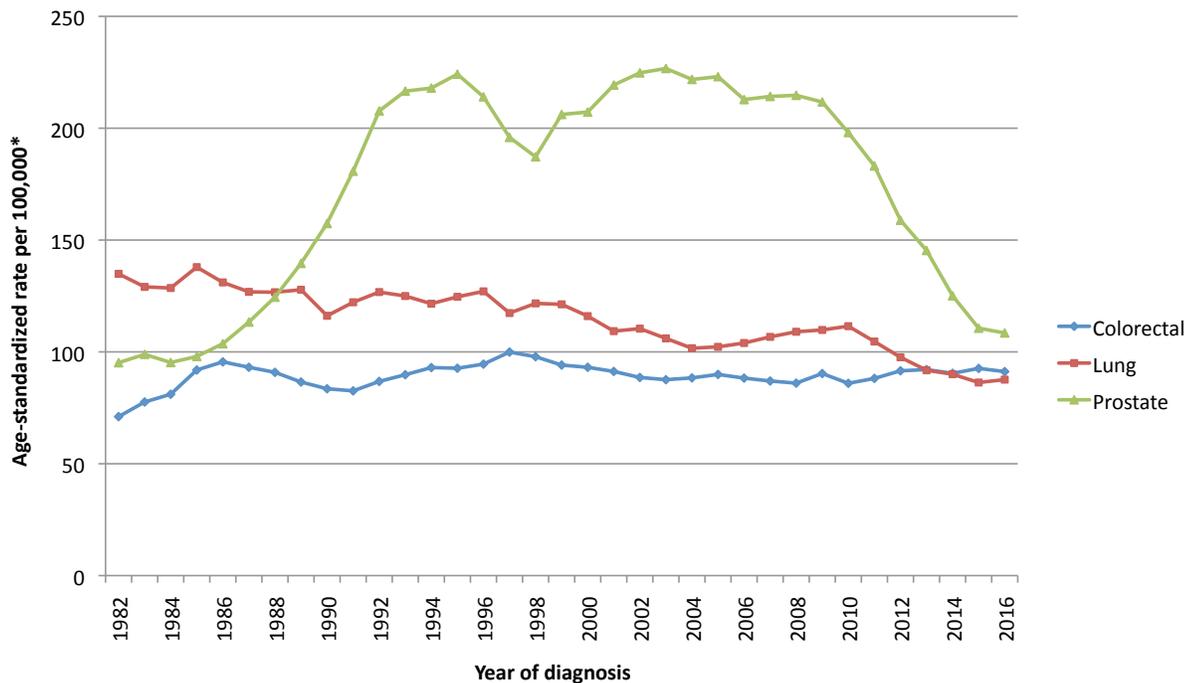
Colorectal cancer (CRC) is the second most commonly diagnosed cancer in Canada and PEI. Recent reports show the incidence of CRC in North America has been decreasing for the last two decades except those younger than 50 years old.^{17,18,19} In addition, the mortality due to CRC has been decreasing in the last two decades, but it is still the second most common cause of cancer mortality in PEI (figures 8 and 9) and Canada.²⁰ The incidence rate has remained stable since 1982 in males while the mortality rate has significantly decreased by an average of 1.4% each year since 1992 (figures 20 and 22). For PEI males in 2016, the incidence and mortality rates were 88 per 100,000 males and 31 per 100,000 males, respectively.

In 1996, the incidence rate began decreasing significantly by 2% each year in PEI females. The mortality rate has been significantly decreasing by an average of 2.1% per year (figures 21 and 23). For PEI females in 2016, the incidence and mortality rates were 47 per 100,000 females and 15 per 100,000 females, respectively.

Although the CRC rates are decreasing in PEI, there is a difference by age group. All Islanders greater than or equal to 50 years old have a decreasing rate of CRC while those less than 50 years of age have an increasing trend in new cases (data not shown). The increasing rates in young adults may be associated with increased time and exposure of risk factors for CRC including obesity, red meat consumption, processed meat consumption, physical inactivity, diabetes mellitus type 2, alcohol consumption, smoking, and low fruit and vegetable consumption.^{7,18,19} Because the rate of CRC in younger adults has been increasing, the best age at which to start screening may be debated.

