

2019

Report on Cancer Statistics
in Prince Edward Island:
Colorectal Cancer



Health PEI
One Island Health System

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:

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Forward

I am pleased to introduce a statistical report on Colorectal Cancer in Prince Edward Island. This is a 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.

Colorectal cancer is the second most commonly diagnosed cancer and the second most common cause of cancer mortality in PEI. Although the risk of diagnoses and the risk of death from colorectal cancer in PEI have been decreasing in women, the same advancements are not occurring in men. The burden of this disease on those diagnosed, their families and the health system is immense.

Over time, it is projected that the number of people diagnosed with colorectal cancer will decrease and outcomes will improve as more Islanders participate in the PEI Colorectal Cancer Screening Program. In addition, there is an increase in the number of young adults being diagnosed with colorectal cancer in Canada. The cause of this is unknown, but modifiable risk factors have been suggested.

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 high quality care.

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Introduction

Colorectal cancer is the second most commonly diagnosed cancer in Canada and PEI. Recent reports show the incidence of colorectal cancer in North America has been decreasing for the last two decades except those younger than 50 years old^{1,2}. In addition, the mortality due to colorectal cancer has been decreasing in the last two decades, but it is still the second most common cause of cancer mortality³. The impact and burden of colorectal cancer in PEI is significant which was identified in the *PEI Cancer Trends: 1980-2009* report⁴. In an effort to advance information on the disease and its burden, further investigation was needed into this leading type of cancer.

Colorectal cancers are a group of cancers confined to the large intestine (colon and rectum) excluding the anus. Most colorectal cancers are adenocarcinomas indicating that they started in the glandular tissue of the colon⁵.

Figure 1 Anatomical parts of the large intestine

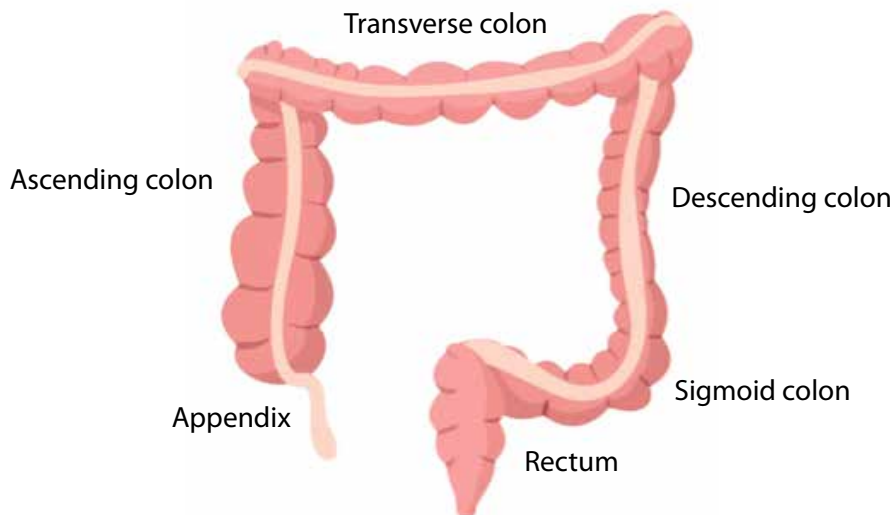


Figure 1 describes the subsites of the colon and rectum. The proximal colon starts at the ascending colon with the appendix and continues through the transverse colon. The distal colon comprises the descending colon and sigmoid colon. The large intestine ends with rectum. The anatomical regions of the colon and rectum are distinguished because of the different types of treatment for each.

A small proportion of adenomatous polyps in the colon and rectum may become cancerous, but the developmental process from polyp to cancer usually takes longer than ten years^{5,6}. Because of the slow process, identifying polyps and early cancers with colorectal cancer

screening and then removing them is an effective cancer control. In 2016, the Canadian Task Force on Preventive Health Care published guidelines for colorectal screening for average risk adults⁷.

PEI follows these guidelines. Fecal test programatic screening has been available to all Islanders age 50 to 74 years old as of 2011. Since that time, the number of early non-invasive cancers (stage 0, defined as colorectal cancer that has not moved beyond the inner layer of the colon or rectum) has increased by eight times. Removing early cancers and polyps will eventually improve mortality and survival rates.

Understanding risk factors for colorectal cancer are important to assess each person's risk level and to minimize the effects of any modifiable risk factors. Non-modifiable risk factors include increasing age, being male, genetics, history of inflammatory bowel disease, and a family history of colorectal cancer⁸. Modifiable risk factors for colorectal cancer include being overweight, being inactive, having a diet high in red meat and processed meat and low in dietary fibre^{8,9}, smoking, and excess alcohol consumption. Reducing risk factors will decrease the incidence.

This report is part of a series of four cancer statistical reports which supports the *PEI Cancer Strategy 2016-2019*¹⁰ 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 intensely influence colorectal cancer rates.

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

Examining the colorectal 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 interested 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 report¹¹. Analyses of new colorectal cancer cases from 1982 through 2016 and colorectal 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 I. Anatomic site of origin and microscopic cellular structure of all cancers counted as colorectal cancers are listed in Appendix II.

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 colorectal cancer risk factors, inactivity levels and daily consumption of 5 or more servings of fruits and vegetables. 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 colorectal cancer rates for incidence and mortality.

Colorectal 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. 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.

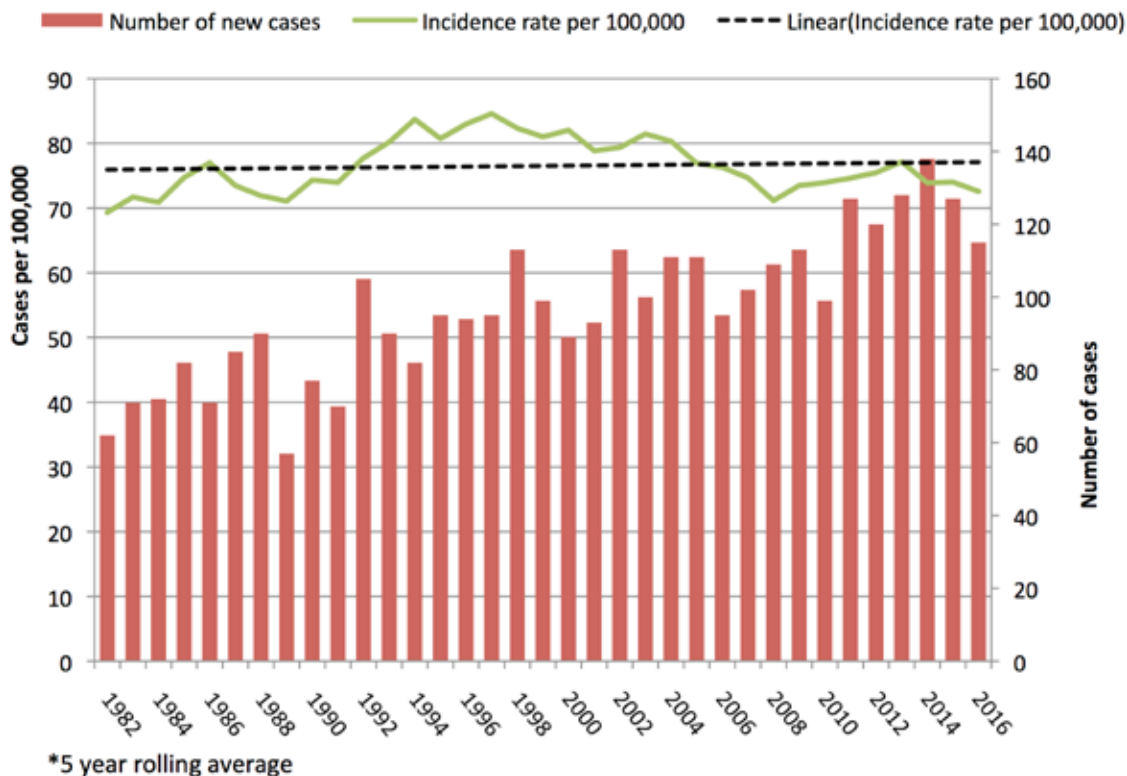
In many measurements, a 5-year rolling average was used to smooth the trend line. Each yearly estimate is an average of the two years before, the year, and two years after the estimated year.

