



# Cancer Mortality Trends, 1999-2013

Yukon Cancer Registry



Office of the Yukon  
Chief Medical Officer of Health

May 2017



## ABOUT THE DEPARTMENT OF HEALTH AND SOCIAL SERVICES

The Department of Health and Social Services, a department of the Yukon Government, coordinates health and social services for the people of Yukon with regional health partners.

Our mission is to promote, protect, and enhance the well-being of Yukon people through a continuum of quality, accessible, and appropriate health and social services.

## ABOUT THE OFFICE OF THE CHIEF MEDICAL OFFICER OF HEALTH

The office of the Yukon Chief Medical Officer of Health is responsible for the Department of Health and Social Services' legislated responsibility to protect and promote the public's health in a variety of areas.

## PROJECT TEAM AND ACKNOWLEDGEMENTS

This report represents the work of a collaborative initiative across several departments of Yukon Government and the British Columbia Cancer Agency which supports the Yukon Cancer Registry.

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This publication is available from the Department of Health and Social Services' website at: [www.hss.gov.yk.ca](http://www.hss.gov.yk.ca).

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# *Foreward from the Deputy Chief Medical Officer of Health*

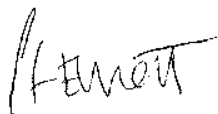
Cancer can take a heavy toll on a person physically, emotionally, socially and spiritually. Each person with cancer has a unique story about their cancer journey and how it has affected them, their family and community. Many Yukoners who have not themselves had cancer, have been touched by cancer in a friend, neighbor or loved one. Perhaps this is why cancer is such a growing concern for Yukoners. We want to understand why cancer is occurring, whether the rates are higher than they should be and what we can do to reduce suffering and disease from cancer.

With this in mind it is my great pleasure to present *Cancer Mortality Trends 1999-2013*. This report provides the first comprehensive analysis of cancer mortality in Yukon. We provide valuable information about major causes of cancer death in Yukon and trends across 15 years. We examine differences between males and females and between Whitehorse and other towns and communities. Throughout the analysis we compare mortality rates for the Yukon population to those for Canada. Then we take a closer look at the causes of cancer, the risk factors that make a person more likely to develop disease as well as factors that can protect a person from developing disease.

*Cancer Mortality Trends 1999-2013* shows that cancer is the leading cause of death for Yukoners and lung cancer is the most common cause of cancer death. With this unpleasant news we offer some positive directions: recommendations to improve cancer outcomes for the major causes of cancer deaths in Yukon, recommendations that are grounded in current evidence and best practice. We also outline ways to maintain and improve on the high standard of data management in Yukon Cancer Registry so that we are able to quantify new cancer diagnoses, examine stage at diagnosis and track mortality over time. This would lead to better cancer information to provide the evidence to prioritize new and to measure effectiveness of existing cancer control initiatives. Overall we recommend a *coordinated approach* to cancer control in Yukon with close collaboration across Yukon Government and between Yukon Government and First Nations.

*Cancer Mortality Trends 1999-2013* will be useful for many Yukoners. Health care administrators and policy makers will find valuable information to help them prioritize programs across the spectrum of cancer control from prevention through to end-of-life care. Health care providers can use this information to set the disease of their patients into the Yukon context. Community leaders and members will have more information than ever to inform their work to prevent cancer, to promote screening and to improve the lives of those with cancer.

I hope that this report will help Yukoners better understand cancer mortality in Yukon and motivate us to work collaboratively to limit the onset of cancer and reduce the harms of cancer when it occurs.



Catherine Elliott

Deputy Chief Medical Officer of Health

# Executive Summary

*Cancer Mortality Trends, 1999 – 2013* describes cancer mortality in the Yukon Territory between 1999 and 2013. The aim of this report is to provide detailed information regarding regional cancer mortality for the most common types of cancer. The report is designed to help health professionals, policy-makers, and researchers, make decisions about regional cancer control and prevention. The media, educators, and members of the public with an interest in cancer may also find this publication valuable.



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deaths in Yukon are cancer-related.  
Cancer is the leading cause of death.



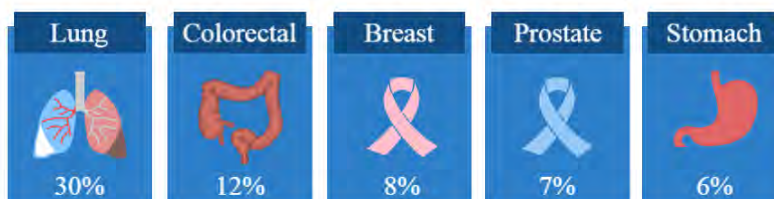
Cancer deaths annually  
since 2009, on average.



Since 2009, males on average lost 9 potential life  
years due to cancer.

Since 2009, females on average lost 14 potential  
life years due to cancer.

Lung cancer is the leading cause of cancer death, accounting for nearly 30% of all cancer deaths.



Yukon shares a similar cancer mortality profile with Canada. Lung is the leading cause of cancer death, followed by colorectal, breast, and prostate cancers. Stomach cancer is also a major cancer causing death in Yukon and accounts for a greater proportion of all cancer deaths than at the national level.



Yukon's age-standardized mortality rate for all cancers has been declining since 1999 for males and 2005 for females. Although Yukon's age-standardized mortality rates for all cancers combined are declining, they remain elevated compared to national rates.



Although Yukon has the third highest smoking prevalence in Canada, it is declining and is the lowest among all the Territories. This is expected to reduce lung cancer mortality in the future.



Yukoners eat more fruits and vegetables than most Canadians and are more physically active, two important protective factors against cancer.

Examining trends in cancer mortality is essential for understanding the impact of cancer on Yukon's communities and identifying key regional characteristics. It is vital for health policy and helps decision-makers and health professionals assess the allocation of health resources. We hope that our readers think critically about what these numbers mean and how they can be used to improve outcomes and develop better overall care for those with cancer in Yukon.

## ABOUT THIS REPORT

### Purpose and Intended Audience

*Cancer Mortality Trends, 1999-2013* describes cancer mortality in the Yukon Territory between 1999 and 2013. The aim of this report is to provide detailed information regarding regional cancer mortality for the most common types of cancer. The report is designed to help health professionals, policy-makers, and researchers make decisions about regional cancer control and prevention. The media, educators, and members of the public with an interest in cancer may also find this publication valuable.

### Yukon Cancer Registry

The Yukon Cancer Registry is a population-based registry of all cancers diagnosed in Yukon residents. The purpose of a population-based cancer registry is to collect information required to plan and evaluate cancer-control activities for the population. The Yukon Cancer Registry is overseen by the Department of Health and Social Services, which contracts the British Columbia Cancer Agency (BCCA) (an agency of the Provincial Health Services Authority) to build and maintain a separate territorial registry within its infrastructure. The registry was built in 1987 and began to enter and stage all Yukon cancer cases diagnosed from 2010 and onwards.

Today, the Yukon Cancer Registry receives notifications of cancer from many sources including diagnostic laboratories, health care providers, and vital statistics. The Yukon Cancer Registry contains personal and demographic information, information about the specific cancer diagnosis, as well as mortality information received from the Yukon Vital Statistics Registry.

Cancer registries across Canada are used to generate cancer statistics that describe trends and regional differences in cancer incidence and mortality, project future service needs, and evaluate patient outcomes and the effectiveness of cancer control programs. The data generated also support important research into the causes, prevention, screening, diagnosis and clinical management of cancer and the demand it places on the public health care system.

### Scope of Report

This report conveys the most up to date information available for cancer mortality in Yukon. Since the annual number of cancer cases and deaths is relatively small in statistical terms, data were aggregated in five and ten-year groups based on year of death to produce more stable rates and enable meaningful statistical analysis. Accurate reporting of cancers is especially important in Yukon as cancer statistics in jurisdictions with small populations are sensitive to small changes in the number of cases. The methodology used in preparation and analysis of Yukon data reflects these considerations (Appendix I: Methodology). Data tables can be found at the end of this report in Appendix II: Data Tables.

In this report, we examined cancer mortality only in residents of Yukon. Therefore, former residents of Yukon who were residing elsewhere at the time of death were not included in these analyses. Information on cancer mortality trends are based on data extracted from the Yukon Cancer Registry and Yukon Vital Statistics Registry. Trends were compared to national level data obtained from Statistics Canada's Canadian Socioeconomic Information Management (CANSIM) database (1).

## Cautions on Interpretation

Many of the rates presented in this report have a large degree of uncertainty due to the small number of cancer deaths. For example, as cancer deaths are further categorized by sex, year and cancer type, the numbers in each sub-category drops substantially, resulting in increasingly imprecise rates for the smallest groups. To limit the uncertainty, data were aggregated to five-year periods and in some cases ten-year periods were used. Although aggregating data may limit uncertainty, the aggregated estimates may not be truly reflective of current estimates. When examining rates, the reader is cautioned to consider the number of cases and the period upon which the estimate is based on.

## Confidentiality

Data in this report are presented in such a way to prevent the identification of individuals with cancer. For this reason, cells with less than five cases, which can occur for rare cancers and when stratifying (e.g. by age, sex and year), have been suppressed from presentation.

## GLOSSARY

### Age-standardized mortality rate

The number of cancer deaths per 100,000 people, standardized to the age structure of the 1991 Canadian population to account for changes in age distribution over time.

### Standardized mortality ratio

A ratio comparing the number of observed cancer deaths to the expected number of cancer deaths, relative to Canadian age-specific cancer mortality rates for a given time period. It is reported as a percent, that is, 100% means the number of observed cancer deaths equaled the expected number. A percentage greater than 100% indicates that there were more observed cancer deaths than expected.

For example, if the standardized mortality ratio between population A and B was 110%, the observed number of cancer deaths in population A was 10% greater than expected relative to the age-specific mortality rates of population B. If the standardized mortality ratio was 90%, the observed number of cancer deaths in population A was 10% less than expected.

### Cancer incidence

The number of new cancer cases of a specific cancer type per person in the general population.

### Cancer incidence rate

The number of new cancers of a specific cancer type occurring in a specified population during a given period of time. The cancer rate is expressed as the number of new cancers per 100,000 persons.

### Cancer mortality

The number of deaths attributed to a specific cancer type for a given time period.

### Cancer mortality rate

The number of cancer deaths of a specific cancer type occurring in a specified population during a given period of time. The cancer rate is expressed as the number of cancer deaths per 100,000 persons.

### Confidence intervals

Confidence intervals help quantify statistical uncertainty associated with estimates such as age-standardized mortality rates. Confidence intervals are often expressed as 95% lower and upper intervals. That is, we are 95% confident that the true value lies within the lower and upper confidence intervals.

### Potential years of life lost

The average number of additional years a person would have lived if he or she had not died prematurely. Years of life lost is a measure of premature mortality. For this report, Yukon sex-specific life expectancies were used as references and obtained from Statistics Canada (2).

## ABBREVIATIONS

**ASMR** – Age-standardized mortality rate

**BC** – British Columbia

**BMI** – Body Mass Index

**CA** – Canada

**CANSIM** – Canadian Socioeconomic Information Management Database

**CI** – Confidence Intervals

**HBV** – Hepatitis B Virus

**HCV** – Hepatitis C Virus

**HPV** – Human Papilloma Virus

**PAP** – Papanicolaou test; also known as Pap test or Pap Smear.

**SMR** – Standardized mortality ratio

**UVR** – Ultraviolet Radiation

**YCR** – Yukon Cancer Registry



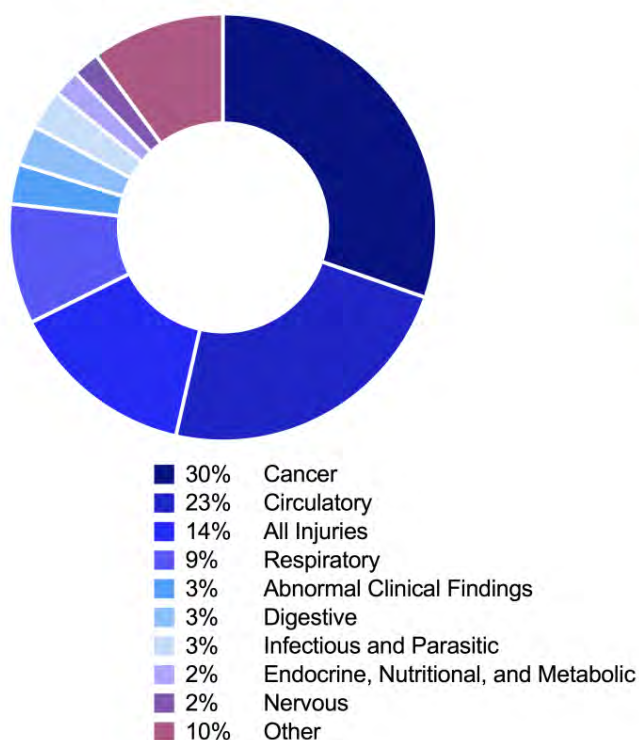
# CANCER MORTALITY

*Cancer was the leading cause of death in Yukon from 2008 – 2012, accounting for 32% of all deaths in the territory (3). Cancer accounted for 30% of all male deaths and 36% of all female deaths (Figure 1). Cancer was also the leading cause of death in Canada during the same time period (3).*