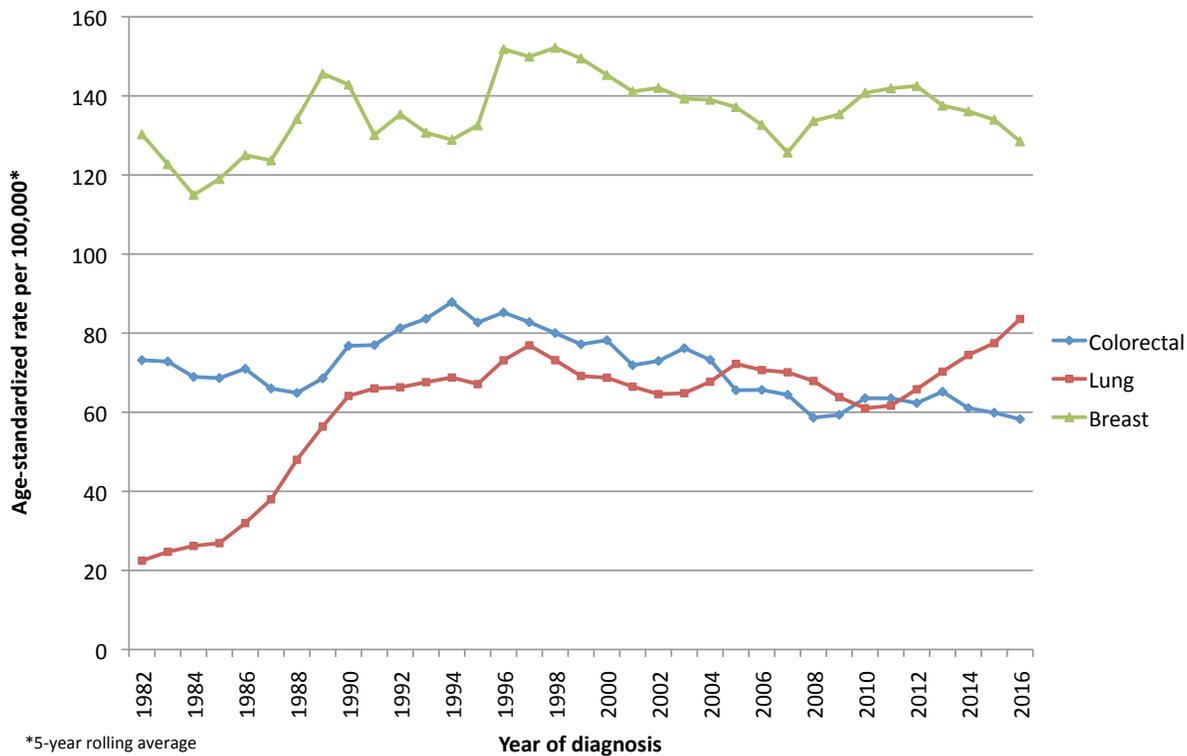
In 2009 and 2010, the PEI government introduced Phase I and Phase II of a pilot colorectal screening program based on the Fecal Occult Blood Test (FOBT). In 2011, the screening program was expanded Island-wide for all Islanders 50 to 75 years of age. Eligible PEI residents continue to have low rates of fecal test screening. In the two year period 2013-2014, the screening participation rate was 20% of eligible Islanders {PEI sys per report}. 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 20: Incidence trends for the most common cancers, males, PEI, 1982-2016