Specific definitions for these measurements and other terms are available at the end of this document in the Methods (Appendix I).

Colorectal 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 colorectal cancer cases diagnosed each year while incident rate is the number of cases per 100,000 people.

Figure 2 Incident number of cases and age-standardized incident rate* of colorectal cancer, 1982-2016, PEI

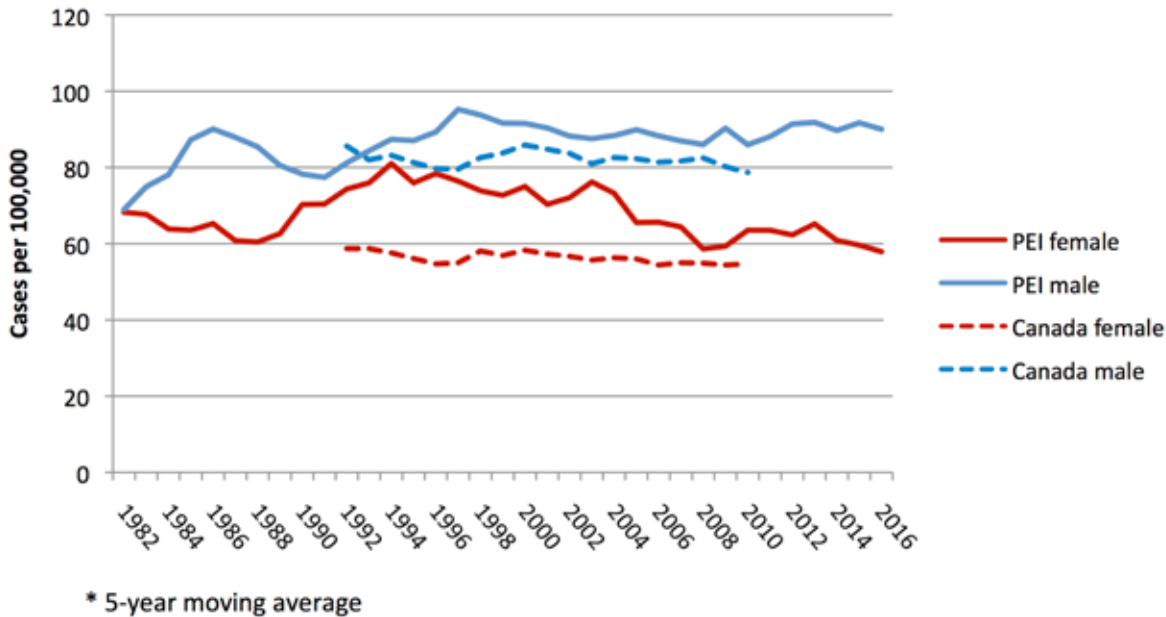


The number of cases in PEI has been rising; however the majority of the increase has been due to the increase in population and increasing age. This increasing number of cases is important when we are projecting health care needs such as utilization of testing, treatment, equipment, aftercare, palliative needs, etc.

Colorectal cancer is second most commonly diagnosed cancer in Islanders. On average, approximately 120 people are diagnosed with colorectal cancer each year in PEI.



Figure 3 Age-standardized incidence rate of colorectal cancer by sex, 1982-2016, PEI* and Canada



The figure above is the age-standardized incidence rates in PEI (solid lines) and in Canada (dashed lines)¹². Although not significantly different, the colorectal cancer rates tend to be higher in PEI than in Canada.

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 colorectal cancer incidence in PEI women decreased by 1.5% in women per year between the years 1997 through 2016. The incidence rate in women has decreased significantly in the last 20 years. Decreasing incidence rate is likely associated with the introduction of better screening methods over time.

The trend in males decreased by 0.3% per year but was not significant indicating that the rate has been stable in the last 20 years.

The risk of colorectal cancer in PEI tends to be higher than in Canada. The risk has decreased significantly in PEI women but not in men over the last 20 years.



Colorectal 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 colorectal cancer.

Figure 4 Age-specific colorectal cancer incidence rate by sex, PEI, 2007-2016

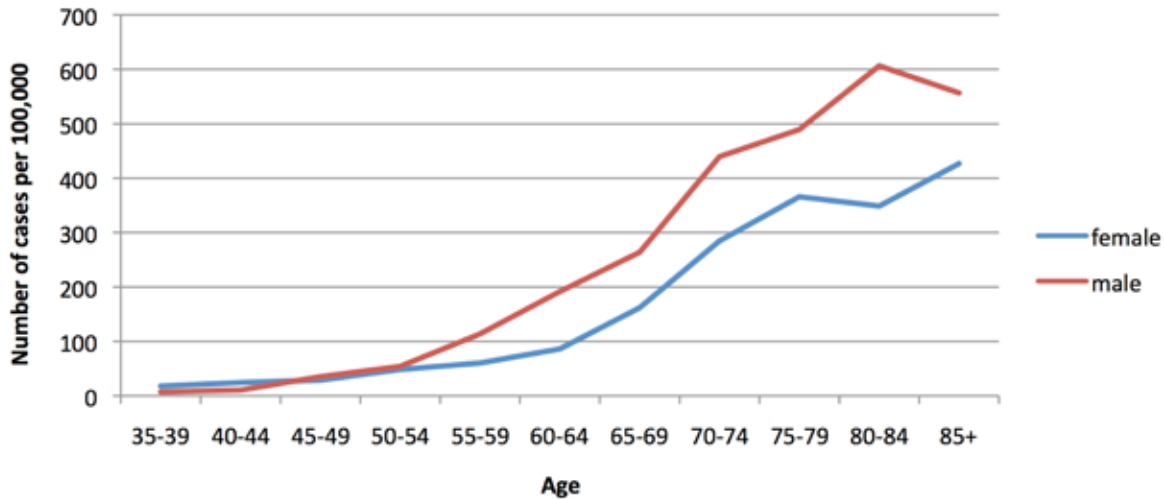


Figure 4 demonstrates how the incidence rate increases as age increases up through the age of 84. The median age for men and women diagnosed during 2007-2016 were 70.5 and 72.7, respectively.