**Figure 1. Causes of Death in Yukon Among Males and Females, 2008-2012.**

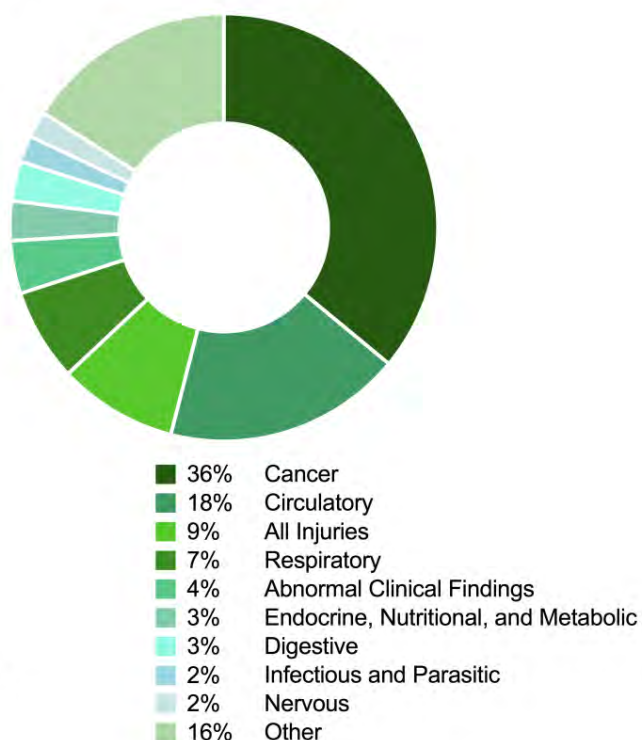
## Causes of Death in Males

Yukon 2008-2012 (n=602)



## Causes of Death in Females

Yukon 2008-2012 (n=394)





## ALL-CANCER MORTALITY TRENDS

From 1999 to 2013, there were an average of 54 cancer-related deaths annually among Yukon residents. In the most recent period from 2009 to 2013, this figure had increased to 62 cancer-related deaths annually.

Among males, the annual number of cancer deaths ranged from 22 to 39, whereas among females, the annual number of cancer deaths ranged from 13 to 33. The wide variation in the number of cases per year can be attributed to both the increasing number of annual cancer deaths since 1999 and the expected random variation within a small population.

On average, from 1999 to 2013, the number of potential years of life lost due to cancer death was 12 for males and 15 for females. Since 2009, these figures have decreased slightly where males on average lost 9 potential life years and females lost 14 potential life years.

The overall number of cases for all cancers combined among males and females is shown in Table 1. The number of cancer deaths among males and females nearly doubled between 1999 and 2013 (Table 1). This is largely due to population aging and growth. Similar observations have been seen at the national level (3).

**Table 1. Number of Total Cancer Deaths by Sex and Five-Year Aggregates, 1999-2013.**

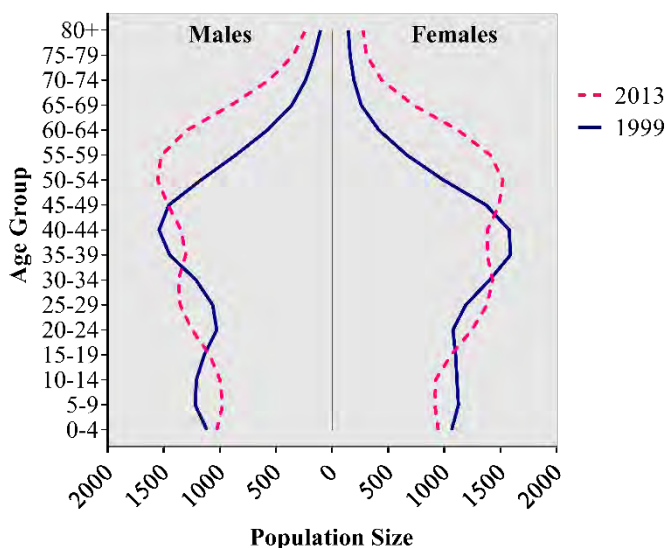
Year	Males	Females	Total
1999-2003	134	78	212
2004-2008	156	132	288
2009-2013	171	137	308
Total	461	347	808

### Population aging and growth in Yukon

Since 1999, Yukon's population has been aging and growing (Figure 2). Population aging and growth have important health implications. That is, as the population ages we can expect a greater number of individuals developing diseases that are strongly linked with age, like cancer. Similarly, as the population grows, the actual number of cases and deaths are expected to increase, that is, if rates remain constant.

Yukon's population grew by approximately 17% since 1999 (Table 6). The population has aged as well (Figure 2). The number of Yukoners aged 65 years or older has increased as a proportion of the total population since 1999 (Table 2).

**Figure 2. Population by Age Group and Sex, June 1999 to June 2013.**



## All-cancer mortality trends

Since 1999, the all-cancer age-standardized mortality rate (ASMR) has been declining for males. Among females, the all-cancer ASMR peaked in approximately 2005 and declined thereafter (Figure 3).

### How do Yukon and Canada compare?

Yukon's ASMRs are elevated compared to Canadian rates (Figure 3, Tables 3 and 4).

Among males, Yukon's rate has been declining similar to the national rate. Among females, Yukon's rate has been declining after peaking in approximately 2005. The Canadian rate has been declining since the early 1990's (3).

Figure 4 shows Yukon's observed number of all cancer deaths compared to the expected number of cancer deaths relative to age-specific Canadian all-cancer mortality rates from 2008 to 2012. The total number of observed cancer deaths in Yukon was 21% higher than expected relative to Canadian rates.

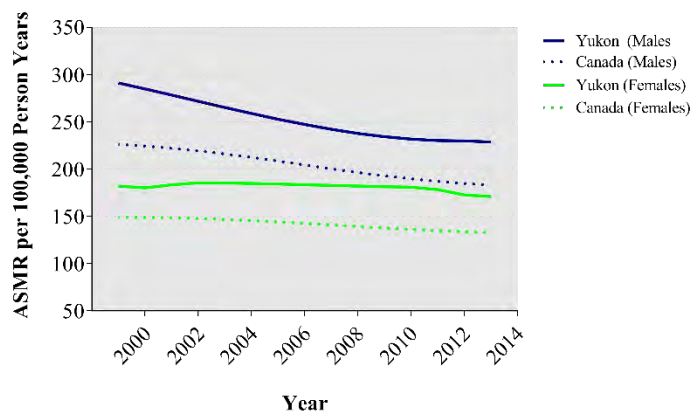
When separated by sex, a statistically significant difference was detected in females but not males. Cancer mortality in Yukon females was 25% higher than would be expected relative to Canadian female rates. Among Yukon males, cancer mortality was 14% greater than expected however, this was not statistically significant.

### What do these statistics mean?

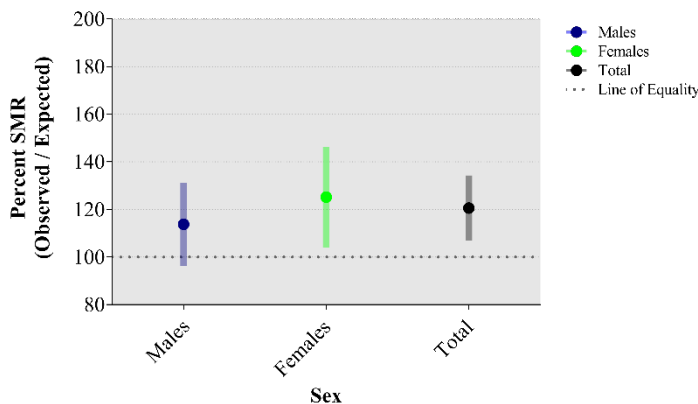
While all-cancer mortality rates in Yukon are declining, they are elevated compared to national rates. Nationally, rates have been declining for the past two decades (3). Declining trends are attributed to reductions in cancer incidence through cancer prevention efforts, such as cancer screening and reductions in smoking among Canadians, as well as improvements in cancer care (3). There is a clear gap in cancer mortality between Yukon and Canada and this difference is largely due to differences in rates for certain types of cancer, which will be discussed in the following sections.

Although Yukon's all-cancer mortality rates are declining, the actual number of cancer deaths continues to increase due to the aging and growth of the population (4). This is well documented at the national level as well (3). This has implications for health policy and resource planning. Measuring cancer deaths over time allows us to evaluate efforts to reduce cancer deaths and improve survival. It also allows us to project potential resource implications for Yukon's healthcare system.

**Figure 3. Yukon and Canadian All-Cancer Age-Standardized Mortality Rates by Sex and Year, 1999-2013**



**Figure 4. Standardized Mortality Ratios for All Cancers Combined by Sex Relative to Canadian All-Cancer Mortality Rates, 2008-2012.**



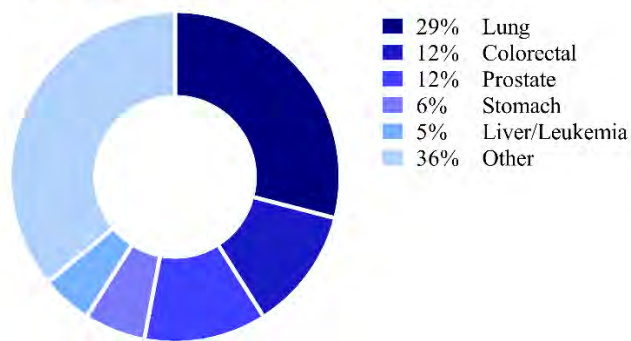
## MAJOR CANCERS IN YUKON

In the past two decades, lung, colorectal, breast, and prostate cancers were the most common causes of cancer death in Yukon. They remain to be the most common cancers causing death in 2009-2013 (Figure 5.1).

**Figure 5.1. Major Cancers Causing Death by Sex, 2009-2013.**

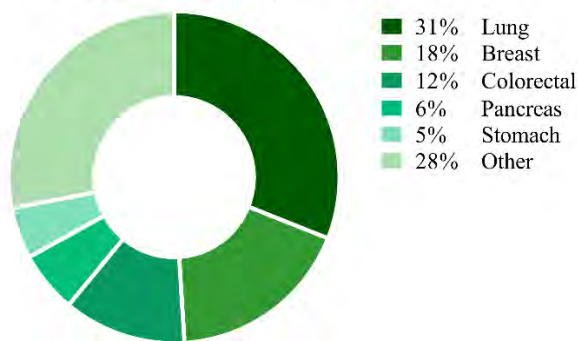
### Cancer Deaths by Type in Males

Yukon 2009 - 2013 (n=171)



### Cancer Deaths by Type in Females

Yukon 2009 - 2013 (n=137)



Tables 7.1 and 7.2 show the number of cancer deaths in Yukon among males and females for major cancers. From 2009 to 2013, there were 308 cancer deaths. The major cancers causing death in both males and females, that is, lung, colorectal, breast, and prostate cancers, account for approximately 50% of all cancer deaths among both sexes combined. Approximately a third of cancer deaths were caused by 'other' cancers, a category that summarizes several cancer types that are less common.

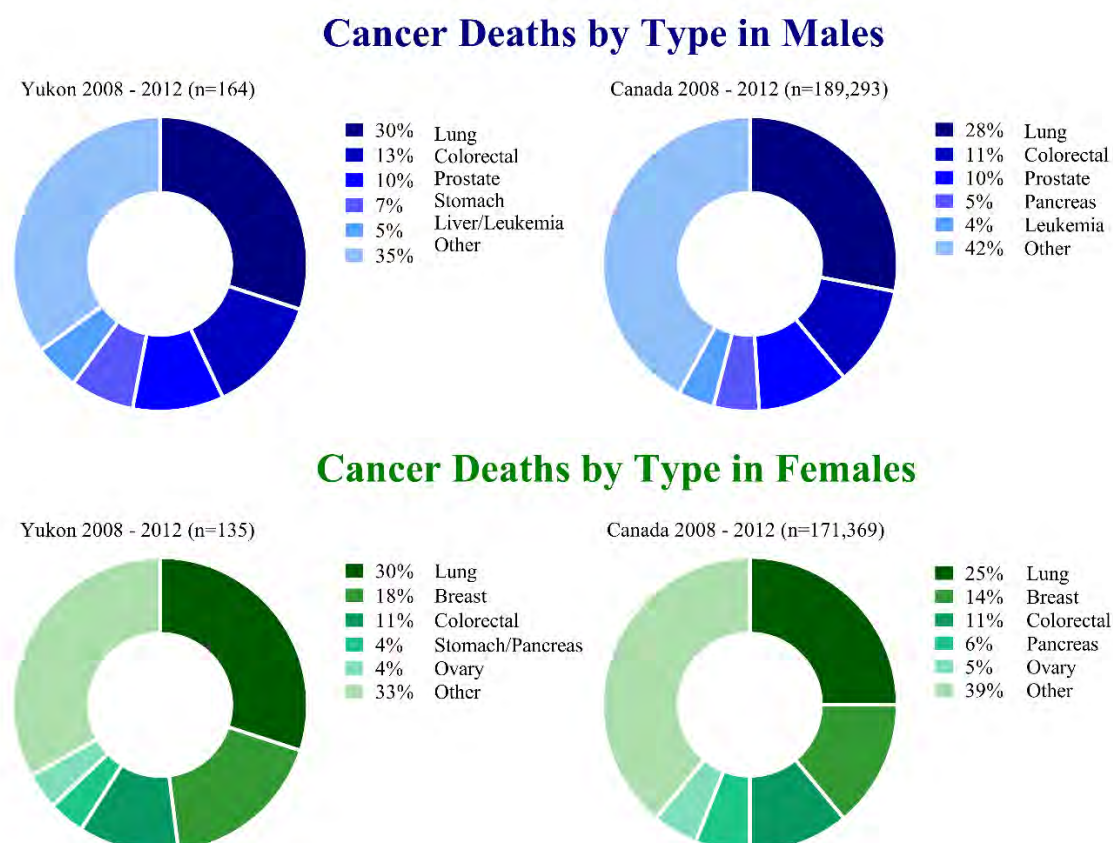
Leading causes of cancer deaths:

- Lung cancer was the leading cause of cancer death for both sexes. It was responsible for approximately equal proportions of all cancer deaths in males and females.
- Colorectal cancer was the second most common cause of cancer death for males and third most common for females.
- Breast cancer was the second most common cause of cancer death for females. Prostate cancer was the third most common cause of cancer death in males.
- Although it is much less diagnosed than many other cancers, stomach cancer is the fourth leading cause of cancer death in males and fifth in females.
- Pancreatic cancer was the fourth most common cancer among females and the sixth among males.

