2018

Report on Cancer Statistics in Prince Edward Island:

Breast Cancer

Prince Edward Island
CANADA

Health PEI
One Island Health System

www.healthpei.ca/cancercare

Acknowledgments

This report is made possible through the leadership of the Provincial Cancer Surveillance Epidemiologist and a collaborative effort of the following Health PEI and Department of Health and Wellness representatives:

Dr. Carol McClure, Provincial Cancer Surveillance Epidemiologist
Marguerite Arsenault, PEI Cancer Coordinator
Dr. Larry Pan, Radiation Oncologist and Chair of Provincial Cancer Coordination Steering Committee
Kim Vriends, PEI Cancer Registry Manager
Staff of the PEI Cancer Registry
Dr. Karen Phillips, Chronic Disease Epidemiologist, PEI Chief Public Health Office
Connie Cheverie, Data Manager, PEI Chief Public Health Office
Melissa Saunders, PEI Health Care Futures Student
PEI Breast Cancer Action Group

Prince Edward Island
CANADA

Health PEI
One Island Health System

Release November 2018

Health PEI
PO Box 2000
Charlottetown, PEI C1A 7N8
902-368-6130
healthinput@gov.pe.ca
www.healthpei.ca/cancercare

Suggested Citation:
PEI Cancer Treatment Centre, Charlottetown, Health PEI. 2018. 2018 Report on Cancer Statistics in Prince Edward Island: Breast Cancer

Forward

It is my pleasure to introduce a statistical report on Breast Cancer in Prince Edward Island. This is one report in a series of cancer statistical reports providing a meaningful look at the four most frequently diagnosed cancers in Prince Edward Island (lung, colorectal, breast and prostate cancers). This is the result of the report on *PEI Cancer Trends: 1980-2009* and recommendations of the *PEI Cancer Strategy 2016-2019* and is made possible by a partnership between Health PEI and the Department of Health and Wellness.

Breast cancer is the most commonly diagnosed cancer in Island women. Although, the rate of breast cancer in women has not change significantly in the last decade, the high prevalence of this disease has a profound impact on those diagnosed, their families, and the health system.

Breast cancer screening with mammography has been available to Island women since 1999. Regular screening has been shown to reduce the risk of mortality from breast cancer due to earlier detection when treatment is most successful. Improved treatment methods complement early detection to reduce mortality and increase survival. Knowing the risk factors for breast cancer and regular screening are the best ways to stay healthy.

As we learn more about cancer in PEI, we find there are more questions. The intention of this series of statistical reports is to provide a robust information base for optimal program planning, investments, and monitoring, so Islanders have access to effective, sustainable and of high quality care.

Carol McClure, PhD, DVM, MS
Provincial Cancer Surveillance Epidemiologist

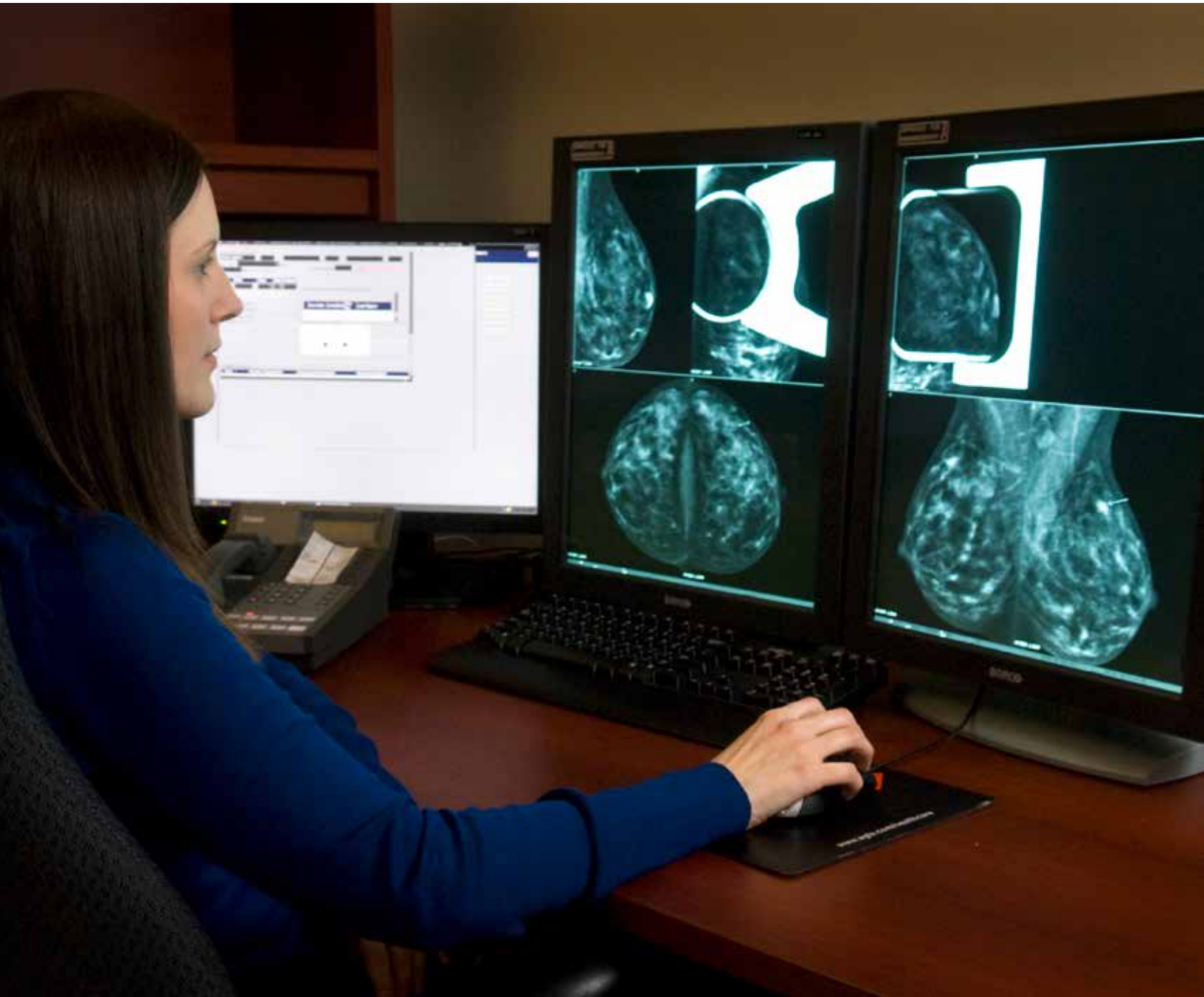


Table of Contents

List of Figures

Introduction

Breast cancer is the most common form of cancer among women in Canada and worldwide[1,2]. Breast cancer has the second highest cancer mortality rate, second to lung cancer in North American women. Internationally, breast cancer mortality claims 14% of all cancer deaths in women[2]. For Canadian women, 1 in 8 will be diagnosed with breast cancer and 1 in 31 will die from it[1]. Island women are similar to Canadian women, with breast cancer the most commonly diagnosed cancer and second most common cause for cancer death.

Breast cancer is diagnosed in men as well as in women and if men have any symptoms, they should tell their health care providers. In the last ten years (2007-2016), there have been 9 cases of breast cancer diagnosed in men. Because incidence is approximately 100 times higher in women[3], this report will focus only on women.

Invasive breast cancer will be the focus of this report; however, there are conditions identified in the breast that are medically followed because their presence is indicative of increased risk for invasive breast cancer[4]. Ductal carcinoma in situ (DCIS) and lobular carcinoma in situ (LCIS) are two non-invasive breast neoplasias that have not advanced beyond the local tissue. In the last ten years (2007-2016), there were 176 women diagnosed with DCIS and 17 women diagnosed with LCIS in PEI. For both types of neoplasias, different management strategies are recommended from increased screening to surgery with or without radiation therapy depending on the type of neoplasia.