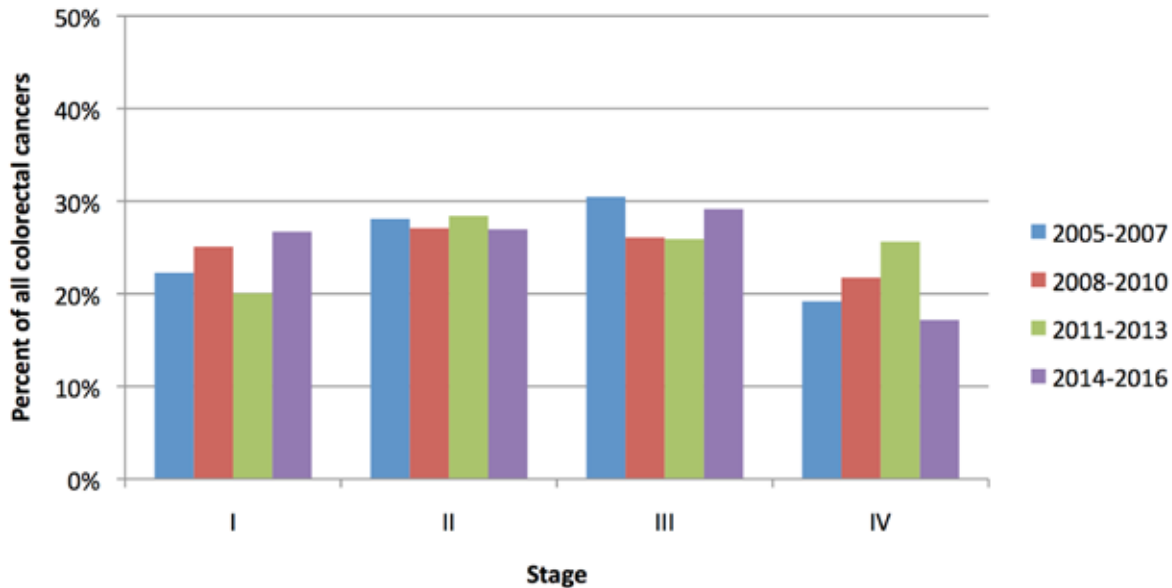
The risk of colorectal cancer increases as people age. The median age at diagnosis in PEI was 72.7 years old for women and 70.5 years old for men.



Colorectal 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.

Figure 5 Colorectal cancer incident cases by stage, by year group 2005-2016, PEI



The percentage of the different stages indicates that colorectal cancers are diagnosed commonly at all stages. When most people follow guidelines and report symptoms early, both the incidence rate and the proportion of late stage cancers (stages III and IV) will decrease. In PEI, the current number of people annually screened is over 4000 people but this number continues to grow slowly each year. Since colorectal cancer takes over 10 years to develop, if the participation rate continues to increase, the proportion of late stage colorectal cancers should decrease in the upcoming years similar to the decrease in incidence rate.

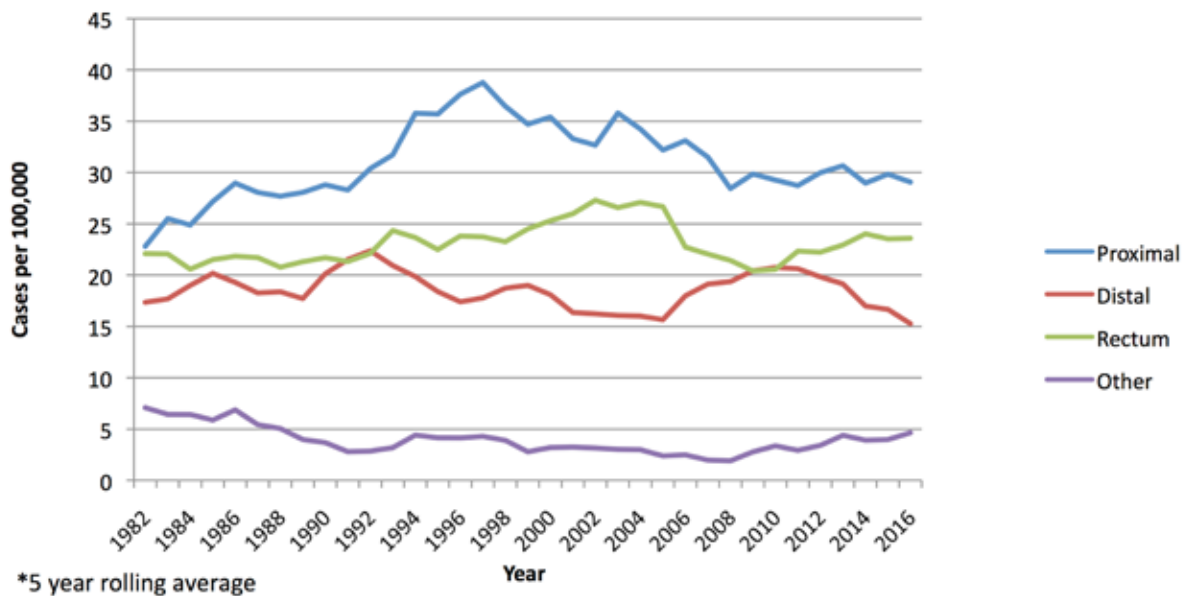
Finding cancer at an early stage will improve mortality and survival. Increasing the participation in colorectal screening is essential.



Colorectal Cancer Incidence by Subsite

Colorectal cancers are divided into proximal colon, distal colon, rectum, and other (Appendix and unspecified large intestine). Cancers are associated with their subsite of the colon because they often come with different predilection for age and sex, different survival rates, and may also require different treatments¹³⁻¹⁵.

Figure 6 Age-standardized incidence rate* of colorectal cancer, by colorectal subsite, PEI, 1982-2016



The highest incidence rate by colon subsites is in the proximal colon followed by the rectum (figure 6).

Figure 7 Proportion and number of cases of each subsite of colorectal cancer, by sex, 2007-2016

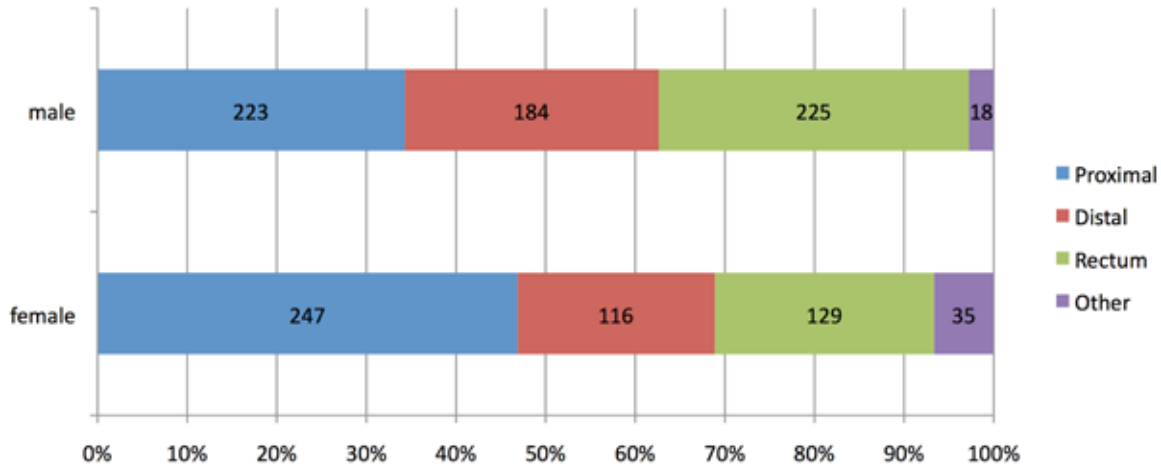


Figure 7 represents the different subsites for Islanders diagnosed in the last 10 years. Island women were diagnosed with a higher proportion of proximal colon cancers compared to Island men. Island men had similar proportions of proximal colon as rectal cancers.

A higher proportion of proximal and a lower proportion of rectal cancers in women compared to men are likely due to a sex difference in the type of cell that becomes cancerous⁶.

***The highest incidence rate is for cancers in the proximal colon.
Island men and women have different proportion of each subsite.***



Colorectal Cancer Mortality

This section of the report provides information on the number of deaths due to colorectal cancer in PEI. Cancer mortality is based on colorectal cancer as the cause of death as it is reported on a person's death certificate.