*5-year rolling average

Figure 21: Incidence trends for the most common cancers, females, PEI, 1982-2016



*5-year rolling average

Figure 22: Mortality trends for most common cancers, males, PEI, 1992-2009

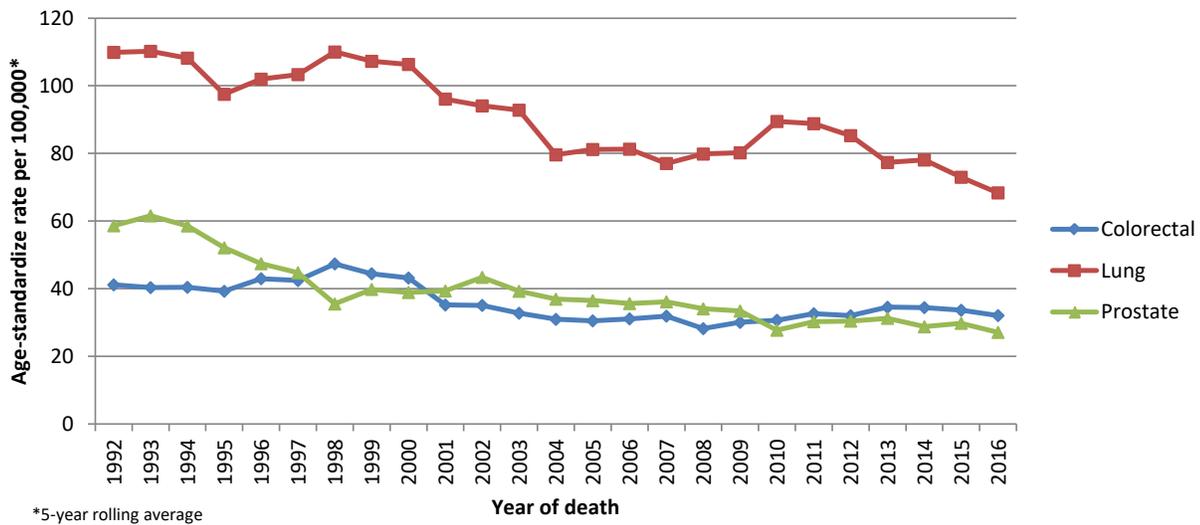
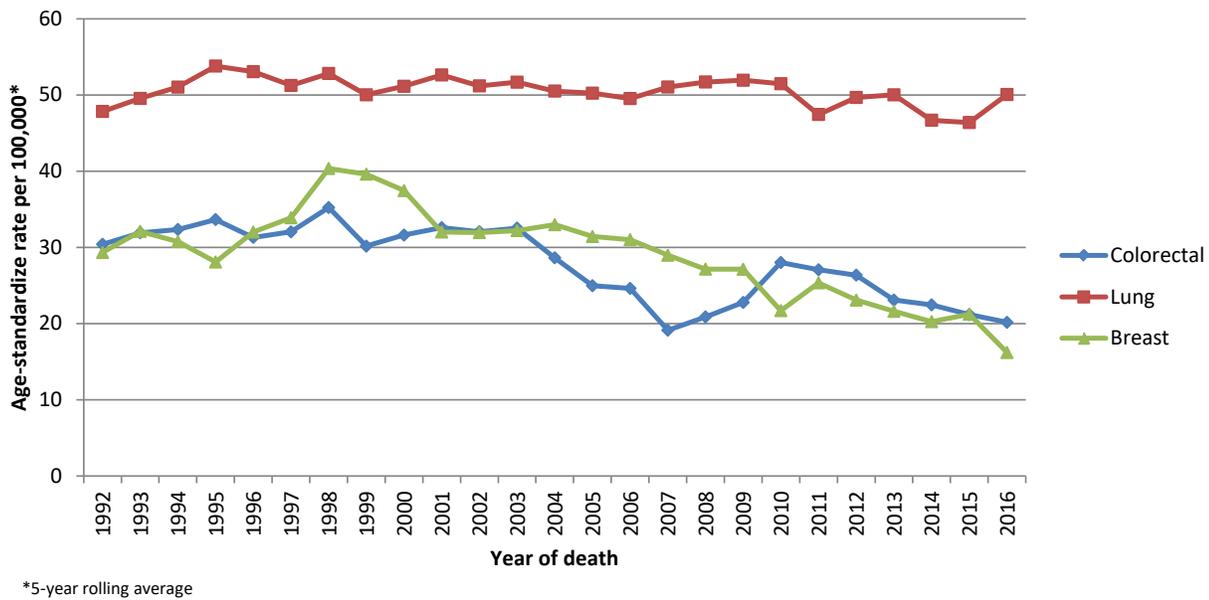


Figure 23: Mortality trends for most common cancers, females, PEI, 1992-2016



5.3 Incidence and mortality trends for other cancers, PEI

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 males was 4.4% and in females was 3.5% (figures 24 and 25). Risk factors for melanoma include exposure to ultraviolet (UV) radiation and having fair skin. Increased exposure to ultraviolet radiation mostly comes from sunlight but also from tanning beds. Since 2011, the PEI Department of Health and Wellness has used 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. As of 2012, The Government of PEI has prohibited tanning bed use in those less than 18 years of age.