## How do Yukon and Canada compare?

Figure 5.2 and Tables 8.1 and 8.2 compare the number of cancer deaths and proportion of all cancer deaths by cancer type in Yukon and Canada. Yukon and Canada share a similar cancer mortality profile, in which the most common cancers causing death are lung, colorectal, breast, and prostate cancers (3). Notably, stomach cancer mortality accounts for a greater proportion of all cancer deaths in Yukon than it does nationally. Stomach cancer accounted for 7% of all Yukon cancer deaths in males and 4% in females, nearly double that of national figures (3). Pancreatic cancer, a highly fatal cancer, was the fourth most common cause of cancer death among males and females in Canada. From 2008 to 2012, it was the fourth most common cancer causing death in Yukon females and sixth in males (3% of all cancer deaths).

**Figure 5.2. Major Cancers Causing Death in Yukon and Canada by Sex, 2008-2012.**



## What do these statistics mean?

While some of the causes of cancer mortality follow national trends, certain causes stand out in Yukon. Lung cancer is the leading cause of cancer death, followed by colorectal, breast and prostate cancers. These are the major cancers causing death in both Yukon and Canada (3). Stomach cancer is a major cancer causing death in Yukon. It represents a greater proportion of cancer deaths in Yukon compared to Canada. It is not clear why this is occurring. Understanding the risk factors for stomach cancer and their prevalence in Yukon will be critical for identifying measures to reduce stomach cancer-related deaths (see *Factors That Influence Cancer Mortality*). Overall, identifying the major cancers in Yukon and comparing these to national statistics helps inform decision-makers and health professionals on regional characteristics for health planning.

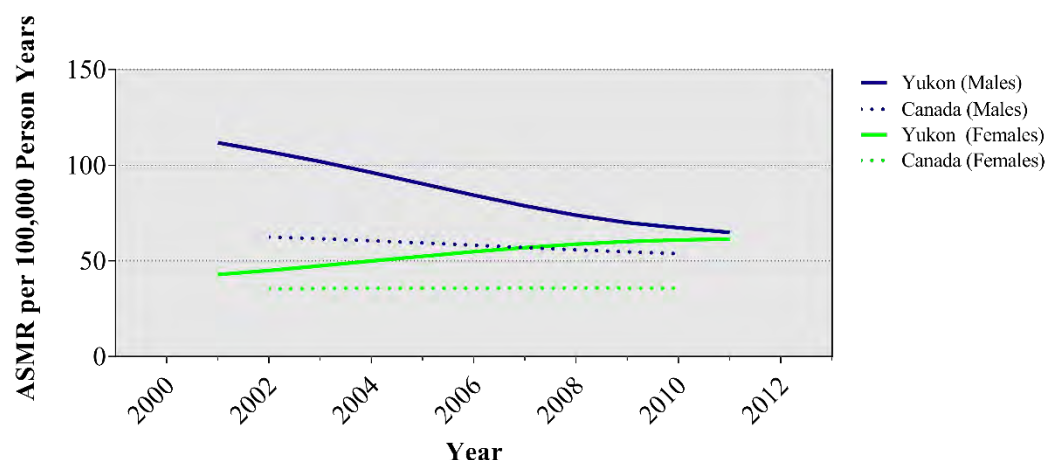
## TRENDS IN CANCER MORTALITY BY CANCER TYPE

Tables 9 to 11 and Figures 6 and 7 show ASMRs and SMRs for the most common cancers causing death. SMRs compare Yukon's cancer-specific mortality to that which would be expected relative to age-specific Canadian cancer mortality rates (Table 10, Figures 6-7).

### Lung cancer

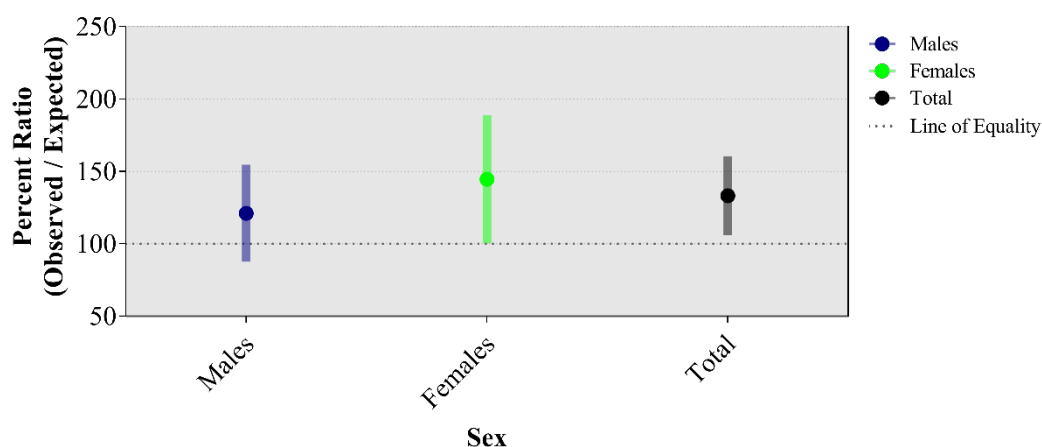
Among males, Yukon's lung cancer mortality rate has been declining since 1999-2003. In contrast, the Yukon female rate has been increasing since 1999-2003 but appears to be reaching a plateau in the last 5-year period (Figure 6.1).

**Figure 6.1. Yukon and Canadian Lung Cancer Cumulative Five-Year Rolling Age-Standardized Mortality Rates by Sex, 1999-2013.**



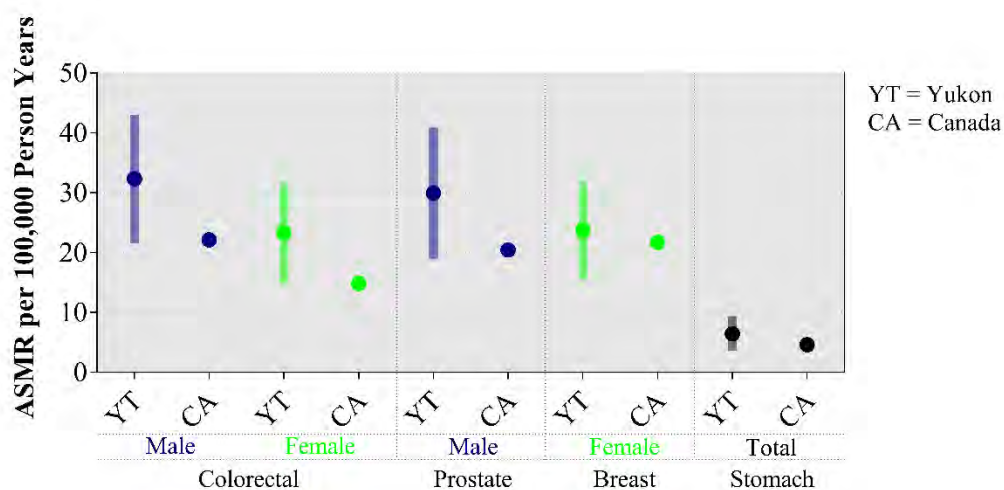
In 2008-2012, Yukon's observed lung cancer mortality was 21% and 45% higher in males and females, respectively, compared to that which would be expected relative to Canadian rates (Figure 6.2). Among females and males combined, lung cancer mortality in Yukon was 33% greater expected relative to Canadian rates. A statistically significant finding was found among females and among males and females combined.<sup>1</sup>

**Figure 6.2. Standardized Mortality Ratios for Lung Cancer Relative to Canadian Lung Cancer Mortality Rates, 2008-2012.**



<sup>1</sup> As cancer deaths are further categorized by sex, year and cancer type, the numbers in each sub-category drops substantially, resulting in increasingly imprecise rates for the smallest groups. Due to small numbers, statistical significance is often not reached and confidence intervals widen.

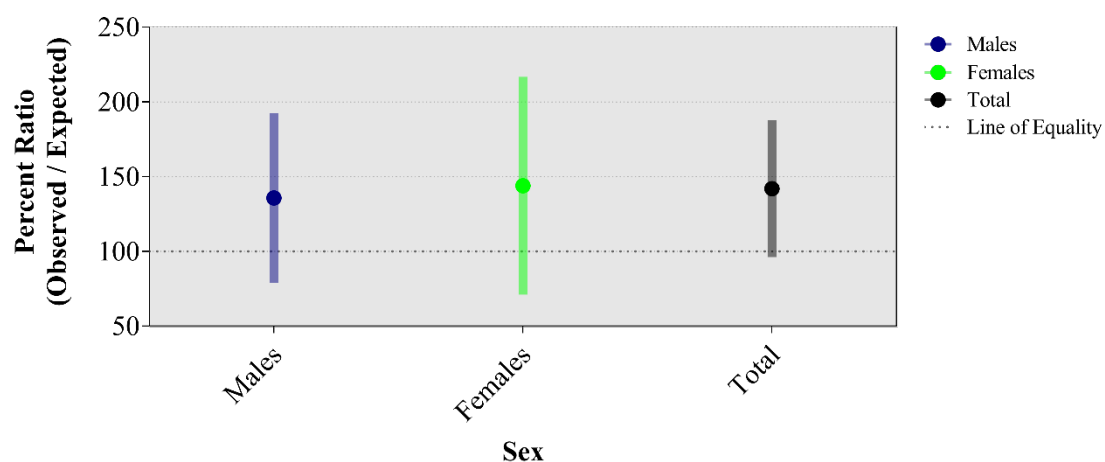
Figure 7.1. Ten-Year Cumulative Age-Standardized Mortality Rates for Select Cancers by Sex in Yukon and Canada, 2003-2012.



## Colorectal cancer

From 2003-2012, the mortality rate from colorectal cancer was elevated in Yukon versus Canada, for males and females (Figure 7.1). In the most recent 5-year period, Yukon's observed colorectal cancer mortality was 36% and 44% greater in males and females, respectively, than expected relative to Canadian rates; neither estimate was statistically significant (Figure 7.2).<sup>1</sup>

Figure 7.2. Standardized Mortality Ratios for Colorectal Cancer Relative to Canadian Colorectal Cancer Mortality Rates, 2008-2012.



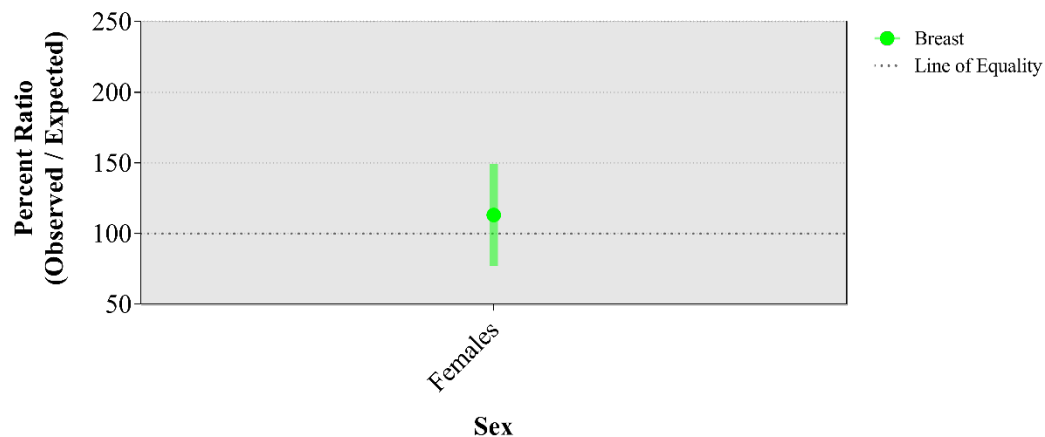
<sup>1</sup> As cancer deaths are further categorized by sex, year and cancer type, the numbers in each sub-category drops substantially, resulting in increasingly imprecise rates for the smallest groups. Due to small numbers, statistical significance is often not reached and confidence intervals widen.