Figure 8 Number of deaths and age-standardized mortality rate* from colorectal cancer, 1992-2016, PEI

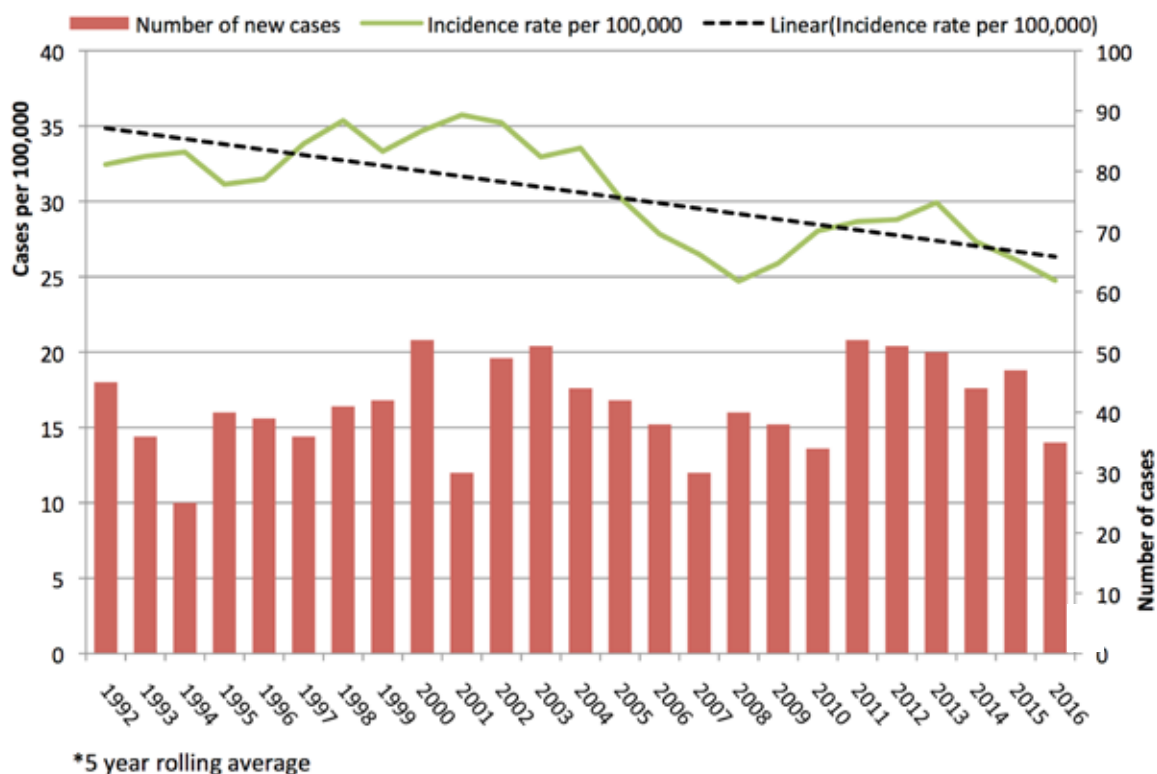


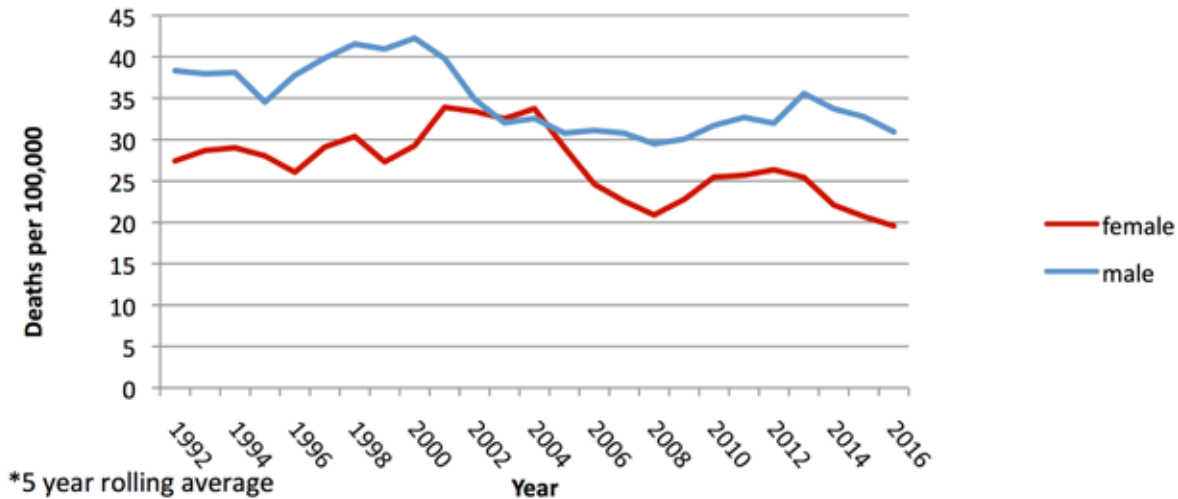
Figure 8 depicts how the mortality rate in PEI due to colorectal cancer decreased rapidly in the early 2000's. Approximately 45 Islanders die from colorectal cancer each year.

Although the risk of dying from colorectal cancer is decreasing, there are still approximately 45 Islanders a year who die from colorectal cancer.



Colorectal Cancer Mortality by Sex

Figure 9 Age-standardized mortality rate* from colorectal cancer, by sex, 1992-2016, PEI



The figure above (figure 9) is the age-standardized mortality rates in PEI for men and women over time. Adjusting for the increasing age and size of the population, the risk of mortality in PEI appears to be decreasing for both males and females since the late 1990s. The pattern of PEI mortality in women corresponds to the changes in incidence rates. The mortality rate for PEI males is higher than the rate in women and also appears to be more stable in recent years. For a short period (2002-2004), the mortality rate in women surpassed that of men. The mortality rate in women eventually returned below that of men and remains there today.

Any increasing or decreasing trend in the PEI mortality rate over the years was estimated by the annual percent change for age-standardized mortality rate for colorectal cancer. On average, colorectal cancer mortality in women decreased by 2.4% per year in the last 20 years. This significant decrease may be due to increased prevention and early detection as well as better treatments.

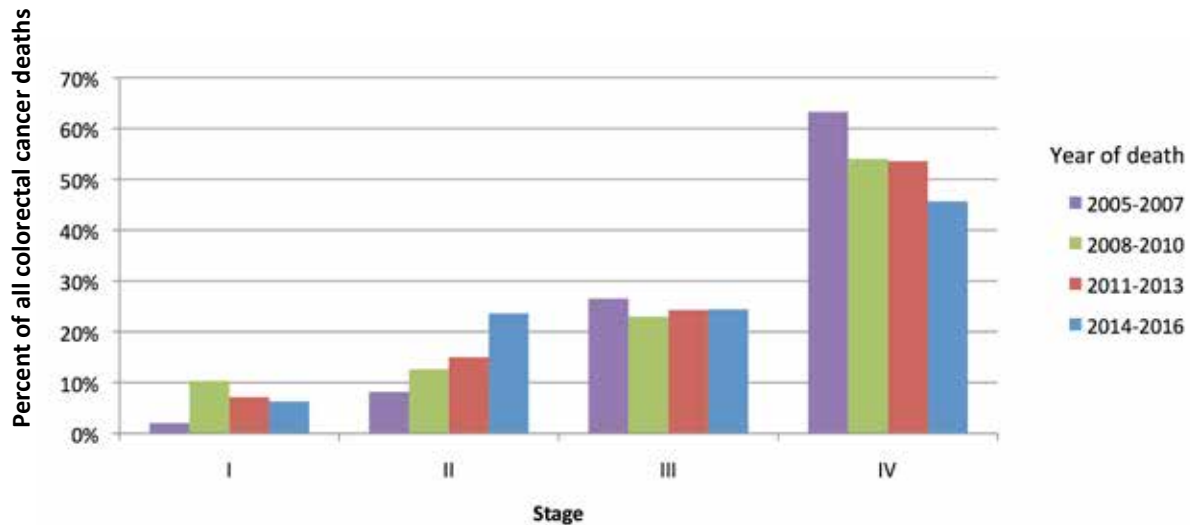
Unlike the women, the PEI men have a nonsignificant decrease in annual percent change. There is a decrease of 1.3% each year in the last 20 years.