Most risk factors for breast cancer are associated with a woman's exposure to female hormones, especially to estrogen[5]. Family history and genetics also play an important role in increasing the risk of breast cancer, including the *BRCA* gene mutations. A woman's age and her reproductive history also influence her risk of developing breast cancer. Other risk factors concern external factors such as exposure to ionizing radiation, alcohol consumption, and being overweight. The importance of knowing your risk cannot be overemphasized. For the risk factors that are non-modifiable, vigilance is essential including consulting with a health care provider and screening. For those risk factors that are modifiable, reductions in risk may be associated with avoidance of these factors. Two modifiable risk factors are explored in this report--being overweight and consumption of alcohol. Additionally, a list of risk factors with more detail is located Appendix I.

This report is part of a series of four cancer statistical reports which supports the *PEI Cancer Strategy 2016-2019*[6] strategic recommendation to increase capacity to monitor cancer trends. It is intended to provide insight into the current state of incidence, mortality, survival and prevalence with an overview of the risk factors that significantly influence breast cancer development.

In this report, the phrase "breast cancer" refers to invasive breast cancers unless otherwise specified. The information is largely from the PEI Cancer Registry.

Examining the breast cancer experience in PEI using the most recent statistics available will assist in guiding efforts and improvement in prevention and early detection, diagnosis, treatment and supportive care, including palliative care. The information is intended for use by health professionals, decision makers and researchers to guide policy, evaluation and planning in PEI, and as an opportunity to educate the public.

Data Sources

Full details on data sources and methods can be found in Appendices.

Prince Edward Island Cancer Registry

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[7]. Analyses of new breast cancer cases from 1982 through 2016 and breast cancer deaths from 1992 through 2016 from the Registry are presented. Staging data is only available from 2005 and later. Full details on methodology can be found in Appendix II. Anatomic site of origin and microscopic cellular structure of all cancers counted as breast cancers are listed in Appendix III.

PEI Population Health Assessment and Surveillance Unit

As part of the PEI Chief Public Health Office, this unit is responsible for monitoring and reporting on health status and health trends in PEI. The unit supports evidence-based decision making, and promotes continuous improvement by generating, analyzing, and interpreting information. The scope of the program and services within the section are: production of technical population health reports, interpretation and analysis of national reports to make information relevant to PEI surveillance of communicable and non-communicable diseases, population research, development of population health databases, and evaluation of health initiatives.

For this report, the unit provided information on breast cancer risk factors. The provincial and national information is the outcome of surveys and information compiled by Health Canada.

Statistics Canada

Under the Statistics Act, Statistics Canada is required to collect, compile, analyze, abstract and publish statistical information relating to the commercial, industrial, financial, social, economic, health, and general activities and condition of the people of Canada. It also requires that Statistics Canada conduct a census of population every fifth year, and that the Agency protect the confidentiality of the information with which it is entrusted. For the purpose of this report, population census information was used to support age-standardized rates. In addition, Statistics Canada provides the data for Canadian breast cancer rates for incidence and mortality.

Breast Cancer Surveillance

Understanding Cancer Measurements

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.** The age-standardized rate is also reported as the number of new cases or deaths per 100,000 Islanders. Age-standardized rates are used to describe the rate of cancer in Islanders if our population was a standard population. To compare them appropriately, provincial and Canadian rates must be age-standardized. **To compare the rate in one year to another, rates must also be age-standardized.** 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 (Canadian population in 2011), the actual or crude incidence rate in PEI is higher than the age-standardized rate. 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.

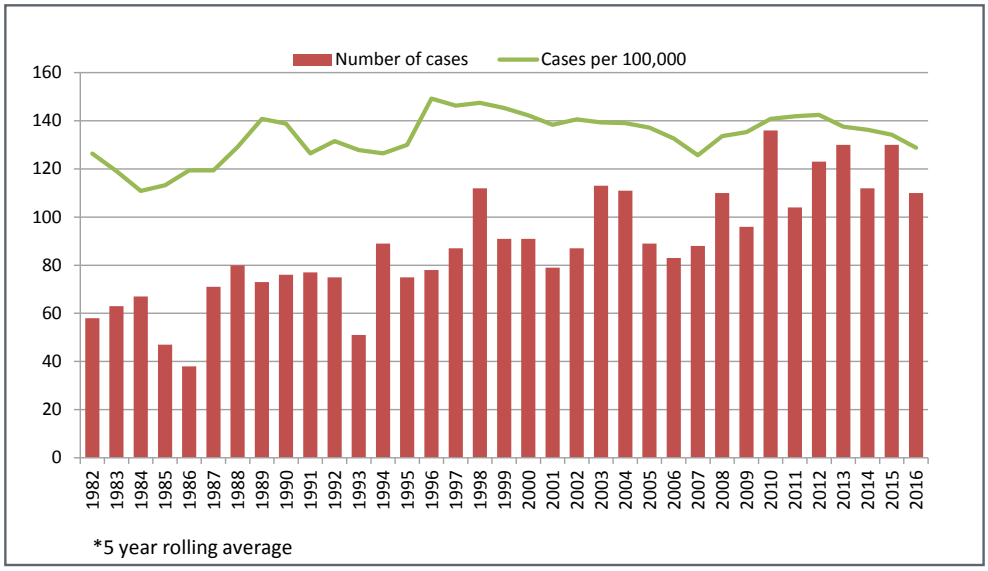
In many measurements, a 5-year rolling average was used to smooth the trend line. Each yearly estimate is an average of the two years before, the year, and two years after the estimated year.

Specific definitions for these measurements and other terms are available at the end of this document in the Appendices.

Breast Cancer Incidence

Cancer incidence is the number of new cases of invasive cancer diagnosed in a specific time period in a specific population. In this section of the report incident cases are the actual number of new breast cancer cases diagnosed each year.

Figure 1 Incident Number of Cases and Age-standardized Incident Rate* of Breast Cancer, women, 1982-2016, PEI



The number of cases in PEI has been rising (figure1). In the last 10 years, the average number of breast cancer cases diagnosed was 114 per year. The rapid increase in the number of cases in the late 2000's may be due to the increased uptake of breast cancer screening in Island women. This increasing number of cases is important when projecting health care needs such as utilization of testing, treatment, equipment, aftercare, palliative needs, etc.

The average PEI age-standardized breast cancer rates for 2004 through 2013 are not higher than Canadian rates for the same time period as estimated by Statistics Canada (data not shown)[8].

Breast cancer is the most frequently diagnosed cancer in women.
On average, over 110 women are diagnosed with breast cancer each year in PEI.

Figure 1 also displays the age-standardized incidence rates in PEI (top line) over time. The age-standardized rate for breast cancer in women has increased slightly since the early 1980's. The prevalence of two risk factors, obesity and hormone replacement therapy (HRT), may have been increasing during this time. In addition, organized breast screening began in the late 1990s, creating a sharp increase at that time. Since the late 1990s, the rate appears to have decreased over time. When screening programs begin, there is usually an increase in cancers identified followed by a period of decreased incidence. There is a dip in the incidence rate in the mid-2000s perhaps due to the reduction on HRT use.