Breast cancer

From 2003-2012, the female breast cancer mortality rate was slightly elevated in Yukon versus Canada (Figure 7.1). Yukon’s observed female breast cancer mortality was 13% greater than expected relative to Canadian rates (Figure 7.3). However, the difference was not statistically significant.<sup>1</sup> Estimates represent cumulative mortality over a ten-year period and may not be truly reflective of the current rate.

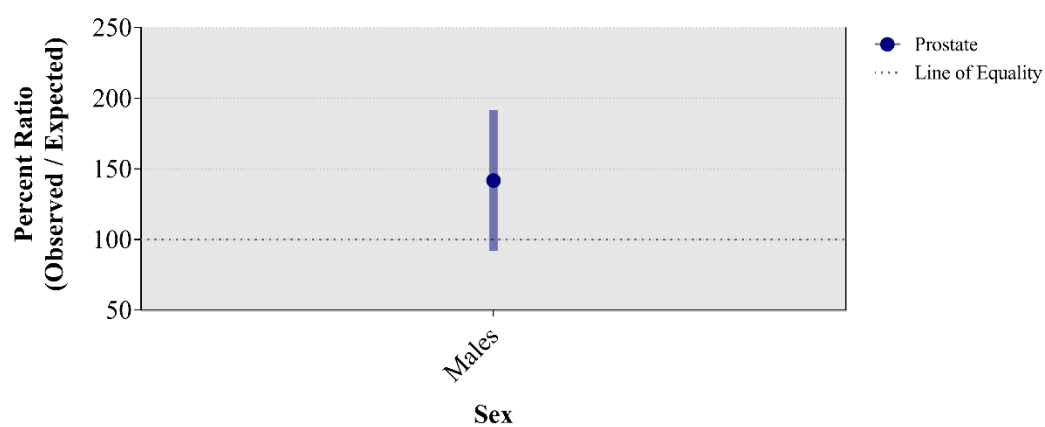
Figure 7.3. Standardized Mortality Ratios for Female Breast Cancer Relative to Canadian Female Breast Cancer Mortality Rates, 2003-2012.



Prostate cancer

From 2003-2012, the mortality rate for prostate cancer was elevated in Yukon versus Canada (Figure 7.1). Yukon’s observed prostate cancer mortality between 2003 and 2012 was 42% greater than expected, relative to Canadian rates (Figure 7.4). However, the difference was not statistically significant.<sup>1</sup>

Figure 7.4. Standardized Mortality Ratios for Prostate Cancer Relative to Canadian Prostate Cancer Mortality Rates, 2003-2012.



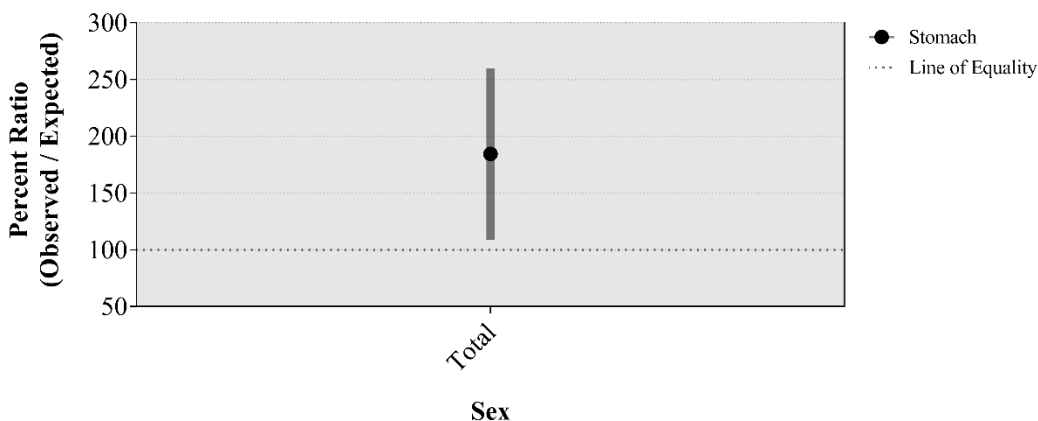
<sup>1</sup> As cancer deaths are further categorized by sex, year and cancer type, the numbers in each sub-category drops substantially, resulting in increasingly imprecise rates for the smallest groups. Due to small numbers, statistical significance is often not reached and confidence intervals widen.



## Stomach cancer

From 2003-2012, the mortality rate for stomach cancer among both sexes was elevated in Yukon versus Canada (Figure 7.1). Yukon's observed stomach cancer mortality between 2003 and 2012 was 84% greater than expected, relative to Canadian rates (Figure 7.5). The difference was statistically significant.<sup>1</sup> We could not further categorize stomach cancer mortality by sex because the number of deaths for this period was too small.

Figure 7.5. Standardized Mortality Ratios for Stomach Cancer Relative to Canadian Stomach Cancer Mortality Rates, 2003-2012.



## What do these statistics mean?

Yukon's overall cancer mortality rate is higher than Canada's and this difference is driven by cancer-specific trends. Mortality rates for major cancers are generally elevated in Yukon compared to Canada. Notably, lung cancer mortality among Yukon females is elevated compared to the Canadian female population. In Yukon, female lung cancer mortality has been increasing since 1999 but the rate of increase is slowing in more recent years. Nationally, the female lung cancer mortality rate peaked around 2005 (3). For males, national lung cancer mortality rates have been declining since the late 1980's (3). The gap in lung cancer mortality is likely related to smoking prevalence in Yukon, which is elevated compared to national counterparts (5).

Approximately 26% of Yukon's population are daily or occasional smokers (5). This is elevated compared to Canada as a whole, where approximately 15% of Canadians are daily or occasional smokers. Additionally, the difference in smoking prevalence between Yukon females and other Canadian females is greater than their male counterparts (3,5). This is likely related to the marked difference in lung cancer mortality rates between Yukon females and the Canadian female population. Despite a higher smoking prevalence, it is declining in the Territory. Before 2010, greater than 30% of the population were daily or occasional smokers (5). Reductions in Yukon's smoking prevalence will likely reduce the lung cancer death rate in the future. Presently, Yukon's male trend is declining and similar to what is seen nationally (3).

## ALL-CANCER MORTALITY BY SEX AND AGE GROUPS

### Mortality by sex

Cancer mortality rates vary between different age groups and by sex. Examining cancer deaths by sex and age provides a sense of who is dying from cancer and therefore, help inform planning for targeted cancer control services.

In 2009-2013, 56% of all cancer deaths occurred among males and 44% among females (Table 12). Although rates are higher relative to Canadian rates (see section *All-Cancer Mortality Trends*), the relative proportion of cancer deaths in males versus females is similar to that of Canada for a similar time period (3). The distribution of all cancer deaths by sex does not appear to have changed since 1999 however, the distribution by cancer type has changed.

Deaths due to lung cancer among males and females have changed substantially in the past two decades (Table 12). Overall, 61% of lung cancer deaths occurred among males and 39% among females. In contrast during 2009-2013, male deaths accounted for 54% of all lung cancer deaths while females accounted for 46%. This is reflective of the declining lung cancer mortality rate in males and the increasing lung cancer mortality rate in females.

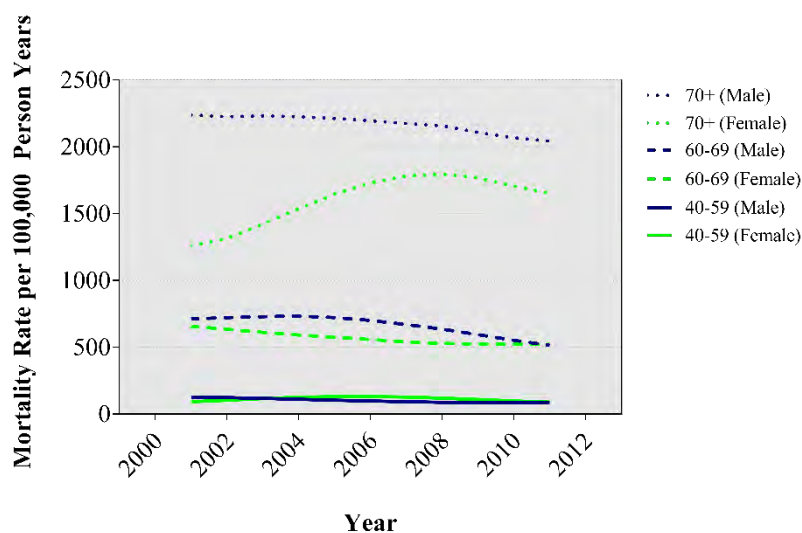
### Mortality by age

During 2009 to 2013, almost 53% of cancer deaths in Yukon occurred in people aged 70 years and older, with the median age for all cancer deaths being 69. In Canada, 62% of cancer deaths occur in people aged 70 years and older (3).

- Yukoners aged 70 years or older accounted for 53% of all cancer deaths.
- Yukoners aged 60 – 69 years accounted for an additional 29%.
- Yukoners aged 0 – 59 years accounted for 18% of all cancer deaths.

Older adults account for the largest proportion of deaths from the most common cancers.

**Figure 8. Age-Specific Cumulative Five-Year Rolling Mortality Rates for All Cancers Combined by Sex, 1999-2013.**



The mortality rate in males 70+ years has steadily declined since 1999. In females 70+ years, the mortality rate has increased since 1999-2003 though, appears to have peaked around 2006-2010 and decreased thereafter.

## What do these statistics mean?

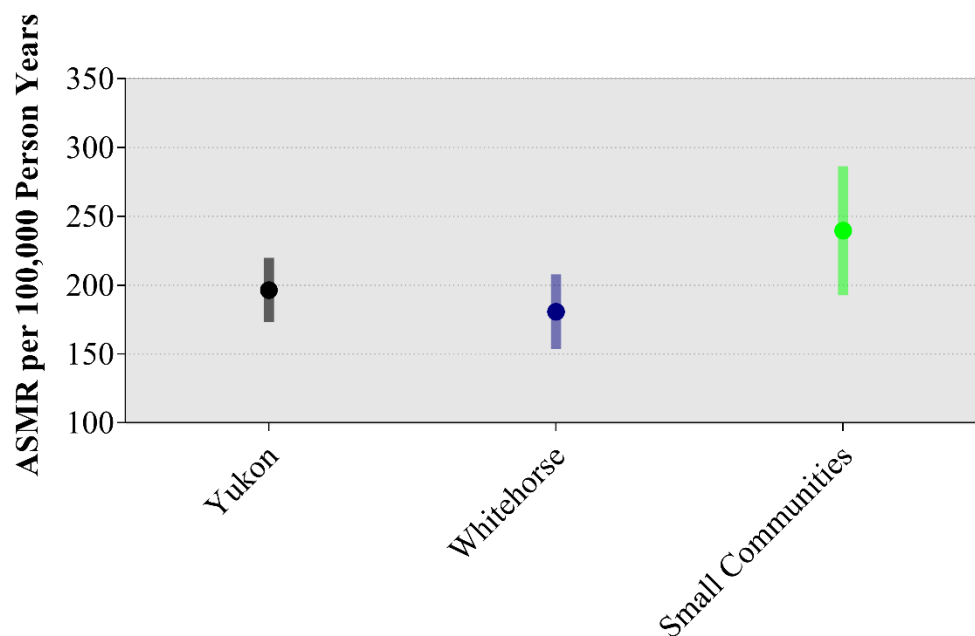
Yukon's cancer death rates are generally higher for males compared to females, which is also seen at the national level (3). The sex distribution of cancer deaths for most cancers has remained relatively stable over the past two decades, except for lung cancer. Female lung cancer deaths as a proportion of all lung cancer deaths in Yukon has steadily increased since 1999. If lung cancer trends continue as they are, it is possible that females will account for a greater proportion of all lung cancer deaths in Yukon within the coming decades.

Approximately half of cancer deaths in Yukon occur among those 70 years or older, which appears less than the proportion observed at the national level for this age group (3). This suggests that cancer deaths occur at younger ages in Yukon, resulting in a greater number of potential life years lost. It would be valuable to evaluate the stage at detection for cancers in Yukon to determine whether we are detecting cancers as early as possible. Investigating these areas further will be essential for improving cancer outcomes in Yukon.

## ALL-CANCER MORTALITY BY COMMUNITY

Currently, Yukon is home to approximately 38,200 residents. Roughly three-quarters of the population live in and around Whitehorse, the Territory's capital and urban center (6). Apart from Whitehorse, the two largest communities are Dawson City and Watson Lake, and the rest of the population live in communities around the Territory (6).

**Figure 9. All-Cancer Cumulative Five-Year Age-Standardized Mortality Rates by Community, 2009-2013.**



Approximately two-thirds of all cancer deaths in Yukon occurred in Whitehorse residents (Table 14). Figure 9 shows all-cancer cumulative five-year ASMRs corresponding to different communities in Yukon (Table 15). Areas outside of Whitehorse had elevated rates relative to Whitehorse, although this was not statistically significant.<sup>1</sup> As cancer deaths are further categorized by community category, the number of cancer cases in each sub-category drops. This results in increasingly imprecise rates for the smallest groups, which is reflected by wider confidence intervals around the estimated rate.<sup>1</sup> This means we are less certain of the estimates.