Kidney

Cancer of the kidney has significantly increased in Islanders since 1980. The average yearly increase for incidence was 1.0% in males and 1.8% in females (figure 25). The age-standardized incidence rate in males increased from 17.8 cases in 100,000 in 1982 to 23.1 cases in 100,000 in 2016 while the rate in females increased from 5.1 in 100,000 in 1982 to 14.1 in 100,000 in the 2016. There were 32 cases of kidney cancer diagnosed in 2016. Some of the risk factors for kidney cancer are smoking, obesity, end-stage kidney disease, and hypertension.²¹ 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.²²

Oral cavity and pharynx

The incidence of cancers of the oral cavity and pharynx significantly decreased by 4.3% each year in males from 1982 through 2004 (figure 24). However, after that period, the rate significantly increased by 5.5% each year. At the same time the age-standardized rate has changed very little in Island females, increasing an average of 0.2% each year. The earlier decrease in the incidence rate in males has been attributed to the decrease in tobacco use. The cause for the recent increase in males is unknown, but risk factors for oral cancers include tobacco use, alcohol use, viruses including HPV and Epstein-Barr, solar radiation/ultraviolet (UV) light, and diets low in fruit and vegetables.²³

Pancreas

The age-standardized rates for pancreatic cancer in PEI females has been declining slowly (1.3% yearly) since 1982. There have also been associated small reductions in the pancreatic cancer mortality rate in females at an average of 2.7% each year. Although pancreatic cancer is less commonly diagnosed in PEI, the mortality rate is still ranked 4th among cancer in PEI and the 5-year relative survival ratio for this disease is very poor at less than 12%. Risk factors include tobacco use, obesity, diabetes, genetic predisposition and occupational chemical exposure.

Non-Hodgkin Lymphoma (NHL)

NHL has been increasing significantly in males at a rate of 1.4% each year (figure 24). Although not significantly, the age-standardized NHL incidence rates in females has been increasing by an average of 0.7% per year since 1982. Both the PEI and Canadian mortality rate have been decreasing over time. Risk factors for NHL have been studied. NHL cancers may differ depending on which cell type (B cell or T cell) the cancer starts in and depending on how fast the cancer grows and spreads. There is evidence that a risk factor for NHL is immunosuppression and specific virus such as HIV and Epstein-Barr virus.²⁴ However, there are many other risk factors for the different types of NHL that still need to be verified.

Thyroid

Over the last 35 years, the age-standardized incidence rate has significantly decreased by an average yearly increase of 2.1% in females (figure 25). The age-standardized incidence rate increased from a yearly average of 5 cases in 100,000 females in the 1980s to a yearly average of 10 cases in 100,000 females in the last 10 years. The rate has also been increasing in Canada. However, there is no increase in mortality rate from thyroid cancer indicating the diagnosis of serious thyroid cancer has not been increasing. Increases in less serious forms of thyroid cancer may be as a result of the advancement in diagnostics.²⁵



Figure 24: Incidence trends for selected rapidly changing cancers, males, PEI, 1982-2016