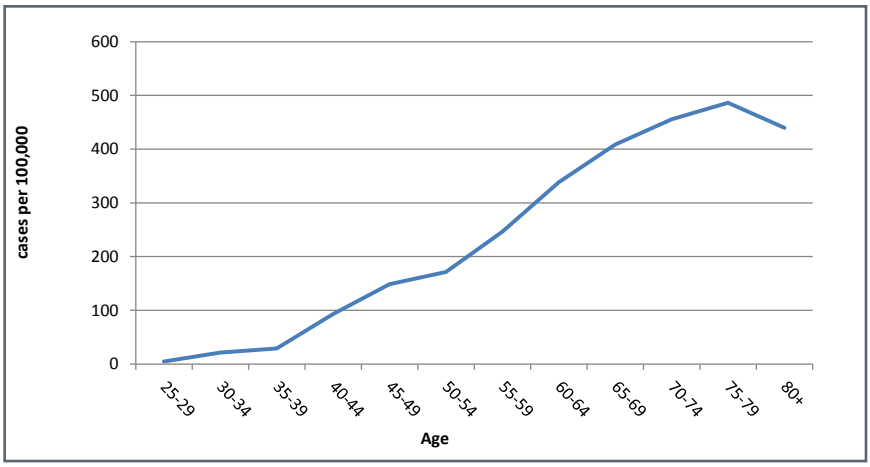
The annual percentage change of the age-standardized incidence rate is an estimate of whether there is a significant increasing or decreasing trend in the rate. The trends can be estimated and tested for significance.

Overall, the age-standardized breast cancer incidence in PEI women increased by by 0.24% yearly between the years 1982 through 2016. The increase in rate was not significant, thus the age-standardized rate for women has not been changing in the last 30 years.

Breast Cancer Incidence by Age

Cancer is more common in older people. As our population ages we expect to see more cancers diagnosed. This is also true for breast cancer.

Figure 2 Age-specific Breast Cancer Incidence in women, PEI, 2007-2016



The incidence rate for breast cancer is lowest at the youngest ages. As figure 2 describes, breast cancer in younger women is rare. Unfortunately, more aggressive breast cancer is often seen in women less than 40 years of age. Over 30% of women in this age group were diagnosed with late stage cancer (stage III and stage IV). The incidence rate increases as women grow older until they are 80 years and older at which point the risk decreases.

Figure 3 Number and Proportion of Breast Cancer Cases by Age Grouping for 5 year periods, women, PEI

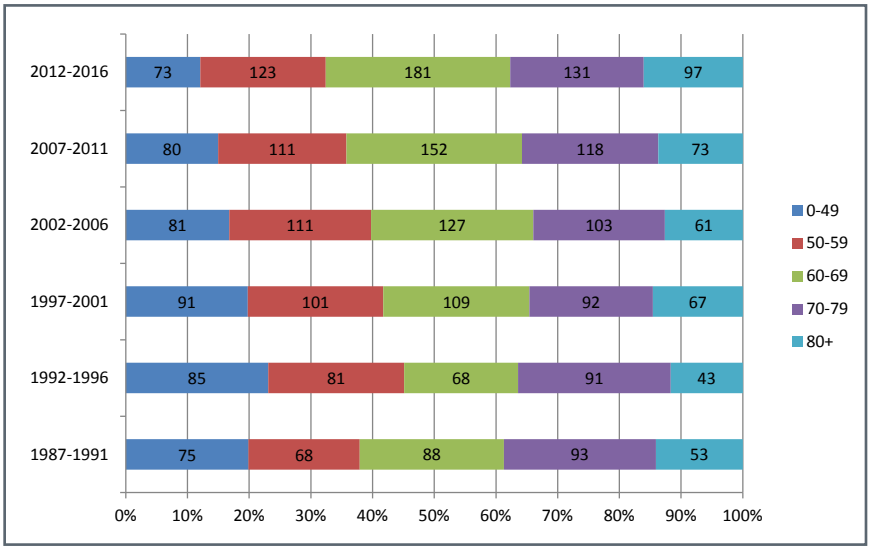


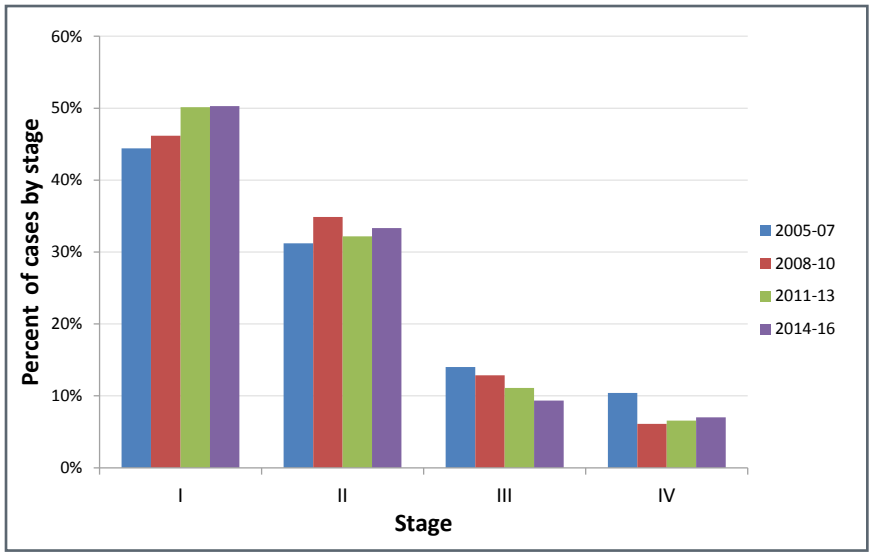
Figure 3 demonstrates how approximately half of all breast cancer cases that are diagnosed are in women age 50-69. Over time, the proportion and number of those diagnosed before the age of 50 has decreased while the proportion and number of those diagnosed at 80 years and older has increased. One reason for this shift is that PEI has an aging population.

The incidence rate increases as women grow older until they are 80 years and older at which point the risk decreases. Approximately half of all breast cancer cases that are diagnosed are in women age 50-69.

Breast Cancer Incidence by Stage

Cancer staging helps predict the risk of disease spreading and informs treatment planning. Information on whether the cancer is contained to one location or if it has spread to other parts of the body is collected to help determine the stage. The earlier the stage at time of diagnosis the better the prognosis is and the least amount of treatment will be required. Collection of stage data in the PEI Cancer Registry began in 2005.

Figure 4 Breast Cancer Incident Cases by Stage in women, by 3-year periods, PEI



The percentage of the different stages indicates that most of the breast cancers are diagnosed early at stage I followed by stage II. Over time, a higher proportion of women are being diagnosed in stage I. This is likely due to increased awareness of the disease and early detection with the breast cancer screening program.

Over 80% of cases of breast cancer are diagnosed at an earlier stage (stages I and II). Survival is improved when cancers are diagnosed at an early stage.

Breast Cancer Mortality

This section of the report provides information on the number of deaths due to breast cancer in PEI women.

Figure 5 Deaths and Age-standardized Mortality rate* of Breast Cancer, women, 1992-2016, PEI