Differences in cancer mortality between urban, rural and remote communities are not anomalous to Yukon and have been previously reported in Canada (7–11). A recent Pan-Canadian report found that cancer mortality rates among rural Canadians for lung and colorectal cancer were higher compared to urban counterparts (7). In terms of factors that influence cancer mortality, such as early detection, screening and treatment, rural Canadians residing in British Columbia and Ontario have been found to access these services less than their urban counterparts (7,9–11).

<sup>1</sup> As cancer deaths are further categorized by sex, year, cancer type and community category, the numbers in each sub-category drops substantially, resulting in increasingly imprecise rates for the smallest groups. Due to small numbers, statistical significance is often not reached and confidence intervals widen.

# *Factors That Influence Cancer Mortality*

Yukon's cancer mortality rates are declining however, compared to national rates they are elevated overall and for several cancers. Trends in cancer mortality are related to a variety of factors such as the stage of the cancer at diagnosis and the availability of early detection, diagnostic and treatment services.

Additionally, cancer is influenced by non-modifiable factors, like our genetic composition, and modifiable factors, like smoking and what we eat. Research indicates that half of cancers can be prevented and individuals can reduce their risk of developing cancer by following a healthy lifestyle and avoiding risk factors.

## EARLY DETECTION, SCREENING AND TREATMENT

Early detection of cancer is a Canadian cancer control priority (3). When cancer is detected early, namely at stages I and II, it is easier to treat and patients experience better outcomes compared to cancers diagnosed at later and more aggressive stages (i.e. stages III and IV) (3). Routine screening of average-risk healthy individuals is one of many strategies to improve early detection. In Yukon, there are currently three routine screening programs:

- Mammography for breast cancer,
- Papanicolaou (PAP) tests for cervical cancer,
- and fecal immunochemical tests (FIT) for colorectal cancer.

Although prostate and lung cancer are also major cancers causing death in Yukon, there is insufficient evidence of effectiveness for routine screening at the population level. Yukon cancer screening programs are informed by evidence-based guidelines published by the Canadian Task Force on Preventive Health Care (12).

Treatment also plays an important role in reducing cancer mortality. Nationally, declining rates are partly reflected by the availability of better treatment options. Advances in treatment have also led to improvements in survival, particularly when cancers are detected early (4). The impact of treatment on mortality and survivorship has been well documented for colorectal, breast, and prostate cancers among others (4). In Yukon, certain chemotherapies are available while radiation therapy is accessed outside the territory. Treatment services are provided in collaboration with the Yukon Hospital Corporation, Health and Social Services, British Columbia Cancer Agency, and other provincial cancer agencies.

Although early detection, screening, and treatment play an important role in reducing the cancer burden in Yukon, an in-depth analysis of these factors is beyond the scope of this report.

## AVOIDING CANCER

Cancer is a complex disease and our risk of developing cancer is influenced by both non-modifiable factors, like our genetic composition, and modifiable factors, like smoking and what we eat. Factors that increase the risk of cancer are referred to as risk factors, like smoking (3). In contrast, factors that decrease the risk of cancer are referred to as protective factors, such as physical activity and a nutritious diet (3). Additionally, our risk of cancer is largely influenced by the social circumstances we live in, like social and economic factors, as well as the built environment. Differences in social and economic factors within the population result in health inequities, in which some individuals may be at a disadvantage when it comes to achieving optimum health and well-being (13). Although these are not

readily modifiable by the individual, together, policy makers, decision makers in health, and community leaders are in a unique position to address health inequities and improve the health and wellbeing of the population.

Cancer typically takes several years or decades to develop and is dependent on the duration, intensity, and frequency of exposure, as well as the type of risk and protective factor over the life course. Generally, the greater the duration, intensity and frequency of exposure, the greater it's impact will be on the risk of developing cancer (14).

Research suggests that half of cancers can be prevented (15). Measuring the prevalence of modifiable factors in Yukon is highly informative for understanding trends and identifying areas where we can focus our cancer control and prevention efforts. In the following section, we will discuss the link between cancer and a variety of factors related to health behaviours, infectious agents, and the environment.

## AVOIDING CANCER: HEALTH BEHAVIOURS

### TOBACCO USE

- Tobacco use is the largest cause of cancer worldwide and the most avoidable risk factor for cancer. It causes cancer in multiple organs and is most strongly related to lung cancer (3,14,16).
- Cigarettes are the main form of tobacco use and there are over 70 known carcinogens in tobacco smoke. There is also clear evidence that other tobacco products, such as cigars and chewing tobacco or exposure to second-hand smoke, have dangerous health effects. There is increasing evidence that e-cigarettes may contain carcinogenic substances as well (2,6,7).
- Quitting smoking reduces the risk of tobacco-related cancers with a greater reduction in risk when one quits at a younger age (16).

Smoking is the most important risk factor for lung cancer (3,18), the leading cause of cancer death in Canada (3). Smoking is a significant public health issue in Northern Canada, where the Territories show a higher smoking prevalence compared to the rest of Canada (5). In 2014, 26% of Yukon's population were daily or occasional smokers, which is well-above Canada as a whole at 15% (5,19). That being said, Yukon has the lowest smoking prevalence among the Territories (5). Smoking prevalence has declined from pre-2010 levels, which ranged from 30%-35% (5). This is likely due to territorial and national tobacco cessation and prevention efforts, as well as changes in attitudes towards smoking in the population. In Yukon, the Yukon Tobacco Reduction Strategy aims to empower both youth and adults to say 'No' to tobacco and increase the number of former smokers. It achieves this by engaging with individuals directly and supporting current smokers with the necessary resources to quit (20).

Early onset smoking is an important public health issue as it increases nicotine dependence in adulthood (19,21). Nationally, smoking among youth is at its lowest (21). Approximately 11% of youth aged 15 to 19 years old and 2% of youth in grades 6 to 9 are daily or occasional smokers. In Yukon, smoking among youth appears elevated compared to national figures and differs between urban and rural status (21). According to the 2014 Yukon *Health Behaviours in School-aged Children Study*, 19% of grade 9-10 rural girls were daily or current smokers and 30% reported being recent smokers. Daily smoking prevalence among urban girls was 7%, similar to urban and rural boys (21).

Although smoking may be elevated among Yukon's youth, research suggests that the majority of youth smokers seriously consider quitting or attempt to quit (19). As school environments play an important role in promoting healthy behaviors and act as an important support system for youth (21,22), it is essential that tobacco reduction and prevention efforts in Yukon continue to engage youth, particularly rural girls.

## NUTRITION

- Dietary factors play an essential role in maintaining health and are linked to various chronic diseases like diabetes, cardiovascular disease and cancer. What we eat matters. Our diet can protect us from cancer or put us at risk (16,18).
- Diets high in dietary fibre, fruits and vegetables, are protective against cancer. In contrast, diets high in fat, red and processed meats, and salted foods increase the risk for cancer (16,18).

What we eat plays a significant role in maintaining health and influences our risk for various chronic diseases like diabetes and cardiovascular disease. When it comes to cancer, nutrition is no different. What we eat over the life course can either protect us from cancer or increase our risk (16,18). Although it is difficult to identify specific foods that put us at risk or protect us, there is sufficient scientific evidence to suggest that diets high in fat, red and processed meats, as well as salted foods, increase our risk of cancer. On the other hand, diets high in fibre, fruits and vegetables are protective against cancer (16,18).

Compared to Canada as a whole, Yukoners report a similar amount of fruit and vegetable consumption. That is, in 2014, 42% of Yukoners and 40% of Canadians reported consuming fruits and vegetables at least five times a day (5). Moreover, Yukon reported the highest fruit and vegetable consumption among the Territories. Given the barriers in accessing nutritious food in Northern Canada, Yukon fares well compared to other Canadians (23).

## BODY COMPOSITION AND OBESITY

- Overweight and obesity is a significant risk factor for many chronic diseases, including cancer. Evidence shows that body fat, particularly abdominal fat, and adult weight gain increases the risk for certain cancers (16,18).
- Body composition and obesity are closely related to nutrition, physical activity and sedentary behaviours (18).
- There are clear benefits to having an active lifestyle and eating nutritious for all, regardless of one's weight and body composition (18).

A balanced lifestyle is essential for maintaining a healthy weight and body composition, which reduces our risk for several chronic diseases including cancer (18). Weight and body composition are largely determined by lifestyle behaviors like physical activity, sedentary behavior, and diet. Everyone, regardless of weight or body composition, can benefit from regular exercise and a nutritious diet (18).

In 2014, 54% of Canadians and 57% of Yukoners 18 years and over reported that they were overweight or obese <sup>1</sup> (5). The reader is cautioned when interpreting these statistics as they are self-reported. Other measures of body composition and obesity were not available at the time of this publication. In respect to Canadian youth, approximately 1 in 3 boys and 1 in 4 girls, among students in grades 6 to 10, are classified as overweight or obese (22). Yukon's estimates are similar however, there are disparities between rural and urban Youth (21). Rural youth in Yukon are more likely to be overweight or obese than urban youth (21,24).

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<sup>1</sup> Body composition is measured in several ways, such as the body mass index (BMI). BMI is a commonly used measure of cancer risk and is calculated by dividing the respondent's body weight (in kilograms) by their height (in meters) squared (5). Although BMI is used internationally as a measure of risk for a variety of diseases, it does not account for the distribution of fat around the body, which more accurately assesses our risk for disease. For example, greater fat around the abdomen increases our risk for certain cancers compared to fat around the rest of the body (16).



## PHYSICAL ACTIVITY AND SEDENTARY BEHAVIOUR

- Regular physical activity and limiting sedentary behaviour have several health benefits, improves our quality of life and reduces the risk of chronic diseases like cancer (16,18,25,26).
- Adults are recommended to be active for at least 150 minutes a week of moderate to vigorous aerobic activity. Youth aged 12-17 years, are recommended to accumulate at least 60 minutes of moderate to vigorous physical activity daily (26).
- Physical inactivity is considered distinct from sedentary behaviour, such as prolonged sitting, which can still increase the risk of cancer despite one's level of physical activity (16,18,25,26).

Staying physically active throughout life and limiting sedentary behavior can substantially reduce one's lifetime risk of developing chronic diseases like cancer (16,18,25,26). The Canadian Society for Exercise Physiology and Public Health Agency of Canada recommend that adults be active for at least 150 minutes a week of moderate to vigorous aerobic activity. Youth aged 12-17 years, are recommended to accumulate at least 60 minutes of moderate to vigorous physical activity daily. Moderate activities include brisk walking or bike riding, while jogging or cross-country skiing are considered vigorous (26). Although physical activity is an individual choice, it is facilitated by the community in which one lives in. Creating a community environment that increases access to physical activity is essential for building healthier communities (18).

Scientific literature indicates that physical activity and sedentary behavior are distinct. That is, sedentary behavior, categorized by time spent doing very little physical movement such as sitting for long periods, is an important independent risk factor for cancer. Public health organizations internationally recommend cutting down on sitting down (16,18,26). The Canadian Society for Exercise Physiology recommend opting for active transportation when possible, like walking or biking to work, and active family time, like walking the dog or a family bike ride (26).

In 2014, 54% of Canadians aged 12 years and over, reported moderately active or active physical activity during leisure-time. Nationally, Yukoners rank highest in this regard. That is, 65% of Yukoners, aged 12 years and over, report physical activity that is moderately active or active during leisure-time (5). It is important to consider that these measures only account for physical activity during leisure-time, that is, time spent away from work or school. Additionally, it does not take into account sedentary behavior like prolonged sitting, which can still increase the risk of cancer despite one's level of physical activity (18).

Nationally, 1 in 5 youth meet Canada's physical activity guidelines (22) (i.e. at least 60 minutes of moderate to vigorous intensity physical activity daily). During school time, approximately 30% of boys and 21% of girls participate in at least 4 hours of moderate to vigorous physical activity. In Yukon, estimates are slightly higher. However, urban girls are more likely to report physical activity than rural girls (21).

In respect to sedentary behavior, 1 in 10 Canadian youth meet the Canadian sedentary behavior guidelines (22) (i.e. a maximum of 2 hours of screen time per day). Additionally, over 50% of boys and 40% of girls in grades 6 to 10 reported watching two or more hours of television per day (22). Similarly, in Yukon, the proportion of youth watching television for two or more hours per day ranged from 46% to 73% (21).

## ALCOHOL CONSUMPTION

- Alcohol consumption causes cirrhosis and is a major risk factor for several cancers, including cancer of the liver (16).
- No clear safe limit for alcohol consumption has been determined to prevent an increased risk of cancer, despite light consumption having a protective effect against cardiovascular disease. Generally, the risk of cancer increases with greater alcohol consumption (16).
- Alcohol consumption interacts synergistically with tobacco smoking to increase the risk for certain cancers (16).