Deaths due to colorectal cancer have been significantly decreasing in women but not changing to a great extent in men in PEI.



Colorectal Cancer Mortality by Stage

Figure 10 Percent of colorectal deaths by stage at diagnosis, by year of death, 2005-2016, PEI



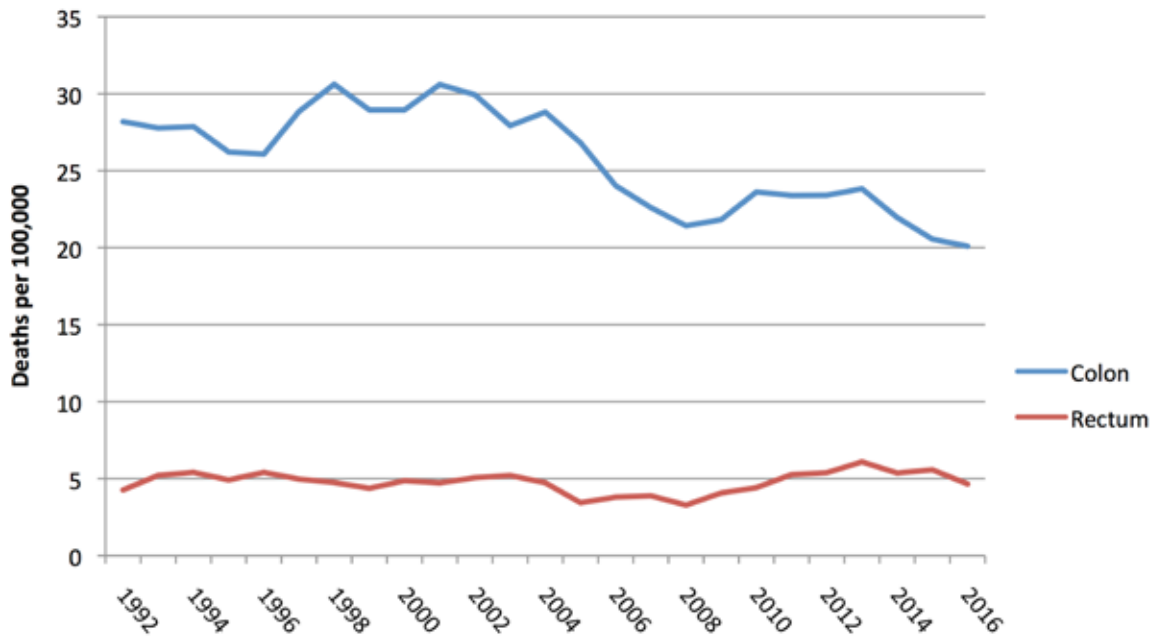
The largest proportion of deaths occurs in people who were diagnosed at stage IV which is consistent with stage IV as the most advanced stage (figure 10). Although stage II is less advanced than stage III, there was an increase in the proportion of stage II deaths in the most recent years. This increase may be due to the higher proportion of the distal colon cancer for this group of stage II cancers.

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



Colorectal Cancer Mortality by Colon and Rectum

Figure 11 Age-standardized mortality rate* from colorectal cancer, by colon and rectum, 1992-2016, PEI



*5 year rolling average

Although colorectal incidence rate is divided into subsites of the colon and rectum, colorectal mortalities are less accurately assessed for subsite. For this reason, mortality rates will only be divided into cancers of the colon and cancers of the rectum (figure 11). Mortality rate often follows the pattern of the incidence rate. Like the overall mortality rate, the rate for cancers of the colon is also decreasing. However, the mortality rate for rectal cancers has not been decreasing.

The mortality rate has been decreasing for patients with colon cancers but not for those with rectal cancers.



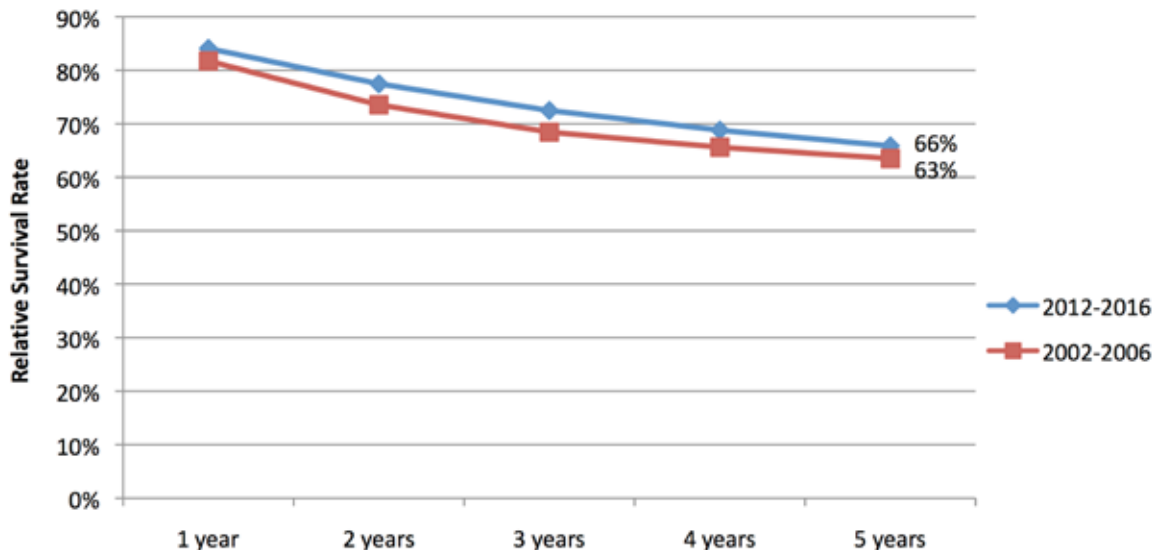
Colorectal Cancer Survival

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 colorectal 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 woman in PEI with colorectal cancer is 66% indicating that a women diagnosed with colorectal cancer has, on average, a 66% chance of surviving to 5 years compared to women without colorectal 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 research¹⁶

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

Figure 12 Five-year relative survival rate* for colorectal cancer diagnosed 2002-2006 and 2012-2016, PEI