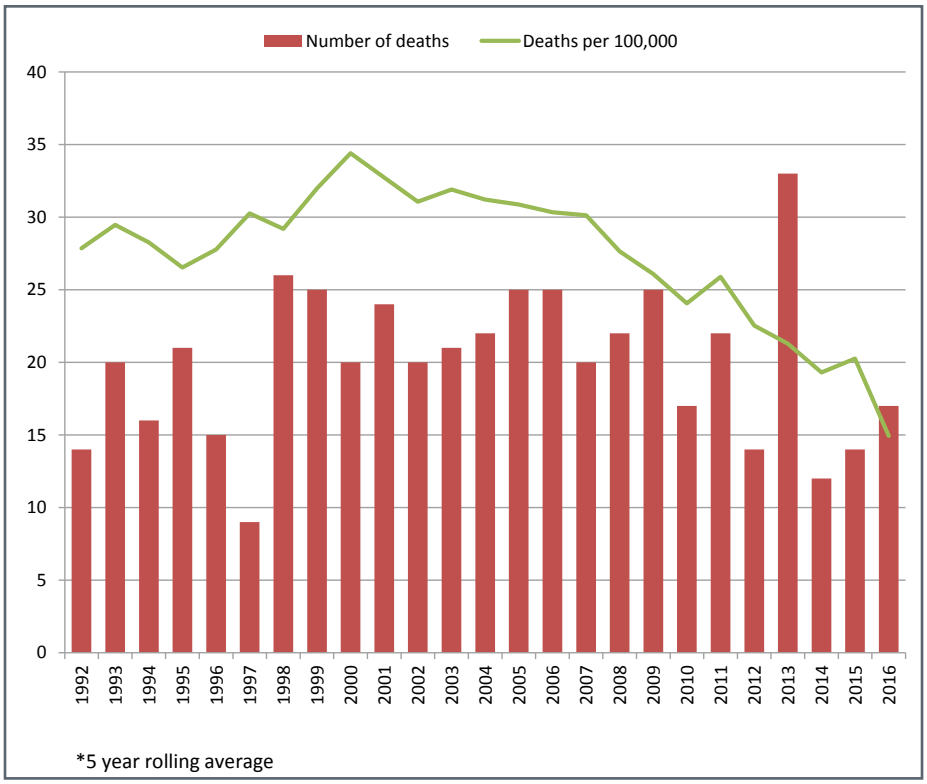


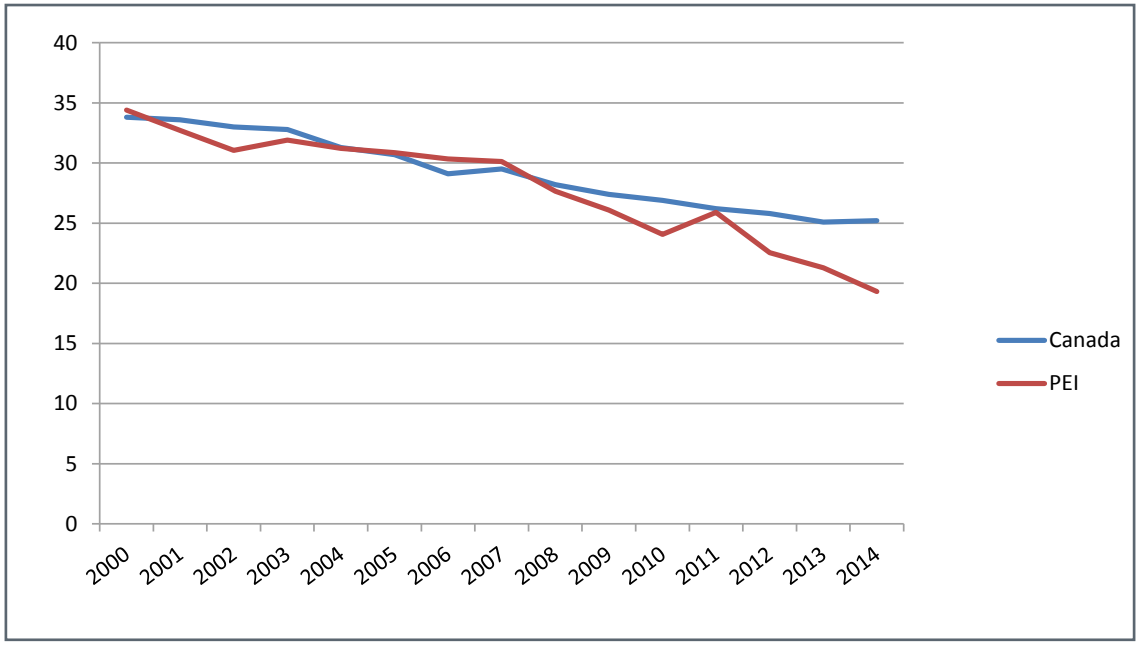
Figure 5 depicts the number of deaths in PEI due to breast cancer. The average number of deaths due to breast cancer between 1992 and 2016 was 20 deaths each year. Although the number of deaths due to breast cancer in 2013 seems like an outlier, this is likely just due to normal variation, as 2012 and 2014 had a very low number of deaths.

Approximately 20 Island women a year die from breast cancer.

The line in figure 5 is the age-standardized mortality rate in PEI. Adjusting for the increasing age and size of the population, the risk of dying from breast cancer in PEI appears to decrease from 1992 to 2016. The reduction in mortality is likely due to early detection from screening and improved treatments.

The trend in the PEI mortality rate over the years was assessed by measuring the annual percent change for age-standardized mortality rate for breast cancer. On average, breast cancer mortality in women decreased 3% yearly in that last 20 years. This decrease is statistically significant, indicating that the risk of dying from breast cancer in island women has decreased over time.

Figure 6 Age-standardized Mortality Rate for Breast Cancer, women, 2000-2014, PEI* and Canada



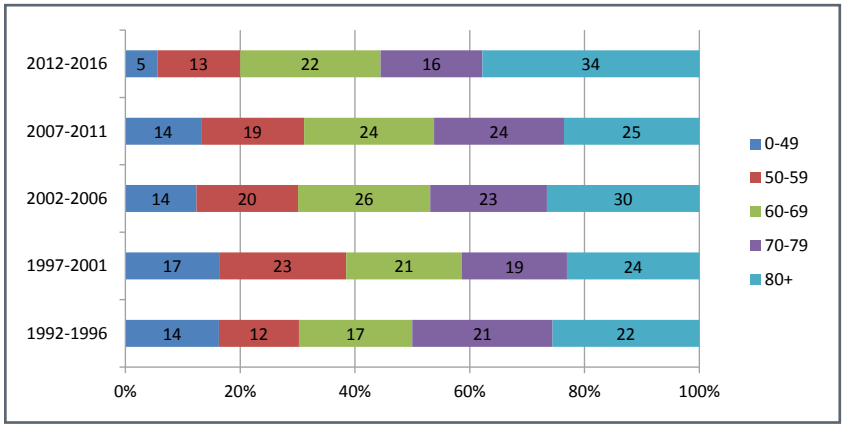
*5 year rolling average

Figure 6 displays the age-standardized mortality rate for breast cancer in PEI and Canada[9]. The rates are very similar until recent years when the PEI rate seems to diverge from the Canadian rate. This recent, rapid reduction is likely a result of early detection and improved treatments but should be monitored in the upcoming years as it may be normal variation due to the PEI small population.

Deaths due to breast cancer have been decreasing over time likely due to early detection from breast cancer screening and improved treatments.

Breast Cancer Mortality by Age

Figure 7 Number and Proportion of Deaths from Breast Cancer by Age Grouping for 5-year periods, women, PEI

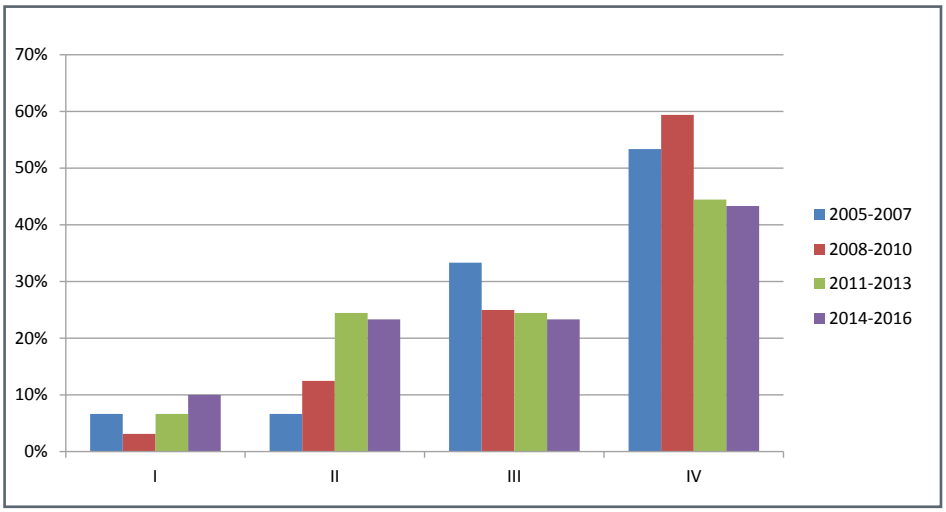


The number of mortalities from breast cancer in PEI has declined from the period of 2012 to 2016 when compared to previous five-year periods. The mortalities from breast cancer were most common in Island women 80 years and older and least common in women younger than 50 years old (figure 7). Although the number of mortalities has been decreasing over time, the proportion of breast cancer mortalities in women 80 years and older has rapidly increased in the most recent years. The Provincial Breast Screening Program increased the number of women screened and changed from analog radiographs to digital radiographs in 2010. This increase in the numbers screened and improved imaging may have helped reduce the deaths in the women less than 80 years of age.