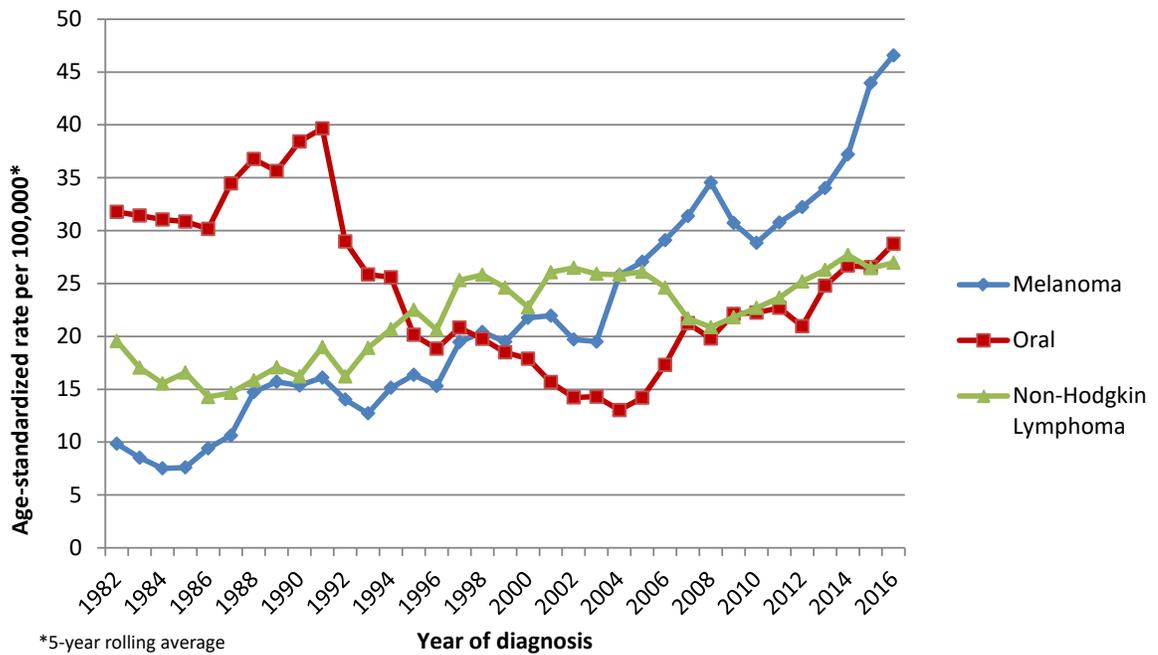
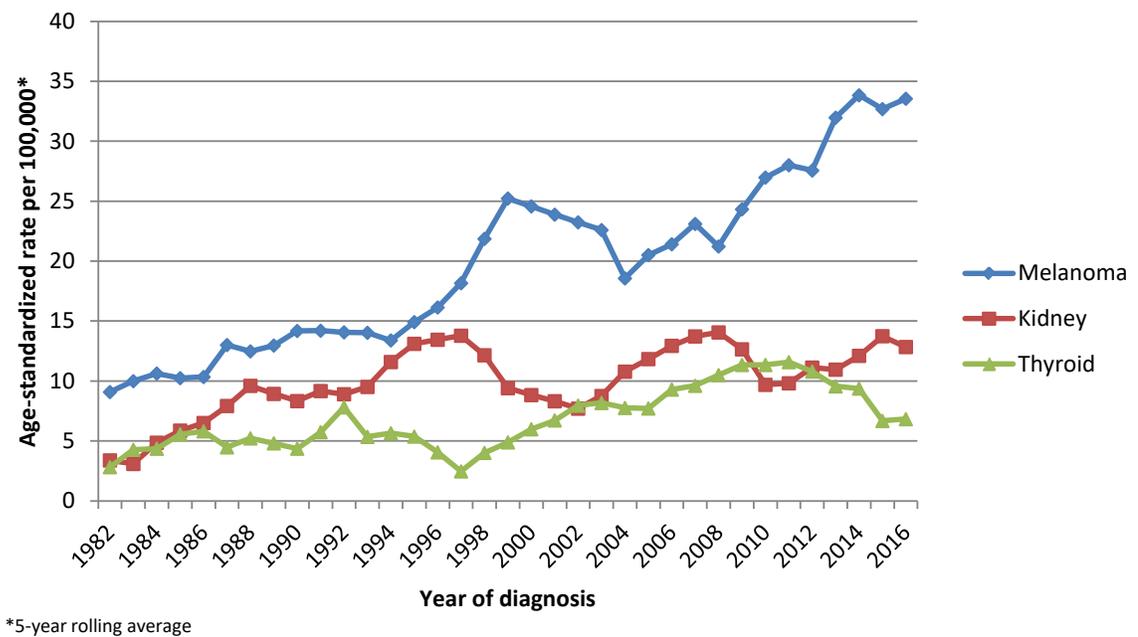


Figure 25: Incidence trends for selected rapidly changing cancers, females, PEI, 1982-2016



Appendices

Appendix I: Methods

Sources

Prince Edward Island Cancer Registry Data Sources

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.²⁶ 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. Registry data sources are listed below. Additional information required to complete the Registry abstracting process is gathered from notification from out-of-province cancer registries.

For this report, analysis of new cancer cases from 1982 through 2016 and cancer deaths from 1992 through 2016 from the PEI Cancer Registry are presented. PEI cancer data in the PEI Cancer Registry is compiled from multiple sources by the Registrar. Staging data is only available from 2005 through 2016.

Prince Edward Island Provincial Health Care Services

Data are collected from PEI Cancer Treatment Centre patient records, laboratory reports, pathology reports, cytology reports, autopsy reports, notification from the Discharge Abstract Database, and notification from other provincial cancer registries in Canada. Additional information required to complete the cancer registry abstracting process is gathered from physician offices and health records.

Prince Edward Island Vital Statistics

The Registry receives quarterly reports from PEI 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 underlying cause of death (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, place of death, underlying COD ICD code if it is cancer, and death registration number.

Statistics Canada

National Death Clearance: The National Death Clearance which contains COD, date of death, underlying COD, province of death, and death registration number, was sent yearly to the Registry between 1992 and 2008. This information was used to verify the Provincial Vital Statistics and to identify other cancer patients that occurred in other provinces except Quebec. Mortality prior to 1992 was not death cleared by Statistics Canada and will not be presented in this report.