* 2012-2016 years used period approach
2002-2006 years used cohort approach

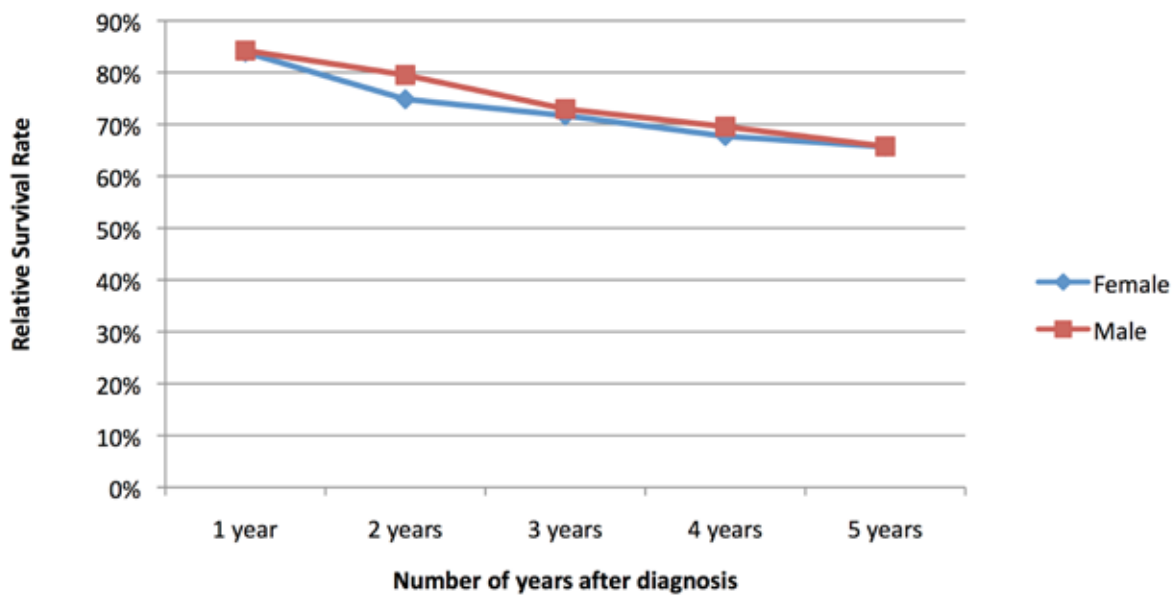
Figure 12 has RSRs for each year up to 5-years after diagnosis for colorectal cancer during two time periods, 2002-2006 and 2012-2016. The most recent 5-year RSR for colorectal cancer is fair at 66%. The historical information is provided from cancers diagnosed from 2002 through 2006. Although not significantly better, there is a trend for the more recent cases (2012-2016) to have an increased 5-year survival. The small improvements to survival may be a result of the screening program and improved treatments.

Long-term survival can be measured by 10-year relative survival rate. For all patients diagnosed with colorectal cancer between 2002-2006, the 10-year relative survival is 57% (58% in women and 56% in men).

Although survival is still fair at 66%, there is minor improvement in survival over the last 15 years.



Figure 13 Five-year relative survival rate for colorectal cancer by sex, 2012-2016, PEI



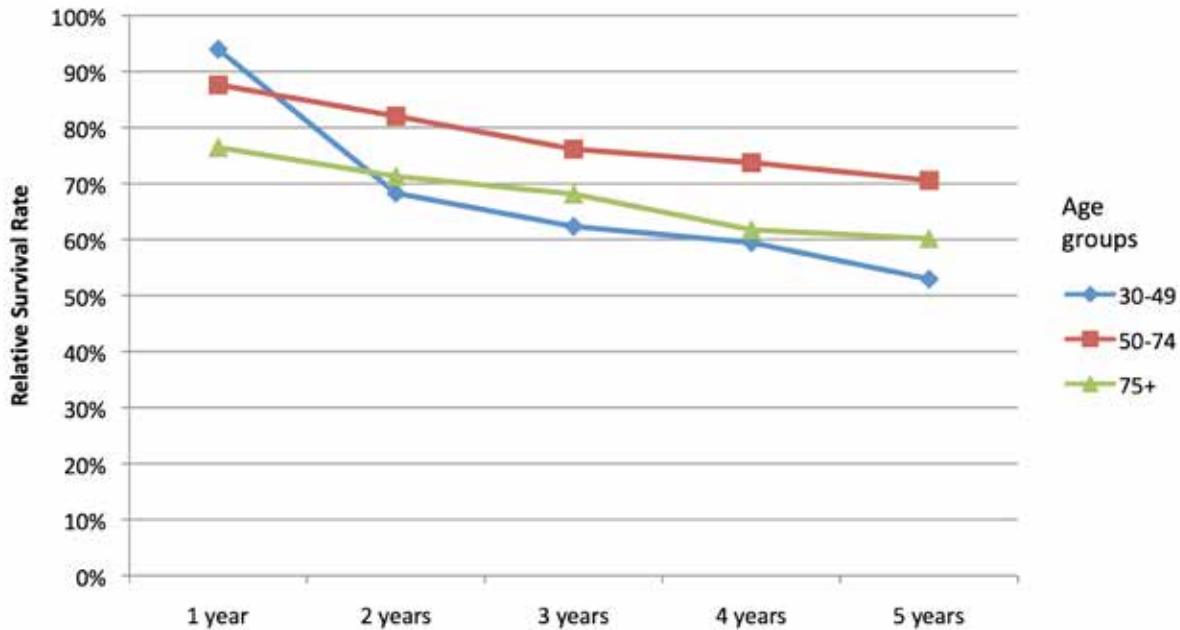
Survival in both men and women is fair (figure 13). The 5-year survival is very similar between men and women.

Women and men have similar five-year survival rates.



Colorectal Cancer Survival by Age

Figure 14 Five-year relative survival rate for colorectal cancer by age group, diagnosed 2012-2016, PEI



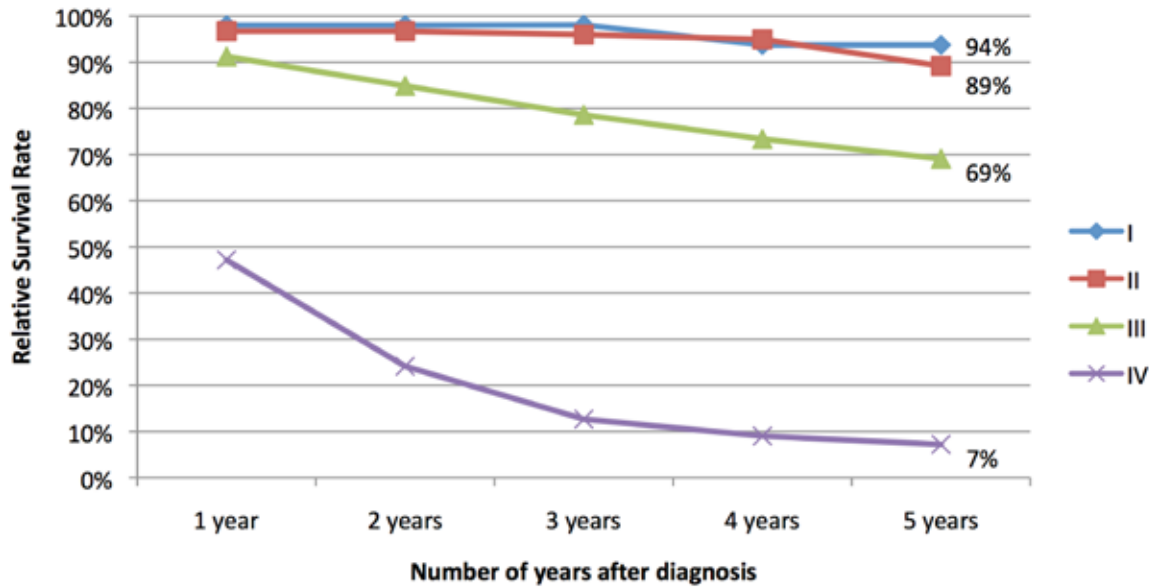
Usually, younger patients have a higher RSR compared with older patients due to fewer comorbidities or improved ability to tolerate the treatments than older patients¹⁷. However colorectal cancer patients diagnosed between 30-49 years of age have a higher proportion of stage III and stage IV cancers and have a non-significantly lower five-year survival rate than the patients diagnosed between 50-74 years old (figure 14).