The deaths from breast cancer were most common in Island women 80 years and older and least common in women younger than 50 years old.

Breast Cancer Mortality by Stage

Figure 8 Breast Cancer Deaths by Stage, women, 2005-2016, PEI



The largest proportion of deaths occurs in people who were diagnosed at stage IV because stage IV is the most advanced stage (figure 8). Diagnosis of stage IV breast cancer is indicative that the woman already has metastatic breast cancer.

The largest proportions of deaths due to breast cancer are in women who were diagnosed at stage IV.

Breast Cancer Survival

Relative survival ratio (RSR), which is often referred to as net survival, is a measure of disease severity and thus prognosis (Table 1). It indicates the probability of an average person with a breast cancer surviving to a certain time after diagnosis compared to the average person without cancer which adjusts for deaths from causes other than breast 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 woman in PEI with breast cancer is 90% indicating that women diagnosed with breast cancer have, on average, a 90% chance of surviving to 5 years compared to women without breast cancer on PEI. Relative survival measured over time can be used to measure improvements in cancer screening and early detection, diagnosis, and treatment.

Table 1 Interpretation of Relative Survival Ratios in Cancer Research

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

Figure 9 Five-year Relative Survival Rate* for Breast Cancer diagnosed 2002-2006 and 2012-2016, women, PEI

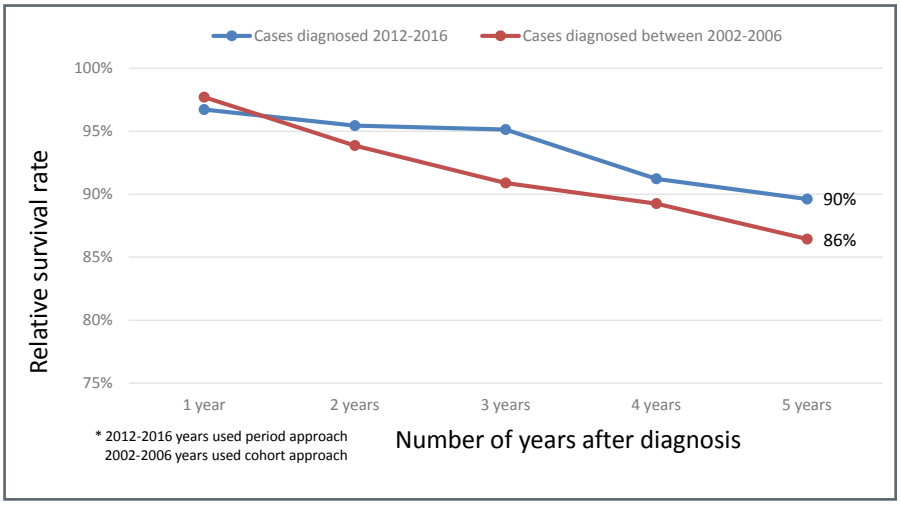


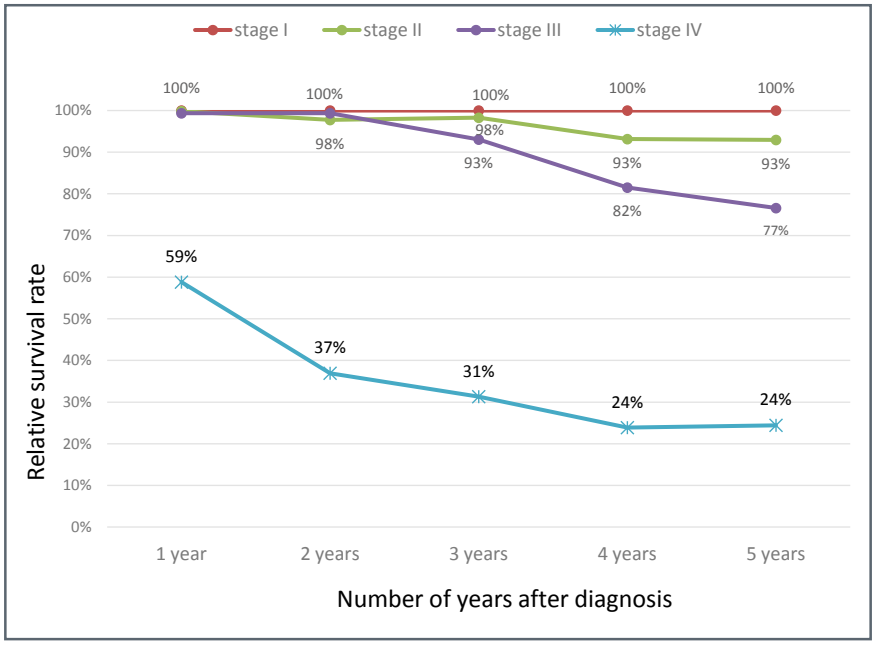
Figure 9 has RSRs for each year up to 5 years after diagnosis for breast cancers diagnosed from 2012 through 2016. The 5-year RSR for breast cancer is 90%. In addition, the historical information is provided from cancers diagnosed from 2002 through 2006. Although not significantly better, there is a trend for the more recent cases (2012-2016) to have a better 5-year survival. Improvements to survival are likely a result of the increase in early stage diagnoses and improved treatments.

Long-term survival can be measured by 10-year relative survival. For all patients diagnosed with breast cancer between 2002 and 2006, the 10-year relative survival is 83%.

The chance of surviving a breast cancer diagnosis 5 years or longer is excellent at 90%.

Breast Cancer Survival by Stage

Figure 10 Five-year Relative Survival Rate for Breast Cancer by Stage, 2012-2016, PEI

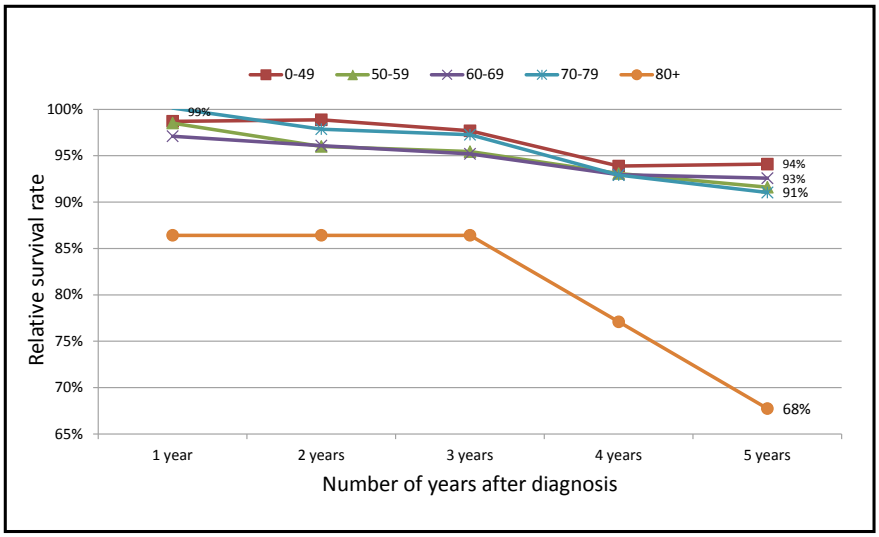


The earlier the stage at diagnosis is, the better the survival is (figure 10), emphasizing the importance of knowing the risk factors and optimizing breast cancer screening programs. Those diagnosed with stage I cancer have the same 5-year survival as Island women of the same age who do not have breast cancer. The RSR for Stage IV patients is poor at 24%. These patients have a significantly lower survival than the other three stages.