Alcohol consumption causes cirrhosis of the liver and is a major risk factor for several cancers such as oral, pharynx, larynx, esophagus, colorectal, breast, and liver cancers (16). Scientific evidence indicates that 3.5% of cancer deaths are attributable to alcohol consumption (27).

Despite having a protective effect against cardiovascular disease when consumed lightly, there is no clear safe limit for alcohol consumption to prevent an increased risk of cancer (16). Scientific evidence suggests that having approximately 2 alcoholic beverages a day substantially increases the risk for certain cancers compared to non-drinkers (16). Alcohol consumption also acts synergistically with tobacco smoke to increase the risk of certain cancers (16).

To examine alcohol consumption in the population, Statistics Canada reports on the proportion of individuals considered as heavy drinkers, which is defined as males that have 5 or more, and females that have 4 or more, drinks on one occasion at least once in the past month (5). In 2014, approximately 18% of Canadians and 28% of Yukoners reported being heavy drinkers (5). Alcohol consumption is generally higher in the Territories compared to the rest of Canada. The percent of heavy drinkers in Yukon's population has not changed in the past five years (5). As alcohol consumption causes a variety of diseases and can cause injury, as is the case with impaired driving, Northern communities should continue to focus on reducing heavy drinking and promote responsible practices in the population.

## AVOIDING CANCER: INFECTIOUS AGENTS

Infectious agents like viruses and bacteria are associated with cancer. Approximately 10% of cancers in developed countries are associated with infections (28). Four important infectious agents related to cancer are Human Papilloma Virus, *Helicobacter Pylori*, Hepatitis B and C Virus.

### HUMAN PAPILLOMA VIRUS (HPV)

- HPV consists of a group of small viruses that are transmitted from skin-to-skin contact, most commonly through sexual contact. HPV infections are most commonly known for causing cancer of the cervix but can cause others as well (16).
- HPV infections are most common in the 20 to 24 year age group. Approximately 70% of sexually active Canadians will contract HPV at some point in their lives (16).
- Yukon delivers many public health measures against cervical cancer and HPV infections, such as Yukon's Papanicolaou (PAP) test program and school-based HPV immunizations (29).

There are over 100 types of HPV viruses, 25 of which are considered high-risk for cancer. HPV infections are associated with nearly all cervical cancer cases but can cause vaginal, penile, anal, oral, and oropharynx cancers as well (16). Although there is no current figure for the number of Canadians infected with HPV, the prevalence is estimated to be approximately 13%-26% of the population (14,30). Most HPV Infection are asymptomatic and generally cleared by the immune system within two years of infection however, a small percentage of infections become chronic (16).

In Yukon, approximately 25% of women are infected with HPV. Similar results were found in the Northwest Territories (29%) and Nunavut (26%) (29). This is higher than other Canadian jurisdictions like British Columbia and Ontario, where approximately 17% and 14% of women, respectively, are infected with any type of HPV (29). In Yukon, there are two major public health measures targeted towards preventing HPV infections and cervical cancer, that is, school-based HPV immunization and PAP test programs (29).

There are currently two vaccines that offer protection against high-risk HPV strains, Gardasil® and Cervarix®. Since 2009, HPV vaccination is provided as a publicly-funded school-based vaccination program for girls in grade 6 (31). HPV immunization is safe, has few side effects, and is most effective when given before sexual contact (31,32).

Another important measure against cervical cancer is PAP smear screening or PAP testing. PAP testing allows for early stage detection of cervical cancer and treatment with complete cure. It is recognized as an effective strategy to reduce cervical cancer mortality in Canada (32). Nationally, women aged 25 to 69 years are recommended to undergo a PAP test every 3 years (33). In 2012, approximately 77% of Yukon women and 74% of Canadian women aged 21 to 69 years had a PAP test within the last 3 years (34).

## HELICOBACTER PYLORI (*H. PYLORI*)

- *H. Pylori* is a small bacterium that infects the stomach mucosa and is transmitted through a variety of ways, particularly through oral ingestion of contaminated water or foods (16,35).
- *H. Pylori* is most known for causing stomach cancer but also causes a rare form of non-Hodgkin's lymphoma (i.e. B-cell mucosa-associated lymphoid tissue gastric lymphoma) (16).
- Although there is no organized program against *H. pylori* infections and stomach cancer in Yukon, individuals can be tested for *H. pylori* by a health care provider and treated if necessary (16).

*H. Pylori* infections are the major cause of peptic ulcers and gastritis, and the most important risk factor for stomach cancer (16,35). Chronic infections cause substantial damage to the gastric mucosa and increase the risk of cancer (16,35). Further, the risk of cancer, when *H. pylori* is present, is influenced by dietary factors. For example, the risk is increased with a diet high in dietary salt, while reduced with intake of fruits and vegetables (16). *H. Pylori* infections can be treated with antibiotics and are commonly detected by means of a Urea Breath Test. Treating *H. pylori* infections substantially reduces the risk of *H. pylori*-associated cancers (16).

In Canada, approximately 30% of individuals who present to their family physicians with dyspepsia (i.e. indigestion) are infected with *H. pylori* (35,36). Recent work done by The Canadian North *H. pylori* Working Group (CANHelp), a team of investigators, health officials and community leaders from Alberta and the Northwest Territories, have identified *H. pylori* as a public health concern in Canada's North (14,35,37). Although Yukon-wide prevalence is unknown, the Old Crow Project identified positive Urea Breath Tests among 69% of 190 recruited participants (35). Similar findings have been reported the Northwest Territories, where *H. pylori* prevalence was 61% and 58% in Aklavik and Tuktoyaktuk, respectively (35). The CANHelp Working Group is collaborating with community members and decision-makers to identify ways to reduce the health risks associated with *H. Pylori* infections (35).

## HEPATITIS B VIRUS (HBV) AND HEPATITIS C VIRUS (HCV)

- HBV and HCV are highly contagious, infect the liver, and cause Hepatitis B and C, respectively. Transmission occurs through contact with infected blood via blood transfusions, injection drug use, and childbirth among others. HBV is also found in other body fluids and can be transmitted sexually (16,38).
- Chronic infections of HBV or HCV cause liver cancer among others. Although most HBV infections are cleared by the immune system, the majority of HCV infections become chronic (16,38).
- Yukon delivers an HBV immunization program to prevent infection and related cancers. The vaccine is given to all infants at 2, 4 and 6 months of age. Children and adults who were not immunized as infants can receive the Hepatitis B vaccine and should contact their local health centre to be immunized (39).

HBV and HCV infect the liver and cause Hepatitis B and C, respectively. When infections become chronic, they are important risk factors for liver cancer. Chronic infections are those that become persistent, which cause serious liver damage and increase the risk of cancer. Co-infection is associated with a greater risk of liver cancer (16,38). Both HBV and HCV infections can present asymptotically or symptomatically, and both can be cleared by the body's immune system. Most HBV infections are cleared; most HCV infections become chronic (16,38).

Hepatitis C is the most common reportable chronic infectious disease in Yukon (34). Although rates of new infections are almost twice than national rates, the rate of new infections is declining (34). Most new cases occur in older adults (i.e. 40-50 years) and those with a history of injection drug use (34). According to the Yukon Communicable Disease Control, the number of HBV infections has increased since 2010. However, the increase likely reflects a change in the reporting of HBV cases and not a true difference in the rate (34).

HBV infection and HBV-induced liver cancer are both preventable through Hepatitis B immunization (38,39). In Yukon, infants are immunized with the HBV vaccine at 2, 4 and 6 months of age (39). Children and adults who were not immunized as infants can receive the HBV vaccine and should contact their local health centre to get immunized (39).

## AVOIDING CANCER: ENVIRONMENTAL FACTORS

### ULTRAVIOLET RADIATION

- Overexposure to ultraviolet radiation (UVR) is the leading cause of skin cancer, the most commonly diagnosed cancer in Canada (16,40).
- Sunlight is the major source for UVR however, tanning beds also place individuals at risk. Personal traits are also important factors that influence the risk of cancer, such as skin complexion, eye and hair colour, and the tendency to burn when exposed to sunlight (16,40).
- Melanoma, a deadly type of skin cancer, is 90% preventable by using sunscreen, avoiding long exposure, wearing protective clothing, and avoiding tanning beds (40).

Overexposure to ultraviolet radiation causes all major skin cancers. The type of skin cancer is strongly related to the pattern of exposure (16,40). For example, intermittent exposure, categorized by periodic exposures during, for example, recreational outdoor activities, is strongly related to melanoma. On the other hand, chronic exposure, categorized by continuous exposure during, for example, occupational activities, is related to squamous cell carcinoma (16,40). Protection against UVR is strongly recommended by using sunscreen, avoiding long exposure, and wearing protective clothing.

Outdoor workers are at a greater risk of UVR exposure (41). Occupations that report the highest prevalence of exposure are farmers, landscapers, and construction workers (41). It is recommended that outdoor workers protect

themselves against long exposure by using sunscreen, wearing protective clothing, and avoiding long exposure if possible.

Personal traits also influence the risk of skin cancer. People with fair skin, light eyes, blond or red hair, and those that have a tendency to burn rather than tan when exposed to sunlight, have a greater risk of all types of skin cancer (16,40). Further, tanning beds and sun lamps are a major source of UVR and are classified as carcinogenic by the International Agency for Research on Cancer (16). Tanning beds increase the risk of cancer with greater frequency of use and the intensity, which can be 10 to 15 times stronger than midday sun (16).

## RADON

- Radon is a colourless and odourless gas produced through the decay of uranium in the earth's crust. We are primarily exposed to it by inhalation (16,42).
- Exposure to radon is highest in the occupational setting but can also accumulate in residential buildings. Radon levels in Canada vary by geography (16,42,43).
- There are a number of ways to limit radon exposure by measuring residential levels and installing proper ventilation systems in the home (42).

Radon is a naturally occurring gas that can't be seen and has no scent. It is the leading cause of lung cancer after smoking, responsible for approximately 16% of lung cancer deaths in Canada, annually. Although smokers are at a greater risk of lung cancer after radon exposure, radon is a major risk factor for non-smokers (16,42,43).

Underground uranium miners are the most at risk for radon exposure but, radon can enter and accumulate in the home as well. There are many factors that influence radon levels in the residential setting. The only way to know if radon is in your home is to use a radon test kit (16,42,43). If high levels of radon are detected, there are several ways to reduce them by increasing ventilation and sealing major entry routes. Health Canada considers radon levels of 200 becquerels per cubic meter as high-risk and recommends homeowners to install ventilation systems within one year to effectively reduce the risk of cancer (42).

In Canada, radon levels vary greatly by geography (42,43). In 2012, Health Canada determined that Yukon, New Brunswick, Manitoba, and Saskatchewan were Canadian jurisdictions with the largest proportion of homes testing above the recommended guidelines in Canada. Health Canada encourages all Canadians to test their homes to determine indoor radon levels (42).

The Yukon Housing Corporation has several informational resources about radon in Yukon, including an interactive map of radon testing done by homeowners in various Yukon communities (44).

# Recommendations

Cancer is the leading cause of death in Yukon and the cancer burden is expected to increase as the population ages and grows. This will impact Yukoners physically, emotionally, socially, economically and spiritually and will demand increasing health care resources. The following recommendations build upon the work that is already underway in the Office of the Chief Medical Officer of Health (OCMOH), Health and Social Services (HSS) and Vital Statistics. The final recommendation – to develop a coordinated approach to cancer control in Yukon – pulls together the many recommendations to look at cancer control from prevention to early detection to treatment. This coordination has the potential to provide considerable benefit for Yukoners.

Briefly, the recommendations are:

1. Address the cancer mortality gap between Yukon and Canada.
2. Examine and address cancer mortality disparities within Yukon.
3. Improve Yukon Cancer Registry data and reporting.
4. Develop a coordinated approach to cancer control involving Yukon Government and First Nations.

These are each examined with more context and rationale below. Action is needed to build a more coordinated and complete cancer control system with the goal of lower cancer rates and better cancer outcomes. Better cancer outcomes will not only reduce the economic burden on the medical system, but ultimately it will improve the lives of many Yukoners and Yukon families and build healthier communities across Yukon.

## 1. ADDRESS THE CANCER MORTALITY GAP BETWEEN YUKON AND CANADA

Yukon's cancer mortality rates are above national rates in general and this disparity appears to exist for lung, colorectal, prostate and stomach cancer in particular. In addition, we have identified an important gender gap: lung cancer mortality rates are higher for females in Yukon than those for Canadian females.

Cancer mortality rates are related to a few key elements: risk factors, early identification of cancers, and treatment. Risk factors are those things that put people at higher risk of getting cancer such as diet, substance use and physical activity, environmental and infectious exposures, and genetic predisposition. Identifying cancer early is achieved through screening of those without symptoms and timely access to diagnostic testing for those with symptoms of concern. A diagnosis of cancer should trigger prompt access to appropriate treatment that follows best practices based on the most current evidence. Therefore in order to reduce cancer mortality we need to: (1) prevent cancer, (2) identify it early and (3) ensure best practice in treatment.