The youngest patients had the lowest five-year survival rate likely due to having later stage cancers at diagnosis.



Colorectal Cancer Survival by Stage

Figure 15 Five-year Relative Survival Rate for Colorectal Cancer by Stage, 2012-2016, PEI



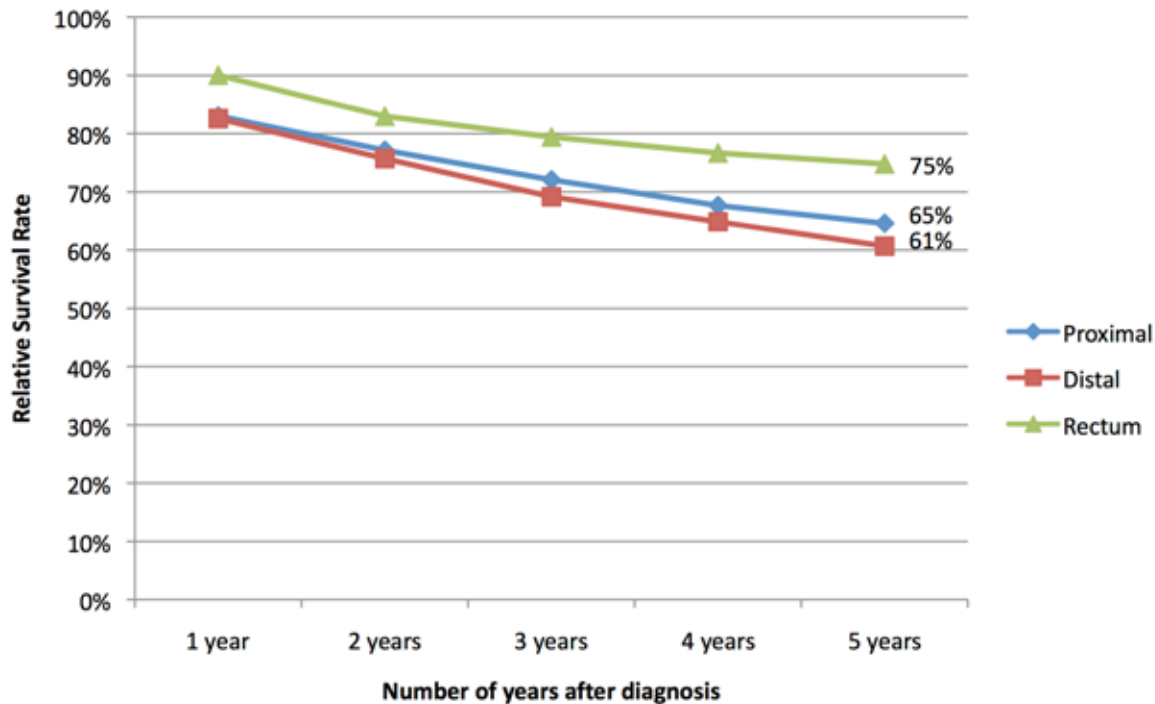
Staging may be useful for prognosis. The lowest stage has the highest RSR, while the highest stage has the lowest RSR. Colorectal cancer screening has the potential to improve colorectal cancer survival by diagnosing cancer at an earlier stage.

Detecting colorectal cancer at its earliest stage increases the relative five-year survival rate.



Colorectal Cancer Survival by Subsite

Figure 16 Five-year relative survival rate for colorectal cancer by subsite*, 2012-2016, PEI



The 5-year relative survival rate for rectal cancer is significantly higher than that of the distal colon. The 5-year RSR for rectal cancer is not significantly higher than that of the proximal colon (figure 16).

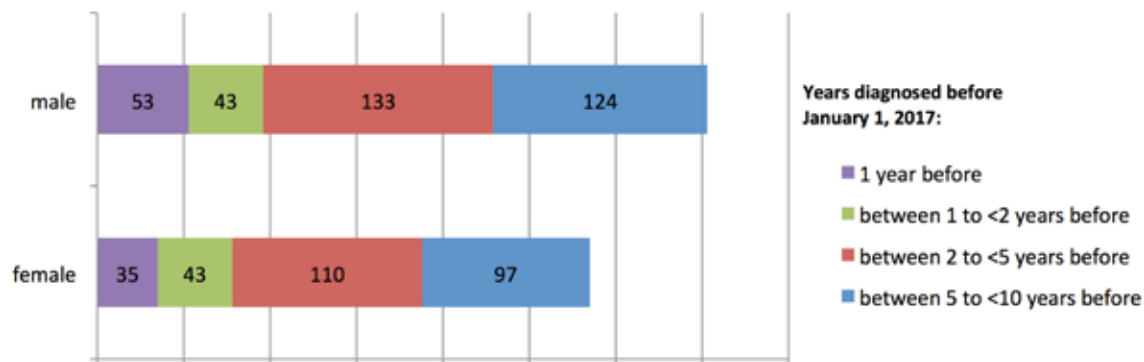
In PEI, rectal cancer tends to have a higher survival rate compared to colon cancer.



Prevalence

The ten-year prevalence of cancer is the proportion of Islanders diagnosed with colorectal cancer 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.

Figure 17 Number of people diagnosed with colorectal cancer between January 1, 2007 to December 31, 2016 who are alive on January 1, 2017, by sex, PEI



The number of people living with colorectal cancer diagnosed in the last ten years is 638 (figure 17). Because colorectal cancer is the second most common cancer in Islanders, there are many people living with a colorectal cancer diagnosis. Approximately 4 in 1000 Islanders are living with a diagnosis of colorectal cancer in the last 10 years. In general men are diagnosed with colorectal cancer more often than women; therefore, there are more men alive with colorectal cancer than women.

Care for the cancer patient consists of a progression of active treatment, continuous follow-up for recurrences, 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.

Although the prognosis for colorectal cancer is fair, there are still a substantial number of Islanders living with colorectal cancer.



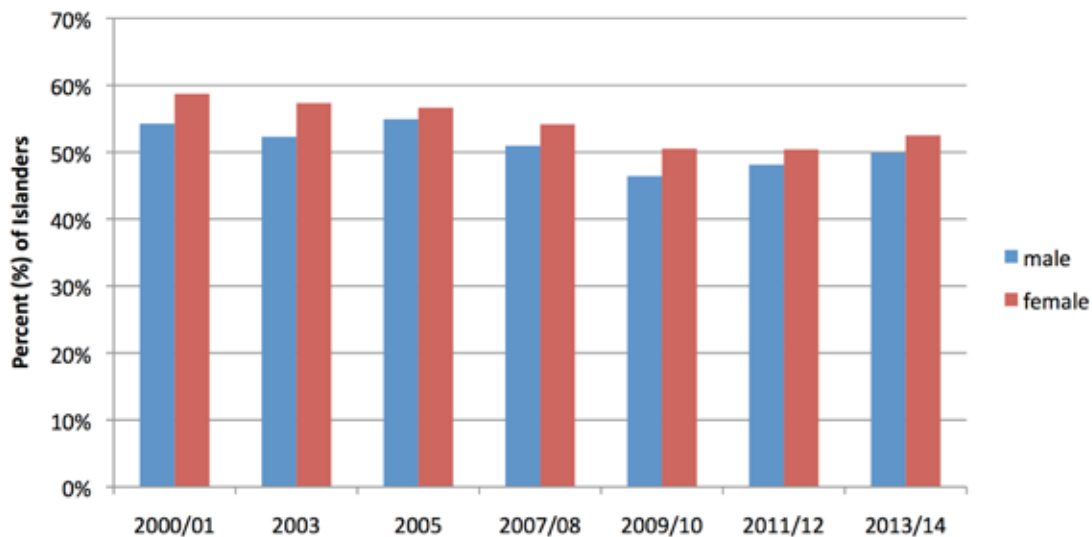
Risk factors

There are non-modifiable risk factors such as increasing age, being male, genetics, history of inflammatory bowel disease, and a family history of colorectal cancer. It is important to understand these risk factors as they are helpful in identifying Islanders that should have increased screening because they are at a higher risk for colorectal cancer⁸. Modifiable risk factors for colorectal cancer include being overweight, being inactive, and having a diet high in red meat and processed meat as well as low in dietary fibre^{8,9}. Additionally, smoking and excess alcohol consumption increase the risk of colorectal cancer. Prevention of colorectal cancer by reducing risk factors will decrease the incidence and burden on individuals and the health care system.