Stage IV breast cancer has poor 5-year survival. Detecting breast cancer at its earliest stages increases the relative five-year survival rate.

Breast Cancer Survival by Age

Figure 11 Five-year Relative Survival Rate for Breast Cancer by Age Group, diagnosed 2012-2016, PEI



There is a trend that younger patients have a higher RSR compared with older patients (figure 11). The oldest group, 80 years and older, has a significantly lower survival than the younger age groups. The oldest age group also has the highest proportion of stage IV breast cancers which results in the fair 5-year survival in this group.

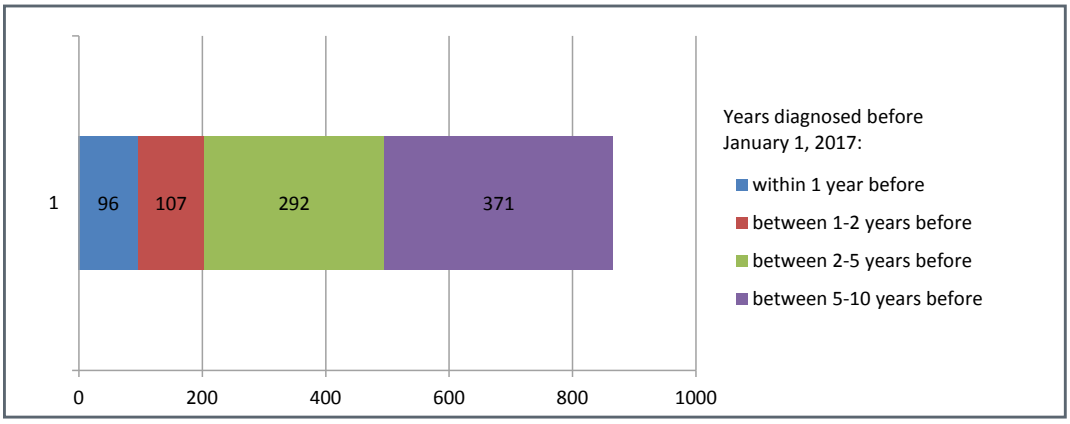
Those diagnosed with breast cancer at an older age (80+ years old) have a lower relative five-year survival rate than those diagnosed in earlier ages.

Prevalence

The ten-year prevalence of cancer is the number 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.

Over the last 25 years, 1,444 women or almost 2% of all Island women have been diagnosed with breast cancer in PEI.

Figure 12 Number of prevalent Cases for Breast Cancer Diagnosed Between January 1, 2007 to December 31, 2016 who are Alive on January 1, 2017, women, PEI



The number of people living with breast cancer diagnosed in the last ten years is 866 (figure 12). Although approximately 27% of all cancer diagnosed in PEI women are breast cancer, the 866 women living with breast cancer represent 43% of all living women who were diagnosed with any cancer in the ten-year period.

Care for the cancer patient consists of a progression of active treatment, continuous follow-up and treatment of recurrences, and possibly palliative and end-of-life care. In addition to medical care, psycho-social and rehabilitative care may be necessary. For the most part, the first two years encompasses the time of treatment and after treatment recovery. Years 3 through 5 are the intermediate years in which follow-up care is high. After 5 years, the greater part of care adjusts to clinical monitoring and the needs of a survivor.

There is a significant proportion of Island women living with a breast cancer diagnosis in PEI.

Risk Factors

There are multiple risk factors associated with breast cancer. There are non-modifiable risk factors that cannot be altered. Some of these include:

- Increasing age
- Personal history or family history of breast cancer especially in close relatives (mother, sister, daughter, father, brother, or son)
- Genetic mutations for *BRCA1*, *BRCA2* and other genes
- Prior diagnosis of ductal carcinoma in situ (DCIS) and lobular carcinoma in situ (LCIS)
- Other benign breast disease (non-proliferative, proliferative with atypia, and proliferative without atypia)
- Early age at first period (menstruation)
- Late age at menopause
- Breast density
- Multiple exposures to medical radiation

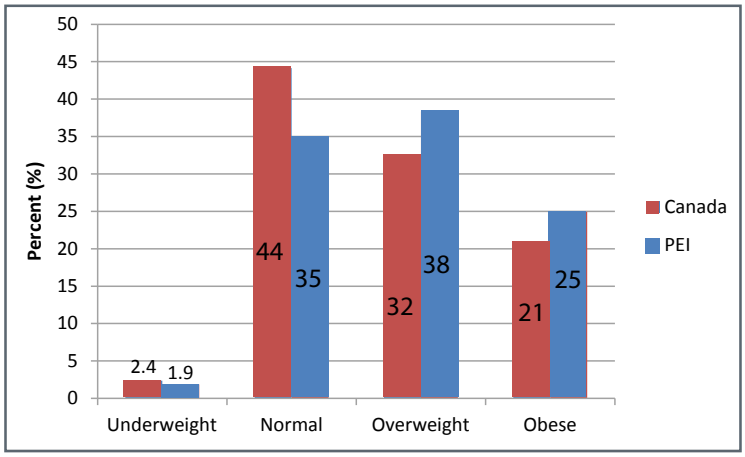
There are modifiable risk factors for breast cancer including:

- Obesity increases risk mainly after menopause
- Use of Hormone Replacement Therapy (HRT)
- Alcohol intake
- Lack of breast feeding

In the following section, information on obesity and alcohol use in Island women are presented.
More details on risk factors are in Appendix I.

Obesity

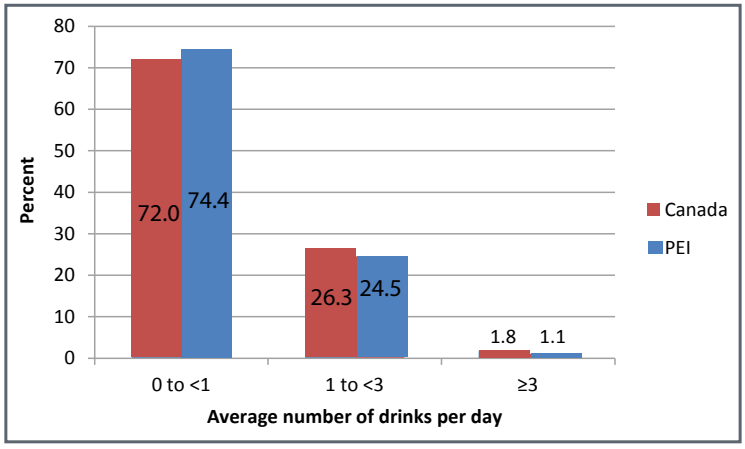
Figure 13 Proportion of Women 50 Years and Older by Body Weight Classification, Canada and PEI, 2015-2016



In general, PEI has a higher proportion of overweight and obese women 50 years and older than Canada. Reducing the proportion of women that are overweight and obese after menopause may help decrease the breast cancer incidence rate by reducing estrogen levels in these women.

Alchol Consumption

Figure 14 Proportion of Women 18 Years and Older by their Daily Alcohol Consumption, Canada and PEI, 2015-2016



Alcohol consumption can affect the risk of breast cancer if one has more than one drink a day. Heavy drinking increases the risk even more. The main effect of alcohol is that it increases estrogen levels[10]. Although PEI has a higher rate of <1 drink per day compared to Canada, reducing alcohol consumption will decrease the risk for breast cancer further.

Most risk factors for breast cancer are non-modifiable such as age and genetics. However, reducing modifiable risk factors such as being overweight and alcohol consumption can help lessen the risk.