Yukon's cancer control system includes prevention, screening, diagnostics, treatment and end-of-life care. Effective cancer care requires close collaboration between many care providers including community health nurses, physicians, hospitals and referral cancer centers outside Yukon. A thorough review of cancer care is needed to better understand whether high mortality is related to gaps in treatment, and if so which improvements in treatment are needed to improve cancer outcomes. Such a review will require collaboration between Health and Social Services, Yukon Hospital Corporation, the clinicians who deliver cancer care and the agencies that deliver the majority of our advanced cancer care, notably British Columbia Cancer Agency. It will involve review of current practice for each type of cancer, identification of gaps between current practice and best practices and recommendations to improve care, and may take some time to complete. As this process could be lengthy, specific areas of concern could be prioritized in order to effect near term improvements in cancer care.

The following section outlines specific elements of cancer prevention, screening, diagnosis and treatment for select cancers which are causing disproportionate mortality in Yukon: lung, colorectal, prostate and stomach. Breast cancer is also discussed because it is a major cause of cancer death in Yukon. It identifies priorities for improving cancer care and can form the basis for a more comprehensive review.

## Lung cancer

Lung cancer is the most important cause of cancer mortality in Yukon. As such, it is a priority to address lung cancer prevention, screening and treatment programs using the model proposed above.

The two main preventable causes of lung cancer are smoking and radon exposure. Yukon has high rates of tobacco use that have been slow to decline compared with other Canadian jurisdictions. An aggressive approach to tobacco control should be developed, that examines gaps and best practices in tobacco taxation, sales, pricing, health promotion, and cessation programming. Yukon is also a region with naturally occurring high radon levels. Collaboration between Yukon Department of Health and Social Services, Office of the Chief Medical Officer of Health, Yukon Lung Association and Yukon Housing has achieved an annual awareness campaign that included distribution of 1250 radon testing kits to Yukoners in 2016/17. The Government of Yukon is conducting radon testing in selected Yukon government buildings and workplaces. These efforts should be augmented and coordinated through an all-of-government action plan to address radon across Yukon with provisions for testing, remediation and ongoing surveillance to identify areas where people may be exposed.

A promising practice in lung cancer screening is the use of low dose CT scans to detect early cancers in individuals with a history heavy smoking. This approach is currently being evaluated in pilot programs in several provinces, and the case for such a program in Yukon should be assessed.

## Colorectal, Prostate and Breast Cancers

Colorectal, prostate and breast cancers, while each distinct diseases, share a number of common issues with respect to prevention, treatment and screening. Age and family history are the main risk factors for prostate cancer. Major risk factors for colorectal cancer and breast cancers include alcohol use, overweight and obesity, sedentary lifestyle and dietary factors as well as a family history of certain cancers. The Yukon population has high rates of alcohol use and high rates of overweight and obesity, but more reassuring rates of physical activity and consumption of fruits and vegetables. Better prevention of these cancers would include programs and policies that support healthy eating and activity, healthy alcohol use and healthy weights.

Screening programs for colorectal cancer have shown to be effective. In short, early detection leads to better outcomes. In contrast, screening for prostate cancer is not recommended by the Canadian Task Force on Preventive Health Care, based on the balance of benefits and harms. Although there is not cause for a coordinated prostate cancer screening program at this time, this is an active area of research that should be followed.

OCMOH has collaborated with HSS to roll out a coordinated colorectal screening program for Yukon in 2017 with the aim of ensuring that evidence based colorectal screening is available and used by those who would benefit. Breast cancer screening is available in Yukon; however, there was not a system-wide coordinated approach at the time of this report and mammography rates are lower than national rates. Coordinated screening programs have been shown to improve evidence-based practice. Consideration of a coordinated screening program for breast cancer should begin with a program review that examines current practice and determines the best methods to improve access and maximize uptake.



Colorectal, prostate and breast cancer treatments occur at regional hospitals and distant cancer care centres, as for lung cancer. A review of current practice in treatment for these cancers in Yukon should be conducted to identify strengths and gaps in cancer care that may be contributing to Yukon's high mortality rates.

## Stomach cancer

Yukon's stomach cancer mortality rate is higher than Canada's. A number of factors are associated with increased risk of stomach cancer including diet, family history, smoking and infection with *Helicobacter pylori*, a bacteria that colonizes the stomach. Colonization with *H. pylori* is associated with chronic inflammation and a higher risk of stomach cancer. Prevalence of *H. pylori* infection has been found to be high in some northern populations. Field studies in northern communities in both Canada and Alaska have found higher *H. pylori* prevalence compared to their southern counterparts. For example, *H. pylori* prevalence in Old Crow (Yukon), Aklavik and Tuktoyaktuk (Northwest Territories) was reported to be 69%, 61% and 58%, respectively (35). Whereas prevalence in Canada is estimated at 30% (35,36). We recommend that stomach cancer incidence, mortality and *H. pylori* prevalence be examined in greater detail by comparing rates found in Northern Canada with those found in other regions in Canada. Yukon should look to our colleagues in Alaska for ways they have used to approach reduction of cancer risk in communities with high *H. pylori* rates. Better understanding of the relationship between *H. pylori* disease and stomach cancer risk should lead to better approaches to treatment for *H. pylori*, as well as earlier detection and treatment of stomach cancer.

## 2. EXAMINE AND ADDRESS CANCER MORTALITY DISPARITIES WITHIN YUKON

A first look at the distribution of cancer mortality across Yukon suggests that while more cancer deaths occur among Whitehorse residents, the rates of cancer mortality may be higher in rural Yukon. It is not clear why this is occurring. Populations in Whitehorse and the communities differ in a number of ways and closer examination of cancer rates as related to these other factors would help understand differences. Several studies in other Canadian jurisdiction have found similar disparities in cancer mortality rates between rural and urban populations within a single province. Proposed causes include: higher burden of risk factors, lower screening rates and differential access to screening and treatment.

We did not examine differences between other population groups in Yukon. Examining differences in cancer outcomes between subpopulations would help identify groups at risk and thereby target programs. For example, a look at outcomes among First Nations populations would help clarify any gaps and support the qualitative work conducted by Council of Yukon First Nations in their Conversation on Cancer Part I, II and III. Higher cancer rates have been found among Indigenous peoples as compared with non-Indigenous in other Canadian jurisdictions including Northwest Territories and British Columbia. First Nations cancer reporting could be accomplished through cooperation between Yukon First Nation, Vital Statistics, HSS and OCMOH.

Information on other population subgroups in Yukon would further our understanding and therefore our ability to address disparities. For example, across Canada groups with lower SES have been shown to have lower screening rates, but we don't know whether this is true for Yukon. Once populations at risk are identified, targeted programs can be established through partnerships with these groups. This would provide context for the work in identifying gaps in service under Recommendation 1. Understanding differences between Yukon populations can help improve all aspects of cancer control and ultimately help to reduce the disparities in cancer burden that exist between population sub-groups within Yukon.

### 3. IMPROVE YUKON CANCER REGISTRY DATA QUALITY AND REPORTING

*Cancer Mortality Trends 1999-2013* is the first territorial report on cancer using Yukon Cancer Registry data. This required close collaboration between Vital Statistics, Department of Health and Social Services and the Office of the Chief Medical Officer of Health. It demonstrates the high data standards of the registry and the potential for reporting from the registry. Such reporting can be used by health care administrators, policy makers, service providers, community leaders and other Yukoners to inform their efforts in cancer control. In this process we also identified some gaps in our registry. We provide the example of incidence rates here, but other quality initiatives are underway and require ongoing government support.

Mortality rates are tightly linked to incidence rates, and better incidence data is needed to answer key questions such as: how many and what types of cancer are diagnosed in Yukon? Are Yukon cancer patients having similar outcomes as cancer patients diagnosed in other Canadian jurisdictions? Are cancer diagnoses in Yukon occurring as early as possible, since early treatment is linked to better outcomes?

With support from the Yukon Department of Health and Social Services, the Office of the Chief Medical Officer of Health is currently calculating cancer incidence rates for 2009-2013. This will help us understand whether the observed higher mortality rates correspond to higher incidence rates in Yukon relative to other jurisdictions. Incidence information will enable estimates of stage at diagnosis for common cancers and measure cancer survival, a key outcome for population cancer control efforts. Moreover, calculating current rates establishes a 'baseline' to evaluate the impact of cancer programming on rates moving forward, such as the new organized program for colorectal cancer screening referred to earlier in this report.

Systematic prospective reporting of hospital discharge data to the cancer registry going forward is essential to ensure that we can monitor stage at diagnosis and incidence rates. We recommend better linkages between hospital discharge data and the cancer registry to enable ongoing prospective incidence reporting. This will support ongoing analyses on cancer incidence rates, stage at diagnosis and provide critical information to evaluate cancer control in the future.

Cancer registries across Canada are used to generate cancer statistics that describe trends and regional differences in cancer incidence and mortality as we have done in this report. Further, they are used to project future service needs, and evaluate patient outcomes and the effectiveness of cancer control programs. Although data from the Yukon Cancer Registry supported the production of this report, more can be done with the registry to support evidence-based cancer programming in the Yukon Territory.

We recommend producing regular reports on critical indicators of cancer control such as incidence, stage at diagnosis, survival and mortality rates. These indicators should be embedded in the government strategic plan and used to evaluate cancer control targets. Improving data consistency, access and reliability is an important prerequisite to efficient production of future reports. With further support from the Yukon Department of Health and Social Services, the Office of the Chief Medical Officer of Health could be in a position to direct improvements in data quality thereby laying the groundwork for better indicators of cancer in Yukon.

#### 4. DEVELOP A COORDINATED APPROACH TO CANCER CONTROL INVOLVING YUKON GOVERNMENT AND FIRST NATIONS

Many jurisdictions have developed cancer strategies to address the burden of cancer. The recommendations here do not necessarily require a strategy, but they do require a coordinated approach with input from Yukon government and First Nations. We recommend striking a *Yukon Cancer Steering Committee* to coordinate many efforts underway and prioritize new initiatives based on Yukon data and best practice. This committee would have a mandate to ensure that cancer control initiatives address Yukon's cancer priorities, are coordinated across governments and are evaluated. It would report to senior leadership in Health and Social Services and advise on existing and proposed cancer initiatives.

Currently cancer control efforts in prevention, screening, diagnosis and treatment are housed in many separate areas of government and health care (e.g. health promotion, physician services, community nursing, Yukon Hospital Corporation) without strong links between them. This has led to gaps in coordination across the cancer control continuum from prevention, early detection and screening, diagnosis, treatment and end-of-life care. For example in prevention, recommendations to prevent cancer risks can be found in the 2015 Health Status Report, within the Yukon Government's response to radon and a number of other reports. Screening and early diagnosis are occurring within health care services and not linked to prevention. Opportunities to target high risk groups (e.g. smokers) for screening are therefore missed. A coordinated approach would bring together leadership from these groups and build an efficient system-wide approach.

Knowledge about First Nations' cancer care experiences are held separately within Council of Yukon First Nations and First Nations peoples. First Nations have been calling for inclusion in cancer control planning and have offered a considerable body of work and recommendations to that effect (*Conversation on Cancer Part I, II, and III*). A coordinated approach would include the First Nations voice in a meaningful way throughout the cancer control continuum.

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### Data sources

Cancer deaths from January 1<sup>st</sup> 1999 to December 31<sup>st</sup> 2013 were derived from the Yukon Vital Statistics Registry. Cancer deaths are those for which some form of cancer was listed as the underlying cause of death. Cancer deaths were coded to the *International Statistical Classification of Disease and Related Health Problems, Tenth Revision* (45). Since the annual number of cancer cases is relatively small in statistical terms, groups of five and ten years of data were aggregated to produce more stable rates and allow for meaningful statistical analysis.

To calculate Yukon cancer mortality rates, the Yukon Bureau of Statistics provided Yukon population data by sex and age at mid-year from 1999 to 2013. Yukon rates were examined in relation to national rates that were obtained from Statistics Canada's CANSIM database (1). The CANSIM database was also accessed to obtain the prevalence of risk and protective factors in Yukon and Canada (5), which are discussed in the *Factors that Influence Cancer Mortality* section of this report.

### Analysis

The direct method (46) was used to calculate age-standardized mortality rates (ASMRs) relative to the age structure of the 1991 Canadian population and are calculated per 100,000 person-years. Standard errors used to compute 95% confidence intervals for ASMRs were derived using the Poisson approximation (46). Rates were smoothed using local polynomial smoothing to assess the general trends while removing some of the uncertainty resulting from Yukon's small population from the trend plots. The CANSIM database was accessed to obtain Canadian sex-specific ASMRs for major cancers and all cancers combined (47). Yukon data was age-standardized to 17 age groups (0-4 years, 5-9 years, ... 75+ years).

The indirect method was used to calculate standardized mortality ratios (SMRs) with confidence intervals. Standard errors used to compute 95% confidence intervals for SMRs were derived using the Poisson approximation (46). Yukon data was age-standardized to 18 age groups (0-4 years, 5-9 years, ... 80+ years). The CANSIM database was accessed to obtain Canadian age-specific cancer mortality rates for major cancers and all cancers combined that were necessary to calculate SMRs (47). Canadian population data were obtained from the CANSIM database (48).