Two lifestyle risk factors will be presented. Both inactivity and having a diet that is low in dietary fibre have been shown to increase the risk of colorectal cancer, and both have been challenging to improve in our population.

Physical inactivity

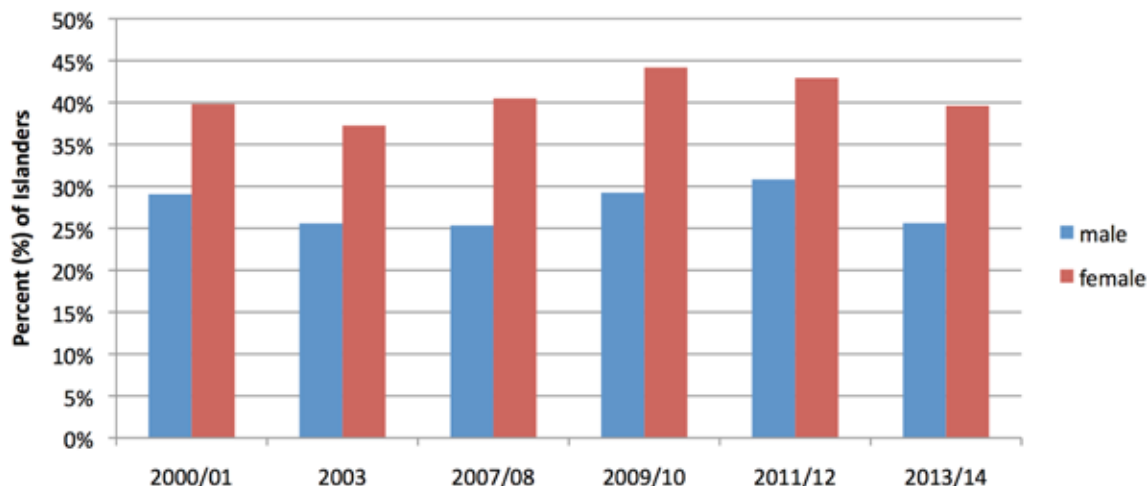
Figure 18 Self-reported physically inactive Islanders (aged ≥ 12) by sex, 2001-2014, PEI



The PEI Chief Public Health Office analyzes self-reported information from the Canadian Community Health Survey (CCHS)¹⁸. Physical inactivity is activity that is equivalent to less than 30 minutes of walking a day. For both males and females, the proportion of Islanders who reported that they were inactive was decreasing up until the 2009/2010 survey period but has since started to increase (Figure 18). In 2013/14 survey period, more than half of Islanders were physically inactive. Males and females report similar rates of inactivity. The inactivity level in PEI has consistently been higher than Canada (data not shown).

Daily consumption of 5 or more servings of fruits and vegetables

Figure 19 Consumption of five or more fruits and vegetables per day (aged ≥ 12) by sex, 2001-2014, PEI



The proportion of Islanders who consumed five or more servings of fruits and vegetables daily is significantly lower than Canada (data not shown). Male Islanders have a significantly lower fruit and vegetable consumption compared to female Islanders (figure 19). Fruits and vegetables are a main source of fibre. Having a diet filled with fruits and vegetables is an important step in reducing the risk of colorectal cancer. PEI needs a multifaceted approach to improving the diets of all in the population.

The high inactivity level and low consumption of fruits and vegetable in PEI increases the risk for colorectal 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 working 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 colorectal cancer including:

- Establish a colorectal cancer action group
- Increase participation in colorectal screening through public awareness, 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

Colorectal cancer is the second most commonly diagnosed cancer and the second most common cause of cancer mortality in PEI. On average, approximately 120 people are diagnosed with colorectal cancer each year in PEI. The risk of colorectal cancer in PEI tends to be higher than in Canada. The risk has decreased significantly in PEI women but not in men over the last 20 years. Although the risk of dying from colon cancer is decreasing, the risk of dying from rectal cancer has not decreased. There are approximately 45 Islanders each year who die from colorectal cancer. The 5-year and 10-year relative survival rate for colorectal cancer are 66% and 57%, respectively. However the 5-year relative survival rate for those diagnosed at stage IV is only 7%, indicating the importance of knowing the signs of colorectal cancer and colorectal screening programs for early diagnosis. Improving participation in screening will decrease the proportion of late stage colorectal cancers and improve overall survival.

There are many non-modifiable and modifiable risk factors for colorectal cancer. Understanding how these factors increase the risk of colorectal cancer will help identify higher risk people and potentially help decrease the risk in all those who improve their lifestyle choices. Identification and removal of colorectal polyps will decrease the number of diagnoses of colorectal cancer and improve outcomes.

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

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 report¹¹. 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 colorectal cancer cases from 1982 through 2016 and colorectal 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 between 1992 and 2008. This information was used to verify the Provincial Vital Statistics and to identify other cancer patient 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.

CANSIM Tables: The Canadian colorectal 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 inactivity and fruit and vegetable consumption 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 America¹⁹. 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 14.1²⁰

Counting Colorectal Cancer Cases and Deaths: All new colorectal cancer cases are counted as incident cases of cancer in the Registry; this may include a new cancer in the colon or rectum 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 2007²¹. 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 once²². The SEER cancer groupings primarily based on anatomical site of origin and microscopic cellular structure were used to identify cases of colorectal cancer (Appendix II)²³.

Colorectal 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 $P < 0.05$.

- Colorectal 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 colorectal 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 colorectal cancer deaths per 100,000 people per year.

- Annual percent change (APC) in colorectal 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 software²⁴. 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 1997 through 2016 for incidence and mortality were used to calculate APC for colorectal cancers in men and women separately. 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^{25,26}. The actuarial method was used to develop the life table and the Ederer II method to calculate expected survival²⁷. 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 colorectal cancer diagnosed between 2002

and 2006. The RSR for cancers diagnosed in the earlier period were calculated using the cohort method²⁸.

In addition, five-year RSR was calculated by age-group, stage, and area (proximal colon, distal colon, rectum, and other which includes the appendix and unspecified large intestine). 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 colorectal cancer making it a useful measure for health care systems planning. A limited duration of 10 years for the prevalent cases of colorectal cancer is the number of Islanders that were diagnosed with a colorectal 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 colorectal cancers in the period, the cancer is only counted once in the prevalence count.

Appendix II: Description of Colorectal Cancer Codes

SITE:	DESCRIPTION:	ICDO-3 CODES for site or histology* (Incidence)	ICD-9 (Mortality)	ICD-10 (Mortality)
Colon and Rectum	Colon excluding Rectum; Rectum and Rectosigmoid Junction	C18, C19.9, C20.9, C26.0 (excluding histology 9050-9055, 9140, 9590-9992)	153, 154.0-154.1, 159.0	C18, C19-C20, C26.0

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