PEI Cancer Strategy Recommendations

The PEI Cancer Strategy: Let's Make a Difference (2016-2019) was developed with guidance by the Provincial Cancer Coordination Steering Committee (the Steering Committee). The strategy goals are to work to:

- Reduce cancer incidence, mortality, and morbidity.
- Enhance the quality of life of individuals at all stages of the cancer continuum.
- Optimize resources and processes to sustain the PEI cancer care system.

Implementation and monitoring of the strategic recommendations are guided by the Steering Committee and reported to the Minister of Health and Wellness and the CEO of Health PEI. While many recommendations support all people experiencing cancer, there are some that are specific to breast cancer including:

- Establish a breast cancer action group
- Ensure clinical practice guidelines for breast cancer screening are based on the latest science, implemented fully and regularly reviewed
- Increase participation in breast, colorectal and cervical cancer screening through public awareness initiatives, increased recruitment and improved public access to programs and services
- Establish the best process to rapidly and accurately diagnose the four most frequent cancers in PEI (lung, breast, colorectal, and prostate)
- Establish standardized care plans beginning with the four most frequent cancers in PEI (lung, breast, colorectal, and prostate)

For more information on the strategy go to www.healthpei.ca/cancercare.

Conclusions

Although breast cancer is the most commonly diagnosed cancer in PEI women, the incidence appears to be stable. Since the early 2000s, there has been a significant decrease in the rate of breast cancer mortalities likely attributed to earlier diagnoses and improved treatments. The 5-year relative survival in Island women is 90%. However, women diagnosed after age 80 or at stage IV have a lower survival than other women with breast cancer. Earlier diagnosis will improve survival while reduction of risk factors is extremely important in preventing the disease.

There are many risks factors for breast cancer. However, risk factors such as personal and family history of breast cancer and modifiable factors such as hormone therapy and obesity should be assessed for each woman to understand her own risk of breast cancer.

The PEI breast cancer screening program is an important part of decreasing the mortality rates in women by diagnosing cancer early. You can find more information and a phone number to call for an appointment on the PEI Breast Cancer Screening Program website, https://www.princeedwardisland.ca/en/information/health-pei/pei-breast-screening-program. Prevention is the best method to decrease the incidence rate. The value of hormone therapy should be evaluated to establish that the benefits outweigh any potential increase in breast cancer risk. Other risk factors that can be improved such as maintaining a healthy weight, drinking less alcohol, and breast feeding a child if possible will decrease risk and likely decrease the incidence of breast cancer.

Health PEI will continue to reduce the impact of breast cancer on Islanders following recommendations from the PEI Cancer Strategy. Recommendations include enhancing the quality of life of individuals and optimizing resources and processes to sustain the PEI cancer care system.

Appendices

Appendix I: Factors that change the risk for breast cancer

A risk factor is any condition that increases the risk for breast cancer. There are many known risk factors for breast cancer and they can be divided into those that are not changeable or non-modifiable, and those that are changeable or modifiable. Here are some of the known risk factors:

1) Non-modifiable risk factors:

   a) Age: Increasing age augments the risk of breast cancer. Currently in PEI, over two-thirds of all diagnoses are made in women 60 years and older.

   b) History of breast cancer: Women who have had a diagnosis of invasive breast cancer, DCIS, LCIS, or any breast cancer are at increased risk of developing a second breast cancer[4].

   c) Changes in the breasts: Certain breast tissue changes especially severe atypical epithelial hyperplasia increase the risk of breast cancer in women[11].

   d) Family history: The risk of breast cancer increases for a woman with a relative or relatives with breast cancer and/or ovarian cancer. The risk of breast cancer is twice or higher if the woman has one first-degree relative (mother, sister, or daughter) with breast cancer prior to the age of 50 years old[11].

   e) Genetics: Only 5-10% of breast cancers are attributed to the inherited genetic mutation of *BRCA* genes[12]. There are two *BRCA* genes, *BRCA1* and *BRCA2*. These genes control the growth of cancer cells and if they become damaged or changed due to mutation, the oncogenes lose their control and cancer cells are able to grow.

   f) First menses prior to age 12: Women who started menstruating at an early age will have an increased risk due to the fact that their body cells are exposed to estrogen for a longer period of time[11].

   g) Menopause after 55 years: The age a woman begins menopause can also increase risk of breast cancer because someone who has experienced menopause later in life will have been exposed to more estrogen then someone who has experienced menopause at an earlier age[13].

   h) Having dense breasts: Having dense breasts renders diagnosis by mammogram more difficult due to the fact that dense tissues turn up very light on the radiograph, making tumour growth difficult to differentiate as much of the radiograph will appear light[14].

   i) No full term pregnancy or first child after age 30: Women who bear their first child before the age of thirty decrease their risk of breast cancer, where as women who have children after the age of thirty find themselves at twice the risk of breast cancer; possibly due to the increased time to acquire premalignant conditions[15].

   j) Radiation to chest or face before age 30: Exposure to ionizing radiation has been shown to correlate with breast cancer risk for women who experienced medical radiation at a young age or who were monitored for disease progress with fluoroscopy and/or medical radiation. "Women with a history of multiple medical radiation exposures at a young age will be at a higher risk of breast cancer than someone who was exposed at an older age. At the stage of development the breast tissue is going through at the earlier age, cells are in a vulnerable state due to increased hormones (estrogen and progesterone) produced in the body[16]. "

2) Modifiable risk factors:

a) Body Weight: Obesity in postmenopausal women increases the risk of breast cancer by a factor of two[11]. Adipose cells produce small amounts of estrogen post-menopause. Therefore, the more fat tissue, the higher the risk for breast cancer due to increased levels of estrogen in the body[17].

b) Using hormone replacement therapy (HRT): Women who suffer from menopausal symptoms may be on HRT consisting of estrogen, progesterone or a combination of the two to help relieve symptoms. Research shows that women who are currently using estrogen-progesterone hormone therapy will increase their risk of invasive breast cancer by 24%[18]. The longer a woman is on HRT, the higher their risk of breast cancer. However, women who have stopped therapy within the last two to five years will find their risk of breast cancer decreased or have no increased risk at all.

c) Drinking alcohol: Lifestyle choices can affect the risk of breast cancer. Alcohol consumption can affect the risk of breast cancer if one has more than one drink a day. Heavy drinking increases the risk even more. The main effect of alcohol is that it increases estrogen levels[10].

d) Breastfeeding lowers risk of breast cancer in women. The longer a women breast feeds, the more the risk for breast cancer decreases[12].

Appendix 2: 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 was referred to as the "Registry" in this report[7]. 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 breast cancer cases from 1982 through 2016 and breast 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 "Cause of Death" (COD) for only those people with cancer as the underlying 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 until 2013. This information was 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.

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. 2011 Canadian Standard Population in 5-year age groups (18 groups) is used for age-standardized rates.

CANSIM Tables: The Canadian breast cancer incidence and mortality rates are provided in the Canadian socioeconomic database from Statistics Canada (CANSIM) tables.

Life Tables: Survival rates are calculated using the life tables containing the expected survival of Islanders that are provided by Statistics Canada through the Data Use and Publication Committee (DUPC). The data have the same yearly expected survival from years 2010 through 2016.

Risk Factors: Analysis of overweight and alcohol use in PEI were provided by the PEI Population Health Assessment and Surveillance Unit of the PEI Chief Public Health Office. The data originated from the Canadian Community Health Survey conducted by Statistics Canada.

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[19]. 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[20]

Counting Breast Cancer Cases and Deaths: All new breast cancer cases are counted as incident cases of cancer in the Registry; this may include a new cancer in the breast in a patient 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[21]. 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[22]. The SEER cancer groupings primarily based on anatomical site of origin and microscopic cellular structure were used to identify cases of breast cancer (Appendix III)[23].