### Limitations

Due to the small Yukon population size, drawing comparisons against other jurisdictions is challenging. Small numbers reduced statistical power to detect statistically significant differences. In particular, high year-to-year variation creates unstable rates and wide confidence intervals. To limit this instability, five years of data were aggregated over a 15-year period. In some cases, when cases were low, ten years of data were aggregated. It is important to note that aggregating data over several years may not be truly reflective of the annual rates. Moreover, it is challenging to interpret trends when comparing aggregated data to a single year of Canadian data.

After aggregating Yukon data by five- and ten-year periods, we reported on cancer types with 20 or more cases of cancer death. As a result, comparisons between Yukon and Canadian rates were limited to the most common types of cancer. Age standardizing rates, where many of the age strata have values of zero, can cause an underestimation in the true variance. To eliminate the risk of falsely suggesting a significant difference when in fact there truly is no statistically significant difference, the analyses were limited to cancers with more than 20 reported cases of cancer death.

## APPENDIX II: DATA TABLES

### ALL-CANCER MORTALITY TRENDS

**Table 1. Number of Total Cancer Deaths by Sex and Five-Year Aggregates, 1999-2013.**

Year	Males	Females	Total
1999-2003	134	78	212
2004-2008	156	132	288
2009-2013	171	137	308
Total	461	347	808

**Table 2. Number and Proportion of People 65 Years or Older in Yukon.**

Year	Males	% of Male Population	Females	% of Female Population	Total	% of Total Population
1999-2003	4809	6%	4268	6%	9077	6%
2004-2008	6164	8%	5451	7%	11615	7%
2009-2013	8784	10%	7334	8%	16118	9%

**Table 3. Yukon All-Cancer Age-Standardized Mortality Rate and Average Rate Change by Sex and Year, 1999-2013.**

Year	Males		Females	
	ASMR	Average Change in ASMR	ASMR	Average Change in ASMR
1999	302.6	-5.5	188.6	-0.5
2000	272.1		163.4	
2001	253.3		135.4	
2002	281.2		197.5	
2003	319.6		174.8	
2004	211.9		216.8	
2005	280.4		154.8	
2006	265.5		226.5	
2007	250.0		181.9	
2008	205.8		192.2	
2009	207.2		175.8	
2010	228.7		218.2	
2011	200.1		144.9	
2012	235.5		147.2	
2013	236.4		167.9	

ASMR = Age-Standardized Mortality Rate

**Table 4. Canadian All-Cancer Age-Standardized Mortality Rate and Five-Year Average Rate Change by Sex and Year, 1999-2013.**

Year	Males		Females	
	ASMR	Five-Year Average Change in ASMR	ASMR	Five-Year Average Change in ASMR
1999	229.8	-3.4	149.8	-0.4
2000	225.8		149.8	
2001	224.3		148.2	
2002	220.3		149.2	
2003	215.4		148.1	
2004	212.1	-3.3	147.0	-1.5
2005	207.7		143.7	
2006	201.5		141.5	
2007	201.7		141.6	
2008	198.4		140.5	
2009	194.3	-3.4	137.5	-1.6
2010	188.8		136.2	
2011	186.1		134.3	
2012	183.0		132.8	
2013	180.0		131.3	

ASMR = Age-Standardized Mortality Rate

**Table 5. Yukon All-Cancer Standardized Mortality Ratios by Sex Relative to Canadian All-Cancer Mortality Rates, 2008-2012.**

Sex	Observed	Expected	SMR	95% CI
Male	164	144	114%	96%-131%
Female	135	108	125%	104%-146%
Total	299	248	121%	107%-134%

SMR = Standardized Mortality Ratio, CI = Confidence Intervals

**Table 6. Yukon Population by Age Group and Sex June 1999 and Percent Change from June 1999 to June 2013.**

Age Groups	Population Size (June 1999)			Percent Change in June 2013		
	Both Sexes	Males	Females	Both Sexes	Males	Females
0-4	2082	1057	1025	-2%	+1%	-5%
4-9	2364	1249	1115	-19%	-19%	-18%
10-14	2427	1246	1181	-25%	-25%	-25%
15-19	2409	1269	1140	-15%	-19%	-12%
20-24	1837	880	957	+38%	+50%	+27%
25-29	2225	1028	1197	+31%	+35%	+27%
30-34	2497	1183	1314	+13%	+19%	+8%
35-39	3249	1538	1711	-20%	-18%	-22%
40-44	3174	1553	1621	-16%	-15%	-16%
45-49	2809	1462	1347	-2%	-6%	+3%
50-54	2241	1230	1011	+48%	+36%	+63%
55-59	1418	819	599	+116%	+94%	+145%
60-64	897	505	392	+160%	+147%	+177%
65-69	702	405	297	+140%	+138%	+144%
70-74	433	259	174	+102%	+92%	+116%
75-79	279	130	149	+102%	+127%	+81%
80+	262	106	156	+121%	+149%	+102%
All ages	31305	15919	15386	+17%	+17%	+16%

## TRENDS IN CANCER MORTALITY BY CANCER

**Table 7.1. Number and Proportion of All Male Cancer Deaths by Cancer Type, 2009-2013 and 1999-2013.**

Males					
2009 – 2013 (n=171)			1999 – 2013 (n=461)		
Cancer	Cases	Percent	Cancer	Cases	Percent
Lung	49	29%	Lung	141	31%
Colorectal	21	12%	Colorectal	57	12%
Prostate	21	12%	Prostate	41	9%
Stomach	11	6%	Stomach	22	5%
Liver/Leukemia	8	5%	Pancreas	16	3%
All other cancers	61	36%	All other cancers	184	40%

**Table 7.2. Number and Proportion of All Female Cancer Deaths by Cancer Type, 2009-2013 and 1999-2013.**

Females					
2009 – 2013 (n=137)			1999 – 2013 (n=347)		
Cancer	Cases	Percent	Cancer	Cases	Percent
Lung	42	31%	Lung	92	27%
Breast	24	18%	Breast	54	16%
Colorectal	17	12%	Colorectal	42	12%
Pancreas	8	6%	Ovary	14	4%
Stomach	7	5%	Pancreas	13	4%
All other cancers	39	28%	All other cancers	164	38%

**Table 8.1. Number and Proportion of All Male Cancer Deaths in Yukon and Canada by Cancer Type, 2008-2012.**

Males					
Yukon 2008 – 2012 (n=164)			Canada 2008 – 2012 (n=189,293) (49)		
Cancer	Cases	Percent	Cancer	Cases	Percent
Lung	50	30%	Lung	52726	28%
Colorectal	22	13%	Colorectal	21376	11%
Prostate	16	10%	Prostate	18727	10%
Stomach	11	7%	Pancreas	9952	5%
Liver	8	5%	Leukemia	7059	4%
All other cancers	57	35%	All Other Cancers	79453	42%

**Table 8.2. Number and Proportion of All Female Cancer Deaths in Yukon and Canada by Cancer Type, 2008-2012.**

Females					
Yukon 2008 – 2012 (n=135)			Canada 2008 – 2012 (n=171,369) (49)		
Cancer	Cases	Percent	Cancer	Cases	Percent
Lung	41	30%	Lung	43395	25%
Breast	24	18%	Breast	24816	14%
Colorectal	15	11%	Colorectal	18421	11%
Stomach/Pancreas	6	4%	Pancreas	10069	6%
Ovary	5	4%	Ovary	8165	5%
All other cancers	44	33%	All other cancers	66503	39%

**Table 9. Yukon and Canadian Cumulative Five-Year Rolling Age-Standardized Mortality Rates for Lung Cancer by Sex, 1999-2013.**

Year	Males		Females	
	Yukon	Canada	Yukon	Canada
1999-2003	116.0 (81.3-150.8)		42.1 (22.3-61.9)	
2000-2004	104.5 (72.7-136.3)	53.6 (63.1-64.2)	43.7 (24.1-63.3)	35.3 (34.9-35.7)
2001-2005	105.3 (74.0-136.7)	62.5 (61.9-63.0)	44.3 (25.1-63.5)	35.4 (35.0-35.8)
2002-2006	106.3 (75.3-137.3)	61.1 (60.6-61.6)	50.3 (30.3-70.2)	35.8 (35.5-36.2)
2003-2007	95.7 (66.8-124.6)	59.7 (59.1-60.2)	49.8 (30.1-69.5)	36.0 (35.7-36.4)
2004-2008	76.6 (51.8-101.4)	58.1 (57.6-58.6)	51.6 (32.0-71.2)	36.2 (35.8-36.6)
2005-2009	74.7 (51.0-98.4)	56.9 (56.4-57.4)	58.5 (38.2-78.8)	36.2 (35.8-36.5)
2006-2010	67.1 (45.4-88.9)	55.5 (55.0-56.0)	67.1 (45.8-88.5)	36.2 (35.9-36.6)
2007-2011	62.3 (41.9-82.7)	54.2 (53.7-54.7)	66.6 (46.0-87.3)	35.8 (35.5-36.2)
2008-2012	70.4 (49.5-91.3)	52.8 (52.4-53.3)	60.3 (41.1-79.4)	35.6 (35.2-35.9)
2009-2013	66.0 (46.2-85.7)		59.0 (40.5-77.4)	



**Table 10. Yukon and Canadian Age-Standardized Mortality Rates by Sex and Ten-Year Aggregates for Selected Cancers, 2003-2012.**

Region	Colorectal		Prostate	Breast	Stomach
	Males	Females	Males	Females	Total
Yukon	32.3 (21.5-43.0)	23.3 (14.8-31.7)	29.9 (18.9-41.0)	23.7 (15.5-32.0)	6.40 (3.50-9.40)
Canada	22.1 (21.8-22.3)	14.8 (14.6-14.9)	20.4 (20.2-20.6)	21.7 (21.5-21.9)	4.56 (4.50-4.63)

**Table 11. Yukon Standardized Mortality Ratios Relative to Canadian Cancer Mortality Rates by Sex and Cancer Type, 2008-2012.**

Cancer	Sex	Observed	Expected	SMR	95% CI
Lung	Males	50	41	121%	88%-155%
	Females	41	28	145%	100%-189%
	Total	91	68	133%	106%-161%
Colorectal	Males	22	16	136%	79%-192%
	Females	15	10	144%	71%-217%
	Total	37	26	142%	96%-188%
Breast*	Females	38	34	113%	77%-149%
Prostate*	Males	31	22	142%	92%-192%
Stomach*	Total	23	13	184%	109%-260%

\* Breast, prostate and stomach cancer estimates were calculated based on a 10-year period, 2003-2012.

SMR = Standardized Mortality Ratio, CI = Confidence Intervals

## ALL-CANCER MORTALITY BY SEX AND AGE GROUPS

**Table 12. Number and Percent Distribution of Cancer Deaths Among Males and Females by Five-Year Aggregates for Selected Cancer Types, 1999-2013.**

Cancer	Sex	Five-Year Aggregates			
		1999-2003	2004-2008	2009-2013	Total
All Cancer	Males	134 (63%)	156 (54%)	171 (56%)	461 (57%)
	Females	78 (37%)	132 (46%)	137 (44%)	347 (43%)
	Total	212	288	308	808
Breast	Females	16	14	24	54
Colorectal	Males	14 (67%)	22 (55%)	21 (55%)	57 (58%)
	Females	7 (33%)	18 (45%)	17 (45%)	42 (42%)
	Total	21	40	38	99
Lung	Males	50 (71%)	42 (58%)	49 (54%)	141 (61%)
	Females	20 (29%)	30 (42%)	42 (46%)	92 (39%)
	Total	70	72	91	233
Prostate	Males	6	14	21	41

**Table 13. Population Size and Cancer Deaths by Sex, Age Group and Five-Year Aggregates, 1999-2013.**

Period	Age	Population (Cumulative)			Cancer Deaths		
		Males	Females	Total	Males	Females	Total
1999-2003	All Ages	76843	75918	152761	134	78	212
	0-59	69099	69471	138570	35	20	55
	60-69	4951	3757	8708	35	25	60
	70+	2793	2690	5483	64	33	97
2004-2008	All Ages	79709	79096	158805	156	132	288
	0-59	69134	70389	139523	28	44	72
	60-69	7009	5186	12195	52	24	76
	70+	3566	3521	7087	76	64	140
2009-2013	All Ages	90006	86697	176703	171	137	308
	0-59	75346	74316	149663	26	30	56
	60-69	9930	8029	17958	50	40	90
	70+	4730	4352	9082	95	67	162

## ALL-CANCER MORTALITY BY COMMUNITY

**Table 14. Number and Proportion of Total Cancer Deaths by Community and Five-Year Aggregates, 1999-2013.**

Period	Region		
	Whitehorse	Small Communities	Total
1999-2003	140 (66%)	72 (34%)	212
2004-2008	200 (69%)	88 (31%)	288
2009-2013	196 (64%)	112 (36%)	308
Total	536 (66%)	272 (34%)	808

**Table 15. All-Cancer Age-Standardized Mortality Rates by Community, 2009-2013.**

Period	Region		
	Whitehorse	Small Communities	Yukon
2009-2013	180.8 (153.8-207.8)	239.6 (192.8-286.4)	196.5 (173.2-219.8)

## Notes