Population Tables: 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 2011 Census. The census is done every five years by Statistics Canada, and mid-year population estimates are produced for the intercensal years. The Canadian Standard Population from 2011 in 5-year age groups (18 groups) is used for age-standardized rates.

Canadian Tables: The Canadian cancer incidence and mortality rates are provided by online tables through Statistics Canada and include data from the Canadian Cancer Registry and Canadian Vital Statistics.

Life Tables: Survival rates are calculated using the life tables prepared using the data from the Statistics Canada Table: 13-10-0140-01 Life expectancy and other elements of the life table, Prince Edward Island territories, for which a Poisson model was used to interpolate to 1-year intervals from the PEI abridged (5-year) life table.

Data Quality

The Registry works with the Canadian Cancer Registry which 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.²⁷ NAACCR has presented the Registry with the Gold or Silver standard award in every year but one since 1998 for the “completeness, accuracy, and timeliness” of PEI cancer data.

Analyses

All statistics were performed using Stata version 14.1.²⁸

Counting Cancer Cases and Deaths: All new cancer cases are counted as incident cases of cancer in the Registry; this may include a new cancer in a specific site in a patient previously diagnosed with another 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 2007.²⁹ These rules are quite complex and site specific and may allow counting multiple cancers in the same primary site 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.³⁰ The SEER cancer groupings primarily based on anatomical site of origin and microscopic cellular structure were used to identify the site for the cases of cancer (Appendix II).³¹

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 relative survival rates are a measure of progress in early diagnosis and improved treatments.

Age-standardization is used to adjust the effects of differences in age and population size when comparing incidence rates between different populations such as PEI and Canada and to compare the rate from one year to another year. The incidence and mortality graphs in this report include estimates for the most recent years, and the PEI rates are 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 were considered statistically significant if $P < 0.05$.

• Cancer Incidence and Mortality

The 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 in males or females or the risk by age group. Mortality rate is the rate of deaths and is calculated by dividing the number of cancer deaths by the number of people in that age group in PEI. Both incidence rates and mortality rates are age-standardized to the standard population (2011 Canadian population). Annual rates are expressed as the number of cancer deaths per 100,000 people per year.

• Annual percent change (APC) in cancer incidence and mortality

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 multiple time periods in the data.

Significant APCs are those statistically different from 0% at $P < 0.05$.

• Five-year colorectal cancer relative survival ratio

One method to measure cancer survival is the five-year relative survival ratio (RSR), which is also referred to as net survival. Five-year RSR 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 (2012-2016) was used for the analysis. For cases diagnosed during the years 2012-2016, the period method was used to give the most up-to-date relative survival information available.^{33,34} The actuarial method was used to develop the life table and the Ederer II method to calculate expected survival.³⁵ 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 their time from diagnosis was unknown.

Five-year relative survivals were calculated for cancers diagnosed between 2002 and 2006. The RSR for cancers diagnosed in the earlier period were calculated using the cohort method.³⁶

In addition, five-year RSR was calculated by sex, age-group, and site. Significance testing between groups was done using a z-test with significance determined at $P < 0.05$.

- Prevalence of cancer

Prevalent cases are the number of Islanders alive with a diagnosis of cancer making it a useful measure for health care systems planning. A limited duration of 10 years for the prevalent cases of cancer is the number of Islanders that were diagnosed with a cancer in the period from January 1, 2007 through December 31, 2016 who were still alive on January 1, 2017. 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. If a person has been diagnosed with two or more cancers in the period, the person is only counted once in the overall prevalence count. In addition, prevalences for individuals with prostate, female breast, colorectal, and lung cancers were calculated. For this calculation, having two different cancers does not exclude a person from being in a site-specific prevalence count.



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 (with histology other than 8720-8790*)	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-C22.9
PANCREAS	pancreas including ducts, Islets of Langerhans	C25	C25
LUNG	bronchus, lung	C34	C34
MELANOMA	malignant melanoma (skin and other sites)	C44 (8720-8790)	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	C56.9	C56
PROSTATE	prostate gland	C61.9	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

SITE:	DESCRIPTION:	ICDO-3 CODES for site or histology* (Incidence)	ICD-10 (Mortality)
HODGKIN LYMPHOMA	nodal and extranodal	*9650-9667	C81
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



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