Breast 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. Differences in rates were considered statistically significant if $P<0.05$.

- Breast 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 females or the risk by age group. Mortality rate is the rate of deaths and is calculated by dividing the number of breast 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 breast cancer deaths per 100,000 people per year.

- Annual percent change (APC) in breast 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[24]. 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.

Yearly age-standardized rates and standard errors from 1982 through 2016 for incidence and from 1992 through 2016 for mortality were used to calculate APC for breast cancers in women. Significant APCs are those statistically different from 0% at $P<0.05$.

- Five-year breast 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[25,26]. The actuarial method was used to develop the life table and the Ederer II method to calculate expected survival[27]. 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 compared with RSR for women with breast cancers diagnosed between 2002 and 2006. The RSR for cancers diagnosed in the earlier period were calculated using the cohort method[28].

In addition, five-year RSR was calculated by age-group and stage.

- Prevalence of cancer

Prevalent cases are the number of Islanders alive with a diagnosis of breast cancer making it a useful measure for health care systems planning. A limited duration of 10 years for the prevalent cases of breast cancer is the number of Islanders that were diagnosed with a breast 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 even if they were considered cancer-free. If a person has been diagnosed with two or more of the same type of cancer in the period, the cancer is only counted once in the prevalence count.

Appendix III: Description of Breast Cancer Codes

SITE:	DESCRIPTION:	ICDO-3 CODES for site or histology* (Incidence)	ICD-9 (Mortality)	ICD-10 (Mortality)
Breast	Breast	C50 (excluding histology 9050-9055, 9140, 9590-9992)	174-175	C50

References

1. Canadian Cancer Statistics publication - Canadian Cancer Society [Internet]. [cited 2017 Jul 14]. Available from: http://www.cancer.ca/en/cancer-information/cancer-101/canadian-cancer-statistics-publication/?region=on

2. Youlden DR, Cramb SM, Dunn NAM, Muller JM, Pyke CM, Baade PD. The descriptive epidemiology of female breast cancer: An international comparison of screening, incidence, survival and mortality. Cancer Epidemiol. 2012 Jun 1;36(3):237–48.

3. Kreiter E, Richardson A, Potter J, Yasui Y. Breast cancer: trends in international incidence in men and women. Br J Cancer. 2014;110(7):1891–7.

4. Li CI, Malone KE, Daling JR. Differences in breast cancer stage, treatment, and survival by race and ethnicity. Arch Intern Med. 2003 Jan 13;163(1):49-49–56.

5. Martin, Anne-Marie, Weber, Barbara L. Genetic and Hormonal Risk Factors in Breast Cancer. J Natl Cancer Inst. 2000;92(14):1126.

6. PEI Cancer Strategy 2016-2019: Let's make a difference [Internet]. Health PEI, Charlottetown, PE; 2016. Available from: www.healthpei.ca/cancercare

7. Public Health Act. Notifiable Disease Regulations, Cap. P-30. RSPEI. 1988;

8. CANSIM - 103-0554 - New cases and 2011 age-standardized rate for primary cancer (based on the July 2016 CCR tabulation file), by cancer type and sex, Canada, provinces and territories [Internet]. [cited 2017 Sep 13]. Available from: http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=1030554

9. Government of Canada SC. CANSIM - 102-0553 - Deaths and mortality rate (age standardization using 2011 population), by selected grouped causes and sex, Canada, provinces and territories [Internet]. 2017 [cited 2017 Oct 11]. Available from: http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=1020553

10. Seitz HK, Pelucchi C, Bagnardi V, Vecchia CL. Epidemiology and Pathophysiology of Alcohol and Breast Cancer: Update 2012. Alcohol Alcohol. 2012 May 1;47(3):204–12.

11. McPherson K, Steel CM, Dixon JM. Breast cancer—epidemiology, risk factors, and genetics. BMJ. 2000 Sep 9;321(7261):624–8.

12. Golubnitschaja O, Debald M, Yeghiazaryan K, Kuhn W, Pešta M, Costigliola V, et al. Breast cancer epidemic in the early twenty-first century: evaluation of risk factors, cumulative questionnaires and recommendations for preventive measures. Tumor Biol. 2016 Oct 1;37(10):12941–57.

13. Canadian Cancer Statistics 2017-EN.pdf [Internet]. [cited 2017 Oct 5]. Available from: http://www.cancer.ca/~/media/cancer.ca/CW/publications/Canadian%20Cancer%20Statistics/Canadian-Cancer-Statistics-2017-EN.pdf

14. Wilson DR, Held S. Screening for Breast Cancer Feared a Risk Factor. Int J Childbirth Educ. 2014 Jan;29(1):86–91.

15. Bilimoria MM, Morrow M. The woman at increased risk for breast cancer: Evaluation andmanagement strategies. CA Cancer J Clin. 1995 Sep 1;45(5):263–78.

16. Ronckers CM, Erdmann CA, Land CE. Radiation and breast cancer: a review of current evidence. Breast Cancer Res. 2004 Nov 23;7:21.

17. Hou N, Hong S, Wang W, Olopade OI, Dignam JJ, Huo D. Hormone replacement therapy and breast cancer: heterogeneous risks by race, weight, and breast density. JNCI J Natl Cancer Inst. 2013 Sep 18;105(18):1365–72.

18. Chlebowski RT, Hendrix SL, Langer RD, Stefanick ML, Gass M, Lane D, et al. Influence of estrogen plus progestin on breast cancer and mammography in healthy postmenopausal women: the Women's Health Initiative randomized trial. JAMA J Am Med Assoc. 2003;289(24):3243–53.

19. NAACCR. North American Association of Central Cancer Registries. 2012; Available from: http://www.naaccr.org/).

20. National Cancer Institute of Canada. National Cancer Institute SEER*Stat software [Internet]. 2011. (Surveillance, Epidemiology and End Results (SEER) Program). Available from: seer.cancer.gov/seerstat

21. Johnson C, Peace S, Adamo A, Percy-Laurry A, Edwards B. The 2007 Multiple Primary and Histology Coding Rules. National Cancer Institute, Surveillance, Epidemiology and End Results Program. Bethesda, MD; 2007.

22. IARC. International rules for multiple primary cancers (ICD-O Third Edition. IARC Intern Rep No 200402 [Internet]. 2004; Available from: http://www.iacr.com.fr/MPrules_july2004.pdf

23. Site Recode ICD-O-3/WHO 2008 - SEER Data Reporting Tools [Internet]. [cited 2017 Oct 11]. Available from: https://seer.cancer.gov/siterecode/icdo3_dwhoheme/index.html

24. National Cancer Institute, SRB. Joinpoint Regression Program [Internet]. 2011. Available from: http://surveillance.cancer.gov/joinpoint/aapc.html

25. Brenner H, Hakulinen T. Advanced detection of time trends in long-term cancer patient survival: experience from 50 years of cancer registration in Finland. Am J Epidemiol. 2002 Sep 15;156(6):566–77.

26. Cronin K, Mariotto A, Hawken S, Green D, Clegg L. Differences Between Brenner et al. and NCI Methods for Calculating Period Survival. Stat Res Appl Branch NCI Tech Rep 2003-02-A [Internet]. 2003; Available from: http://surveillance.cancer.gov/reports/tech2003.02.a.pdf

27. Cho H, Howlader N, Mariotto A, Cronin K. Estimating relative survival for cancer patients from the SEER Program using expected rates based on Ederer I versus Ederer II method. Surveill Res Program NCI Tech Rep 2011-01 [Internet]. Available from: http://surveillance.cancer.gov/reports/tech2011.01.pdf

28. Ederer F, Axtell LM, Cutler SJ. The relative survival rate: a statistical methodology. Natl Cancer Inst Monogr. 1961 Sep;6:101–21.

Prince Edward Island
CANADA

Health PEI
One Island Health System

2018
18HPE35-49093